



Section 1

Safety, Maintenance and Adjustments

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IN THE INTEREST OF SAFETY

1

	 DANGER
	FOLLOW INSTRUCTIONS CAREFULLY !


- Before attempting to service this equipment, read and understand this manual and the operating instructions.
- Failure to follow instructions could result in **DEATH, SERIOUS INJURY** (including paralysis) or property damage.

* Briggs & Stratton does not necessarily know what equipment this engine will power. For that reason, carefully read and understand the operating instructions for the equipment your engine is powering.


THE OPERATING, MAINTENANCE & REPAIR INSTRUCTIONS CONTAIN SAFETY INFORMATION TO:


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


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 that, if not avoided, **will result in death or serious injury**.










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

 **CAUTION** indicates a hazard that, if not avoided, **might result in minor or moderate injury**.









CAUTION, when used **without** the alert symbol, indicates a situation that **could result in damage to the engine**.




NOTE: A **NOTE** is used to inform you of a method, reference or procedure that could assist with specific operations or procedures.




HAZARD SYMBOLS AND MEANINGS





		
Fire	Explosion	Hot Surface
		
Shock	Toxic Fumes	Moving Parts
		
Eye Protection Required	Flying Objects	Kickback

INTERNATIONAL SYMBOLS AND MEANINGS





		
Safety Alert	Oil	Read Operator's Manual
		
Choke	Start Position	Stop
		
Fuel	Fuel Shutoff	



 	<p style="text-align: center;"> WARNING</p> <p>Gasoline and its vapors are extremely flammable and explosive.</p> <p>Fire or explosion can cause severe burns or death.</p>
<p>WHEN ADDING FUEL</p>	
<ul style="list-style-type: none"> • Turn engine OFF and let engine cool at least 2 minutes before removing gas cap. • Fill fuel tank outdoors or in a well-ventilated area. Keep gasoline and its vapors away from sparks, open flames, pilot lights, heat, and other ignition sources. • Do not overfill fuel tank. Fill tank to approximately 1-1/2 inches below top of neck to allow for fuel expansion. • Check fuel lines, tank, cap, and fittings frequently for cracks or leaks. Replace if necessary. 	
<p>WHEN STARTING ENGINE</p>	
<ul style="list-style-type: none"> • 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 and the vapors dissipate before starting engine. • If engine floods, set choke to OPEN/RUN position, place throttle in FAST position. Crank until engine starts. 	
<p>WHEN OPERATING EQUIPMENT</p>	
<ul style="list-style-type: none"> • Do not tip engine or equipment at an angle that causes gasoline to spill. • Do not choke carburetor to stop engine. 	
<p>WHEN TRANSPORTING EQUIPMENT</p>	
<ul style="list-style-type: none"> • Transport with fuel tank EMPTY or with fuel shut-off valve OFF. 	
<p>WHEN STORING GASOLINE OR EQUIPMENT WITH FUEL IN TANK</p>	
<ul style="list-style-type: none"> • Store away from furnaces, stoves, water heaters or other appliances that have pilot light or other ignition source. These can ignite gasoline vapors. 	




 	<p style="text-align: center;"> WARNING</p> <p>Kerosene and its vapors are extremely flammable, and should be handled with the same precautions as gasoline.</p>
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  	<p style="text-align: center;"> WARNING</p> <p>Unintentional sparking can result in fire or electric shock.</p> <p>Unintentional start-up can result in entanglement, traumatic amputation, or laceration.</p>
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<p>BEFORE PERFORMING ADJUSTMENTS OR REPAIRS</p>	
<ul style="list-style-type: none"> • Disconnect spark plug wire and keep it away from spark plug. • Disconnect battery at negative terminal (only engines with electric start). 	
<p>WHEN TESTING FOR SPARK</p>	
<ul style="list-style-type: none"> • Use approved spark plug tester. • DO NOT check for spark with spark plug removed. 	



  	<p style="text-align: center;"> WARNING</p> <p>All fuel components should be in good condition and properly maintained.</p> <ul style="list-style-type: none"> • 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. Replace damaged or leaking components.
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	 WARNING
	<p>Engines give off carbon monoxide, an odorless, colorless, poison gas.</p> <p>Breathing carbon monoxide can cause nausea, fainting or death.</p>
<ul style="list-style-type: none"> • Start and run engine outdoors. • DO NOT start or run engine in enclosed area, even if doors or windows are open. • Inhalation of high concentrations of vapor, even for short periods can cause unconsciousness or might prove fatal. • Inhalation may cause irritation to the nose and throat, headache, nausea vomiting, dizziness, and drowsiness. • Unconsciousness or asphyxiation may result in poorly ventilated areas or confined spaces. 	

 	 WARNING
	<p>Running engines produce heat. Engine parts, especially muffler, become extremely hot.</p> <p>Severe thermal burns can occur on contact.</p> <p>Combustible debris, such as leaves, grass, brush, etc. can catch fire.</p>
<ul style="list-style-type: none"> • Allow muffler, engine cylinder and fins to cool before touching. • Remove accumulated combustibles from muffler area and cylinder area. • Install and maintain in working order a spark arrester before using equipment on forest-covered, grass-covered, brush-covered unimproved land. The state of California requires this (Section 4442 of the California Public Resources Code). Other states may have similar laws. Federal laws apply on federal land. 	

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

	 WARNING
	<p>Rapid retraction of starter cord (kickback) will pull hand and arm toward engine faster than you can let go.</p> <p>Broken bones, fractures, bruises or sprains could result.</p>
<ul style="list-style-type: none"> • When starting engine, pull cord slowly until resistance is felt, then pull rapidly. • Remove all external equipment/engine loads before starting engine. • Direct coupled equipment components such as, but not limited to, blades, impellers, pulleys, sprockets, etc., must be securely attached. 	

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

Additional Precautions

Before working on the engine, read and understand the applicable sections of this manual. Follow all safety warnings. Death, personal injury and/or property damage may occur unless service instructions are followed carefully.

DO NOT store, spill, or use gasoline near an open flame, or near an appliance like a stove, furnace, or water heater that uses a pilot light or creates a spark.

DO NOT refuel indoors or in an unventilated area.

DO NOT operate or tip engine/equipment at an angle that causes gasoline spillage.

DO NOT operate engine if gasoline is spilled, when smell of gasoline is present, or when other explosive conditions exist. (Move equipment away from spill. Avoid ignition until gasoline has evaporated.)

DO NOT transport engine with fuel in tank or fuel shut-off valve open.

DO NOT choke carburetor to stop engine, especially in an enclosed vehicle. (Gradually reduce engine speed before stopping.)

DO NOT tamper with governor springs, links or other parts to increase engine speed. (Run engine at speed set for equipment manufacturer.)

DO NOT check for spark with spark plug removed. (Use an approved tester.)

DO NOT run engine with blower housing or other safety shields removed.

DO NOT crank engine with spark plug removed. (If engine is flooded, place throttle in FAST position and crank until engine starts.)

DO NOT strike flywheel with a hammer or hard object. This could cause the flywheel to shatter in operation.

(Use only Briggs & Stratton approved tools and procedures to remove the flywheel.)

DO NOT operate engine without a muffler. (Inspect periodically and replace if worn or leaking. If engine is equipped with muffler deflector, inspect periodically and replace if necessary. Replacement parts must be same as on original equipment.)

DO NOT operate engine with grass, leaves or other combustible material accumulated in the muffler area.

DO NOT touch hot muffler, cylinder, or fins which can cause burns.

DO NOT start engine with air cleaner or air cleaner cover removed.

DO NOT attempt to start engine with cutting blade loose or removed. (Blade must be tight, otherwise kickback may occur.)

DO NOT remove fuel tank cap or fill the fuel tank while the engine is hot or running. **DO NOT** refuel indoors or in an unventilated area. Allow the engine to cool at least 2 minutes before refueling.

WEAR suitable eye protection (safety glasses, goggles or face shield) when performing repair procedures.

PREVENT ACCIDENTAL STARTING by disconnecting spark plug wire from spark plug when servicing engine or equipment. Disconnect negative wire from battery terminal if equipped with electric starting system.

USE ONLY genuine Briggs & Stratton parts or their equivalent. The use of non-equivalent replacement parts may damage the engine.

GASEOUS FUEL ENGINES – Check fuel lines and fittings frequently for cracks or leaks. Replace as necessary.

BRIGGS & STRATTON NUMERICAL IDENTIFICATION SYSTEM

YOUR KEY TO THE WORLD'S FINEST ENGINES

This chart explains the unique Briggs & Stratton numerical model 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, general configuration, etc.
- C. The second digit after the displacement indicates ORIENTATION OF CRANKSHAFT.
- D. The third digit after the displacement indicates TYPE OF BEARINGS, and whether or not the engine is equipped with REDUCTION GEAR or AUXILIARY DRIVE.
- E. The last digit indicates the TYPE OF STARTER.

BRIGGS & STRATTON MODEL NUMBERING SYSTEM

<u>A</u>	<u>FIRST DIGIT AFTER DISPLACEMENT</u> <u>B</u>	<u>SECOND DIGIT AFTER DISPLACEMENT</u> <u>C</u>	<u>THIRD DIGIT AFTER DISPLACEMENT</u> <u>D</u>	<u>FOURTH DIGIT AFTER DISPLACEMENT</u> <u>E</u>
<u>CUBIC INCH DISPLACEMENT</u>	<u>BASIC DESIGN SERIES</u>	<u>CRANKSHAFT ORIENTATION</u>	<u>PTO BEARING, REDUCTION GEAR, AUXILIARY DRIVE, LUBRICATION</u>	<u>TYPE OF STARTER</u>
6	0	0 to 4 - Horizontal Shaft	0 - Plain Bearing/DU Non-Flange Mount	0 - Without Starter
8	1	5 to 9 - Vertical Shaft	1 - Plain Bearing Flange Mounting	1 - Rope Starter
9	2	A to G - Horizontal Shaft	2 - Sleeve Bearing Flange Mounting Splash Lube	2 - Rewind Starter
10	3	H to Z - Vertical Shaft	3 - Ball Bearing Flange Mounting Splash Lube	3 - Electric Starter Only 110 or 230 Volt Gear Drive
11	4		4 - Ball Bearing Flange Mounting Pressure Lubrication	4 - Electric Starter/110 or 230 Volt Gear Drive with Alternator
12	5		5 - Plain Bearing Gear Reduction (6 to 1) CCW Rotation Flange Mounting	5 - Electric Starter Only 12 or 24 Volt Gear Drive
13	6		6 - Ball Bearing Gear Reduction (2 to 1) CCW Rotation	6 - Alternator Only
16	7		7 - Plain Bearing Pressure Lubrication	7 - Electric Starter 12 or 24 Volt Gear Drive with Alternator
18	8		8 - Plain Bearing Auxiliary Drive (PTO) Perpendicular to Crankshaft	8 - Vertical Pull Starter or Side Pull Starter
19	9		9 - Plain Bearing Auxiliary Drive Parallel to Crankshaft	9 - Mechanical Starter
20	A to Z		A - Plain Bearing Pressure Lubrication Without Oil Filter	A - Electric Starter 12 or 24 Volt Gear Drive with Alternator and Inverter
21				
22				
23				
24				
25				
28				
29				
30				
31				
32				
35				
38				
40				
42				
43				
44				
46				
47				
52				
54				
58				

EXAMPLE - To identify Model 303447:

<u>30</u>	<u>3</u>	<u>4</u>	<u>4</u>	<u>7</u>
30 Cubic Inch	Design Series 3	Horizontal Shaft	Ball Bearing Flange Mounting Pressure Lubrication	Electric Starter 12 or 24 Volt Gear Drive with Alternator

TYPE 1234-01, The type number identifies the engines mechanical parts, color of paint, decals, governed speed, and Original Equipment Manufacturer.

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

<u>YEAR</u>	<u>MONTH</u>	<u>DAY</u>	<u>ASSEMBLY LINE AND MANUFACTURING PLANT</u>
01	06	12	01

Revised 4/04

FUEL & OIL RECOMMENDATIONS

Fuel Recommendations

Gasoline Engines



- Use clean, fresh regular unleaded gasoline with a minimum of **85 octane**. Fresh fuel prevents gum from forming in the fuel system or on essential carburetor parts. Purchase fuel in a quantity that can be used within 30 days.
- Do not use gasoline containing Methanol.
- Do not mix oil with gasoline.
- For engine protection use Briggs & Stratton Fuel Stabilizer #5041 or single use pouch #5058 available from your Authorized Briggs & Stratton Dealer.

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.

Inline Fuel Filter Service

Replace inline fuel filter yearly or every **100 hours**, whichever occurs first. Replace filter if dirt or water are present. See illustrated parts list for correct fuel filter.



Gaseous Fuel Engines

	 DANGER AVOID INJURY! Gaseous fuel systems should only be worked on in a very well ventilated area.
<ul style="list-style-type: none">• Many state, county and city governments require that service be performed ONLY outdoors.• Have a fan blowing across the engine BEFORE loosening fuel line connections!	

NOTE: Gaseous fueled engines require special equipment to remain emissions certified. See a certified gaseous fuel dealer or a certified OEM dealer for service.

Use clean fuel free of moisture or particulate material, within the following values:

For propane (LPG) fueled engines, use commercial grade HD% propane. Recommended fuel has a minimum fuel energy of **2500 BTU/ft³**, maximum propylene content **5%**, butane, heavier gas content **2.5%**, minimum propane content **90%**.

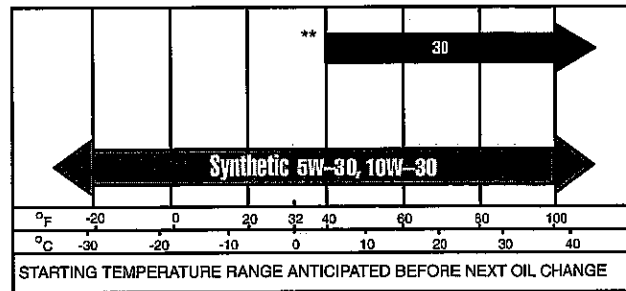
	 WARNING AVOID INJURY! Gaseous fueled equipment is equipped with an automatic safety gas fuel lock-off valve.
<ul style="list-style-type: none">• Do not operate gaseous fueled equipment if the fuel lock-off valve is missing or inoperative.	

Oil Recommendations

Oil has four purposes. It cools, cleans, seals and lubricates. During normal operation, small particles of metal from the cylinder walls, pistons, bearings and combustion deposits contaminate the oil. Dust particles from the air also contaminate the oil, forming an abrasive mixture that can wear internal engine parts if the oil is not changed regularly. Fresh oil assists in cooling. Old oil gradually thickens and loses its cooling ability and its lubricating qualities.

Briggs & Stratton OHV V-Twin engines are lubricated with a gear-driven oil pump.

Use a high quality detergent oil classified "For Service **SJ or HIGHER**" such as Briggs & Stratton 30 weight oil part #100005 or #100028. Detergent oils keep the engine cleaner and retard the formation of gum and varnish deposits. Do not use additives with recommended oils.



Air cooled engines run hotter than automotive engines. Use of multi-viscosity oils (10W-30, etc.) in ambient temperatures above 40° F (4° C) will result in high oil consumption. If multi-viscosity oil is used, check oil level more frequently to prevent any possible engine damage due to lack of lubrication.

** SAE 30 oil, if used in ambient temperatures below 40° F (4° C) will result in hard starting and possible engine damage due to inadequate lubrication.

Synthetic oil meeting ILSAC GF-2, API certification mark and API service symbol with "SJ/CF ENERGY CONSERVING" rating or higher, is an acceptable oil at all temperatures.

NOTE: Use of synthetic oil does not alter the required oil change intervals.

MAINTENANCE & ADJUSTMENTS SCHEDULE

The following maintenance schedule is a general guide. See the Engine Operating & Maintenance Instructions for details on specific engine models.


Maintenance Schedule	8 Hours or Daily	25 Hours or Every Season	50 Hours or Every Season	100 Hours or Every Season	500 Hours
Check oil level *	•				
Change oil			• Note #1		
Change oil filter				•	
Clean/Replace air filter pre-cleaner		• Note #2			
Clean/Replace air filter cartridge				• Note #2	
Clean cooling system				• Note #2	
Inspect/clean spark arrester (if used)			•		
Replace or clean spark plugs				•	
Replace in-line fuel filter				•	
Remove combustion chamber deposits					•

* Change oil after the first 5 to 8 hours of operation (break-in period), then after every 50 hours or every season.

NOTE: #1 – Change oil every 25 hours when operating under heavy load or in high temperatures.

NOTE: #2 – Clean more often under dusty conditions or when airborne debris is present. Replace air cleaner parts when dirty.

AIR CLEANER SERVICE

	WARNING
AVOID FIRES!	
• Never operate an engine with the air cleaner assembly or air cleaner cartridge removed!	

A properly 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 quickly. As the rings and bore wear, the abrasive particles enter the crankcase and contaminate the oil, forming an abrasive mixture that will wear internal parts.

Examine the air cleaner on every engine brought in for a check up or repair. If the air cleaner shows signs of neglect, show it to the customer before cleaning. Instruct the customer on proper care to assure long engine life.

NOTE: Replace worn or damaged air cleaner gaskets and mounting gaskets to prevent dirt and dust from entering engine through improper sealing. Replace air cleaner mounting bracket if bent.

Remove and service foam pre-cleaner, if equipped, every **25** hours or every season, whichever occurs first. Service cartridge every **100** hours or every season, whichever occurs first.

NOTE: Service air cleaner more often under dusty conditions.

Round Air Cleaner

1. Remove cover (1), knob (2), plate (3), and air cleaner cartridge (4) with pre-cleaner (5), **Fig. 1** or **Fig. 2**.

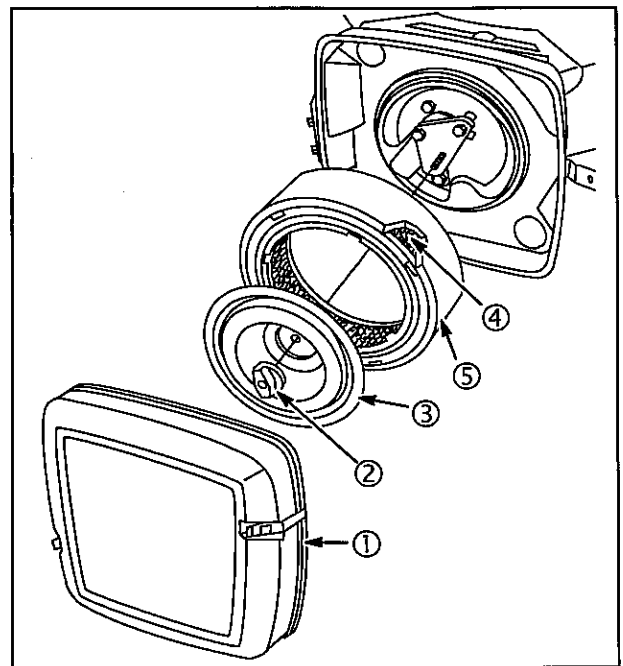


Fig. 1

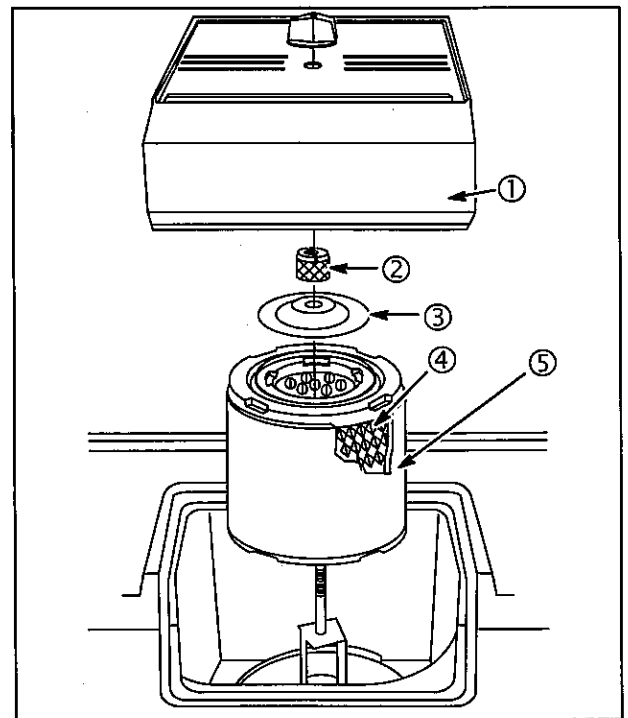


Fig. 2

2. Remove foam pre-cleaner from cartridge.
3. Wash pre-cleaner in liquid detergent and water.
4. Squeeze dry in a clean cloth. Set aside.
5. Inspect cartridge. Replace if damaged or dirty.

CAUTION: DO NOT use petroleum solvents to clean paper cartridge.
DO NOT oil paper cartridge.
DO NOT use pressurized air to clean or dry paper cartridge.

6. Reinstall pre-cleaner over cartridge.
7. Install cartridge to air cleaner.
8. Install plate, knob and air cleaner cover.

Square Air Cleaner

1. Remove knob(s) (2) and cover assembly (1), Fig. 3.

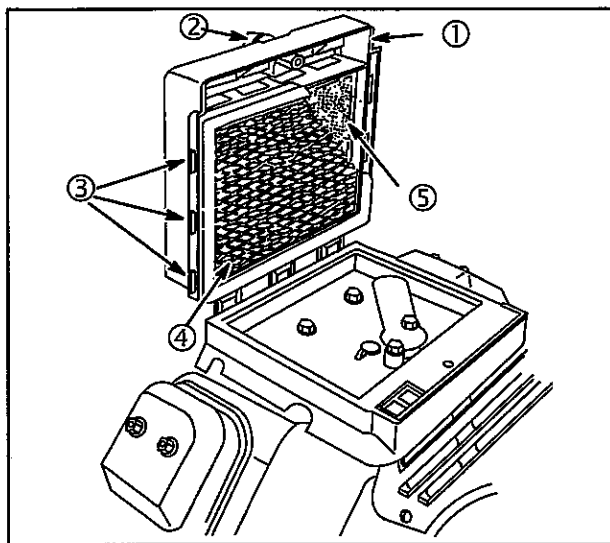


Fig. 3

2. Remove cartridge (4) and pre-cleaner (5) from cover.
3. Wash pre-cleaner in liquid detergent and water.
4. Squeeze dry in a clean cloth. Set aside.
5. Inspect cartridge. Replace if damaged or dirty.

CAUTION: DO NOT use petroleum solvents to clean paper cartridge.
DO NOT oil paper cartridge.
DO NOT use pressurized air to clean or dry paper cartridge.

6. Install pre-cleaner in cover with foam toward cover. (Nylon screen toward paper element.)
7. Install paper cartridge in cover with tabs on cartridge (3) in slots of cover, Fig. 3.
8. Reinstall cover assembly on air cleaner body.

Cyclonic Air Cleaner

NOTE: The debris valve automatically discharges dust and debris. There should be minimal debris for removal.

1. Remove debris from the air cleaner by squeezing the ends of the debris valve (5), Fig. 4.

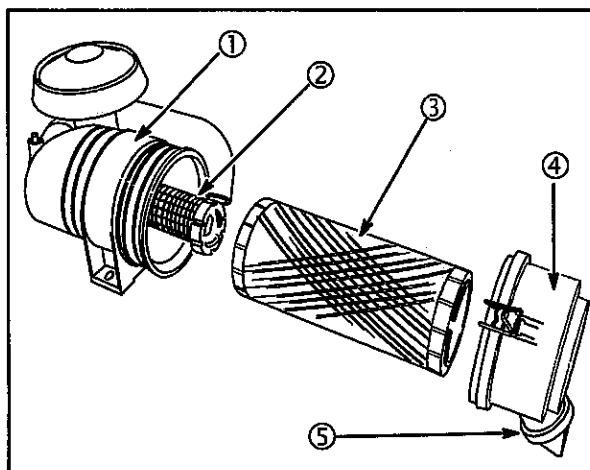


Fig. 4

2. Remove the cover (4) from the air cleaner housing (1).
3. Remove the primary filter (3) and inspect. Replace the filter if damaged, or dirty.

CAUTION: DO NOT clean or oil these filters.
DO NOT use pressurized air to clean or dry filters.
REPLACE filters if damaged or dirty

4. Inspect the safety filter (2).

NOTE: DO NOT remove the safety filter (2) as part of the inspection.

If it is necessary to remove the safety filter, Fig. 5, be sure all debris is removed from the air cleaner housing before removal.

Replace the safety filter with every third replacement of the primary filter, or if damaged or dirty.

5. Reinstall filter(s).
6. Reinstall air cleaner cover.

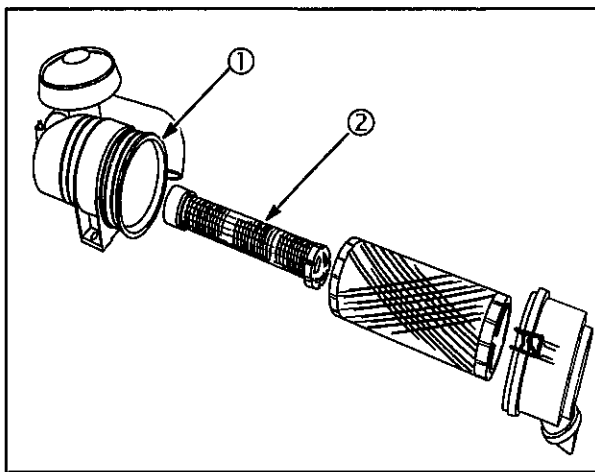


Fig. 5

ARMATURE AIR GAP ADJUSTMENT

1. Loosen screws holding armature in place. Slide armature away from flywheel and tighten one of the screws.
2. Rotate flywheel until magnet is under armature laminations.
3. Place thickness gauge (1) between magnet and armature laminations, Fig. 6.
 - All EXCEPT Models 540000, 610000 – Use 0.008" – 0.012" (0.20 – 0.30 mm) gauge.
 - Models 540000, 610000 – Use 0.005 – 0.007" (0.13 – 0.18 mm) gauge.

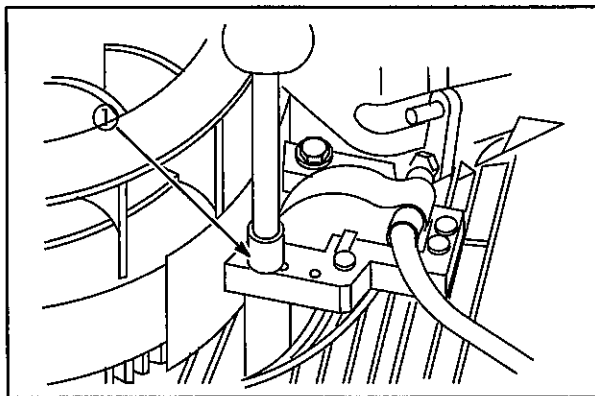


Fig. 6

4. Loosen screw on the armature. Allow armature to be pulled against the gauge by the flywheel magnet. Tighten both armature screws to **25 in. lbs. (3 Nm)**.
5. Rotate flywheel to remove gauge.
6. Repeat procedure for the other armature.

CARBURETOR ADJUSTMENTS

Models 290000 – 350000

The Vanguard™ OHV twin cylinder engine carburetor fuel mixture adjustment procedure is unique. Perform adjustments exactly in the sequence shown.

NOTE: If engine is equipped with Performance Control™ electronic governor see separate adjustment procedure.

Initial Adjustment

1. Turn idle mixture screw (1), Fig. 7, **CLOCKWISE** until it just seats. **DO NOT FORCE**.
2. Turn valve **COUNTERCLOCKWISE 1-1/4 turns**.

This setting will permit engine to start. Final adjustment will be made with engine running.

NOTE: Parts removed for clarity.

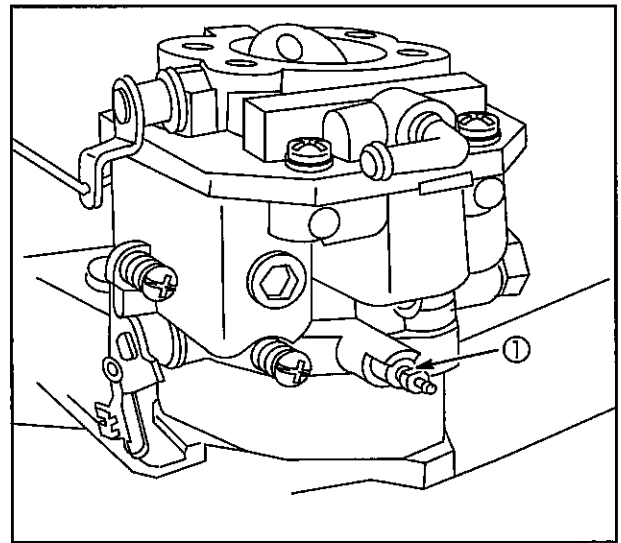


Fig. 7

If engine is equipped with a secondary governor spring, Fig. 8, check governor lever adjustment procedure before starting engine.

- (1) Primary Governor Spring
- (2) Loop (faces UP)
- (3) Secondary Governor Spring
- (4) Loop Over Tab
- (5) #2 Hole (Generators)
- (6) #1 Hole (Remote Control)

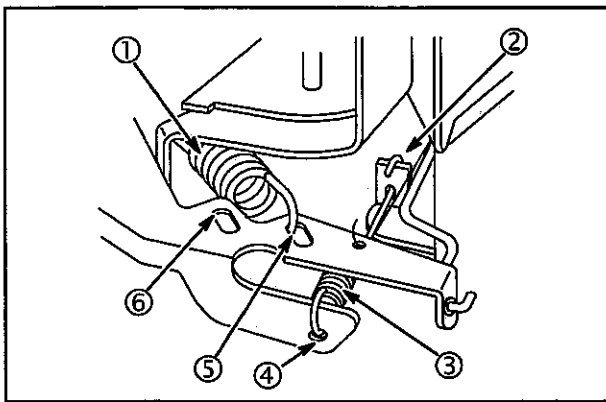


Fig. 8

Final Adjustment

All carburetor adjustments performed with the engine running must be made with the air cleaner installed.

• Tools Required, Fig. 9:

Tachometer #19200 or #19389

Tang Bender #19352

1. Start engine. Run for approximately 5 minutes to allow engine to warm up.
2. Move control lever on equipment to SLOW position.

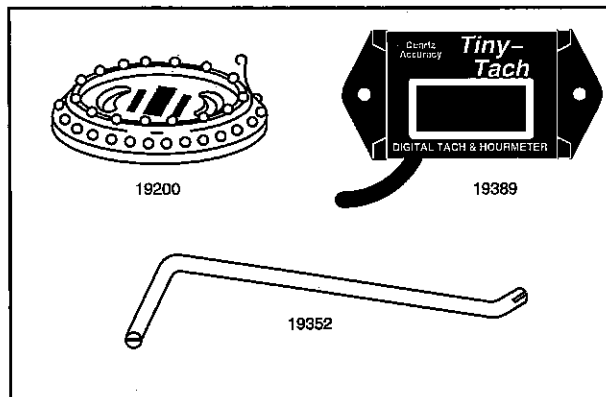


Fig. 9

3. Hold throttle lever (2) against idle speed screw (1), Fig. 10. Temporarily adjust idle to RPM shown below.
 - a. **1400 RPM** – Governed Idle Spring #805453 (RED).
 - b. **1100 RPM** – Governed Idle Spring #805454 (WHITE).

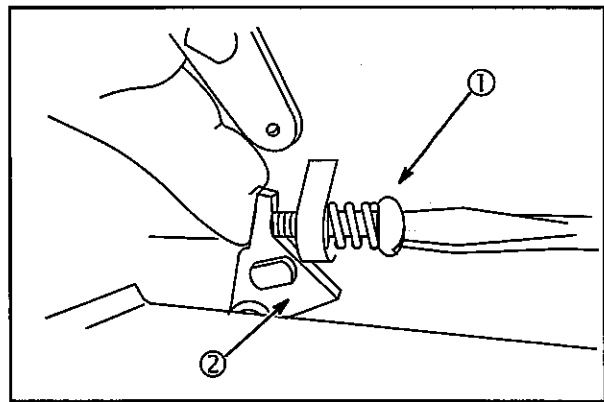


Fig. 10

4. Turn idle mixture screw slowly **CLOCKWISE** (1) until engine speed just starts to slow (LEAN mixture), Fig. 11.

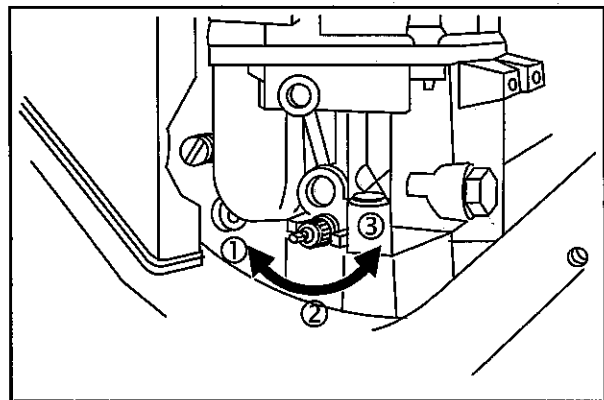


Fig. 11

5. Then turn idle mixture screw **COUNTER-CLOCKWISE** (3) until engine speed just starts to slow (RICH mixture).
6. Turn screw to mid point (2) between RICH and LEAN.
7. Hold throttle lever against idle speed adjustment screw and re-adjust idle to RPM shown below:
 - a. **1200 RPM** – Governed Idle Spring #805453 (RED).
 - b. **900 RPM** – Governed Idle Spring #805454 (WHITE).
8. Release throttle lever. Note RPM.
9. If necessary bend governed idle tang (5) with Tang Bender #19352 (4), Fig. 12, to obtain RPM shown:
 - a. **1750 RPM** – Governed Idle Spring #805453 (RED).
 - b. **1100 RPM** – Governed Idle Spring #805454 (WHITE).

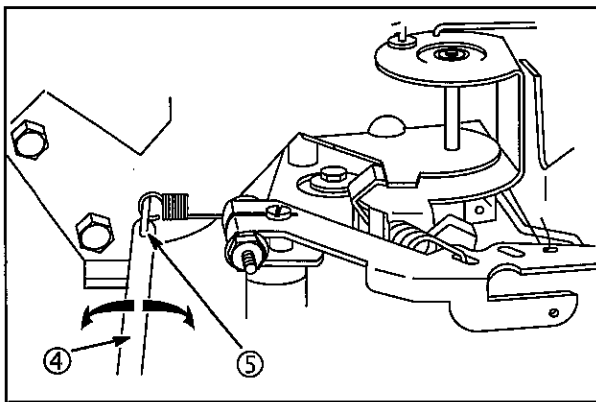


Fig. 12

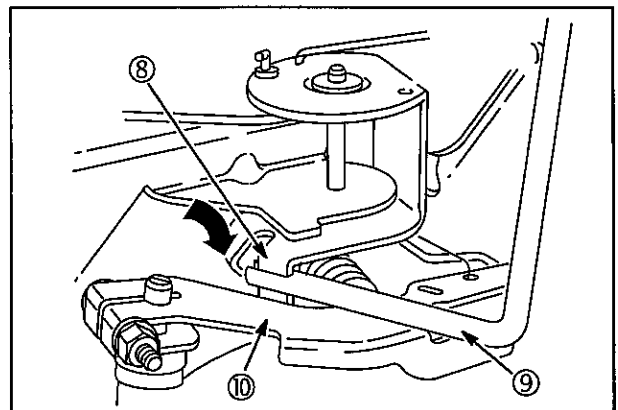


Fig. 14

10. If the carburetor is equipped with an idle mixture limiter cap install it at this time.

- a. Position limiter cap (7) so that stop(s) on limiter cap are at mid point between stop(s) on carburetor body, Fig. 13.

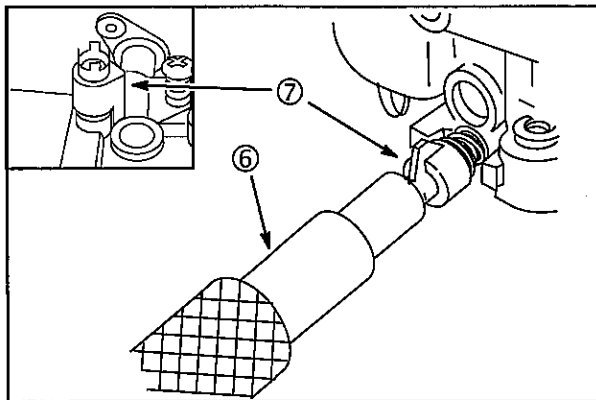


Fig. 13

- b. Press limiter into position using Knock Out Pin, #19135 (6) as shown.

11. With equipment control lever in SLOW position and engine running at governed idle, use Tang Bender, #19352 (9), to bend throttle restrictor tang (8) so that tang just contacts governor lever (10), Fig. 14.

12. Move equipment control to FAST position. Engine should accelerate smoothly.

Re-adjust idle mixture valve 1/8 turn richer if necessary.

Performance Control™ Engines

NOTE: All carburetor adjustments with engine running must be made with the air cleaner correctly installed.

1. Start engine and run it for approximately 5 minutes to allow engine to reach operating temperature.
2. Activate idle down device, or ground BLUE wire (1) from control module using a jumper wire (2), Fig. 15.
3. Temporarily adjust idle speed to **1400 RPM**.

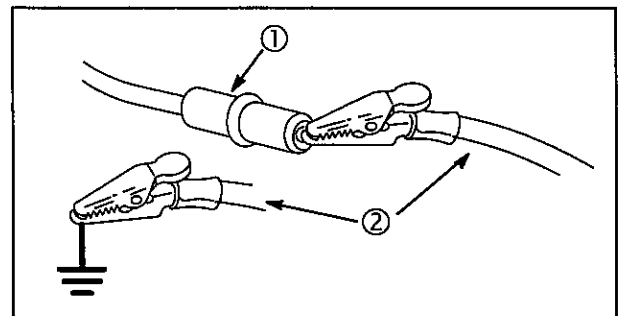


Fig. 15

4. Turn idle mixture screw slowly **CLOCKWISE** (3) until engine speed just starts to slow (LEAN mixture), Fig. 16.
5. Then turn idle mixture valve **COUNTERCLOCKWISE** (5) until engine speed just starts to slow (RICH mixture).
6. Turn valve to mid point (4) between RICH and LEAN.
7. Re-adjust idle speed to **1750 RPM**.

NOTE: Idle speed may vary according to OEM specifications.

1

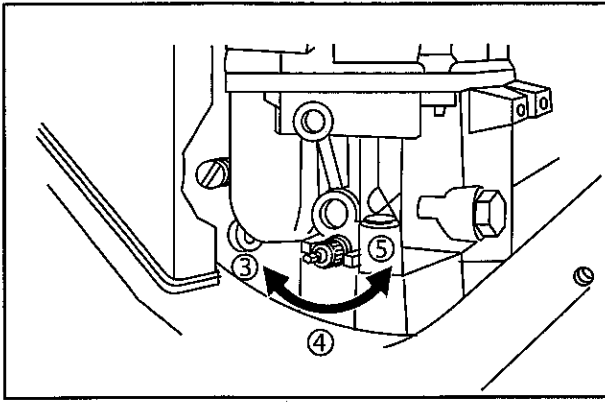


Fig. 16

8. Deactivate idle-down device, or remove jumper wire. Engine should accelerate smoothly to top governed speed. Re-adjust idle mixture screw 1/8 turn richer if necessary.
9. If the carburetor is equipped with an idle mixture limiter cap, install it at this time.
 - a. Position limiter cap (7) so that stop on limiter cap is at mid point between stops on carburetor body, **Fig. 17**.

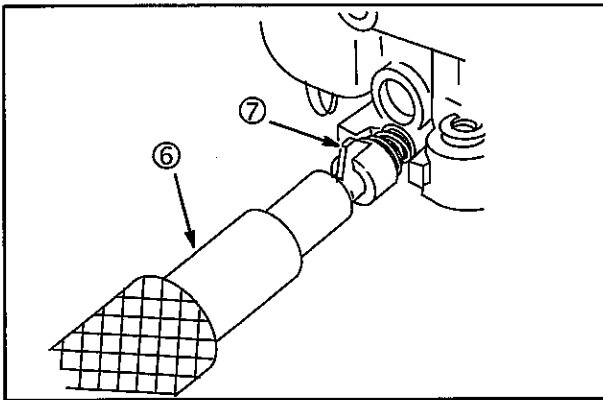


Fig. 17

- b. Press limiter into position using Knock Out Pin #19135 (6).

Models 351400, 380400, 351700 and 380700

The OHV twin cylinder engine carburetor fuel mixture adjustment procedure is unique. Perform adjustments exactly in the sequence shown. Horizontal crankshaft engines (1) and vertical crankshaft engines (2) are shown in **Fig. 18**.

Initial Adjustment

1. Turn idle mixture screw for #1 cylinder **CLOCKWISE** until it just seats. **DO NOT FORCE**, **Fig. 18**.

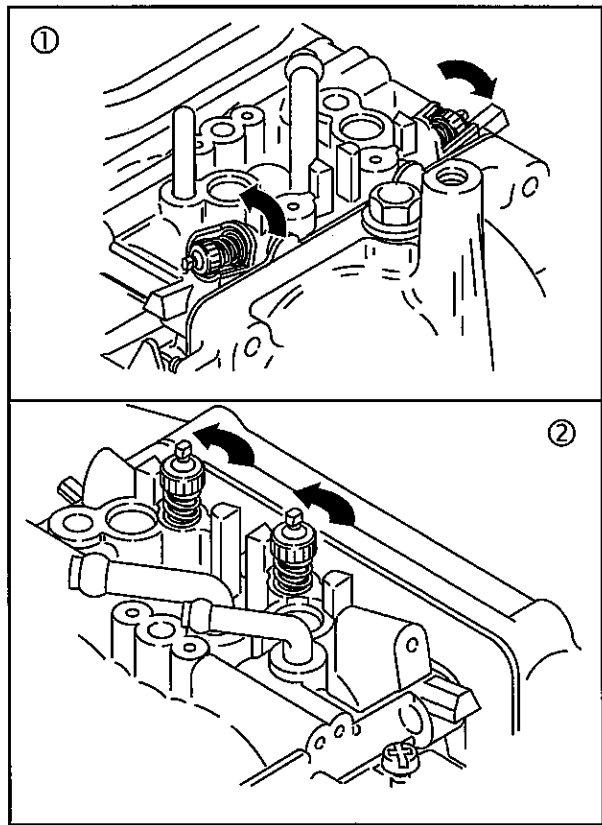


Fig. 18

2. Then turn screw **COUNTERCLOCKWISE** 3/4 turn.
3. Repeat for #2 cylinder.

This setting will permit engine to start. Final adjustment will be made with engine running.

Final Adjustment

Carburetor adjustments performed with engine running must be made with the air cleaner correctly installed.

NOTE: Idle mixture adjustment **MUST** be performed with the engine running at **1200 RPM**.

Tools Required:

- Tachometer #19200 or #19389
- Tang Bender #19352

1. Start engine and run it for approximately 5 minutes to allow engine to reach operating temperature.
2. Move equipment control lever to **SLOW** position.
3. Hold throttle lever (1) against idle speed screw (2), **Fig. 19**. Temporarily adjust idle to **1200 RPM**.

4. While holding throttle lever, SLOWLY turn idle mixture screw for #1 cylinder CLOCKWISE until engine speed just starts to slow (LEAN mixture).

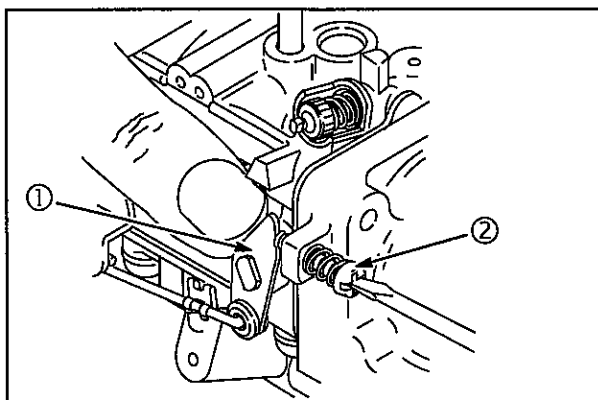


Fig. 19

5. Then turn idle mixture screw (3) COUNTER-CLOCKWISE 3/8 turn, Fig. 20.

NOTE: It may be necessary to re-adjust idle speed to 1200 RPM before proceeding.

6. Adjust idle mixture screw for #2 cylinder as described in steps 4 and 5.
7. If necessary, re-adjust idle speed screw to RPM shown below.
 - a. **1200 RPM** – Governed Idle Spring #805453 (RED).
 - b. **900 RPM** – Governed Idle Spring #805454 (WHITE).
8. Release throttle lever. Note RPM.

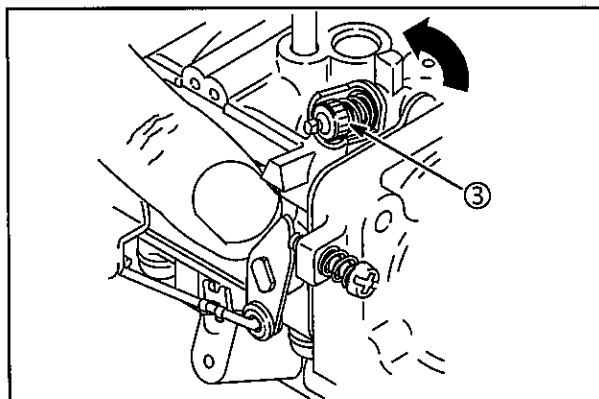


Fig. 20

9. If necessary, use Tang Bender #19352 (6), Fig. 21. Bend governed idle tang LEFT to INCREASE (4), right to DECREASE (5) engine speed to obtain RPM shown:

- a. **1750 RPM** – Governed Idle Spring #805453 (RED).
- b. **1100 RPM** – Governed Idle Spring #805454 (WHITE).

NOTE: Parts removed for clarity.

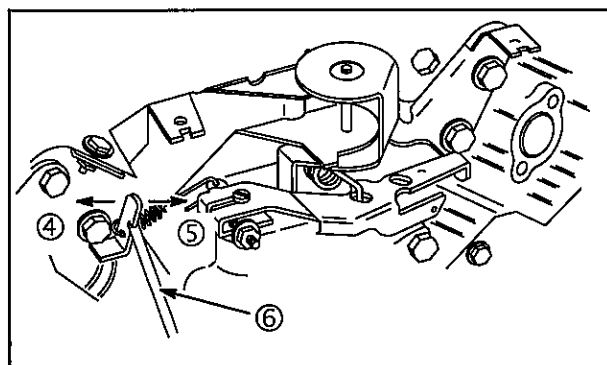


Fig. 21

10. If carburetor is equipped with idle mixture limiter caps, install at this time.
 - a. Position limiter cap (8) so that stop on limiter cap is at mid point between stops on carburetor body. Press limiter into position using Knock Out Pin #19135 (7) as shown in, Fig. 22.
 - b. Repeat for other idle mixture valve.

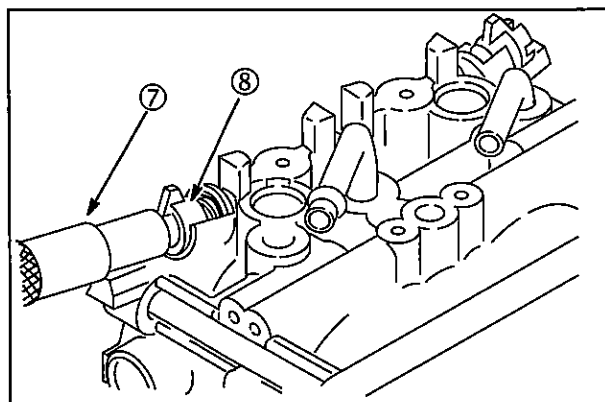


Fig. 22

11. With equipment control lever in SLOW position and engine running at governed idle, use Tang Bender #19352 (10), to bend throttle restrictor tang (9) so that it just contacts governor lever (11), Fig. 23.
12. Move equipment control to FAST position. Engine should accelerate smoothly. Re-adjust idle mixture valve 1/8 turn richer if necessary.

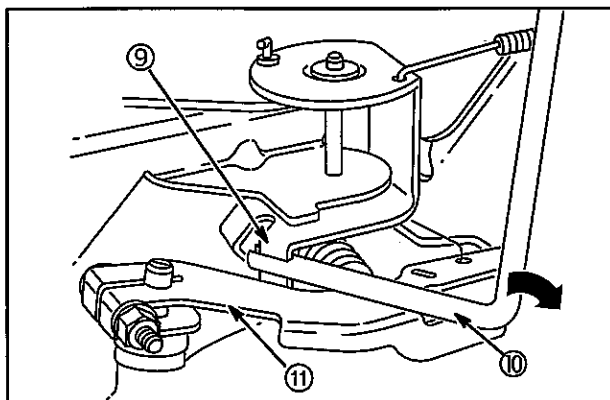


Fig. 23

Choke Control Adjustment

NOTE: Be sure choke control wire is installed in #2 hole (2) in choke lever, **Fig. 24**.

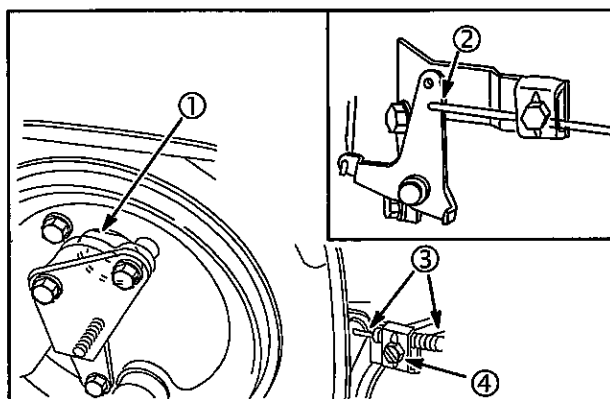




Fig. 24

1. Place choke control lever on equipment in CHOKE position.
2. Loosen control casing clamp screw (4).
3. Move control casing and wire (3) until choke is completely closed (1).
4. Tighten casing clamp screw.

Combustion Chamber Deposits

Combustion chamber deposits should be removed every **500 hours** or whenever cylinder heads are removed.

	 <p>WARNING</p>
<p>AVOID EYE INJURY!</p>	
<ul style="list-style-type: none"> • Wear eye protection whenever using compressed air to clean parts. 	

Remove deposits from combustion chamber and around valves using a wire brush or scraper. With piston at Top Dead Center (TDC), remove combustion chamber deposits from top of piston. Use care to prevent combustion chamber deposits from entering push rod or oil return cavity in cylinder.

Take care not to damage cylinder, top of piston, cylinder head and cylinder head gasket surfaces.

NOTE: Remove only the combustion chamber deposits. It is not necessary to remove the discoloration marks on the piston, valves and 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 or a soft bristle brush.

Cooling System Cleaning

Grass particles, chaff or dirt can clog the air cooling system, especially after prolonged service in cutting dry grass or very dirty air. Operating with a clogged cooling system can cause overheating and engine damage. Cleaning the cooling system should be a regular maintenance operation, performed yearly or every **100 hours**, whichever comes first.

All Except Models 540000, 610000

Fig. 25 shows the blower housing removed and areas to be cleaned (1) on the Vanguard™ engine.

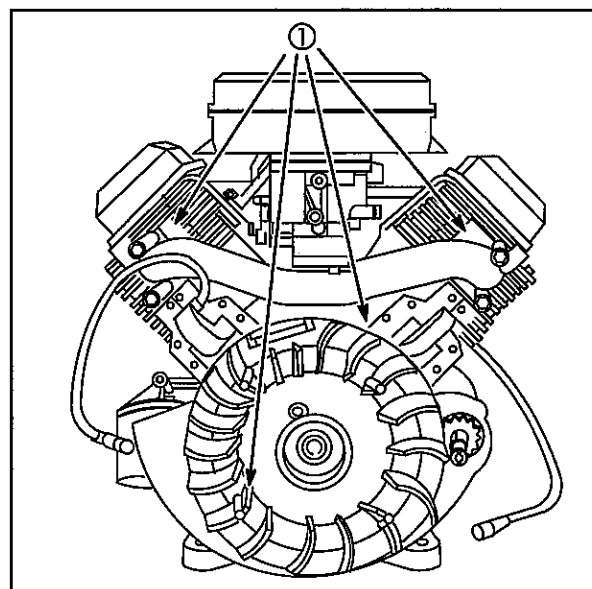


Fig. 25

Models 540000, 610000

1. Use a coin or screwdriver to twist the Easy Clean Access™ panel fasteners (1), **Fig. 26** COUNTERCLOCKWISE until a **CLICK** is heard (approx. 3/4 turn).
2. Remove the panel (2).

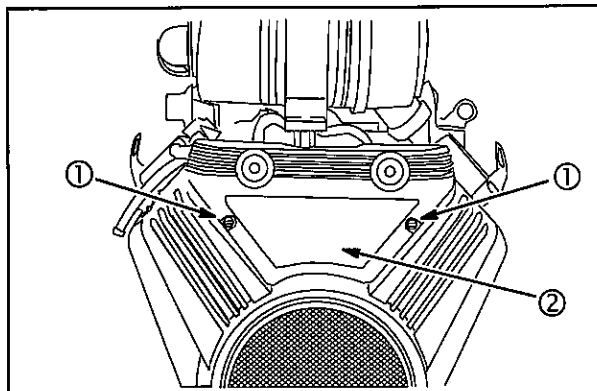


Fig. 26

3. Blow compressed air from the PTO side to clean the cooling fins (3), **Fig. 27** around each cylinder and to back flush the cooling system.

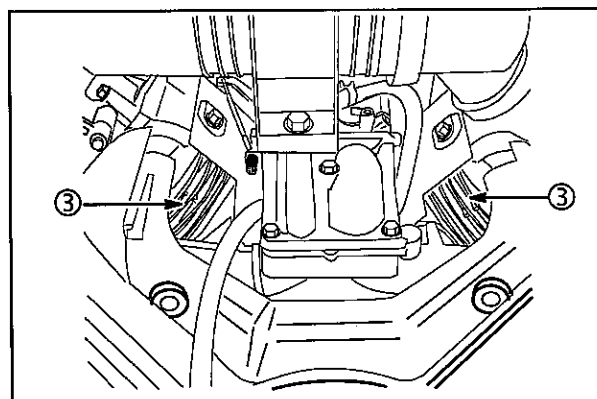


Fig. 27

4. Insert the access panel tab into the blower housing slot. Be certain the access panel is correctly engaged to the blower housing. Push the panel completely into the housing. Twist each fastener **CLOCKWISE** until it "**CLICKS**", approx. 3/4 turn.

CAUTION: DO NOT run the engine unless the Easy Clean Access™ panel is correctly installed.

Crankcase Oil

Change Oil and Filter

Drain oil while the engine is still warm. See **Fig. 28** for approximate drain plug locations on vertical crankshaft engines; **Fig. 29** for horizontal crankshaft engines.

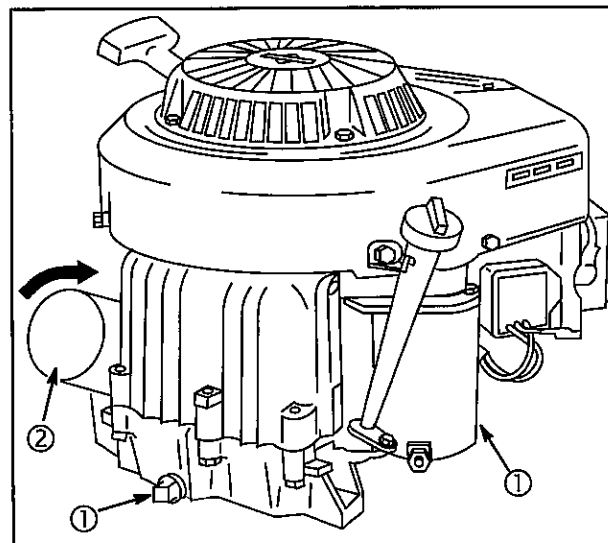


Fig. 28

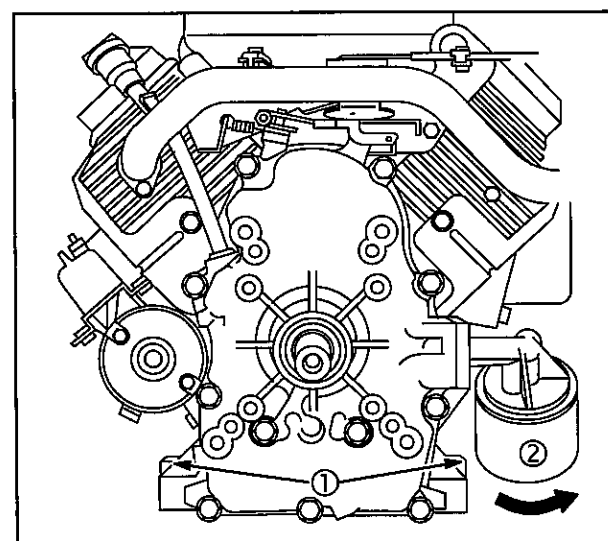


Fig. 29

1. Remove oil drain plug (1). Drain oil into approved container.
2. Remove dipstick.
3. Replace oil filter (2) every **100** hours. Before installing new filter, lightly oil filter gasket with new engine oil.
4. Screw filter on **CLOCKWISE** (arrow) by hand until gasket contacts filter adapter. Hand tighten an additional 1/2 - 3/4 turn.
5. Replace drain plug.
6. Refill crankcase slowly with new oil of proper service classification and viscosity grade. Refill to **FULL** mark on dipstick.

CAUTION: DO NOT OVERFILL THE ENGINE WITH OIL!



The crankcase capacity of Vanguard™ V-Twin engines is approximately:

- All (except Model 540000) – 48 oz. (1.4 liters) with filter
- Models 540000, 610000 – 79 oz. (2.3 liters) with filter
- Models 540000, 610000 – 71 oz. (2.1 liters) without filter

NOTE: When checking oil level, screw the dipstick all the way in for accurate readings.

7. Start engine. Run at IDLE for 30 seconds and stop engine. Recheck oil level and add if required. Restart engine and check for oil leaks.

Governor Adjustments

	 CAUTION
AVOID INJURY! Complete the governor static adjustment BEFORE starting or running engine.	
<ul style="list-style-type: none"> • Incorrect adjustment could result in engine overspeeding, causing engine damage, property damage or personal injury. 	

Static Governor Adjustment (Before Running Engine)

1. Loosen governor lever nut. Push on governor lever (1) until throttle is wide open, **Fig. 30**.

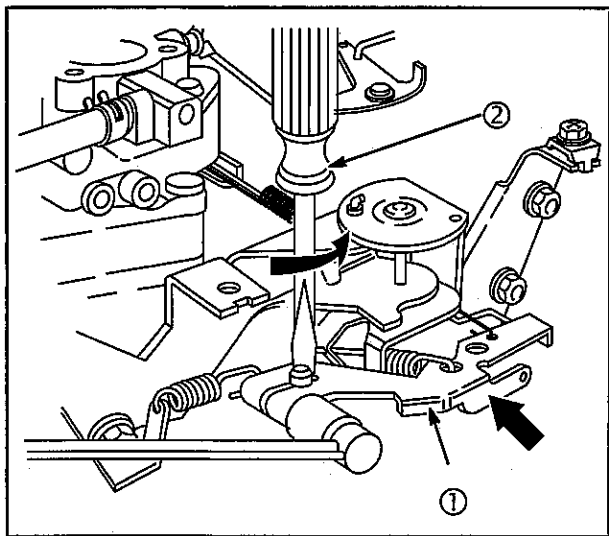


Fig. 30

CAUTION: Do not bend governor link or distort governor lever.

2. Use a screwdriver (2) to rotate governor shaft **COUNTERCLOCKWISE** as far it will go. Torque governor nut to **70 in. lbs. (8 Nm)**.
3. Install throttle and choke control cables and check for proper operation.

Dynamic Governor Adjustment

NOTE: Carburetor mixture adjustments must be made before adjusting governed idle, throttle restrictor and top no-load RPM.

- Tools Required, **Fig. 31:**

Tachometer #19200 (1) or #19389 (3)

Tang bender #19352 (2)

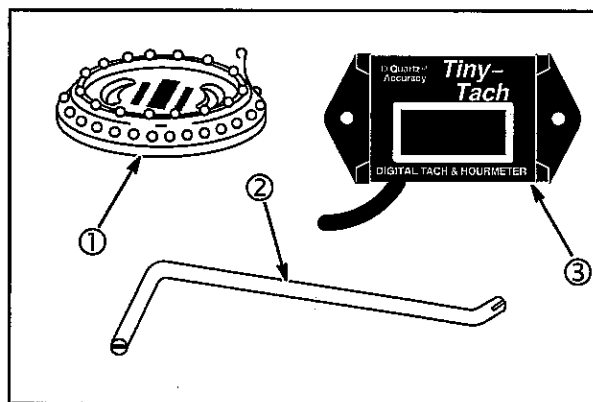


Fig. 31

Manual Friction and Remote Speed Controls

Governor spring is installed in #1 hole (3) in governor lever, **Fig. 32**.

Start and run engine for approximately 5 minutes to allow engine to warm up.

1. Move control lever to SLOW position.
2. Use tool #19352 (1) to bend governed idle tang (2) to obtain RPM shown:
 - a. **1750 RPM** – Governed Idle Spring #805453 (RED).
 - b. **1100 RPM** – Governed Idle Spring #805454 (WHITE).

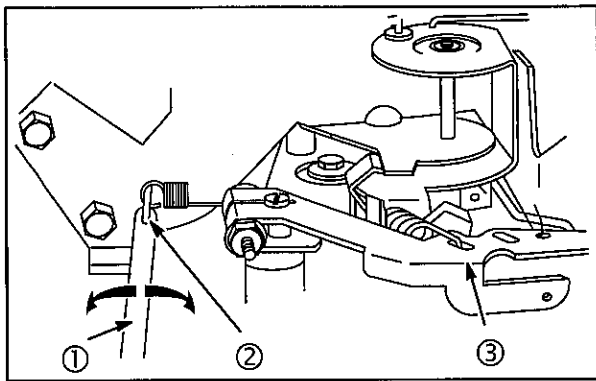


Fig. 32

3. With equipment control lever in SLOW position and engine running at governed idle RPM, use Tang Bender #19352 (1), to bend throttle restrictor tang (4) so that it just contacts governor lever (5), Fig. 33.

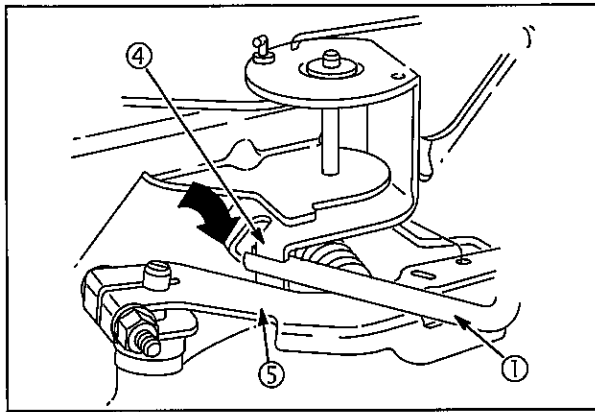


Fig. 33

4. Refer to Service Engine Sales Microfiche, MS-6225 or the Service Engine Sales Manual, MS-4052, for Top No-Load RPM by engine Model and Type Number.
5. Move control throttle lever to FAST position and check engine RPM.
6. Use Tool #19352 (1) to bend tang (6) UP (7) to increase and DOWN (8) to decrease engine speed, to obtain desired Top No-Load RPM, Fig. 34.

NOTE: Air cleaner removed for clarity.

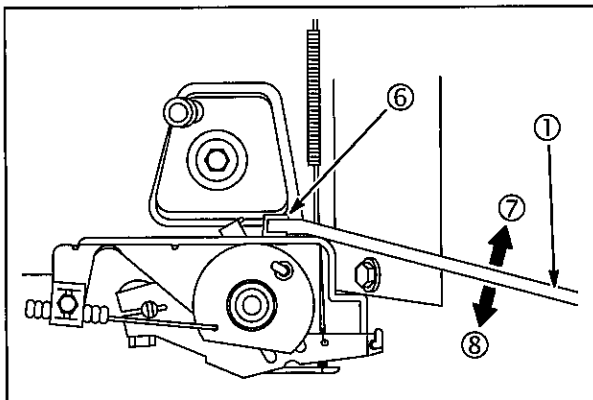


Fig. 34

Fixed Speed Adjustable – Except Generators

Governor spring is installed in #1 hole in governor lever (3), Fig. 35.

Start and run engine for approximately 5 minutes to allow engine to warm up.

1. Turn fixed speed adjustable control nut counter-clockwise until control swivel contacts slow speed stop.
2. Use Tool #19352 (1) to bend governed idle tang (2) to obtain RPM shown:
 - a. 1750 RPM – Governed Idle Spring #805453 (RED).
 - b. 1100 RPM – Governed Idle Spring #805454 (WHITE).

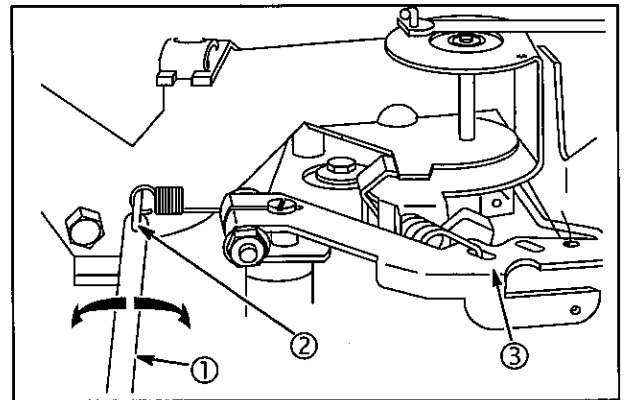


Fig. 35

3. Use Tool #19352 (1) to bend throttle restrictor tang (4) so that it just contacts governor lever (5), Fig. 36.

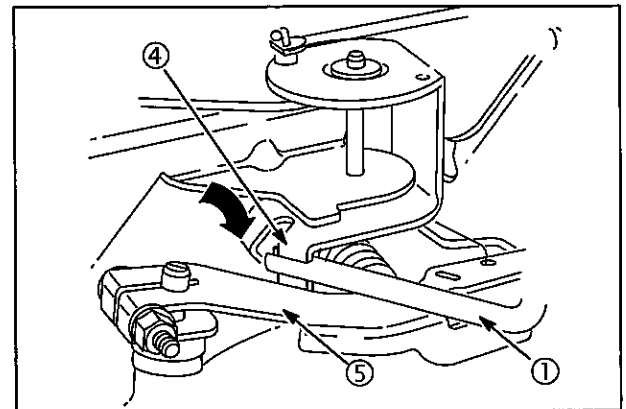


Fig. 36

NOTE: Be sure the governor spring is installed in #1 hole in governor lever (9), Fig. 37.

4. Refer to Service Engine Sales Microfiche, MS-6225 or the Service Engine Sales Manual, MS-4052, for Top No-Load RPM by engine Model and Type Number.

5. Turn fixed speed adjustable control nut (6) clockwise (8) to increase or counter-clockwise (7) to decrease engine speed until desired Top No-Load RPM is obtained, **Fig. 37**.

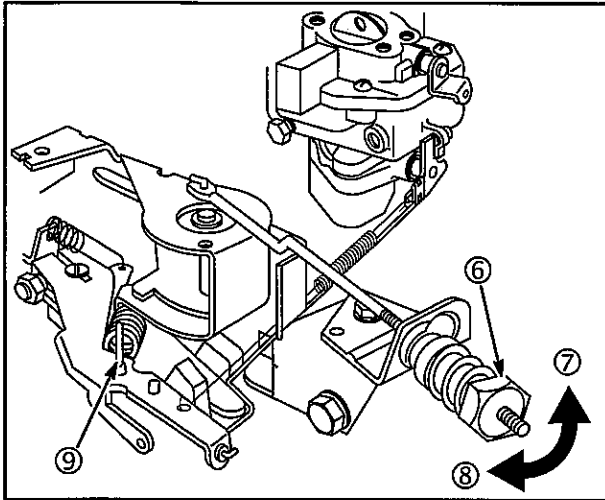


Fig. 37

Fixed Speed Adjustable – Generators

No governed idle spring is used with this system. No throttle restrictor adjustment is necessary. The primary governor spring (1) is installed in #2 hole on governor lever (5). A secondary governor spring (3) is installed with loop (4) over the governor lever tab (4), and the rear loop facing (2) UP as shown in **Fig. 38**.

NOTE: Secondary governor spring must be adjusted **BEFORE** the engine is started. Perform adjustment in the sequence shown.

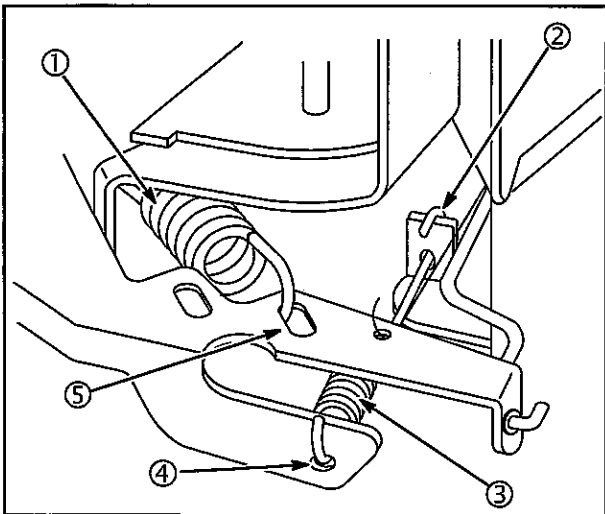


Fig. 38

Adjust Secondary Governor Spring

1. Disengage the adjustable fixed speed control nut (Inset, **Fig. 40**).
2. Loosen and remove fixed speed adjustable control nut, spring and retainer.
3. Rotate governor control swivel (1) counterclockwise to end of travel, **Fig. 39**.
4. Install Adjustment Gauge #19385 (3), with notch over end of governor lever and flat end of tool against governor control bracket as shown in **Fig. 39**.
5. Hold gauge in position and bend tab (5) with Tang Bender #19352 (4) so that all slack is removed from secondary governor spring (2) between its two anchor points, **Fig. 39**. **DO NOT STRETCH SPRING.**
6. Remove adjustment gauge.

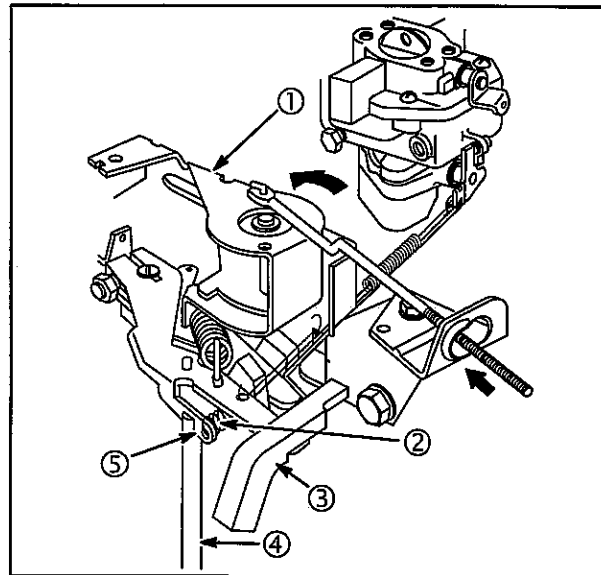


Fig. 39

Start engine. Run for approximately 5 minutes to allow engine to warm up.

7. With engine running, pull control rod (7) out until swivel is against stop. Hold in this position, **Fig. 40**.
8. Use tang bender (4) to bend tang (6). Adjust to Top No-Load RPM for the type of generator listed in Table 1.
9. Re-install control nut, spring and retainer. Turn nut clockwise until threads on control rod are visible from end of nut, inset **Fig. 40**.

TABLE NO. 1

Generator Type	Top No-Load RPM	Regulated No-Load RPM
3600 RPM 60 Cycle	4250 RPM	3750 RPM
3000 RPM 50 Cycle	3600 RPM	3150 RPM

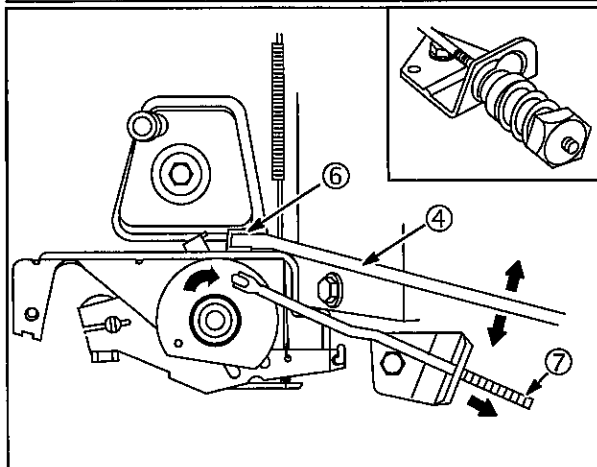


Fig. 40

10. Engage fixed speed adjustable control nut (8) and adjust to Regulated No-Load RPM for the type of generator listed in Table 1, Fig. 41.
 - a. Turn nut CLOCKWISE (10) to increase speed.
 - b. Turn nut COUNTERCLOCKWISE (9) to decrease speed.

NOTE: Final adjustment should be made with generator loaded to rated capacity or to manufacturer's specifications.

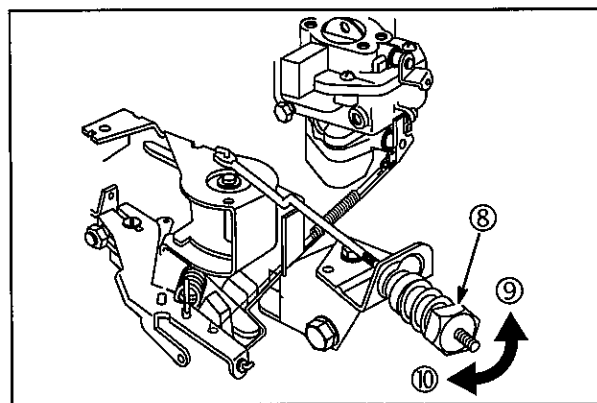


Fig. 41

Remote Speed Control Engines Equipped With Secondary Governor Spring

Some Vanguard™ OHV V-Twin engines with remote speed control are equipped with a secondary governor spring (5). The primary governor spring is installed in #1 hole (3) on governor lever, Fig. 42.

NOTE: The secondary governor spring must be adjusted BEFORE the engine is started. Perform the adjustment in the sequence shown.

Adjust Secondary Governor Spring

1. Move equipment control to SLOW position.
2. Install Adjustment Gauge #19385 (4), with notch over end of governor lever and flat end of tool against governor control bracket as shown in Fig. 42.
3. Hold gauge in position and bend tab (2) with Tang Bender #19532 (1), so that all slack is removed from secondary governor spring (5) between its two anchor points, Fig. 42. DO NOT STRETCH SPRING.
4. Remove adjustment gauge.

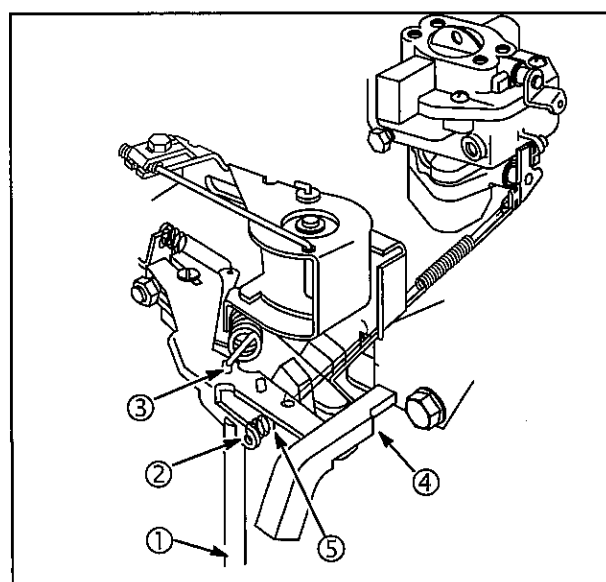


Fig. 42

Start engine. Run for approximately 5 minutes to allow engine to warm up.

5. Move control lever to SLOW position.
6. Use tang bender (1) to bend governed idle tang (6) to obtain RPM shown, Fig. 43:
 - a. **1750 RPM** – Governed Idle Spring #805453 (RED).
 - b. **1100 RPM** – Governed Idle Spring #805454 (WHITE).

NOTE: Engine Model 303447 Type 0411-01 – Set governed idle to **1350 RPM ± 50 RPM**.

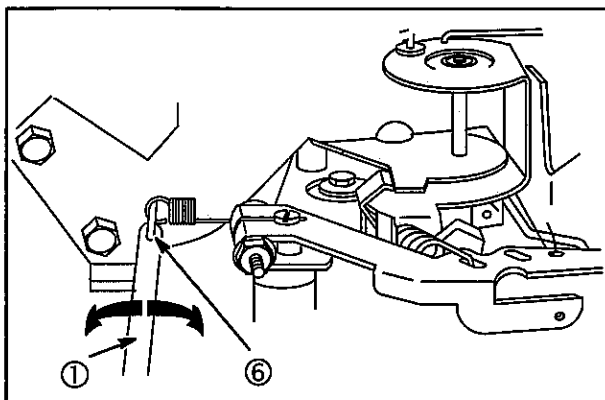


Fig. 43

7. With equipment control lever in SLOW position and engine running at governed idle RPM, use Tang Bender #19352 (1), and bend throttle restrictor tang (7) so that tang just contacts governor lever (8), Fig. 44.

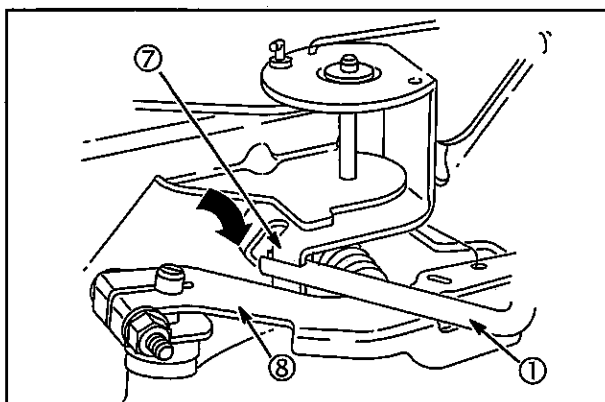


Fig. 44

8. Refer to Service Engine Sales Microfiche, MS-6225 or the Service Engine Sales Manual, MS-4052, for Top No-Load RPM by engine Model and Type Number.
9. Move control throttle lever to FAST position and check engine RPM.
10. Bend tang (8) with Tool #19352 (1) to obtain desired top no-load RPM, Fig. 45.

NOTE: Engine Model 303447 Type 0411-01 – Set Top No-Load Speed to **2900 RPM ± 50 RPM**.

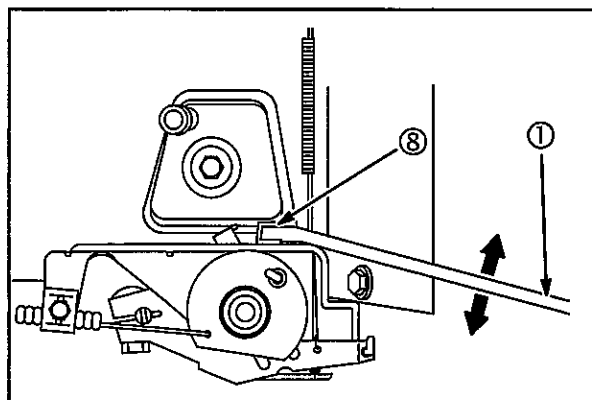


Fig. 45

Oil Cooler

Some engines are equipped with an oil cooler, Fig. 46. The oil cooler is mounted on the blower housing. Filtered oil is routed through the oil cooler through two oil lines from a special oil filter adapter. Forced air from the flywheel fan flows through the oil cooler fins dissipating heat from the engine oil.

The oil cooler fins should be cleaned every **100** hours, checked periodically for debris, and cleaned with compressed air or a soft bristle brush.

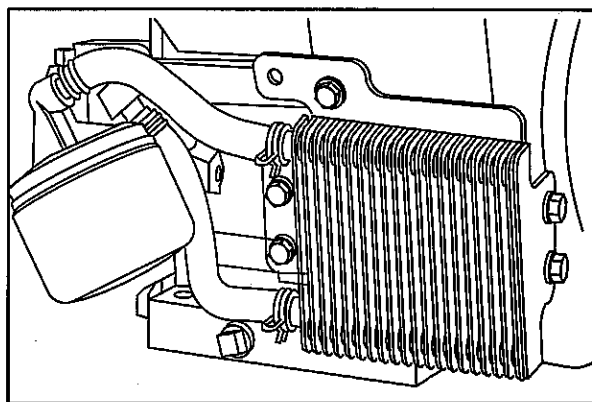


Fig. 46

Spark Plugs

Replace spark plugs every **100** hours of operation or every season, whichever occurs first. Replace spark plugs if electrodes are burned away, or if the porcelain is cracked.

NOTE: 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 (1) to set spark plug gap, Fig. 47.

Torque spark plugs to **180 in. lbs. (20 Nm)**.

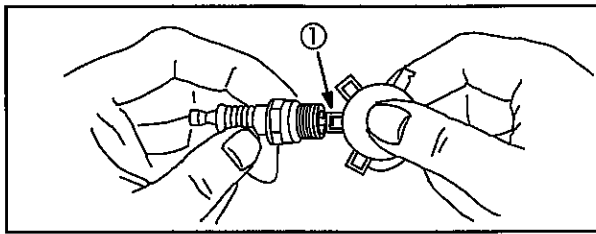


Fig. 47

All Except Models 540000, 610000

Resistor spark plugs recommended by Briggs & Stratton:

- B&S #491055 (Champion RC12YC) or
- B&S #496018 (Champion RC14YC)

Gap to **0.030" (0.76 mm)**.

Models 540000, 610000

Resistor spark plug recommended by Briggs & Stratton:

- B&S #692051

Gap to **0.020" (0.51 mm)**.

Speed Control Wire Adjustment

NOTE: Manual friction and remote control adjustment procedure is identical.

1. Loosen control casing clamp screw (1) at governor control bracket, **Fig. 48**.
2. Move speed control lever to FAST position (inset, **Fig. 48**).
3. Move control casing and wire until governor control swivel is at end of travel.
4. Tighten casing clamp screw.

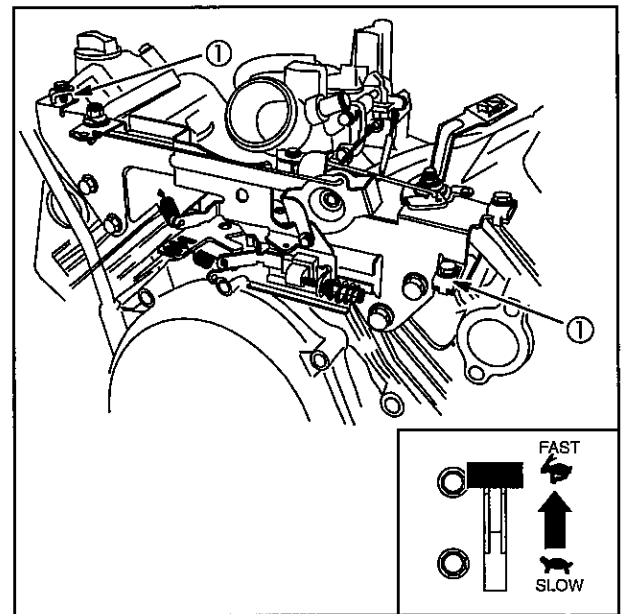


Fig. 48

Valve Clearance Adjustment

1. Set No. 1 cylinder at **1/4" (6 mm)** past TDC, compression stroke.
2. Use a feeler gauge (1) to measure the valve clearance. Valve clearance should be **0.005" (0.13 mm)** for the intake and exhaust valve.

NOTE: Measure valve clearance with the engine **COLD**.

3. If the valve clearance requires adjustment, loosen the lock nut (2) with a wrench (4). Use a hex wrench (5) to turn the adjusting screw (3) to adjust the valves, **Fig. 49**.
4. With the valve clearance correctly adjusted, hold the adjusting screw. Torque the lock nut to **70 in. lbs. (8 Nm)**.
5. Repeat for No. 2 cylinder.

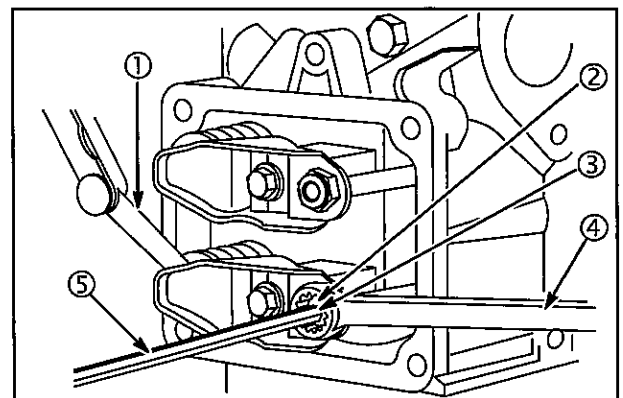


Fig. 49

TUNE-UP PROCEDURE

1

A "Tune-Up," see the steps listed below, would normally be performed on relatively new engines brought in for minor difficulties. By performing these steps you will either be sure that the engine is functioning properly or will know what major repairs should be made. The steps are also covered in the Overhaul Procedure and will normally be performed as a part of the complete overhaul.

1. Disconnect and ground spark plug wires.
2. Remove air cleaner cartridge, check for proper servicing. Check gaskets, pre-cleaner and cartridge for damage.
3. Check oil level. Drain oil. Remove oil filter.
4. Remove blower housing, inspect rewind assembly when equipped.
5. Clean cooling fins and entire engine.
6. Check governor, linkage and springs for damage and wear. Check governor adjustment.
7. Remove intake manifold and carburetor. Disassemble carburetor. Wash in solvent and inspect for wear or damage. Replace gaskets and parts as necessary. Reinstall carburetor on manifold. Set initial adjustment.
8. Replace spark plugs. Remove flywheel. Check flywheel key. Check for oil seal leakage on both flywheel and PTO sides.
9. Check coils. Inspect all wires for breaks and/or damaged insulation. Be sure ground wires do not touch flywheel. Check ground wire and stop switch connections.
10. Remove cylinder heads. Remove carbon. Check head gaskets. Inspect valves for seating.
11. Install cylinder heads and new gaskets. Tighten to specified torque. Adjust valve clearance. Set spark plug gaps.
12. Reinstall intake manifold using new gaskets.
13. Reinstall blower housing.
14. Install new oil filter. Replace oil and fuel.
15. Adjust equipment control and cables, if used, for correct operation.
16. Service air cleaner pre-cleaner and cartridge, or replace.
17. Check muffler for restrictions or damage.
18. Start engine and bring up to operating temperature. Then, adjust carburetor mixture and engine top speed.

OVERHAUL PROCEDURE

The following Overhaul Procedure is intended to help you to establish a systematic method of repairing Briggs & Stratton OHV engines. These steps may be performed in a different order but best efficiency is obtained when the repairs are performed in the same sequence every time. The exact procedure will vary according to the engine model being repaired. Be careful to locate the instructions covering the specific model being repaired.

Disassemble

1. Drain oil. Remove oil filter.
2. Remove spark plugs.
3. Air cleaner assembly (if equipped).
Fuel tank and bracket assembly (if equipped).
Fuel pump and bracket (if equipped).
4. Rotating screen (if equipped). Blower housing.
5. Rewind starter (if equipped).
6. Exhaust manifold, muffler(s).
7. Intake manifold and carburetor.
8. Check throttle shaft and bushings for wear.
9. Disassemble carburetor.
10. Check armature air gap. Remove armatures.
11. Flywheel.
12. Electric starter.
13. Breather. Valve covers and valley cover.
14. Governor control bracket.
15. Check valve clearances.
16. Cylinder shields, rocker arms, push rods, cylinder heads.
17. Valves, springs and seals. Inspect valve guides and seats.
18. Check crankshaft end play. Remove burrs from crankshaft extension.
19. Crankcase cover. Inspect bearings. Remove oil seal.
20. Cam gear and tappets. Inspect governor.
21. Connecting rods and pistons.
22. Inspect crankshaft.

23. Cylinder – check cylinder bores and bearings. Remove oil seal.
24. Disassemble and check connecting rods, pistons, piston pins and rings.
25. Disassemble and inspect oil pump.

Inspection and Repairs

1. Clean parts.
2. Resize cylinder bore as required.
3. Replace main bearing.
4. Replace all oil seals.
5. Replace valve guides.
6. Reface and lap valves and seats.
7. Replace armatures.
8. Repair carburetor.
9. Replace rewind starter spring and rope (if equipped)

Reassemble

1. Crankshaft.
2. Pistons, piston pins, rings and connecting rods.
3. Tappets, cam gear.
4. Mechanical governor.
5. Oil pump.
6. Crankcase cover – check end play. Replace oil seal.

7. Electric starter.
8. Flywheel and starter pulley (if equipped).
9. Armatures – adjust air gap.
10. Check spark.
11. Valves, seals, springs and retainers.
12. Cylinder heads, push rods, rocker arms and cylinder shields.
13. Adjust valve clearance.
14. Valve covers, breather and valley cover.
15. Linkage and governor controls.
16. Carburetor and intake manifold.
17. Check and adjust mechanical governor.
18. Blower housing.
19. Fuel pump and bracket (if equipped).
Fuel tank and bracket (if equipped).
20. Clean and assemble air cleaner.
21. Exhaust manifold, mufflers.
22. Install new spark plugs.
23. Replace oil filter. Fill crankcase with oil. Fill with gas. Start engine.
24. Adjust carburetor.
25. Adjust governor controls to obtain correct engine speed (remote controls).
26. Re-torque cylinder head screws.
27. Spray paint engine and apply decals.

Section 2

Troubleshooting

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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

NOTE: What appears to be an engine problem may actually be the fault of the powered equipment. If equipment is suspect, see Equipment Affecting Engine Operation.

SYSTEMATIC CHECK



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 engine models. 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
2. Carburetion
3. Compression

Ignition

Test Using Electric Starter

NOTE: Magneton® ignition systems require a minimum of **350 RPM** to produce spark.

	 WARNING
AVOID ELECTRICAL SHOCK!	
<ul style="list-style-type: none"> • A partially sheared flywheel key will affect ignition timing and engine performance. • Spark can still occur with a sheared flywheel key. A severe shock or kickback hazard may exist. 	

With spark plugs installed, attach Ignition Tester #19368 (1) to each spark plug lead (2). Ground the other end of the tester as shown, **Fig. 1**. Spin the flywheel rapidly with engine starter. If spark jumps the tester gap the ignition system is working correctly.

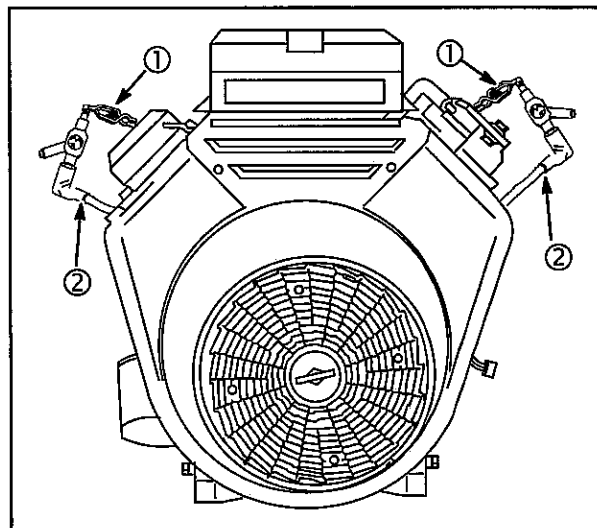


Fig. 1

If there is **NO SPARK** look for –

1. Improperly operating equipment interlock system
2. Shorted equipment stop switch wire
3. Two closed diodes in ground wire harness (current style) or ground terminal (early style)
4. Incorrect armature air gap
5. Armature failure

Test With Engine Running

If the engine runs, but misses under load, test the ignition by installing an Ignition Tester #19368 (2) between the spark plug lead (1) and each spark plug (3), **Fig. 2**. A spark miss will be readily apparent when the engine is running. If the spark appears good in the tester but the engine misses, check for a fouled spark plug.

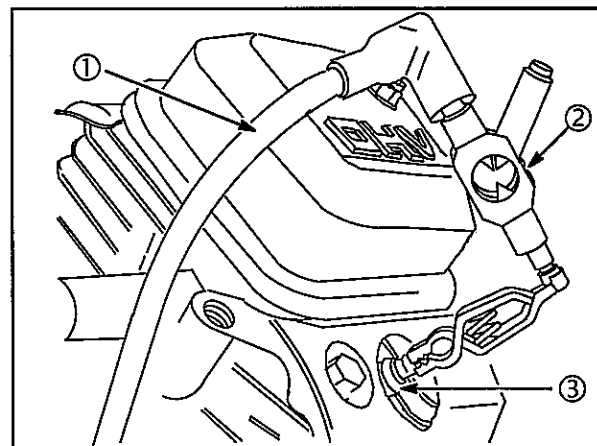


Fig. 2

Fouled Plug or Dead Cylinder

To test for a fouled spark plug or a non-functioning cylinder, attach Ignition Tester #19368 (2) between the spark plug lead (1) and each spark plug (4). With engine running at top no-load speed, use a screwdriver (3) with an insulated handle to ground one spark plug by contacting the alligator clip on the ignition tester to a good ground on the engine, **Fig. 3**. The engine should continue to run on the other cylinder. Repeat this test with the other cylinder. If the engine dies when performing this test, the cylinder that is NOT grounded is not functioning and/or the spark plug is fouled. Install a new spark plug and re-check. If miss continues see the following procedures.

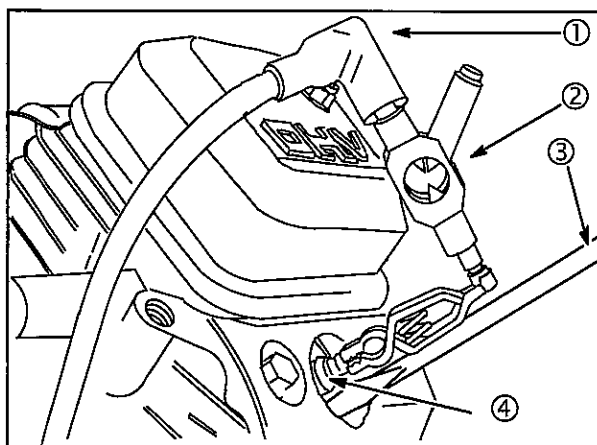


Fig. 3

Carburetion

NOTE: Gaseous fuel engines use carburetors that must be serviced by a certified gaseous fuel installer or by a certified dealer for the equipment powered.

Before performing a carburetion check, 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 before starting engine. Inspect and adjust the idle needle valve. Make sure the choke closes completely. If engine will not start, remove and inspect the spark plugs.

If plugs are wet, look for –

1. Overchoking
2. Excessively rich fuel mixture
3. Water in fuel
4. Float needle valve stuck open
5. Plugged air cleaner

If plugs are dry, look for –

1. Leaking carburetor mounting gaskets
2. Gummy or dirty carburetor, fuel line or tank
3. Float needle valve stuck shut
4. Inoperative fuel pump
5. Inoperative anti-afterfire solenoid

To determine if fuel is getting to the combustion chamber through the carburetor, remove either 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, look for the same conditions as for a dry plug.

Compression

Compression Test

Briggs & Stratton does not publish compression pressures, as it is difficult to obtain an accurate reading without special equipment. An assessment of the engine's compression can be made as follows:

Remove both spark plugs and insert a compression gauge into either cylinder (one cylinder at a time). Turn engine over with engine starter until there is no further increase in gauge pressure reading. Record this reading. Repeat procedure on other cylinder and record that reading. Divide the difference between the cylinders by the compression pressure of the higher of the two cylinders. A difference over **25%** between the cylinders indicates a loss of compression in the cylinder with lower pressure. See example below.

	Engine #1	Engine #2
Cylinder #1	65 PSI	75 PSI
Cylinder #2	60 PSI	55 PSI
Difference	5 PSI	20 PSI
% Difference	7.7%	26.7%

If compression is poor, look for –

1. Loose cylinder head bolts
2. Blown head gasket
3. Burned valves, burned and/or loose valve seats
4. Insufficient valve clearance
5. Warped cylinder head
6. Warped valve stems
7. Worn bore and/or rings
8. Broken connecting rods

Cylinder Leakdown Test


Use a leakdown tester to test the sealing capability of each cylinder. Follow the instructions for the leakdown tester you are using to determine the likely problem area(s).

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

NOTE: If the 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 plug from engine. Disconnect crankcase breather tube.
3. Rotate crankshaft in direction of operation until piston is at Top Dead Center (TDC) of the compression stroke.
4. Hold flywheel nut with socket and breaker bar.

NOTE: Hold the crankshaft with the piston at TDC to minimize the chance of rotation.

	CAUTION
AVOID INJURY!	
<ul style="list-style-type: none">• Injury could occur if the crankshaft is allowed to rotate or if the engine is not securely fastened to a stand or to the application.	

5. Connect tester to a shop air source with minimum air pressure of **70 psi (480 kPa)**.
6. Install outlet hose into spark plug hole of cylinder being tested. Insure O-ring is seated to prevent air leak at spark plug hole. Connect other end to tester.
7. While securely holding the flywheel nut with the breaker bar and socket, pull the adjustment knob **OUT** (arrow), **Fig. 4**. Slowly turn the regulator adjustment knob (1) **CLOCKWISE** until tester needle (2) is on the set point. Push in regulator adjustment knob.

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

8. Slowly open the valve and note the reading on the gauge.

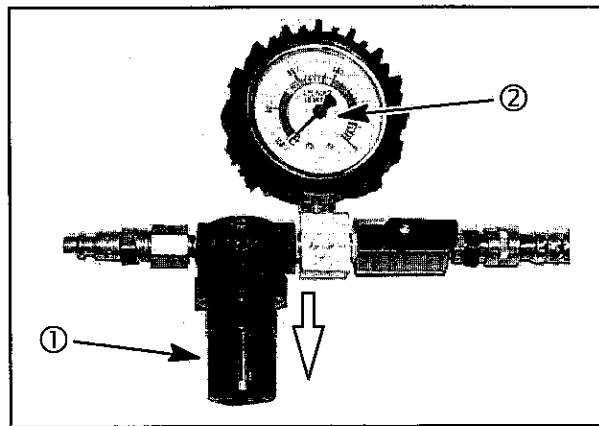


Fig. 4

Cylinder Balance Test

If the engine starts hard, runs rough, misses or lacks power, perform a cylinder balance test to determine whether both cylinders are operating correctly.

A cylinder balance test will also detect a cylinder that is not functioning. When grounding one cylinder there will be no RPM loss. When the other cylinder is grounded the engine will stop.

- Tools Required:

Tachometer #19200

Two @ Ignition Tester #19368

Screwdriver with insulated handle.

1. Attach Ignition Tester #19368 (2) between each spark plug lead (1) and spark plug (3), **Fig. 5**.

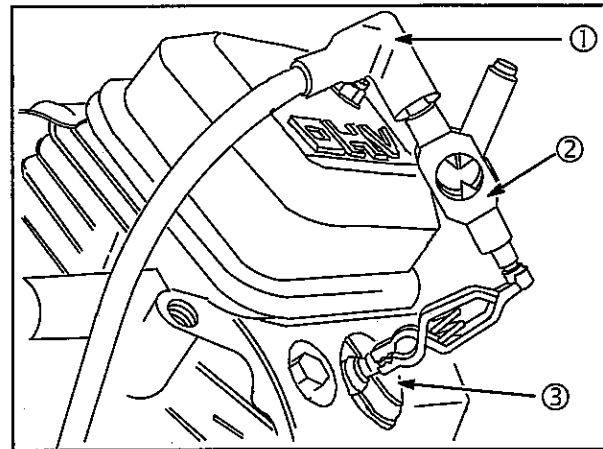


Fig. 5

2. Start engine. Run at top no-load speed and note spark at ignition testers. If the spark is equal at both ignition testers, the problem is not ignition related. A spark miss should be readily apparent.
3. Note RPM of engine. Ground one cylinder with screwdriver (4) by contacting alligator clip on ignition tester to a good ground on engine, **Fig. 6**. Note RPM loss.

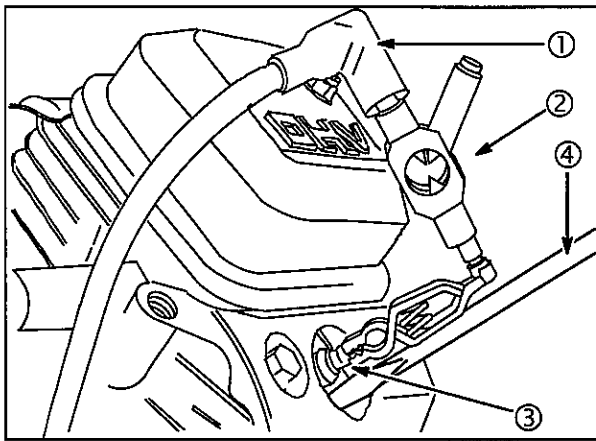


Fig. 6

4. Ground the other spark plug and again note the RPM loss.

If the difference between the two cylinders does **not exceed 75 RPM**, the amount of work the two cylinders are doing is considered equal.

An RPM loss **greater than 75 RPM** indicates that the cylinder with the lower RPM loss is the weaker of the two cylinders. Look to that cylinder for a problem. See example below.

Engine RPM – Both Cylinders = **3400 RPM**

Engine RPM – Cylinder #1 Grounded = **3300 RPM**

Engine RPM – Cylinder #2 Grounded = **3100 RPM**

Conclusion: Cylinder #1 is weaker cylinder.

NOTE: A partially sheared flywheel key will affect ignition timing and engine performance.

Problems Affecting One Cylinder

NOTE: A two cylinder engine will run on one cylinder as long as the power required for the application does not exceed the power produced by one cylinder.

1. Spark plug – A fouled spark plug may also indicate that carburetor is out of adjustment.
2. Spark plug wire
3. Head gasket
4. Intake manifold – A leak at either end of the intake manifold will affect only one cylinder.
5. Valves
6. Rings
7. Piston
8. Cylinder

Problems Affecting Two Cylinders

1. Carburetion
2. Crankcase vacuum
3. Ignition timing

ELECTRICAL SYSTEMS

Alternators

Alternator System Diagnosis

The following list is provided to help diagnose alternator system problems.

2

COMPLAINT	POSSIBLE CAUSES
Battery not charging	<ul style="list-style-type: none">• Engine RPM too low.• Inline fuse "blown" (if equipped).• Defective battery.• Loose, pinched, or corroded battery ground leads.• Loose, pinched, or corroded battery charge leads.• Open, shorted, or grounded wires between output connector and battery.• Defective diode (open or shorted).• Defective or improperly grounded regulator-rectifier.• Diode installed incorrectly (reversed).• Damaged battery (shorted battery cells).• Excessive current draw from accessories.• Low magnetic flux or damaged alternator magnets.
Battery overcharged	<ul style="list-style-type: none">• Severe battery vibration (missing or broken tie-down straps).• Battery rate of charge not matched to alternator output.• Damaged battery (shorted battery cells).• Defective regulator.• One OHM resistor shorted or grounded (Tri-Circuit system only).
Headlamps not working	<ul style="list-style-type: none">• Inline fuse "blown" (if equipped).• Defective headlamps.• Loose or corroded wires.• Open, shorted or grounded wires between output connector and headlamps.• Light switch defective.• Defective diode Tri-Circuit system (open or shorted – white output lead side).• Low magnetic flux or damaged alternator magnets.
Electric clutch not working (Tri-Circuit Alternator)	<ul style="list-style-type: none">• Inline fuse "blown" (if equipped).• Loose or corroded wires.• Open, shorted or grounded wires between output connector and electric clutch.• Defective diode (open or shorted - red output lead side).• NOTE: Battery will also not charge.• Defective electric clutch switch.• Open, shorted or grounded clutch circuit.• Low magnetic flux or damaged alternator magnets.

Charging System Identification

Table No. 1 provides a means of identifying the various alternator systems.

The alternator systems installed on Briggs & Stratton OHV V-Twin Cylinder Engines can be identified by the color of the stator output wires and the connector.

TABLE 1

Alternator Type	Stator Output Wire(s) Color	Connector Color	Alternator Output (at 3600 RPM)	Test Page
AC Only	Black	White	5 Amps AC (Lights) Unregulated	35
DC Only	Red	Red	2-4 Amps + DC (Charging) Unregulated	36
Dual Circuit	Red Black	White	2-4 Amps + DC (Charging) Unregulated 5 Amps AC (Lights) Unregulated	37
Tri-Circuit	Black	Green	5 Amps + DC (Charging) 5 Amps – DC (Lights)	38
Regulated 5 Amp	Black	Green	* 1-5 Amps + DC (Charging) Regulated	40
Regulated 9 Amp	Black	Green	* 1-9 Amps + DC (Charging) Regulated	40
Regulated 10 Amp	2-Black	Yellow	* 1-10 Amps + DC (Charging) Regulated	41
Regulated 16 Amp	2-Black	Yellow	* 1-16 Amps + DC (Charging) Regulated	41
Regulated 20 Amp	2-Yellow	White	* 1-20 Amps + DC (Charging) Regulated	43

* Alternator output is determined by flywheel alternator magnet size.

Flywheel Magnet Identification

NOTE: Does NOT include engines with the Power-Link™ system.

The V-Twin flywheels have a ring of magnets (1) on the inside of the flywheel, **Fig. 7**, that provides the magnetic field for the charging systems. The size of the magnet determines the alternator output.

NOTE: Flywheels are NOT interchangeable. Use ONLY correct flywheel for the application.

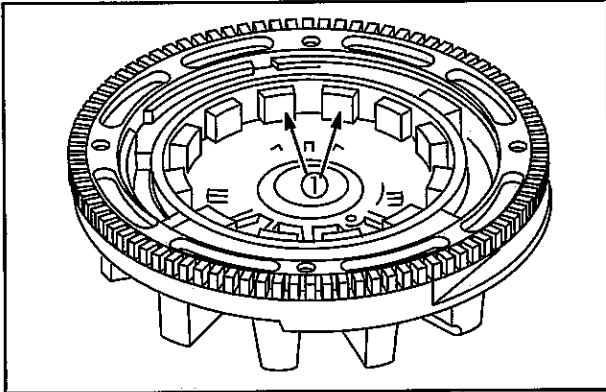


Fig. 7

Table 2 identifies the magnet size used with the different charging systems.

TABLE 2

Alternator	Small Magnet	Large Magnet	20A Fly-wheel
Magnet Size	7/8 X 21/32" (22 X 17 mm)	7/8 X 29/32" (22 X 23 mm)	1-3/32 X 29/32" (27 X 23mm)
AC Only	•		
DC Only	•		
Dual Circuit	•		
Tri-Circuit	•		
Regulated 5 A	•		
Regulated 9 A		•	
Regulated 10 A	•		
Regulated 16 A		•	
Regulated 20 A			•

Equipment Used to Test Alternators

Digital Multimeter

The Digital Multimeter #19464, **Fig. 8**, is available from your Briggs & Stratton source of supply. The Digital Multimeter can be used to read volts, ohms, amperes, and to test diodes.

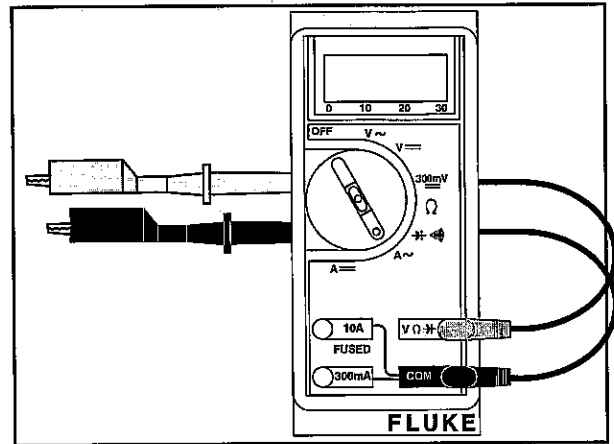


Fig. 8

DC Shunt

The Digital Multimeter will withstand DC input of **10 - 20 amps** for up to **30 seconds**. When checking DC output on 16 and 20 amp regulated systems, use the DC Shunt #19359, **Fig. 9**, to avoid blowing a fuse in the Multimeter.

NOTE: The Digital Multimeter is equipped with two fuses to prevent damage to the meter if the input limits of the meter are exceeded. Check the fuses if the meter displays a reading of **0.00** when testing DC output (V==). Refer to the FLUKE Operators Manual for this procedure. Replacement fuses, Part # 19449, are available from your Briggs & Stratton source of supply.

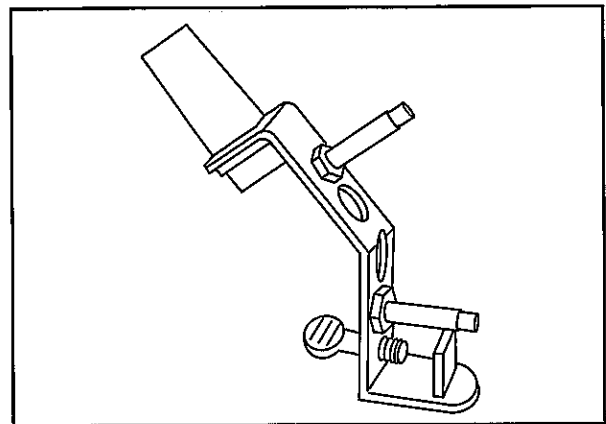



Fig. 9

Testing Alternator Output

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

NOTE: Before testing alternator output, use an accurate tachometer to temporarily adjust the engine speed to the RPM specified in the test instructions.

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

	<p>WARNING</p> <p>AVOID INJURY! Engine may exceed safe operating speed, causing personal injury.</p>
<ul style="list-style-type: none">• UPON COMPLETION OF THE ALTERNATOR OUTPUT TEST, READJUST THE ENGINE TO THE CORRECT TOP NO-LOAD GOVERNED SPEED!• Correct speed is found in the Service Engine Sales Manual Microfiche, MS-6225 or the Service Sales Manual, MS-4052.	

AC Alternator

The AC alternator provides current for headlights only. Current for the lights is available when the engine is running. To check, use **12 volt** lights with a total rating of **60 – 100 watts**. Alternator output varies with engine speed. With lights rated at **70 watts**, the voltage rises from **8 volts @ 2400 RPM** to **12 volts @ 3600 RPM**. The lights should become brighter as the engine speed increases.

1. Stator assembly (1), **Fig. 10**, is 5 amps or 14 volts AC for lighting circuit.
2. One BLACK lead from stator (2).
3. WHITE connector output lead (3).

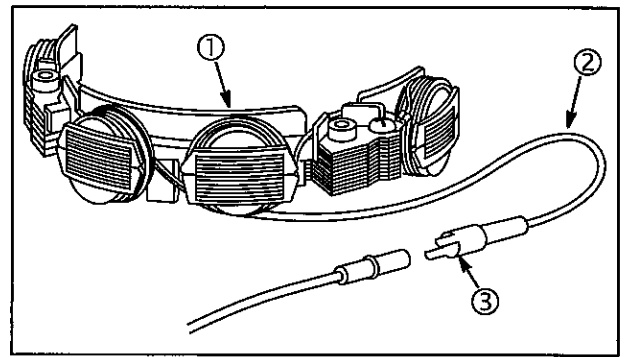


Fig. 10

Output Test

1. Insert RED test lead (2) into **VΩ** receptacle in meter.
2. Insert BLACK test lead (1) into **COM** receptacle.
3. Rotate selector to **V~ (AC VOLTS)** position.
4. Attach RED test lead clip to AC output terminal (3), **Fig. 11**.
5. Attach BLACK test lead clip to engine ground.
6. With engine running at **3600 RPM**, AC output should be no less than **14 volts**.

If **NO** or **LOW** output is found, replace the stator.

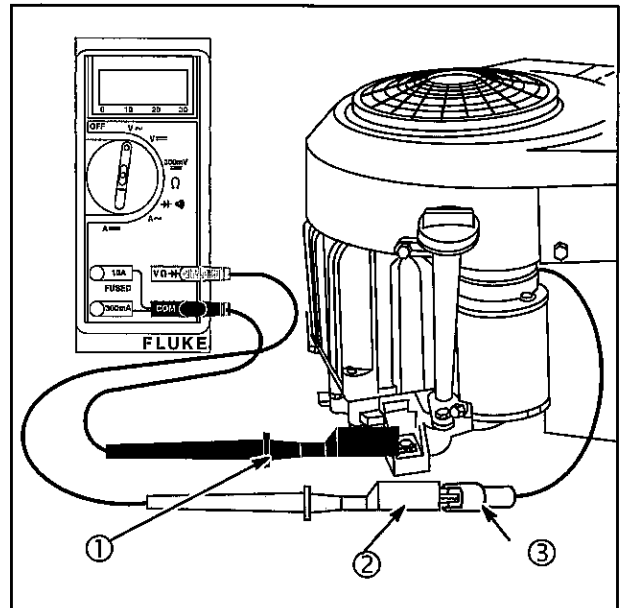


Fig. 11

DC Alternator

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

1. Stator assembly (1), Fig. 12.
2. One RED lead from stator (2).
3. DIODE encased at connector (3).
4. RED connector output lead (4).

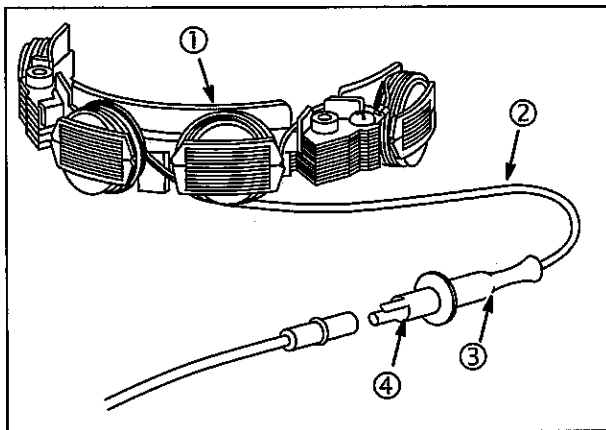


Fig. 12

Output Test

NOTE: The battery MUST be in good condition to perform this test.
WHEN CHECKING ALTERNATOR COMPONENTS, PERFORM THE TEST IN THE FOLLOWING SEQUENCE:

1. Insert RED test lead into **10A** receptacle in meter.
2. Insert BLACK test lead into **COM** receptacle.
3. Rotate selector to **A==** (DC amps) position.
4. Attach RED test lead clip (1) to DC output terminal, Fig. 13.
5. Attach BLACK test lead clip to POSITIVE (+) battery terminal (2).
6. With engine running at **3600 RPM**, output should be **2 - 4 amps DC**.

NOTE: The output will vary with the battery voltage. If the battery is at maximum voltage the output will be approximately 2 amps.

7. If **NO** or **LOW** output is found, test diode.

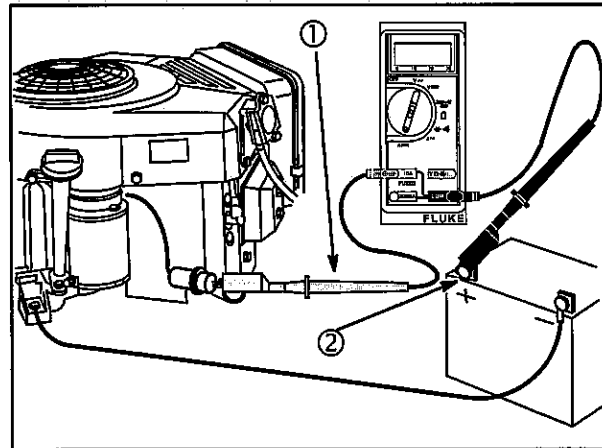


Fig. 13

Diode Test

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 and display the voltage drop. A **CONTINUOUS TONE** indicates CONTINUITY (shorted diode). An **INCOMPLETE CIRCUIT** (open diode) is displayed as **OL**.

1. Insert RED test lead (1) into **VΩ** receptacle in meter.
2. Insert BLACK test lead (2) into **COM** receptacle in meter.
3. Rotate selector to **+)))))** (**DIODE TEST**) position.
4. Attach RED test lead clip to point A and BLACK test lead clip to the stator output lead (3), Fig. 14. (It may be necessary to pierce the wire with a pin as shown.)
 - a. If meter **BEEPS once**, diode is OK.
 - b. If meter makes a **CONTINUOUS TONE**, diode is defective (shorted). Replace diode.
 - c. If meter displays **OL** proceed to step 5.
5. Reverse test leads.
 - a. If meter **BEEPS once**, diode is installed backwards. Replace diode.
 - b. If meter still displays **OL**, diode is open. Replace diode.
6. If diode tests OK, check stator for bare wires or other obvious defects. If bad or grounded leads are not visible, replace the stator.

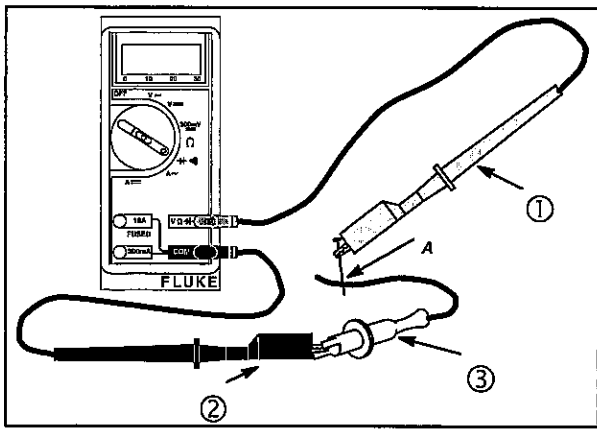


Fig. 14

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

Dual circuit alternators use a polarized plug with two pins. One pin provides DC current for charging the battery, the second pin is an independent AC circuit for headlights.

Current for lights is available when the engine is running. The output varies with engine speed, so brightness of the lights changes with engine speed. **12 volt** lights with a total rating of **60 to 100 watts** may be used. With lights rated at **70 watts**, the voltage rises from **8 volts @ 2400 RPM** to **12 volts at 3600 RPM**. Since the battery is not used for the lights, the lights are available even if the battery is disconnected or removed.

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

1. Stator assembly (1), Fig. 15.
2. RED lead from stator (2), DC output for charging battery.
3. BLACK lead from stator (3), AC output for lighting circuit.
4. DIODE encased at connector (4).
5. WHITE lead (5) for AC lighting circuit.
6. RED lead (6) for DC charging circuit.

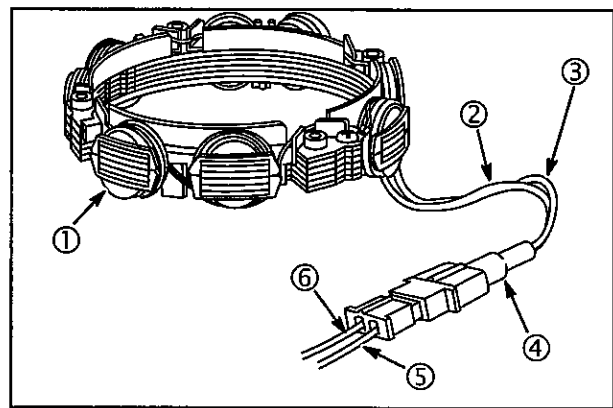


Fig. 15

DC Output Test

NOTE: The battery **MUST** be in good condition to perform this test.

1. Insert RED test lead into **10A** receptacle in meter.
2. Insert BLACK test lead into **COM** receptacle in meter.
3. Rotate selector to **A==** (DC AMPS) position.
4. Attach RED test lead clip (1) to DC output pin (6) in connector (4), Fig. 16.

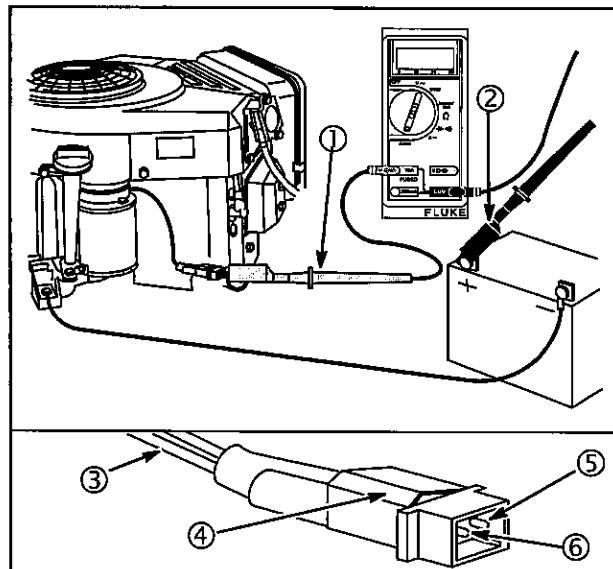


Fig. 16

NOTE: The raised rib on the connector or the RED wire (3) indicates the DC output pin side. The AC pin (5) is not used for this test.

5. Attach BLACK test lead clip (2) to POSITIVE (+) battery terminal.
6. With engine running at **3600 RPM** output should be between **2 - 4 amps DC**.

NOTE: The output will vary with the battery voltage. At maximum battery voltage the output will be approximately 2 amps.
7. If **NO** or **LOW** output is found, test diode.

Diode Test

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 and display the voltage drop. A **CONTINUOUS TONE** indicates **CONTINUITY** (shorted diode) An **INCOMPLETE CIRCUIT** (open diode) will be displayed as **OL**.

2

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.
4. Attach RED test lead clip (1) to point A and BLACK test lead clip (2) to DC output pin (6), **Fig. 17**. (It may be necessary to pierce wire with a pin as shown.)
 - a. If meter **BEEPS** once, diode is OK.
 - b. If meter makes a **CONTINUOUS TONE**, diode is shorted. Replace diode.
 - c. If meter displays **OL**, proceed to step 5.
5. Reverse test leads.
 - a. If meter **BEEPS** once, diode is installed backwards. Replace diode.
 - b. If meter still displays **OL**, diode is open. Replace diode.
6. If diode tests OK, check stator for bare wires or other obvious defects. If grounded leads are not visible, replace the stator.

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.**

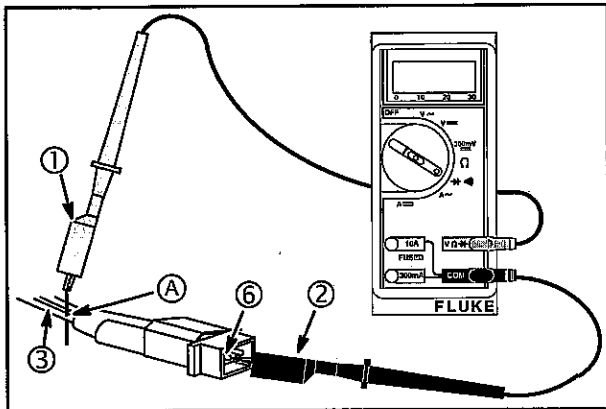


Fig. 17

AC Output Test

1. Insert RED test lead into **VΩ** receptacle in meter.
2. Insert BLACK test lead into **COM** receptacle.
3. Rotate selector to **V~** (AC VOLTS) position.
4. Attach RED test lead clip (1) to AC output terminal (5), **Fig. 18**.
5. Attach BLACK test lead clip (2) to engine ground.
6. With engine running at 3600 RPM output should be no less than **14 volts AC**.
7. If **NO** or **LOW** output is found, replace stator.

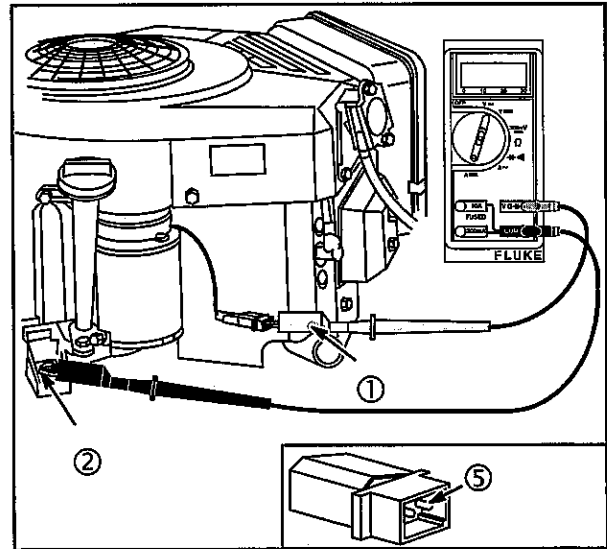


Fig. 18

Tri-Circuit Alternator

The tri-circuit alternator provides alternating current (AC) through a single output lead and connector to a wiring harness containing two diodes.

One diode rectifies the AC current to 5 amps **NEGATIVE (-) DC** for lights. The second diode rectifies the AC current to 5 amps **POSITIVE (+) DC** for battery charging and external loads, such as an electric clutch.

NOTE: Some original equipment manufacturers (OEMs) supply diodes as an integral part of the equipment wiring harness. Some OEMs use a 1 Ohm-20 Watt resistor placed in series with (+) 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.

The battery is not used for the lights, so lights are available even if the battery is disconnected or removed. Current for the lights is available when the engine is running. The output varies with engine RPM, so the brightness of the lights changes with engine speed.

Stator assembly (1), Fig. 19.

BLACK lead from stator (2).

Connector (3).

Two diodes encased in wiring harness (4).

WHITE lead – 5 amps DC (–) to lights (5).

RED lead – 5 amps DC (+) to battery, clutch (6).

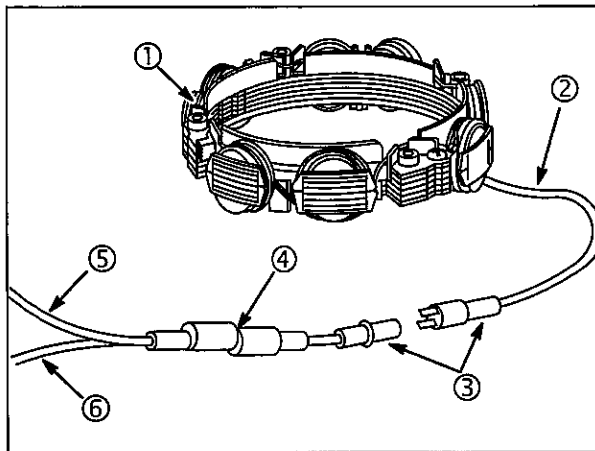


Fig. 19

Output Test

1. Insert RED test lead into **VΩ** receptacle in meter.
2. Insert BLACK test lead into **COM** receptacle.
3. Rotate selector to **V~ (AC VOLTS)** position.
4. Attach RED test lead clip (1) to output terminal (GREEN connector), 20.
5. Attach BLACK test lead clip (2) to engine ground.
6. With engine running at **3600 RPM**, output should be no less than **28 VOLTS AC**.
7. If **NO** output or **LOW** output is found, replace stator.
8. If alternator output is good, test the diodes in the wiring harness.

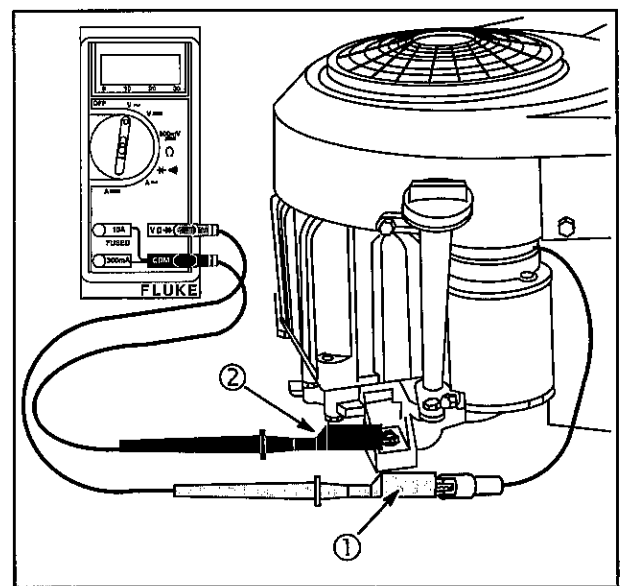


Fig. 20

Diode Test

NOTE: One diode is for the charging circuit, 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**.

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.
4. Attach BLACK test lead clip (2) to point A of the RED wire (3), Fig. 21. (It may be necessary to pierce wire with a pin as shown.)
5. Insert RED test lead (1) into harness connector.
 - a. If meter **BEEPS** once, diode is OK.
 - b. If meter makes a **CONTINUOUS TONE**, diode is shorted. Replace harness.
 - c. If meter displays **OL** proceed to step 6.
6. Reverse test leads.
 - a. If meter **BEEPS ONCE**, diode is installed backwards. Replace harness.
 - b. If meter still displays **OL**, diode is open. Replace harness.

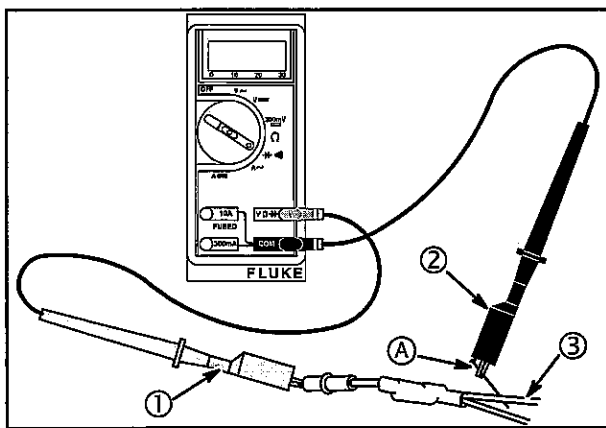


Fig. 21

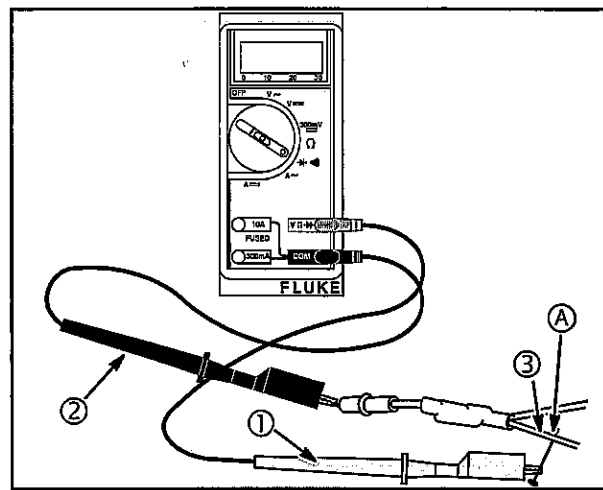


Fig. 22

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.
4. Attach RED test lead clip (1) to point A, of the WHITE wire (3) Fig. 22. (It may be necessary to pierce wire with a pin as shown.)
5. Insert BLACK test lead probe (2) into harness connector.
 - a. If meter **BEEPS** once, diode is OK.
 - b. If meter makes a **CONTINUOUS TONE**, diode is shorted. Replace harness.
 - c. If meter displays **OL** proceed to step 6.
6. Reverse test leads.
 - a. If meter **BEEPS** once, diode is installed backwards. Replace harness.
 - b. If meter still displays **OL** diode is open. Replace harness.

NOTE: Service replacement diode harnesses are available.

5 & 9 Amp Regulated Alternator

The 5 & 9 amp regulated alternator systems provide AC current through a single lead to the regulator-rectifier. The regulator-rectifier converts the AC current to DC and regulates current to the battery. The charging rate will vary with engine RPM and temperature.

Alternator output is determined by the flywheel alternator magnet size. The stator and regulator-rectifier are the same for the 5 & 9 amp regulated system and the Tri-Circuit system.

Stator assembly (1), Fig. 23.

BLACK lead (2).

GREEN connector (3).

YELLOW wire (4).

RED connector (5).

Regulator-rectifier (6).

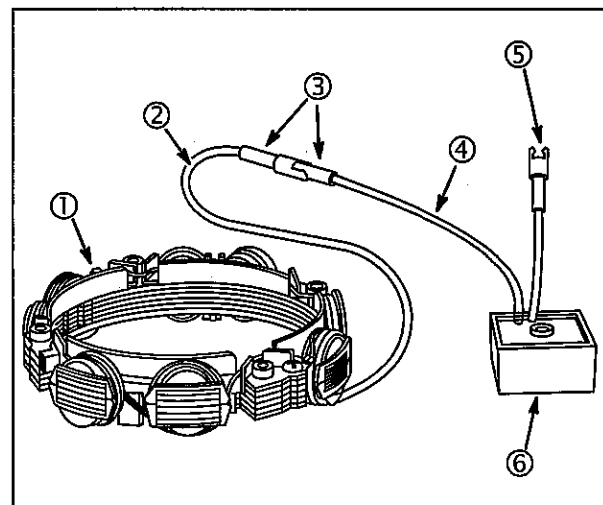


Fig. 23

Output Test

WHEN CHECKING ALTERNATOR COMPONENTS MAKE TESTS IN THE FOLLOWING SEQUENCE:

Temporarily disconnect stator wire harness from regulator-rectifier.

1. Insert RED test lead into **VΩ** receptacle in meter.
2. Insert BLACK test lead into **COM** receptacle.
3. Rotate selector to **V~** (AC VOLTS) position.
4. Attach RED test lead clip (1) to GREEN output terminal (3), Fig. 24.
5. Attach BLACK test lead clip (2) to engine ground.
6. With the engine running at **3600 RPM**, AC output should be **no less than**:
 - **28 Volts AC – 5 Amp System**
 - **40 Volts AC – 9 Amp System**
7. If **NO** or **LOW** output is found, replace the stator.

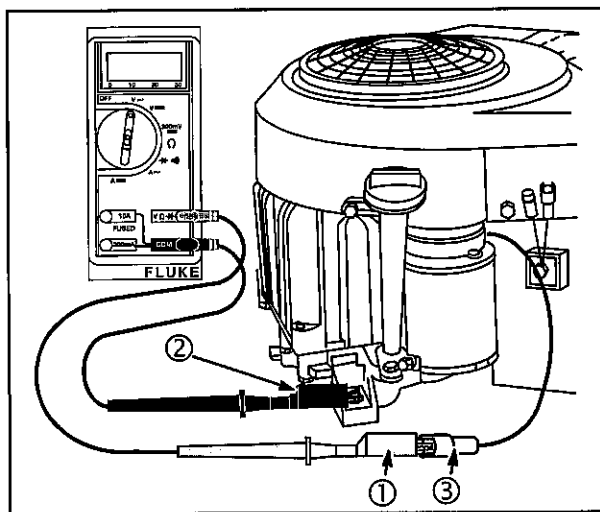


Fig. 24

Regulator-Rectifier Test

NOTE: The regulator-rectifier will not function unless it is grounded to engine. Make sure the regulator-rectifier is securely mounted to the engine. When testing regulator-rectifier for amperage output, a 12 volt battery with a minimum charge of 5 volts is required. There will be no 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, the regulator-rectifier may be damaged.

Connect stator wire harness to regulator-rectifier.

1. Insert RED test lead into **10A** receptacle in meter.
2. Insert BLACK test lead into **COM** receptacle.
3. Rotate selector to **A==** (DC AMPS) position.
4. Attach RED test lead clip (1) to RED DC output terminal (3) on regulator-rectifier, Fig. 25.

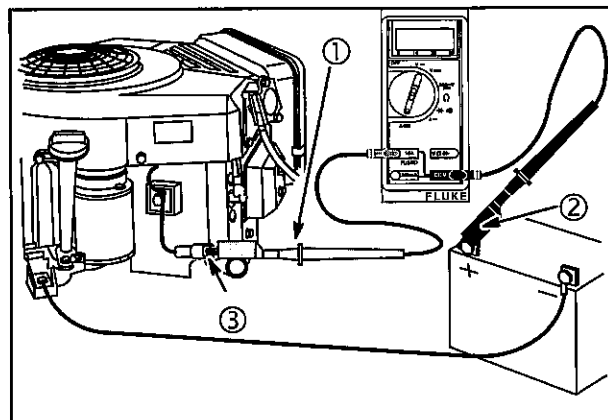


Fig. 25

5. Attach BLACK test lead clip (2) to POSITIVE (+) battery terminal.
6. Run the engine at **3600 RPM**. The output should be:
 - **3-5 Amps – 5 Amp System**
 - **3-9 Amps – 9 Amp System**

NOTE: The amperage produced depends on battery voltage. If the battery is below **11 volts**, the output reading would be **5 or 9 amps**, depending upon the alternator system being tested. The amperage will be less at maximum battery voltage.

7. If **NO** or **LOW** output is found, be sure that regulator-rectifier is grounded properly and all connections are clean and secure. If there is still **NO** or **LOW** output, replace the regulator-rectifier.

10 & 16 Amp Regulated Alternator

The 10 or 16 amp regulated alternator system provides AC current through two **YELLOW** output leads to the regulator-rectifier. 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.

1. Stator Assembly (1) – 10 or 16 amp DC regulated system, Fig. 26.

2. Two BLACK leads (2) from stator.
3. YELLOW connector (3) with two pin terminals.
4. Two YELLOW leads (4) to regulator-rectifier.
5. Regulator-rectifier (5).
6. One RED lead from regulator-rectifier to RED connector output lead (6).

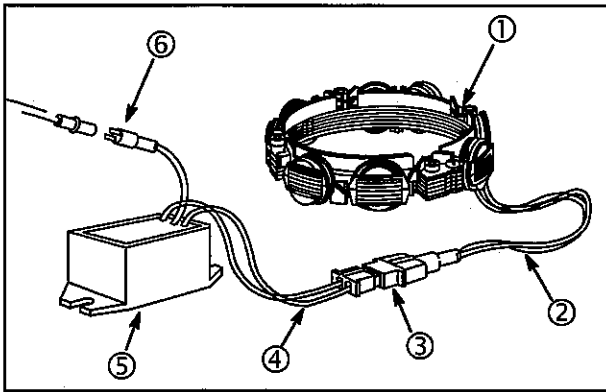


Fig. 26

Output Test

Temporarily, disconnect stator wire harness from regulator-rectifier.

1. Insert RED test lead into **VΩ** receptacle in meter.
2. Insert BLACK test lead into **COM** receptacle.
3. Rotate selector to **V~ (AC VOLTS)** position.
4. Insert RED (1) and BLACK (2) test lead probes into output terminals (4, 5) in YELLOW connector (3), as shown in Fig. 27. (Test clip leads may be attached to either terminal.)

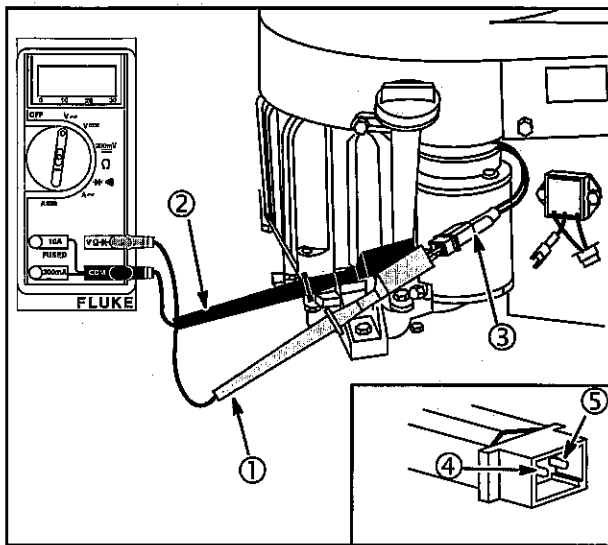


Fig. 27

5. With the engine running at **3600 RPM** output should be no less than:

- **20 Volts – 10 Amp System**
- **30 Volts – 16 Amp System**

6. If **NO** or **LOW** output is found check for bare wires or other defects. If wiring defects are not visible, replace the stator.

Regulator-Rectifier Test

NOTE: Make sure the regulator-rectifier is securely mounted to engine. Regulator-rectifier will not function unless it is grounded to engine. When testing regulator-rectifier for amperage output, a 12 volt battery with a minimum charge of 5 volts is required. There will be no 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, the regulator-rectifier could be damaged.

Use the DC Shunt #19359 (4) to avoid blowing the fuse in the test meter when testing the DC output of the 16 amp system.

The DC shunt **MUST** be installed to the **NEGATIVE (-)** terminal of the battery, Fig. 28. All connections must be clean and tight to obtain accurate readings.

1. Connect stator wire harness to regulator-rectifier.
2. Install shunt to negative battery terminal.
3. Insert RED test lead (1) into **VΩ** receptacle in meter. Connect to RED post terminal (3) on shunt, Fig. 28.
4. Insert BLACK test lead (2) into **COM** receptacle in meter and connect to BLACK post terminal (5) on shunt.
5. Rotate selector to **300mV** position.
6. With the engine running at **3600 RPM**, the output should be:

- **3-10 Amps – 10 Amp System**
- **3-16 Amps – 16 Amp System**

NOTE: The amperage produced depends on battery voltage. If the battery is below 11 volts, the output would be **10 or 16 amps** depending on the alternator system being tested. The amperage will be less at maximum battery voltage.

- If **NO** or **LOW** output is found, be sure that regulator-rectifier is grounded properly and all connections are clean and secure. If there is still **NO** or **LOW** output, replace the regulator-rectifier.

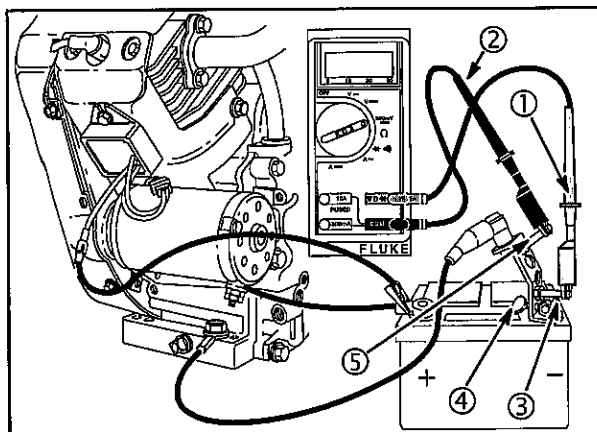


Fig. 28

Regulator-Rectifier With Charge Indicator

Regulator-rectifier Part #493219, Fig. 29, is used by OEMs that have a charging indicator light instead of an ammeter. In addition to the RED DC output wire (1), the regulator-rectifier has a BLUE wire (2), to activate a charging indicator light when battery voltage is below 12 volts. The connector has a raised rib (3) on the RED wire side to indicate the output side of the connector.

The charging indicator light should light when the key switch is ON and the engine not running. With engine running, the charging indicator light should go out, indicating that the charging circuit is operating and the battery voltage is above **12 volts**.

The charge indicator light and wiring is supplied by the OEM. See typical wiring diagram.

DC charging output values and test procedures are the same as those listed for the 10 amp or 16 amp system.

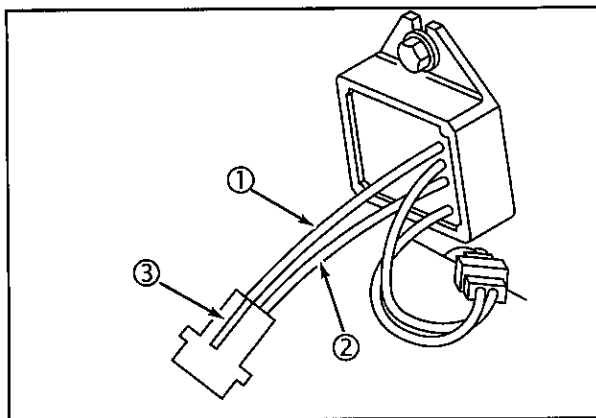


Fig. 29

20 Amp Regulated Alternator

The 20 amp regulated alternator system provides AC current through two output leads to the regulator-rectifier. The regulator-rectifier converts the AC current to DC, and regulates current to the battery. The charging rate will vary with engine RPM and temperature.

- Stator assembly (1), Fig. 30.
- Two YELLOW leads (2) from stator.
- RED DC output lead (3) from connector.
- Connector (4).
- Two YELLOW AC input leads (5).
- Regulator-rectifier (6).
- RED DC output lead (7) to connector

NOTE: Stator (1), regulator-rectifier (6) and fly-wheel are **NOT INTERCHANGEABLE** with any other charging system.

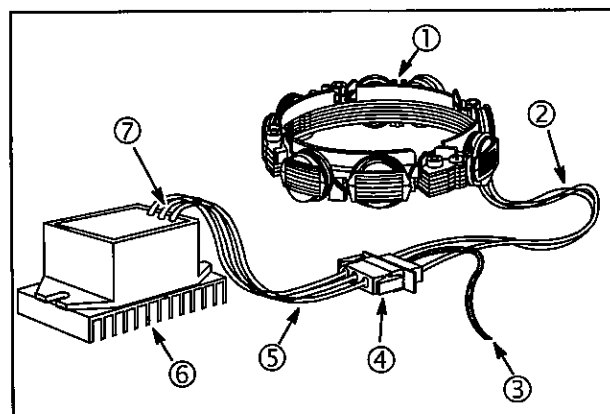


Fig. 30

Output Test

WHEN CHECKING THE ALTERNATOR COMPONENTS, PERFORM THE TESTS IN THE FOLLOWING SEQUENCE:

Temporarily disconnect stator wire harness from regulator-rectifier.

- Insert RED test lead into **VΩ** receptacle in meter.
- Insert BLACK test lead into **COM** receptacle.
- Rotate selector to **V~ (AC VOLTS)** position.

CAUTION: Attach meter test leads to the AC output terminals (YELLOW wires) in the connector **BEFORE** starting the engine. If the stator is grounded (defective) and the meter test leads contact the center DC output pin (RED wire) in the connector, arcing could occur, damaging the wiring.

4. Attach RED (2) and BLACK (1) test lead probes to the YELLOW wire (4) AC output terminals (6), of the connector (3), as shown in Fig. 31. (Meter test clip leads may be attached to either AC output terminal.)
5. If **NO** or **LOW** output is found check for bare wires or other defects. If shorted leads are not visible, replace the stator.
6. With the engine running at **3600 RPM** output should be **no less than 26 Volts**.

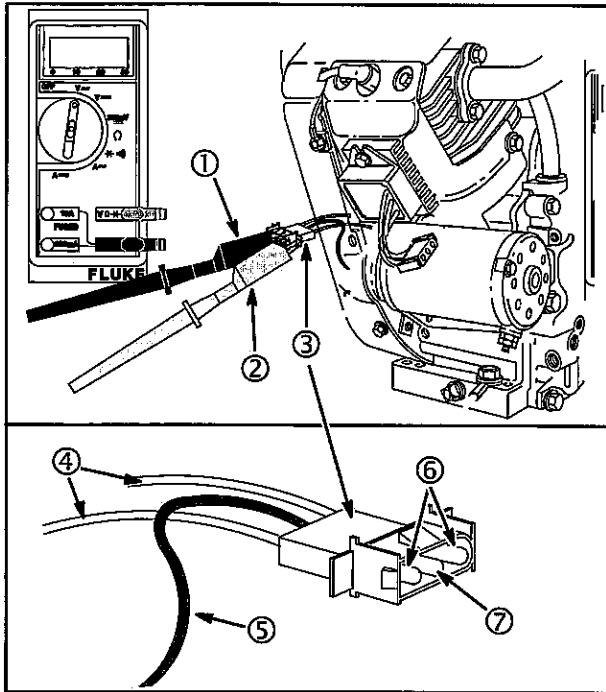


Fig. 31

DC Output Charging Wire Test

A simple test can be used to test the DC output charging wire circuit. If a wiring problem exists it can be corrected before testing regulator-rectifier.

Leave stator wire harness disconnected from regulator-rectifier.

Equipment key switch must be in OFF position.

1. Insert RED test lead into $V\Omega$ receptacle in meter.
2. Insert BLACK test lead into **COM** receptacle.
3. Rotate selector to $V=$ (DC volts) position.
4. Attach RED test lead probe (2) to the RED wire (5) DC output terminal (7), of the connector, Fig. 31.
5. Attach BLACK test lead probe (1) to negative battery terminal.
6. Turn equipment key switch to ON position. Meter should display **BATTERY VOLTAGE**.

7. If meter does not display battery voltage, check for blown fuse or broken or shorted wires.

Regulator-Rectifier Test

Tools Required:

DC Shunt #19359

The DC Shunt **must** be installed on the **NEGATIVE** (-) terminal of the battery, Fig. 32 to avoid blowing the fuse in the meter when testing the output of the 20 amp system. All connections must be clean and tight for correct readings.

1. Connect stator wire harness to regulator-rectifier.
2. Install DC shunt #19359 (4) on **NEGATIVE** battery terminal.
3. Insert RED test lead into $V\Omega$ receptacle in meter and connect to RED post terminal on shunt (5), Fig. 32.
4. Insert BLACK test lead into **COM** receptacle in meter. Connect to BLACK post terminal on shunt (3).
5. Rotate selector to **300mV** position.
6. With the engine running at **3600 RPM**, the output should be **3-20 Amps**.

NOTE: Depending upon battery voltage and/or current draw on system.

If **NO** or **LOW** output is found, be sure that regulator-rectifier is grounded properly and all equipment connections are clean and secure. If there is still **NO** or **LOW** output, replace the regulator-rectifier.

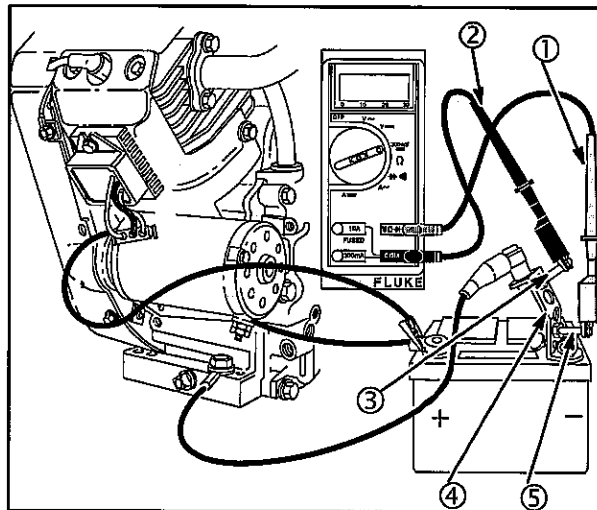


Fig. 32

POWERLINK™ SYSTEM

Some V-Twin engines are equipped with the PowerLink™ System, an on-board generator system for riding tractors that provides 120 volt, 60 cycle AC to a GFCI receptacle provided by the OEM.

The PowerLink™ system will not function unless the parking brake on the tractor is ENGAGED (1), Fig. 33, and the PTO on the tractor is OFF. The PowerLink™ system will shut down if there is a system or temperature overload, or if there is a ground fault.

Resetting PowerLink™ System

NOTE: Turn OFF or unplug any device or appliance that was connected to the PowerLink™ System. Verify that the reset button on the GFCI has not been tripped.

1. The engine must be running with the parking brake set and the PTO DISENGAGED.
2. Actuate the PowerLink™ reset switch. Move the reset switch to the OFF position, then return it to the ON position. For operator safety there is a two second delay in power to the GFCI receptacle after reset.

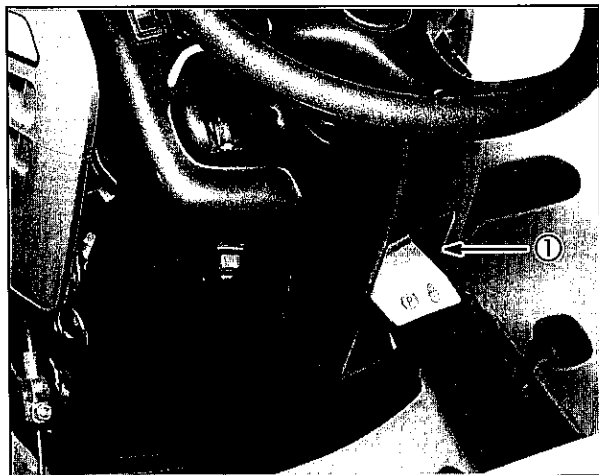


Fig. 33

Testing the GFCI

1. The engine must be running with the parking brake (1) set and the PTO DISENGAGED.
2. Plug in a trouble light or radio to confirm that electrical power is present.
3. Press the GFCI test button (1) to trip the GFCI, Fig. 34.

If the device is still being powered the GFCI is NOT working correctly. Replace the GFCI.

4. If the power goes OFF the GFCI is working correctly. Press the reset button to restore power.

NOTE: Use only OEM approved GFCI components.



Fig. 34

Test PowerLink™ System

If a problem occurs and the PowerLink™ system is suspect, follow the test procedure in exactly the order shown to isolate the faulty component.

Required tools:

- Digital Multimeter, Tool #19464
- PowerLink™ Test Box, Tool #19528

1. Test the GFCI (previous procedure).
2. Test the parking brake interlock switch.
3. Test the PowerLink™ reset (ON-OFF) switch on the tractor.
4. Check alternator output.

Test PowerLink™ System Ground Continuity

Digital Multimeter #19464 is used to test the ground circuits.

With the meter in the +))) (DIODE TEST) position, and the test leads attached to the grounds, a **CONTINUOUS TONE** indicates CONTINUITY (complete circuit). **NO TONE** indicates NO CONTINUITY (open circuit). Open circuits are displayed as **OL**.

1. Insert RED test lead into **VΩ** receptacle in meter.
2. Insert BLACK test lead into **COM** receptacle.
3. Test for continuity between the inverter case and the engine frame, Fig. 35.

4. Test for continuity between the inverter case and the GFCI ground.

There should be **CONTINUITY** in Step 3 and Step 4. If there is **NO CONTINUITY** a problem exists in the ground circuit.

2

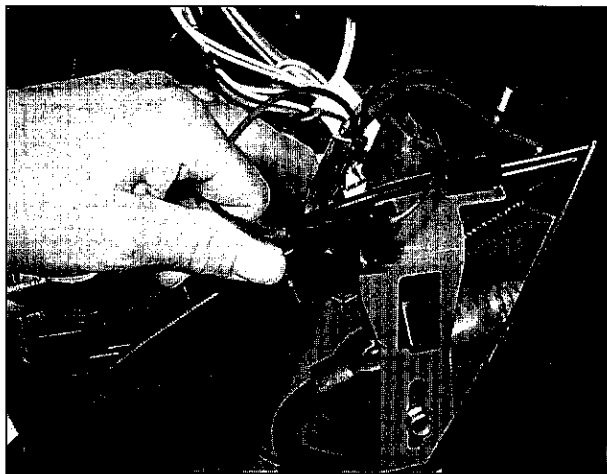


Fig. 35

Test Parking Brake Interlock Switch

Digital Multimeter #19464 is used for this test.

Set the meter in to the DC VOLTS position.

1. Place the key switch in the OFF position. Lock the parking brake and ensure the PTO is **OFF**.
2. Disconnect the interlock switch wire from the RED inverter wire.
3. Insert RED meter test lead into the brake interlock switch wire connector (1), Fig. 36.
4. Attach the BLACK meter test lead to the NEGATIVE battery terminal (2).
5. Turn the equipment key switch **ON**.

The meter should display **BATTERY VOLTAGE**. If the meter does not display battery voltage there is a problem with the equipment wiring or the interlock switch. Refer to the equipment repair manual.

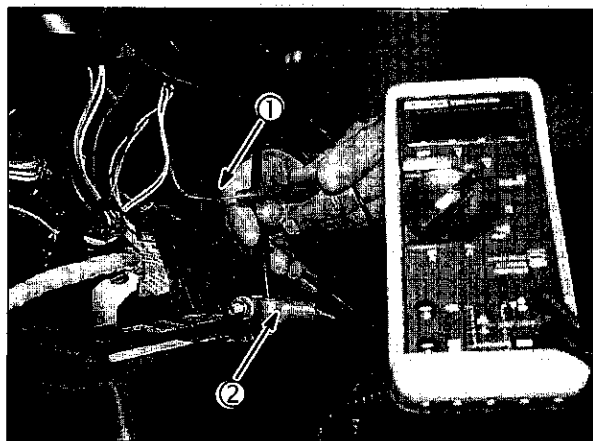


Fig. 36

Testing PowerLink™ Reset Switch

Digital Multimeter #19464 is used for this test. Set the meter to the +))))) (DIODE TEST) position.

1. Remove reset (ON-OFF) switch from equipment. Disconnect from wiring harness.
2. Attach one meter test lead to each terminal on the switch, Fig. 37. Activate switch.

There should be a **CONTINUOUS TONE** (continuity) with the switch in the **ON** position. There should be **NO TONE** (open circuit) with the switch in the **OFF** position.

Replace the switch if not to specification.

NOTE: Use only OEM approved reset switch components.

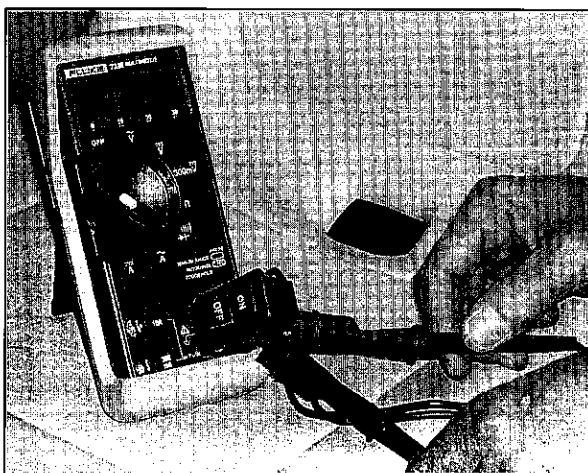


Fig. 37

Testing PowerLink™ Alternator Output

NOTE: It may be necessary to remove the inverter from the equipment.

If the previous tests have not revealed a faulty component it is necessary to check the alternator output. If the alternator output is within specification the inverter box is faulty and must be replaced.

Required tools to test the PowerLink™ system are:

- Digital Multimeter (2), Tool #19464
- PowerLink™ Test Box (1) #19528
- Torx Driver #19445
- Tachometer #19389 or 19200

CAUTION: Make all connections BEFORE starting the engine.

1. Use Torx Driver #19445 to remove tamper proof screws and the PowerLink™ harness plug at the inverter.
2. Install alternator harness plug into socket in PowerLink™ Test Box #19528 (1), Fig. 38.

If the alternator output is **LESS THAN 100 Volts**, replace the stator.



Fig. 38

3. Set Digital Multimeter (2) to read AC Volts.
4. Insert meter test leads into either receptacle in test box.
5. Start engine. Set speed to **1800 RPM**.

NOTE: DO NOT exceed 1800 RPM.

6. Press button on test box and note AC voltage.

Alternator output should be **NO LESS THAN 100 Volts**.

If the alternator output is **100 volts or HIGHER**, replace the inverter.

Anti-Afterfire Solenoid

The anti-afterfire solenoid is controlled by the equipment ignition 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** and **OFF**.

If solenoid does not **CLICK**, the problem could be the equipment wiring, engine wiring or the solenoid. To determine which is the problem, perform the following tests in the order shown.

Solenoid Test

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

1. Remove anti-afterfire solenoid from carburetor.
2. Place a jumper wire on either terminal of a 9 volt transistor battery and on one of the pins in the solenoid connector.
3. Place another jumper wire on the remaining pin in the solenoid connector and on the other terminal on the battery, Fig. 39.

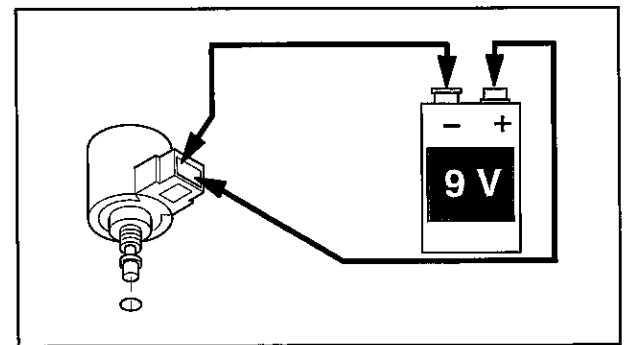


Fig. 39

Plunger should retract freely.

When battery connection is removed, plunger should return.

Replace solenoid if plunger sticks or doesn't move.

NOTE: Model 350400 with Mikuni carburetor:
With 9 volt battery applied to solenoid, apply finger pressure to tip of solenoid. The tip must be retracted manually approximately **0.030" (0.8 mm)** before the solenoid will energize.

Test Equipment

Digital Multimeter #19464.

The following tests will be performed with the meter in the **V== (DC volts)** position, **Fig. 40**.

2

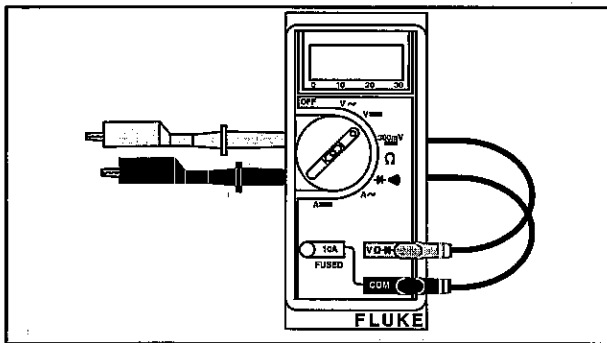


Fig. 40

Equipment Wiring Test

1. With key switch **OFF**, disconnect equipment wiring harness connector (1) from engine wiring harness.
2. Attach RED meter test lead (2) into equipment wiring harness connector (1) (side opposite raised rib).
3. Attach BLACK test lead to a good ground, **Fig. 41**.
4. Turn key switch **ON**. Meter should display **battery voltage**.

If meter does not display **battery voltage**, the problem is with the equipment wiring harness. If meter displays **battery voltage**, test engine harness.

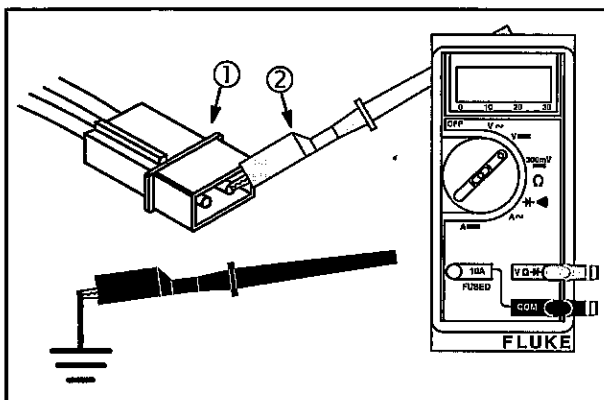


Fig. 41

Testing Battery

	WARNING Batteries contain ACID which is poisonous and causes severe burns. Avoid contact with skin, eyes or clothing.
<ul style="list-style-type: none">• EXTERNAL CONTACT: Flush with clear water for AT LEAST 20 minutes. Call a Physician IMMEDIATELY.• INTERNAL: Drink large quantities of milk or water. Follow with Milk of Magnesia or Vegetable Oil. Call a physician IMMEDIATELY.• EYES: Force eye open and flush with clear water for AT LEAST 20 minutes. Call a physician IMMEDIATELY.	

	WARNING Batteries give off explosive gasses! DO NOT smoke. Sparking can ignite nearby flammable gasses, resulting in explosion and/or fire.
<ul style="list-style-type: none">• DO NOT store, charge or service a battery near an open flame or any device that uses a pilot light or creates sparks.• Before servicing the battery, disconnect the NEGATIVE (-) battery cable first, then disconnect the POSITIVE (+) battery cable. Arcing can occur when improperly disconnecting battery cables.	

The typical battery used is a 12 volt, lead acid, wet cell type. This battery is available as a maintenance-free or a dry-charged battery.

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

The dry-charged battery is manufactured with fully charged plates. Electrolyte must be added when the battery is placed in service. Before activating a dry-charged battery, read and follow the manufacturer's procedure.

NOTE: Recommended battery sizes range from 30 ampere hour for warm ambient temperature service, to 50 ampere hour for the coldest ambient temperature service.

Installation

1. Before installing battery, connect all equipment to be operated. See typical wiring diagram, **Fig. 42**.
2. Place battery in holder with a flat base. Tighten hold downs evenly until snug. **DO NOT** over-tighten.
3. Connect **POSITIVE** terminal to **POSITIVE (+)** battery post first to prevent sparks due to accidental grounding. Tighten connectors securely.
4. Connect **NEGATIVE** terminal to **NEGATIVE (-)** battery post. Tighten connectors securely.

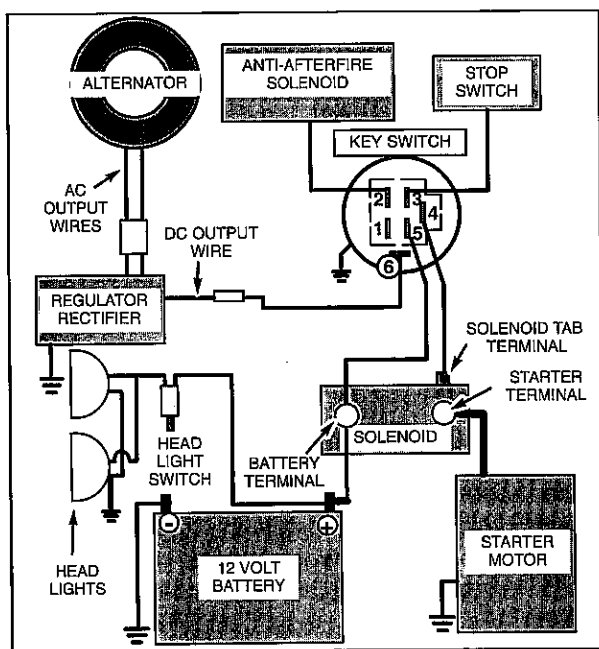


Fig. 42

Test Battery

1. Physical check – clean if necessary.
 - a. Corrosion
 - b. Dirt
 - c. Terminal and clamps (secure-good condition)
2. Bring battery to full charge.

CAUTION: DO NOT exceed a charge rate of 1/10 ampere for every ampere of battery rating! Consult battery manufacturer for charging recommendations. Overcharging may cause battery failure.

- a. Use a taper charger (automatically reduces charge rate).

- b. Fill battery cells with distilled water after charging (for batteries that have been in service).

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

3. Use Digital Multimeter #**19464**. Set meter to read **DC Volts**.
4. Attach **RED** meter test clip to **POSITIVE (+)** battery terminal.
5. Attach **BLACK** meter test lead to **NEGATIVE (-)** battery terminal.
6. With ignition switch **OFF**, press starter button. If ignition and starter are run off the same switch, disconnect wires from spark plugs and ground the ignition using two Ignition Testers #**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 fully charged, check specific gravity readings of each cell (2) with a hydrometer (1) and record readings, **Fig. 43**. All readings should be above **1.250** (compensating for temperature). If specific gravity readings vary **.50** or if all cells read less than **1.225**, replace battery.

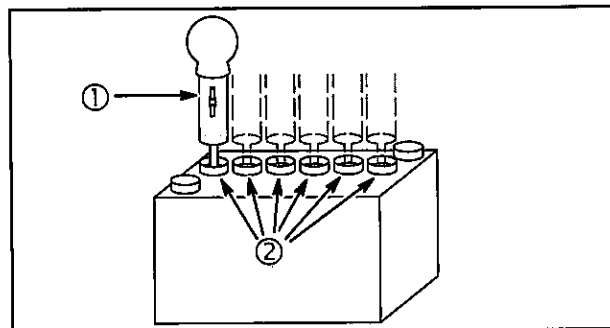


Fig. 43

Charge Indicator Test

- **SYMPTOM:** Charge Indicator Light Will Not Light – Key Switch ON – Engine Not Running

To identify whether the problem is related to the regulator/rectifier or the charging indicator wiring system, the test procedure must be followed in the sequence listed.

A known good battery is required for this test.

NOTE: Verify alternator and regulator/rectifier output before testing the charging indicator system.

Output values are the same as the 10 amp and 16 amp system.

A jumper wire is required for this test.

Make sure key switch is **OFF** before connecting jumper wire.

NOTE: Mark or identify the charging indicator wire in the output harness before disconnecting the harness from the connector.

CAUTION: If the jumper wire contacts the charging output wire during the test while the key switch is ON, the wiring harness could be damaged.

1. Disconnect output harness (3) at WHITE connector (4), **Fig. 44**.
 2. Attach one end of jumper wire (5) to a good ground.
 3. Attach other end of jumper wire (6) to charge indicator terminal in harness connector, **Fig. 44**.
 - a. Turn key switch to ON position (1).
 - b. If bulb (2) **LIGHTS**, charge indicator wiring system is OK. Replace regulator/rectifier.
 - c. If bulb **DOES NOT LIGHT**, replace bulb.
 - d. If new bulb does not light, the problem is an **OPEN CIRCUIT** (broken wire) in the charging indicator circuit. Refer to typical wiring diagram.
- **SYMPTOM:** Charge Indicator Light Stays ON – Engine Running.
- NOTE:** Indicator light will remain ON if battery voltage is **below 12 volts**.
4. Check indicator light wiring.
 - a. If wiring is grounded, light will remain ON when engine is running.
 - b. If wiring is OK, replace regulator/rectifier.

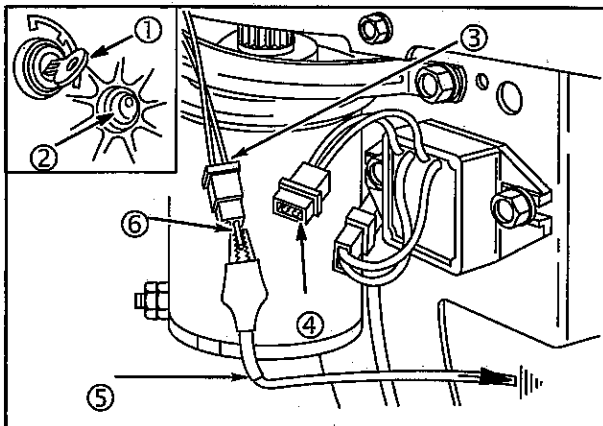


Fig. 44

Testing Engine Wiring Harness

The engine wiring harness consists of a ground wire (1) with a diode (4) for each armature (5) and a separate wire (2) for the carburetor solenoid, **Fig. 45**. The engine wiring harness is connected to the wiring harness provided by the equipment manufacturer. A raised rib on the polarized connector (3) indicates the ground side.

See engine wiring harness diagram on the next page.

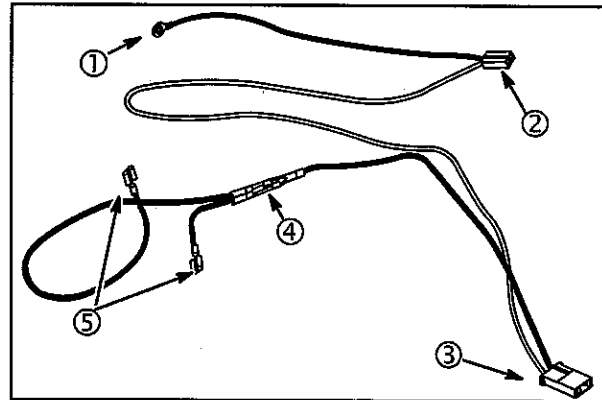


Fig. 45

Ground Wires

Digital Multimeter #19464 is used for these tests.

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 and display the voltage drop. A **continuous tone** indicates **CONTINUITY** (shorted diode). An **INCOMPLETE CIRCUIT** (open diode) will be displayed as **OL**.

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.
4. Insert RED test lead clip into connector (1) (BLACK wire), **Fig. 46**. Leave attached for remainder of test.
5. Touch BLACK test lead probe to terminal (2).
 - a. If meter **BEEPS** once, diode is OK.
 - b. If meter makes a **CONTINUOUS TONE**, diode is shorted. Replace ground harness.
 - c. If meter displays **OL**, diode is open. Replace ground harness.
6. Repeat test for terminal (3). Results must be the same.

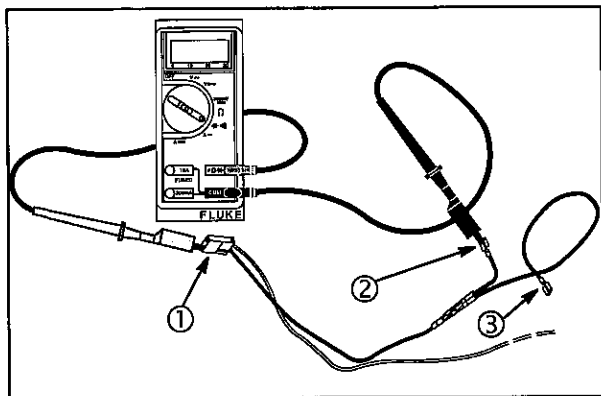


Fig. 46

Engine Wiring

1. With key switch **OFF**, re-connect equipment wiring harness to engine wiring harness. Disconnect harness at solenoid.
2. Insert RED meter test lead (2) into GRAY wire (1) in solenoid connector.

3. Attach BLACK test lead to a good ground, **Fig. 47**.
4. Turn key switch to **ON** position. Meter should display **battery voltage**.

If meter does not display battery voltage, replace engine wiring harness. If meter displays battery voltage, test the solenoid.

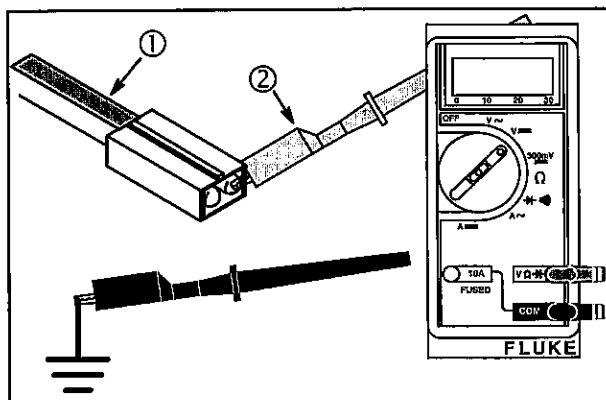
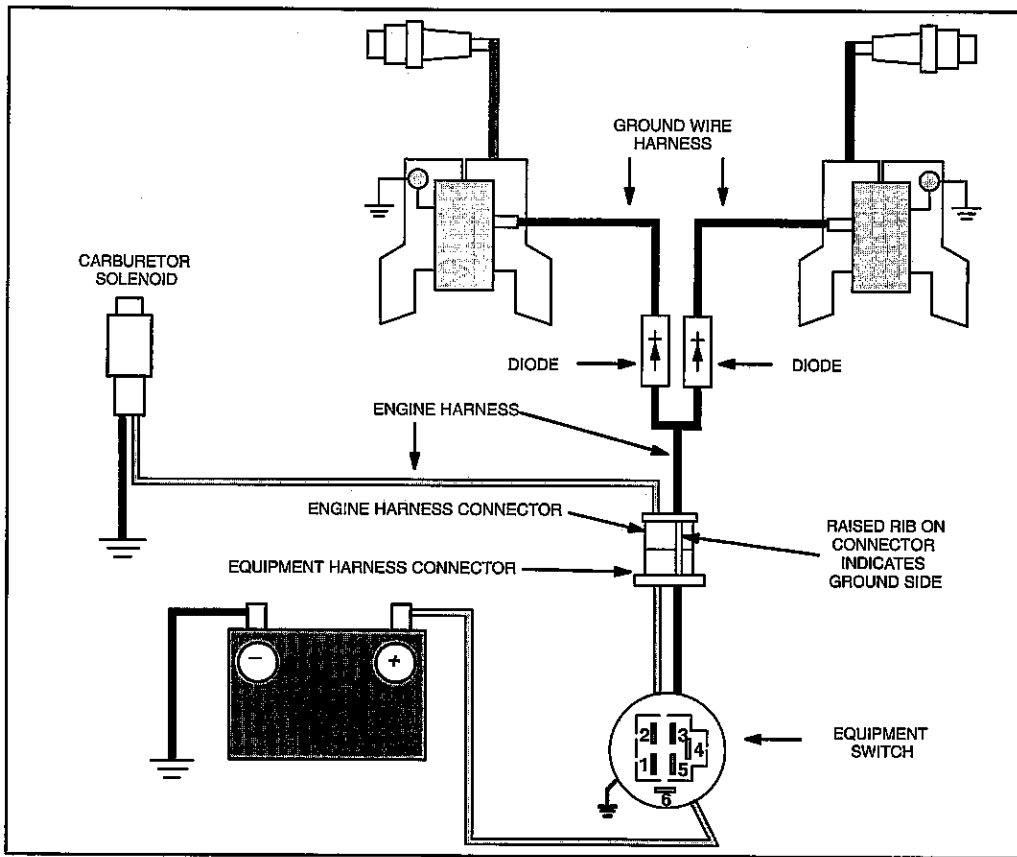


Fig. 47

2

ENGINE WIRING HARNESS DIAGRAM



DIODE FAILURE DIAGNOSIS

SWITCH ON	SWITCH OFF	CAUSE
Engine Runs On 1 Cylinder	Shuts Off OK	1 Closed Diode
Engine Runs (Both Cylinders)	Only One Cylinder Shuts Off	1 Open Diode
Won't Run (No Spark)		2 Closed Diodes
Engine Runs (Both Cylinders)	Engine Won't Shut Off	2 Open Diodes

Oil Pressure

Test Switch

Use Digital Multimeter #19464. Set meter to test for continuity.

Remove pressure switch. Connect one tester lead to the switch terminal and the other lead to the metal body of the switch, **Fig. 48**. The tester should indicate **CONTINUITY** when no pressure is applied to the switch. The switch should **OPEN** (no continuity) when approximately **4.5 PSI (0.3 Bar)** is applied. Replace the switch if test results are not to specification.

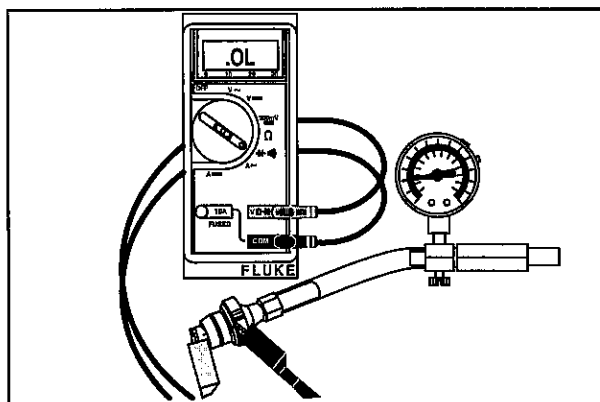


Fig. 48

If the oil pressure switch is within specification and the warning light remains ON, verify engine oil pressure with an oil pressure gauge.

Test Pressure

1. Oil level must be between the LOW and FULL mark on dipstick. If oil level is low, check for leaks and add oil to FULL mark.
2. Remove pressure switch or 1/8" NPTF plug in oil filter adapter.
3. Install oil pressure gauge (1), **Fig. 49**.
4. Start engine. Run for approximately **5 minutes**.
5. Check oil pressure at **3000 RPM**.

Oil Pressure – measured @ **70° F (21° C)**:

- **10~50 psi (0.7~3.5 Bar)**

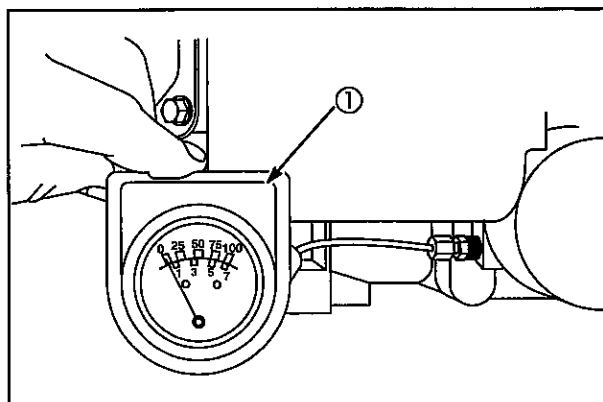


Fig. 49

OIL PRESSURE TROUBLESHOOTING GUIDE

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

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

Panel Kit With Key Switch and Solenoid

Some V-Twin engines are equipped with a rotary key switch panel and starter solenoid. See wiring diagram for details.

Testing Key Switch

The rotary key switch can be checked for continuity using the Digital Multimeter #19464.

Remove carburetor cover with key switch. Disconnect wiring harness from key switch.

With meter selector switch in +))))) (DIODE TEST) position, and test leads attached to switch terminals, a **CONTINUOUS TONE** indicates continuity (complete circuit). **NO TONE** indicates no continuity (open circuit). An open circuit will be displayed as **OL**.

1. Insert RED test lead into **VΩ** receptacle in meter.
2. Insert BLACK test lead into **COM** receptacle.
3. Rotate meter selector to +))))) (DIODE TEST) position.
4. Meter must indicate **CONTINUITY** between terminals with key switch in position shown. See number sequence of terminals shown in **Fig. 50**.

NOTE: Terminals #1, #3 and #6 are grounded to key switch case when key switch is **OFF**. Meter must indicate **CONTINUITY** between these terminals and the key switch case when key switch is **OFF**.

When testing **RUN** and **START** terminals, meter should show **CONTINUITY** between terminals, with key switch in position shown.

NOTE: The #2 and #5 terminals should show **CONTINUITY** in both the **RUN** and **START** position.

Switch Position	Continuity
1. OFF	1+3+6
2. RUN	2+5+6
3. START	2+4+5

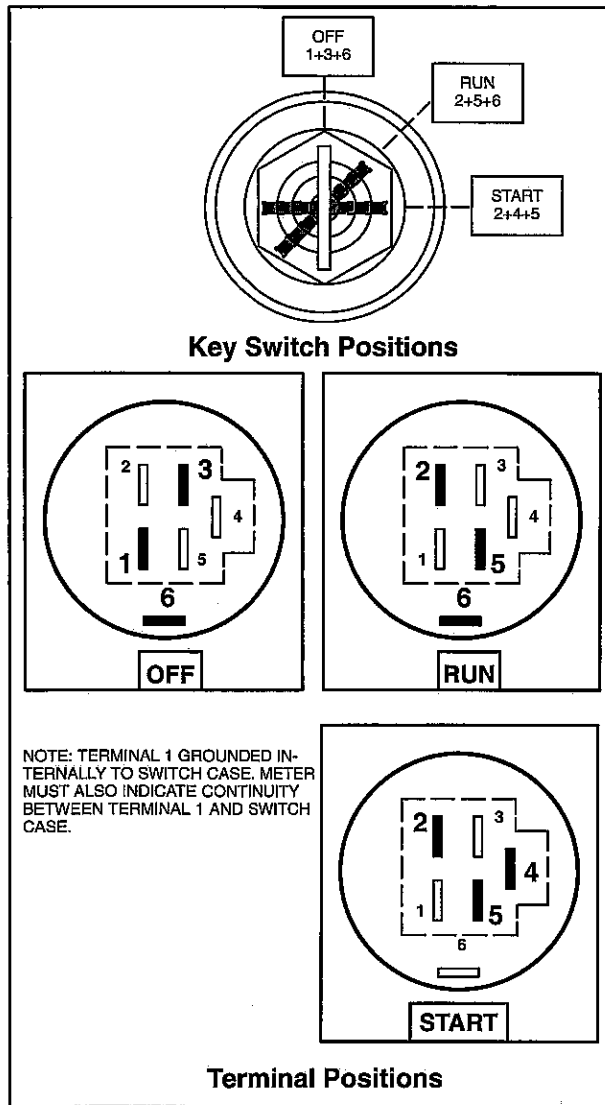
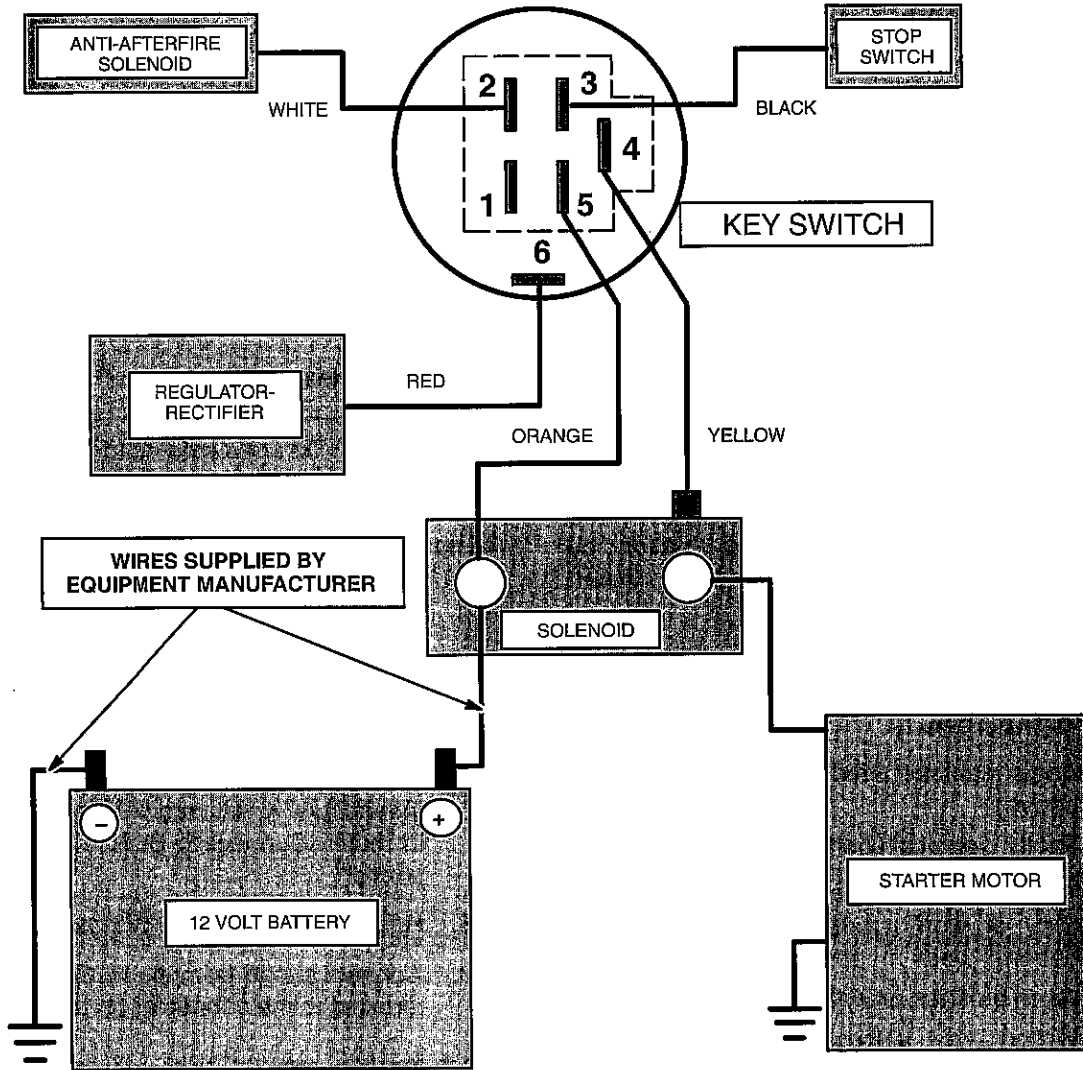


Fig. 50

Wiring Diagram For Starter Panel & Key Switch For V-Twin Engines

Terminal No.	Wire Color	Function
1	Not Used	
2	White	To Carburetor Solenoid (when used)
3	Black	To Stop Switch Terminal On Engine
4	Yellow	To Solenoid (tab terminal)
5	Orange	To Battery (battery terminal on solenoid)
6	Red	To Regulator/Rectifier



Switch Position	Continuity
1. OFF	1+3+6
2. RUN	2+5+6
3. START	2+4+5

Starter Motor

Conditions Affecting Starter Motor Performance

1. Bound or seized starter motor bearings.
2. A shorted, open or grounded armature.
 - a. Shorted armature (wire insulation worn and wires touching one another) will be indicated by **LOW** or **NO RPM**.
 - b. Open armature (wire broken) will be indicated by **LOW** or **NO RPM** and excessive current draw.
 - c. Grounded armature (wire insulation worn and wire touching armature lamination or shaft) will be indicated by **excessive current draw** or **NO RPM**.
3. A defective starter motor switch.
4. Broken, damaged or weak magnets.
5. Dirty or binding starter drive.

Troubleshooting

If a starting problem is encountered, check the engine to eliminate it as the cause of the problem. Check the engine for freedom of rotation by removing the spark plugs and turning the crankshaft over slowly by hand.

Test the battery, see page 47.

Engine Cranks Slowly

- a. Additional load affecting performance (see above).
- b. Faulty electrical connection (battery circuit).
- c. Discharged battery (also see alternators).
- d. Dirty or worn starter motor commutator, bearing, weak magnets, etc.
- e. Worn brushes or weak brush spring.
- f. Wrong oil viscosity for temperature expected.
- g. Battery leads too long or wire too small.
- h. Battery too small.

Engine Will Not Crank

- a. Faulty safety interlocks.
- b. Discharged or defective battery.
- c. Faulty electrical connections.
- d. Faulty starter motor switch (open circuit).
- e. Open circuit in starter motor.
- f. Brushes sticking, etc.
- g. Faulty solenoid.

Starter Motor Spins But Does Not Crank Engine

- a. Sticking pinion gear due to dirt.
- b. Damaged pinion or ring gear.
- c. Starter clutch slipping.
- d. Battery faulty or damaged.
- e. Reverse rotation due to incorrect motor polarity – all motors rotate counterclockwise viewed from pinion gear.

Starter Motor Spins But Does Not Stop

- a. Defective starter switch.
- b. Defective Solenoid

Testing

A fully charged 12 volt battery (5) is required. Remove starter motor from the engine to test.

1. Assemble starter motor to test bracket.
2. Clamp test bracket in vise, **Fig. 51**.

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

3. The DC Shunt (6) **MUST** be installed on the **NEGATIVE (-)** battery terminal as shown in **Fig. 51**.
4. Insert **RED** test lead (4) into **VΩ** receptacle in meter. Connect to **RED** post terminal on shunt.
5. Insert **BLACK** test lead (3) into **COM** receptacle in meter. Connect to **BLACK** post terminal on shunt.
6. Rotate selector to **300mV** position.
7. Connect a lead from the **POSITIVE (+)** battery terminal to the connector on the starter.

NOTE: If an optional starter switch (2) is **NOT USED** connecting the **POSITIVE** lead will activate the starter motor.

8. Activate the starter motor. Note reading on meter and RPM on tachometer (1).

NOTE: Take reading after meter stabilizes (approximately 2 – 3 seconds).

9. A starter motor in good condition will be within specifications listed.
 - **Minimum RPM – 6500**
 - **Maximum Amperes – 35**

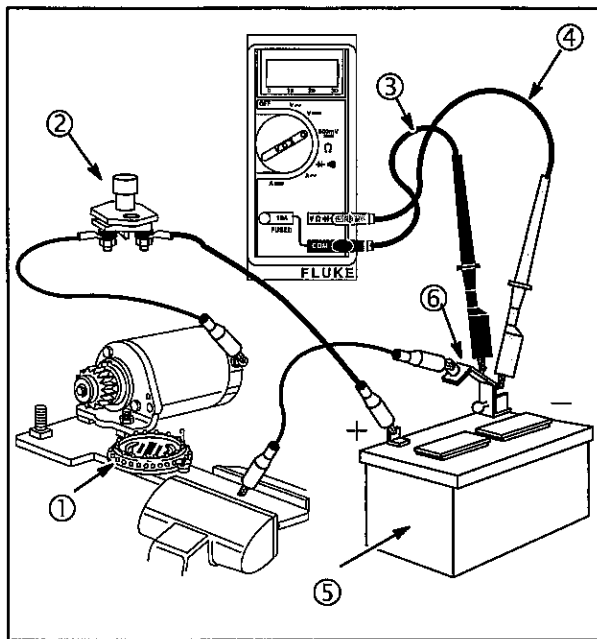


Fig. 51

Solenoid Test

The starter solenoid is a normally open, electrically activated switch. When the key switch is turned to the START position, the switch closes, allowing battery current to flow to the starter motor and crank the engine.

1. The solenoid may be tested while mounted on engine. A jumper test lead (1) is required for this test.
2. Remove POSITIVE battery cable from battery. Remove battery cable from stud terminal on solenoid.
3. Disconnect YELLOW wire from tab terminal on solenoid.
4. Key switch must be in OFF position.
5. Insert RED test lead into VΩ receptacle in meter.

6. Insert BLACK test lead into COM receptacle in meter.
7. Rotate meter selector to +))))) (DIODE TEST) position.
8. Attach one meter test lead to each stud terminal on solenoid (2, 3), Fig. 52.
9. Attach one end of jumper lead to POSITIVE terminal on battery (5).
10. Touch jumper wire to tab terminal (4) on solenoid.
 - a. An audible CLICK should be heard as the solenoid switch closes.
 - b. Meter should make a **CONTINUOUS TONE** (indicates continuity).

2

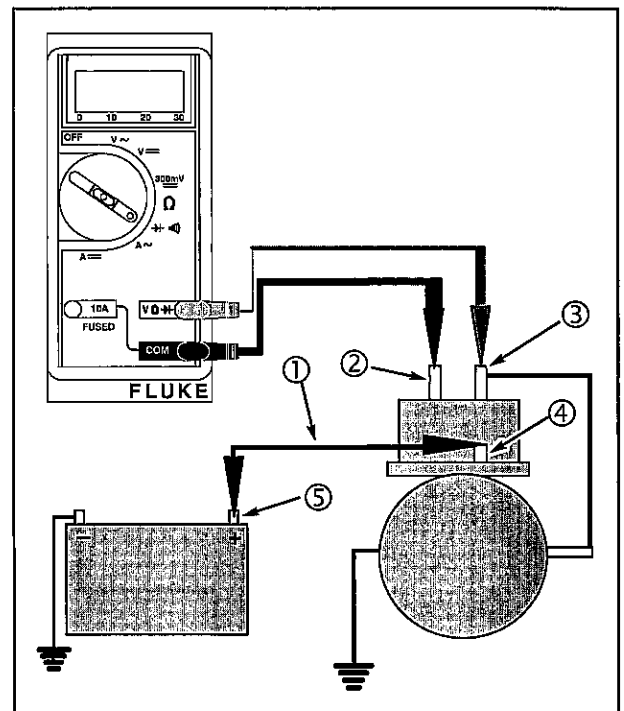


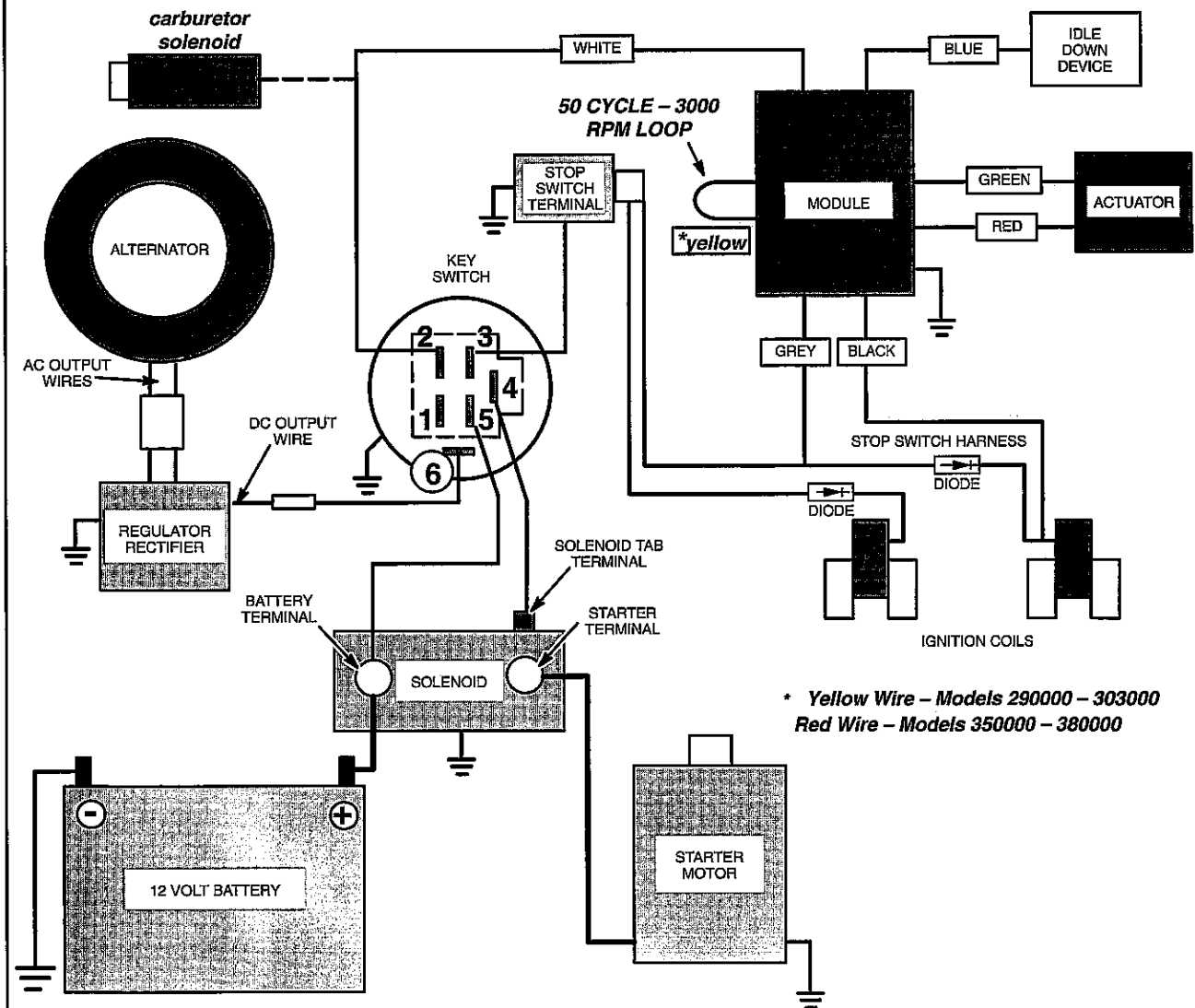
Fig. 52

PERFORMANCE CONTROL™ ELECTRONIC GOVERNOR

Some V-Twin engines are equipped with the Performance Control™ electronic governor system for generator or welder applications. The electronic governor provides more responsive governing than a mechanical system. Engines equipped with the Performance Control™ electronic governor system have no mechanical governor components, and cannot be retrofitted to mechanical governor engines.

The Performance Control™ electronic governor control system consists of an electronic control module, wiring and stop switch harness and a throttle actuator. The control module is equipped with an idle-down circuit for applications requiring that feature. By cutting and removing the yellow or red loop wire, the control module can be converted to 50 cycle – 3000 RPM generator applications.

Performance Control Electronic Governor Wiring Diagram



Governor Test

Dynamic Check

Perform dynamic check exactly in order shown.

1. Start engine and check RPM. Top governed speed should be:
 - a. 3600 RPM – 60 cycle applications.
 - b. 3000 RPM – 50 cycle applications (YELLOW or RED loop removed).
2. Manually move throttle link to wide open throttle (WOT), **Fig. 53**. Engine should not exceed 4000 RPM (approximately).

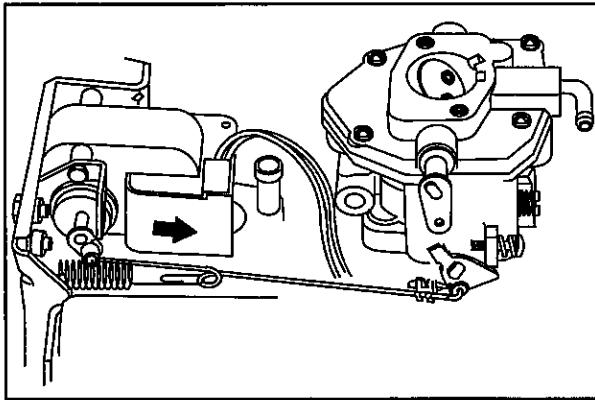


Fig. 53

3. With engine running at top governed speed, attach one end of a jumper (2) wire to BLUE wire from control module (1). Attach the other end of the jumper wire (3) to a good ground, **Fig. 54**. After 4 – 6 seconds engine speed should return to idle (approximately 1750 RPM).

NOTE: Idle speed may vary according to equipment manufacturers specifications.

4. Remove jumper wire from ground. Engine should return to top governed speed.

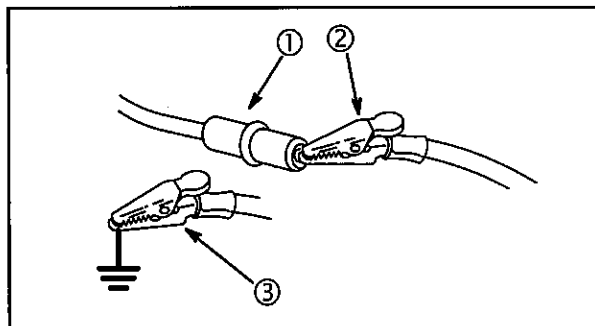


Fig. 54

Static Check

To determine whether a governor problem is being caused by the actuator or the control module, perform the following static check exactly in order shown.

A pair of jumper wires and a known good 12 volt battery is required.

1. Disconnect RED (1) and GREEN (2) wires from control module to actuator.
2. Attach jumper wires from battery to RED and GREEN wires to actuator, **Fig. 55**.
 - a. Attach 12 volt + (POSITIVE, 4) to RED wire.
 - b. Attach 12 volt – (NEGATIVE, 3) to GREEN wire.

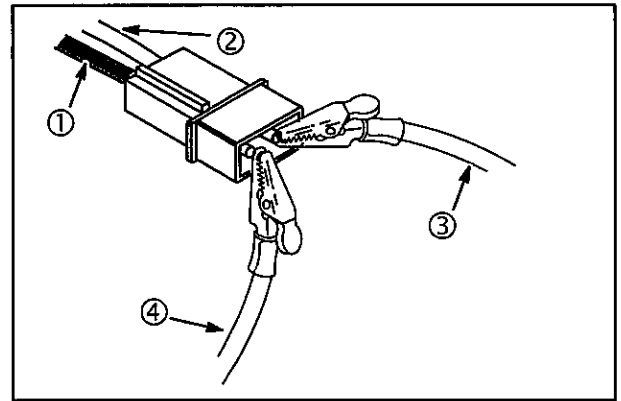


Fig. 55

3. Actuator should move throttle lever to wide open position (5), **Fig. 56**.
 - a. If actuator does not move it is defective. Replace.
 - b. If actuator moves throttle to WOT, position, the module is defective. Replace.

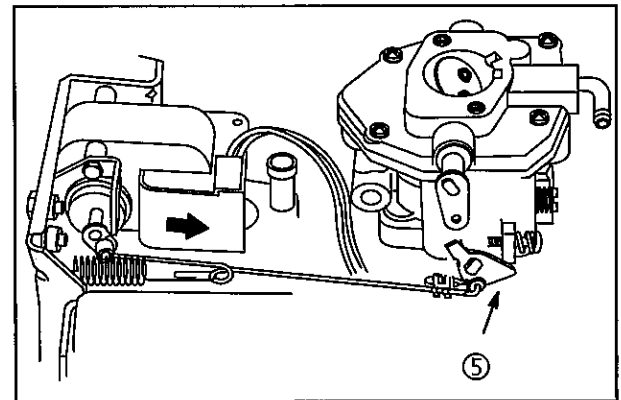


Fig. 56

Replacing Actuator

Removal

1. Disconnect RED and GREEN wires from control module to actuator.

2. Remove air cleaner assembly.
3. Disconnect governor link at carburetor.
4. Remove governor control bracket with actuator.
5. Disconnect governor link from actuator and remove throttle return spring.
6. Remove two screws, nuts and actuator from control bracket.

Installation

1. Assemble actuator to governor control bracket (3), Fig. 57. Torque screws (4) and nuts (1) to **30 in. lbs. (3 Nm)**.

NOTE: Hold screws (2) with a wrench when torquing nuts. Screws must NOT turn while torquing nuts.

2. Assemble governor link to actuator. Make sure link snaps into hole in actuator grommet.
3. Assemble throttle return spring through slot in governor control bracket with open end of spring facing out and through small hole in governor bracket.
4. Assemble governor control bracket assembly to engine.

- a. Torque four 8mm screws to **150 in. lbs. (17 Nm)**.
- b. Torque two 6mm screws to **70 in. lbs. (10 Nm)**.

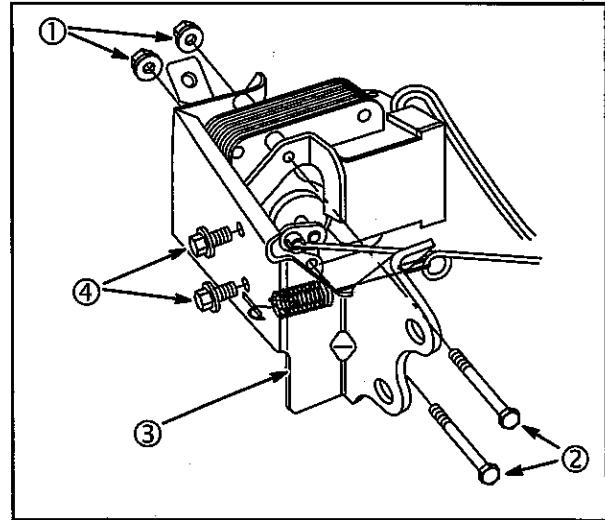


Fig. 57

5. Rotate actuator lever to position shown and connect governor link to carburetor.
6. Connect RED and GREEN wires from control module to actuator.

**GASEOUS FUELED ENGINES
TROUBLESHOOTING GUIDE**

2

Symptom	Potential Cause	Action
Engine does not accelerate from low speed or high speed or run smoothly when loaded.	Plugged vent ports on the regulator.	Remove plastic shipping plugs.
	Less than 11 inches of water pressure at the inlet of the secondary regulator.	Adjust the primary regulator output to 11 inches of water pressure. If natural gas supply is lower than 11 inches of water, a different secondary regulator may be required – consult OEM.
	More than 14 inches of water pressure at the inlet of the secondary regulator under full load.	Adjust the primary regulator to achieve 11 inches of water pressure while under load. Note: If pressure at inlet of secondary regulator increases upon starting the engine, check primary regulator for holes or tears in the diaphragm or dirt on the inlet seat.
	Plugged fuel filter.	Replace fuel filter.
	Kinked or obstructed fuel hose.	Remove the kink and/or replace the hose.
	No or low fuel in tank.	Refuel the tank.
	Propane tank is too small.	Appropriately size the fuel tank for the engine horsepower and lowest ambient temperature.
	Fuel transfer solenoid in the wrong position.	When the fuel solenoid is energized or if the main mixture adjustment screw is completely seated, the engine is configured for propane gas (mixture too lean for natural gas). If the fuel solenoid is not energized, the engine is configured for natural gas (mixture too rich with propane).
	Carburetor not adjusted properly (natural gas only).	Readjust the mixture needles on the carburetor.
	Air leak in the fuel line from secondary regulator to carburetor.	Tighten the clamps or replace the hose.
	Holes, tears or damaged diaphragm in secondary regulator.	Replace damaged part.
	Debris on inlet needle of regulator.	Clean system of debris and add a fuel filter. Use liquid pipe sealant – do not use Teflon tape.

TROUBLESHOOTING GUIDE (CONTINUED)

2

Engine will not start.	Out of fuel.	Refuel the tank.
	Fuel supply shut off.	Open fuel tank.
	Filter or vacuum lock off is not opening.	Check for proper operation of all fuel lock-off (safety) devices. If electrically actuated, check for dead battery or blown fuse. Replace lock-off device if it is not functioning properly.
	Vacuum leak in the vacuum lock-off device.	Replace vacuum line or tighten clamps. Replace vacuum lock-off if damaged.
	Filter is plugged.	Replace filter.
Frost forming on the regulator or on the fuel line – liquid (not vapor) entering the system.	Wrong type of propane tank – set up for liquid withdrawal	Replace the fuel tank or change to the vapor withdrawal port.
	Tank is positioned incorrectly (typically tanks that lay on their side).	Fuel tanks have a receptacle for a locator pin that orients the tank for a specific withdrawal. Pin may be in the wrong location or missing. Reposition tank.
	Fuel tank is overfilled.	Fill to labeled tank capacity only.
	Fuel tank is too small, especially if the ambient temperature is low.	Increase the size of the fuel tank to increase the vaporization rate of the fuel. Consult with local gas supplier.
	Restriction within the fuel line.	Remove restriction or replace damaged part.
Gas will not stop flowing after engine is stopped.	Regulator is not adjusted properly.	Adjust the regulator so that when the outlet tube is placed in water, a gas bubble just begins to form. Back off on the adjustment so that the bubble is maintained but does not grow.
	Atmospheric side of the secondary regulator is pressurized.	Remove plastic shipping plugs or revise the regulator venting.
	Debris on inlet needle of secondary regulator.	Clean the system of debris and install a fuel filter. Use liquid pipe sealant – do not use Teflon tape.
	Regulator not positioned vertically.	Regulator may only be positioned with the outlet pointing straight up. A directional arrow is also shown on the smooth side of the regulator.
Gas leak from fuel line.	Loose fitting.	Tighten fitting – replace if damaged.
	Damaged, cracked or worn hose.	Replace hose.
Gas leak from regulator.	Damaged diaphragm in regulator.	Replace damaged part.

GASEOUS FUEL CARBURETOR ADJUSTMENT

Some Briggs & Stratton V-Twin engines were available factory-built to operate on liquefied petroleum gas (LPG) or natural gas (NG). To maintain the California Air Resource Board (CARB) emissions certification on these engines, the Original Equipment Manufacturer (OEM) must use specific equipment and procedures to complete the installation. The following describes the OEM requirements. Always have a certified LPG/NG technician perform repairs on gaseous fuel systems.

NOTE: The main adjustment is the large brass adjustment screw (1) just to the left of the solenoid (2) and capped port (3), **Fig. 58**. The idle adjustment is located below and to the left of the main adjustment. An accurate CO meter is required to adjust the gaseous fuel mixture.

1. Start the engine. Set the main mixture adjustment at high speed under load to achieve **1/2 – 1% CO** in the exhaust.
2. Allow the engine to warm up at top speed for **2 minutes**.
3. Slow the engine to between **1100 – 1750** no-load RPM. Adjust the idle mixture to achieve **1/2 – 1% CO** in the exhaust.
4. Return the engine to high speed full-load. If required, readjust the setting to **1/2 – 1% CO**.
5. Stop the engine. Install the anti-tampering plugs.

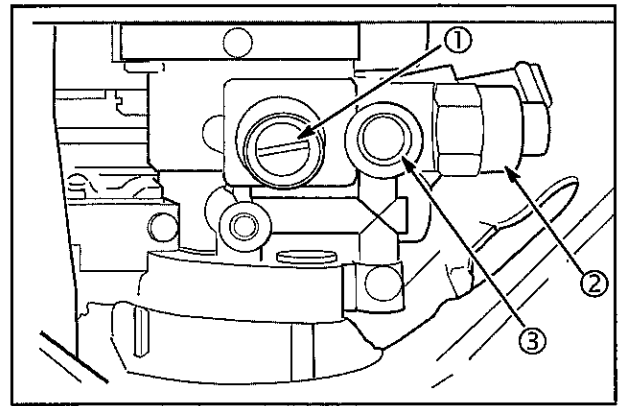


Fig. 58

LPG-Only Operation

NOTE: If the application is designed so that the engine normally operates on NG, but defaults to LPG if the NG supply is interrupted, no adjustments for LPG operation are required. The following steps describe the setting procedure when the engine is ONLY powered by LPG.

1. Follow steps 1 through 4 above. The same components (regulators, lock-off, fuel lines, etc.) used with the NG installation are used for the LPG installation.
2. Connect the fuel transfer solenoid to a **12 volt DC** power supply. As an alternative the main adjustment screw may be turned in until completely seated eliminating the need for applying power to the solenoid.
3. Start the engine and run it at top speed for **2 minutes** to warm up. The engine uses a fixed main jet for LPG operation, no adjustment is necessary.
4. Slow the engine to **1100 – 1750 RPM** no-load. Adjust the idle mixture to achieve a reading of up to **3% CO**.
5. Stop the engine. Install the anti-tampering plugs.

EQUIPMENT PROBLEMS AFFECTING ENGINE OPERATION

Frequently, what appears to be an engine problem may be the fault of the equipment powered rather than the engine itself. Since many types of equipment are powered by Briggs & Stratton engines, it is impossible to list all the conditions that can exist. Listed below are some common equipment problems, and what to look for as the probable cause.

Hard Starting or Will Not Start

1. Loose belt or blade – a loose belt or blade can cause a backlash effect that will counteract engine cranking effort.
2. Starting under load – be sure the unit is disengaged when engine is started; if the unit remains engaged, it should not have a heavy load when starting.
3. Check remote control assembly for proper adjustment.
4. Check interlock system for shorted wires, loose or corroded connections, or defective modules or switches.

Engine Will Not Stop

1. Check equipment ignition stop switch.

2. Check for loose or disconnected equipment stop switch wire.
3. Check ground wire harness (current style) or ground terminal (early style) on engine. See test procedure.

Vibration

1. Cutter blade bent or out of balance – remove and balance.
2. Mounting bolts loose – tighten bolts.

Power Loss

1. Bind or drag in unit – If possible, disengage engine. Operate unit manually to check for binding.
2. Grass cuttings built-up under deck.
3. No lubrication in transmission or gear box.
4. Excessive drive belt tension may cause seizure.

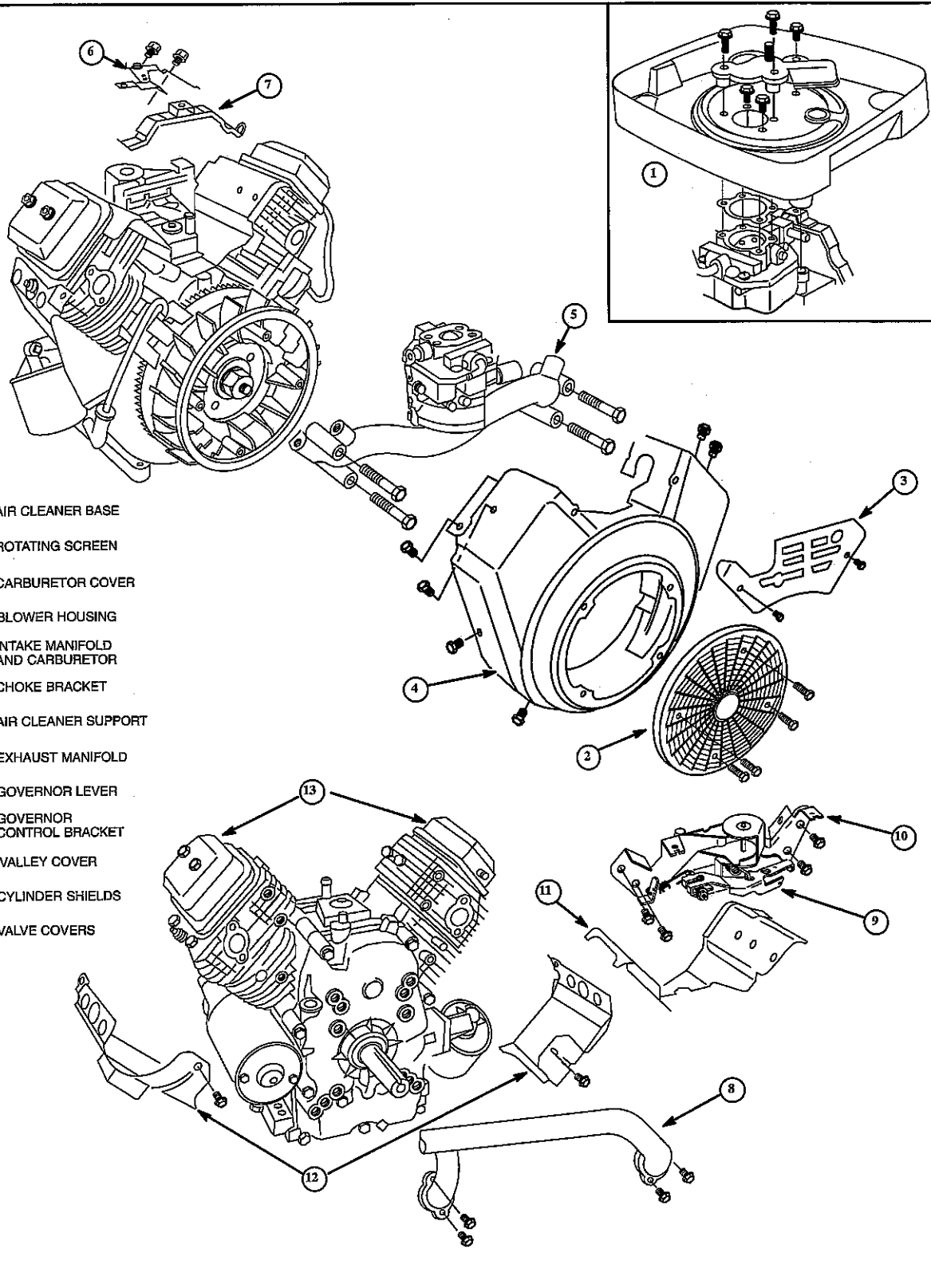
Noise

1. Cutter blade coupling or pulley – an oversize or worn coupling can result in knocking, usually under acceleration. Check for fit or tightness.
2. No lubricant in transmission or gear box.

Section 3

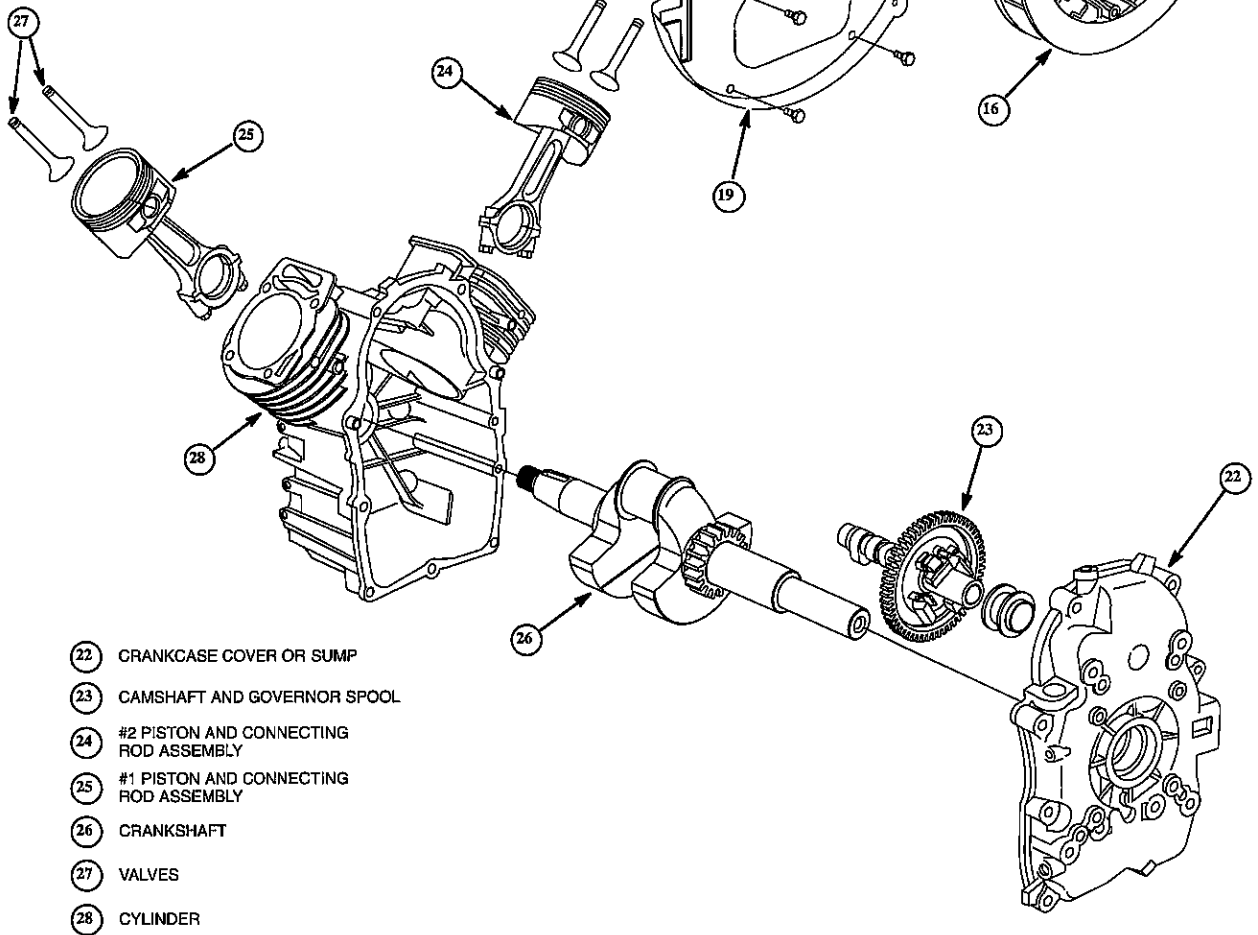
Engine Disassembly

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- ① AIR CLEANER BASE
- ② ROTATING SCREEN
- ③ CARBURETOR COVER
- ④ BLOWER HOUSING
- ⑤ INTAKE MANIFOLD AND CARBURETOR
- ⑥ CHOKE BRACKET
- ⑦ AIR CLEANER SUPPORT
- ⑧ EXHAUST MANIFOLD
- ⑨ GOVERNOR LEVER
- ⑩ GOVERNOR CONTROL BRACKET
- ⑪ VALLEY COVER
- ⑫ CYLINDER SHIELDS
- ⑬ VALVE COVERS

- 14 #2 CYLINDER HEAD
- 15 #1 CYLINDER HEAD
- 16 FLYWHEEL AND FAN
- 17 ALTERNATOR
- 18 ARMATURES
- 19 BACKPLATE
- 20 STARTER MOTOR
- 21 BREATHER



- 22 CRANKCASE COVER OR SUMP
- 23 CAMSHAFT AND GOVERNOR SPOOL
- 24 #2 PISTON AND CONNECTING ROD ASSEMBLY
- 25 #1 PISTON AND CONNECTING ROD ASSEMBLY
- 26 CRANKSHAFT
- 27 VALVES
- 28 CYLINDER

ENGINE DISASSEMBLY

Preparation

- Drain oil. Remove and discard oil filter.
- Disconnect choke and throttle control cables.
- Remove engine from equipment.
- Remove spark plugs.
- Remove muffler and exhaust manifold.

3

Remove Air Cleaner Assembly

Vertical Crankshaft – Models 290700 – 380700

Current style: (Round cartridge), Fig. 1.

1. Remove air cleaner cover, cartridge and pre-cleaner.
2. Remove three screws (2) and breather deflector (3).
3. Remove two carburetor mounting nuts (1).
4. Remove air cleaner base and breather tube.

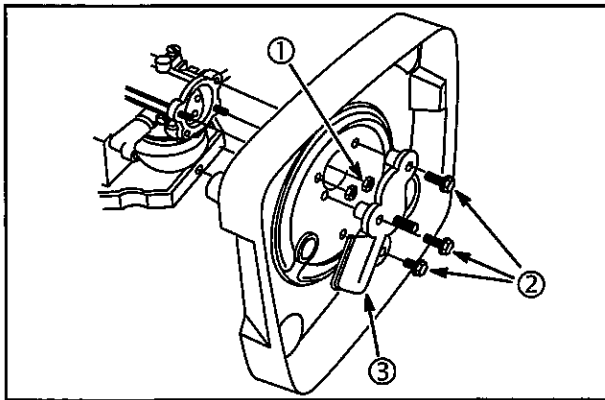


Fig. 1

Early style: (Square cartridge), Fig. 2.

1. Remove air cleaner cover.
2. Remove four screws (6), lock washers (4) and flat washers (7).
3. Remove air cleaner base (5) and breather tube.

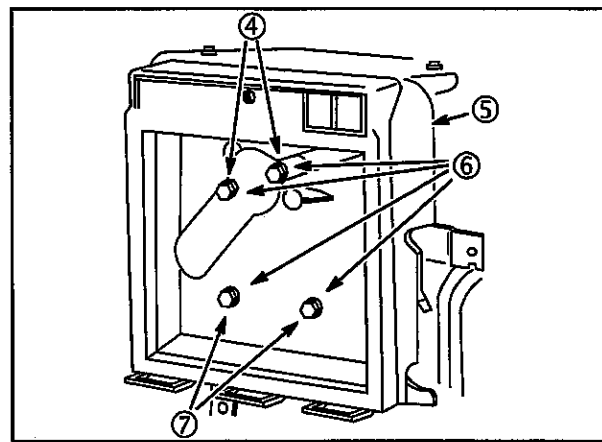


Fig. 2

Horizontal Crankshaft Models 290400 – 350400

Current style: (Round cartridge), Fig. 3.

1. Remove air cleaner cover, cartridge and pre-cleaner.
2. Remove three screws (1) and breather deflector (2).
3. Remove two air cleaner base mounting screws (3).
4. Remove air cleaner base (4) and breather tube.

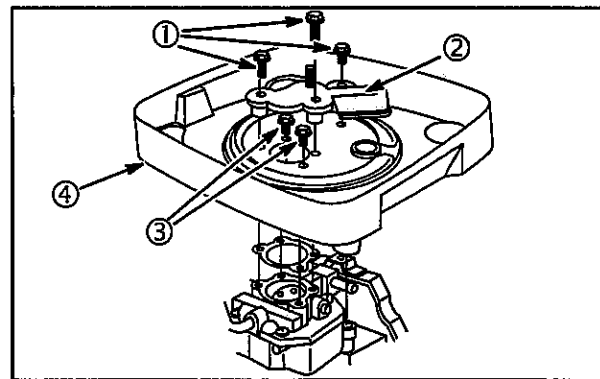


Fig. 3

Early style: (Square cartridge), Fig. 4.

1. Remove air cleaner cover.
2. Remove four screws (2).
3. Remove air cleaner base (1) and breather tube.

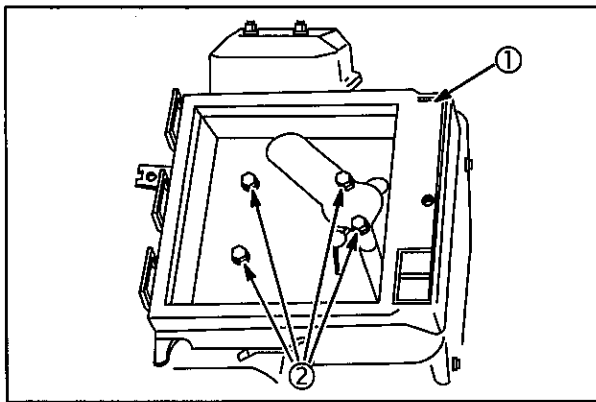


Fig. 4

Horizontal Crankshaft – Models 351400 – 380400

1. Remove air cleaner cover, cartridge and pre-cleaner.
2. Remove five screws (1) and carburetor shield (2), Fig. 5.
3. Disconnect breather tube at air cleaner base and remove air cleaner base (3).

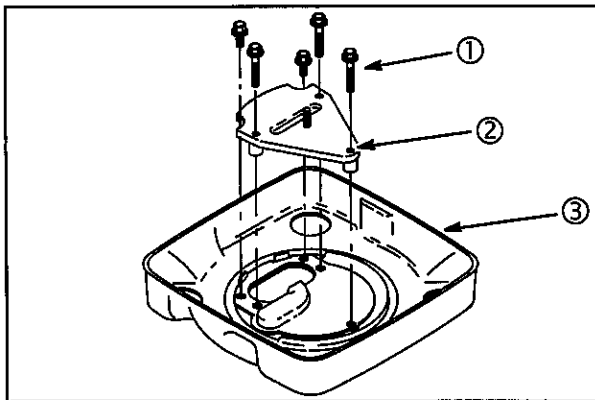


Fig. 5

Horizontal Crankshaft – Models 540000, 610000

1. Loosen the clamp (1) for the air inlet hose, Fig. 6.
2. Remove two mounting band screws (2). Remove the air cleaner assembly.

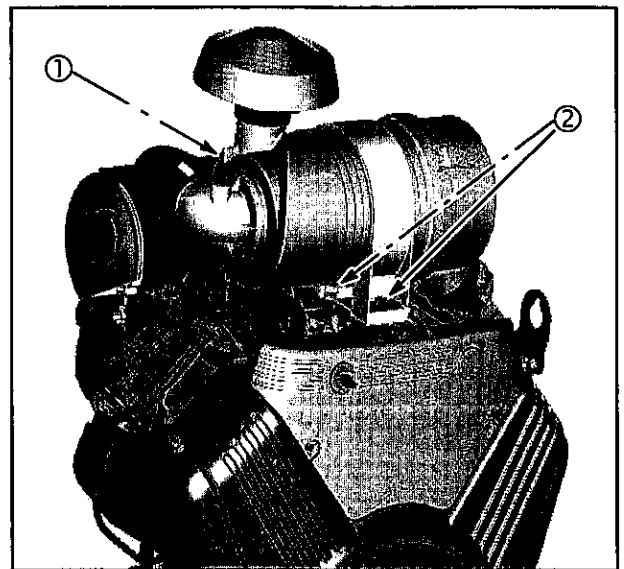


Fig. 6

Remove Blower Housing and Fan

1. Remove blower housing (1) and debris screen (2), Fig. 7.

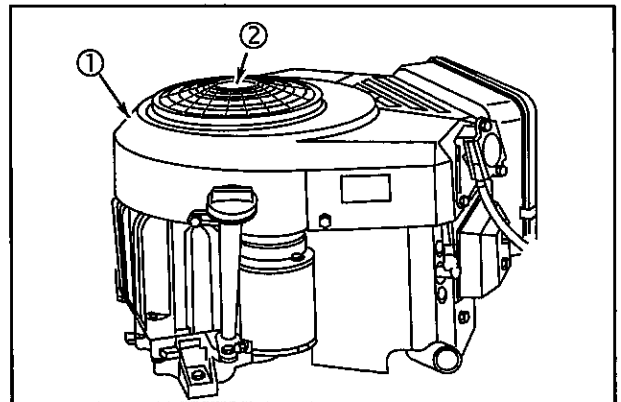


Fig. 7

2. Remove two screws (5), fan retainer (6) and fan (7), Fig. 8.

NOTE: If engine is equipped with rewind starter hub (4), remove starter hub screw (3) first.

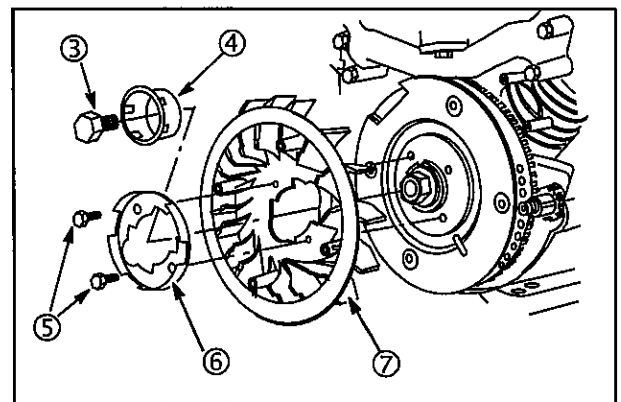


Fig. 8

Remove Carburetor and Intake Manifold

Vertical Crankshaft, All Models

1. Remove air cleaner assembly.
2. Remove two screws (2) and choke control bracket, **Fig. 9**.
3. Disconnect choke link (1) from carburetor.

NOTE: If engine is equipped with anti-afterfire solenoid, air cleaner bracket (3) must be removed **BEFORE** removing carburetor, **Fig. 9**.

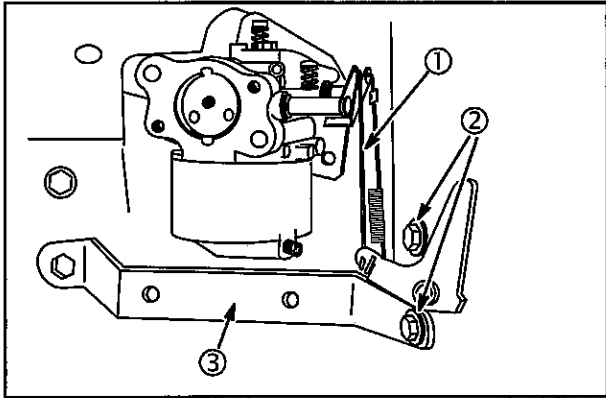


Fig. 9

4. Remove carburetor mounting screws (4) and carburetor, **Fig. 10**.

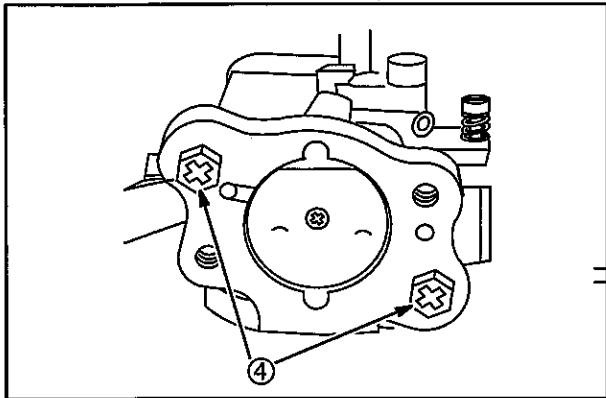


Fig. 10

Horizontal Crankshaft – All Models

NOTE: Disconnect anti-afterfire solenoid wire from equipment switch wire. Remove blower housing.

1. Remove two screws and choke control bracket (5), **Fig. 11**.

2. Disconnect choke link (1) from carburetor.
3. Disconnect fuel line at carburetor.
4. Disconnect governor link and spring (4) from retainer (3) and throttle lever (2).
5. Disconnect governor link.

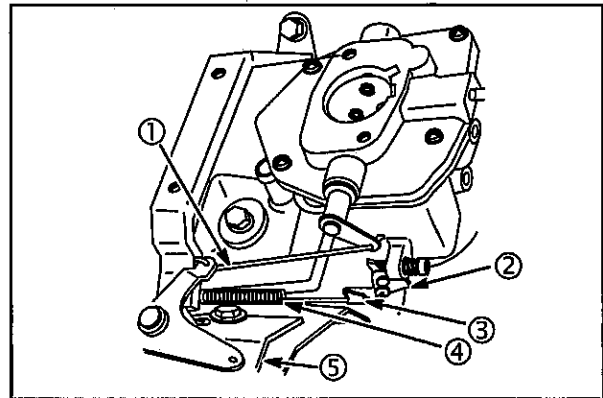


Fig. 11

6. Disconnect fuel line at carburetor.
7. Remove intake manifold and gaskets.

Remove Control Bracket

1. Remove governor control bracket (1), **Fig. 12**.
2. Remove valley cover (2) and cylinder shields (3).

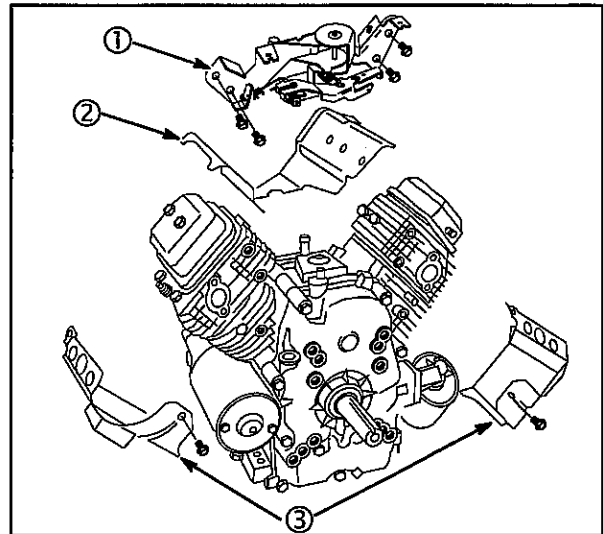


Fig. 12

Remove Armatures

1. Disconnect stop switch wires at armatures.
2. Remove armature screws and lift off armatures (1), **Fig. 13**.

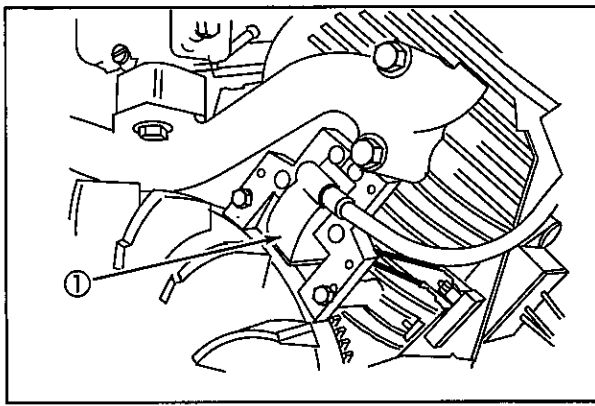


Fig. 13

Remove Flywheel

Flywheel Nut – Models 290000, 303000, 540000, 610000

1. Prevent the flywheel from turning with Flywheel Strap Wrench, #19433 (5) around outer rim of flywheel, Fig. 14.
2. Turn the flywheel nut COUNTERCLOCKWISE (arrow) with a 1/2" breaker bar (4) and a 30 mm socket to remove.

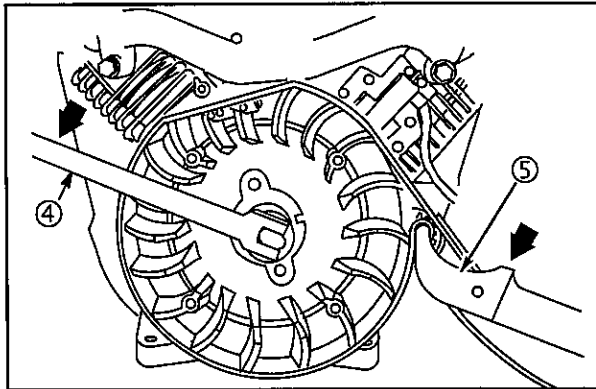


Fig. 14

Models 350000, 380000

1. Place Flywheel Holder #19321 (6) on fan retainer with lugs of flywheel holder engaging slots on the fan retainer, Fig. 15.

NOTE: If engine is equipped with rewind starter hub remove starter hub screw first. Then remove flywheel nut.

2. Turn the flywheel nut COUNTERCLOCKWISE (arrow) with a 1/2" breaker bar (4) and a 30 mm socket to remove

NOTE: Do not remove fan retainer and fan at this time.

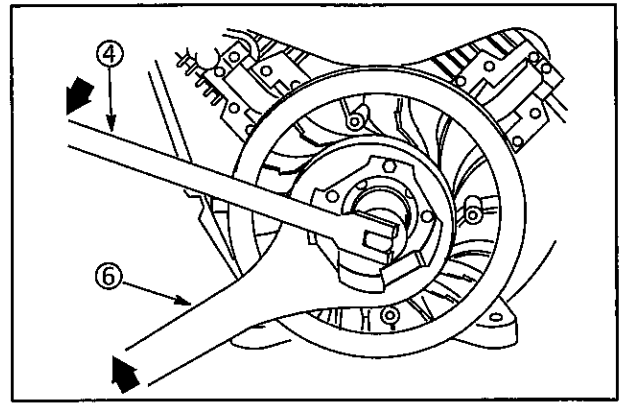


Fig. 15

Flywheel – All Models EXCEPT Engines with PowerLink™

NOTE: See the special procedure at the end of this section for flywheel removal on engines with the PowerLink™ system.

1. Reinstall flywheel nut (2). Turn nut down flush with top of threads, Fig. 16.
2. Install Flywheel Puller #19203 (1).
3. Tighten puller screws equally until flywheel loosens.

	CAUTION
	AVOID INJURY!
<ul style="list-style-type: none"> • DO NOT strike the flywheel with a hard object or a metal tool. This could cause the flywheel to shatter in operation. • Use approved flywheel removal tools. 	

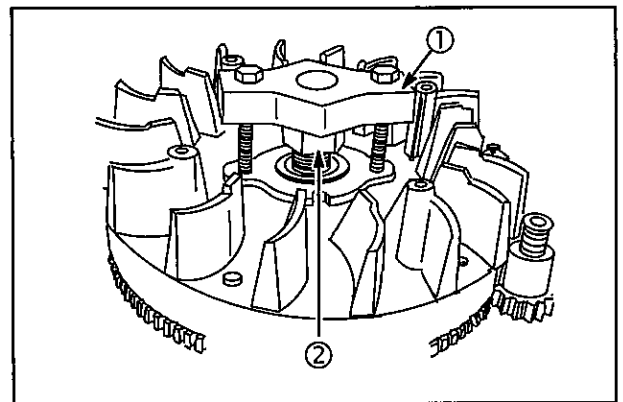



Fig. 16

	<p style="text-align: center;">CAUTION</p> <p style="text-align: center;">AVOID HAND AND/OR FINGER INJURY!</p>
<p>• The flywheel magnets are VERY POWERFUL and can rapidly draw the flywheel to the engine. Exercise caution and use the proper tools when servicing the flywheel.</p>	

3

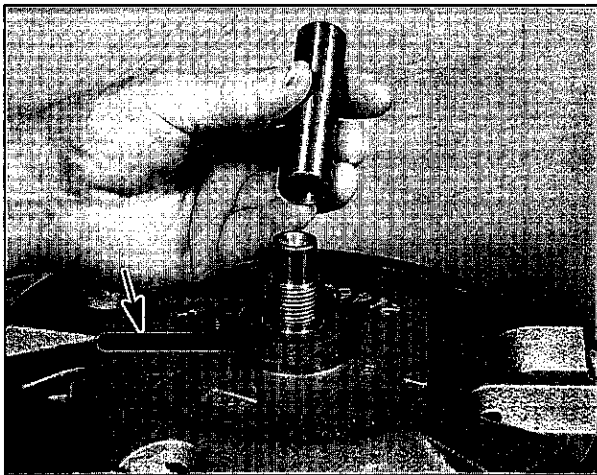


Fig. 18

Required Tools

NOTE: The components of Flywheel Puller #19534, are shown in Fig. 17. This tool is REQUIRED to service the flywheel on engines with the PowerLink™ system.

1. Puller
2. Vanguard™ Pilot
3. Intek™ Pilot
4. Screws

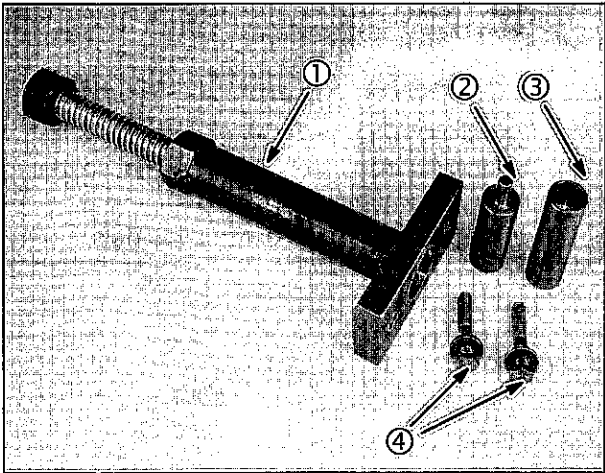


Fig. 17

1. Remove the ignition coils from the engine.
2. Remove the flywheel nut, fan retainer and fan from the flywheel.
3. Mark the flywheel (arrow) as shown to locate the flywheel keyway when reinstalling, Fig. 18.
4. Install the correct pilot over the crankshaft as shown.

5. Place the flywheel puller over the pilot. Back out the puller screw (5) until the flange on the puller is flush with the flange on the flywheel, Fig. 19.
6. Align the holes in the puller flange with the holes in the flywheel. Install the puller screws (4) and tighten until the screws are flush with the flange on the puller.
7. While holding the hex on the puller, tighten the puller screw until the flywheel loosens.
8. Continue tightening the puller screw until the flywheel is clear of the stator and can be lifted from the crankshaft. Leave the puller screw in this position.
9. Leave the puller attached to the flywheel, and place the flywheel on a clean work surface with the ring gear side down, until the flywheel is ready to be installed.

CAUTION: Use extreme care when handling the flywheel. The alternator magnets are fragile and easily damaged.

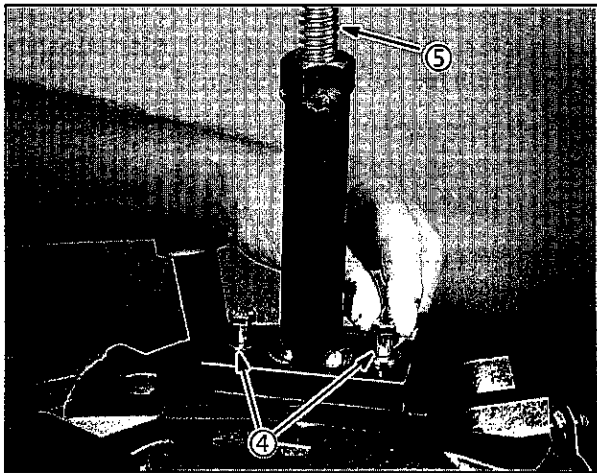


Fig. 19

Remove Breather and Starter Motor

1. Remove breather (3), alternator (6), backplate (5) and starter motor (4), **Fig. 20**.

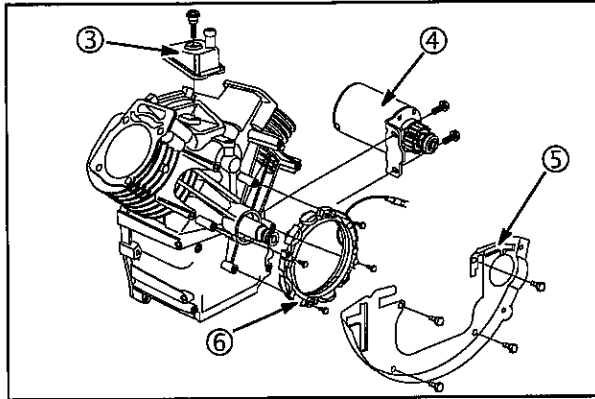


Fig. 20

2. Remove crankcase cover/sump.

Remove Cylinder Head

1. Remove two rocker studs (1) supports (2) and rocker arm assemblies (3), **Fig. 21** (current) or **Fig. 22** (early). Remove rocker arm shaft (4, early versions).

2. Remove push rods.

NOTE: Label push rods for reassembly in the original location.

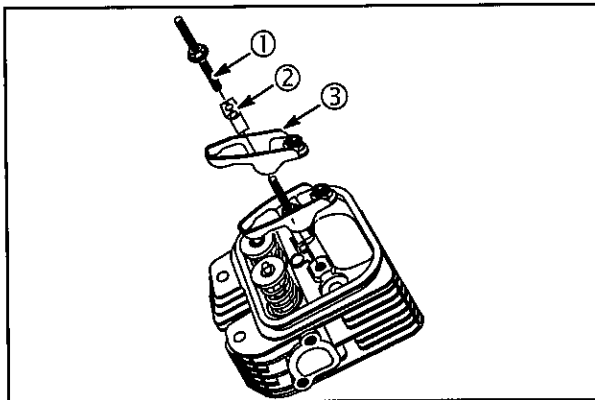


Fig. 21

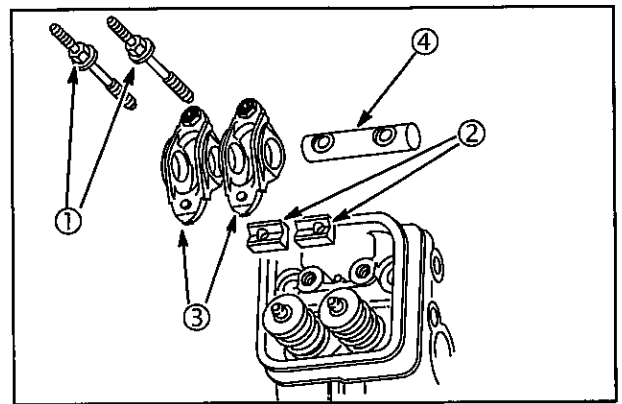


Fig. 22

3. Remove head bolts (5, 6, 7, 8) and cylinder head, **Fig. 23**. Discard cylinder head gasket.

NOTE: Engines manufactured before 940501xx were equipped with sealing washers under cylinder head bolts (5) and (6).

Repeat for other cylinder head.

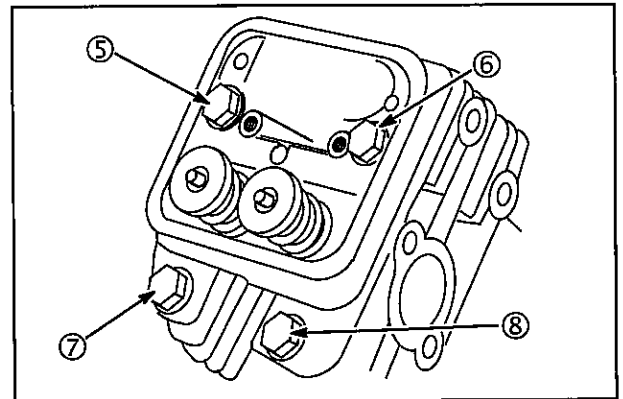


Fig. 23

Remove Oil Pump

1. Remove gear baffle (1) and oil pump (2) with pickup (4) from crankcase cover (horizontal crankshaft engines), **Fig. 24**, or sump (vertical crankshaft engines), **Fig. 25**.

NOTE: Discard all O-rings (3).

2. Remove oil pickup from oil pump.

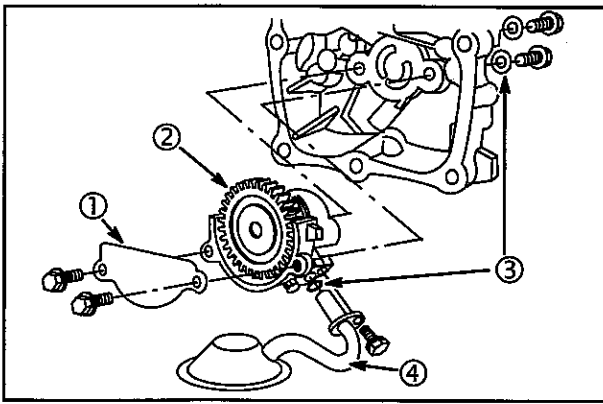


Fig. 24

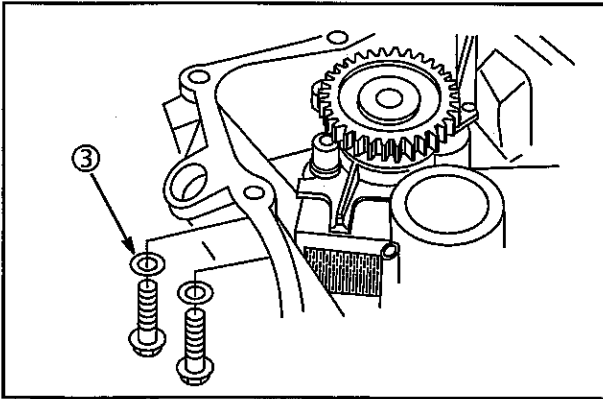


Fig. 25

Remove Camshaft

1. Remove governor spool (8) from camshaft (7), Fig. 26. Discard gasket and O-ring.
2. Rotate crankshaft and camshaft until timing marks (9) align. Remove camshaft.
3. Remove tappets.

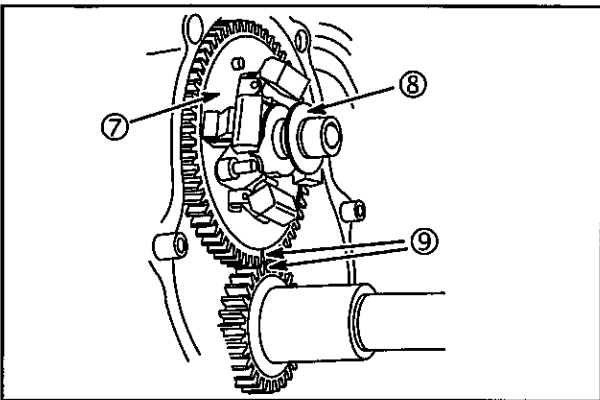


Fig. 26

Remove Pistons and Connecting Rods

NOTE: Remove any carbon or ridge at the top of cylinder bores to prevent breaking rings when removing piston and connecting rod assemblies.

1. Remove #2 connecting rod cap.
2. Push connecting rod and piston assembly (11) out of #2 cylinder (arrow), Fig. 27. Reassemble cap to rod to prevent interchanging.
3. Repeat for #1 cylinder (10).

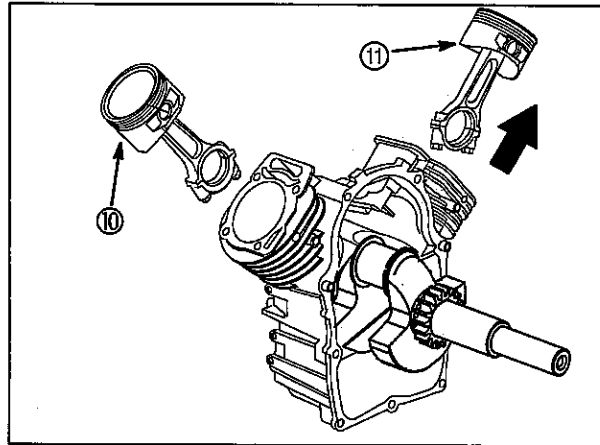


Fig. 27

Remove Crankshaft

Remove crankshaft (1) from cylinder, Fig. 28.

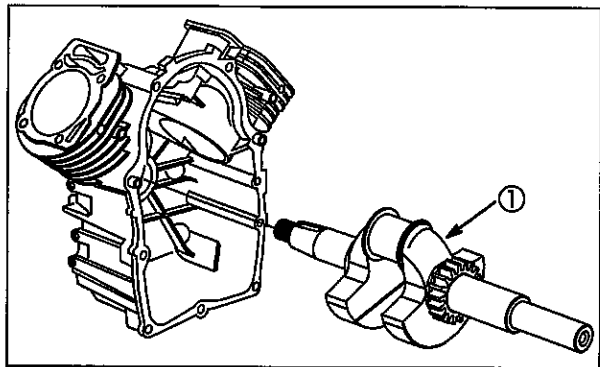


Fig. 28

AFTER DISASSEMBLY

- Remove gasket material from ALL surfaces.
- Remove oil seals.
- Thoroughly clean parts in solvent.
- Organize all components. Keep parts that are assemblies together.

Section 4

Fuel Systems and Carburetion

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FUEL SYSTEMS

7 Quart Fuel Tank

Removal

1. Remove air cleaner knob (1) and cover (2), Fig. 1.
2. Remove air cleaner nut (3), top plate (4) and element (5).

4

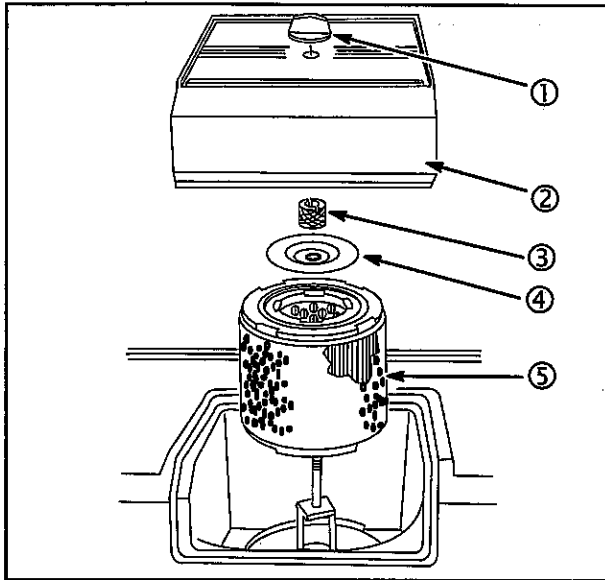


Fig. 1

3. Turn the fuel shut-off to the OFF position. Disconnect fuel valve shut-off link.
4. Remove 2 screws (flywheel side) and 2 shoulder bolts (PTO side) from the fuel tank.
5. Lift the fuel tank. Disconnect the fuel line from the carburetor. Remove the fuel tank.
6. Remove air cleaner base. Disconnect the breather tube.
7. Remove 4 screws (6) and the fuel tank base plate, Fig. 2.

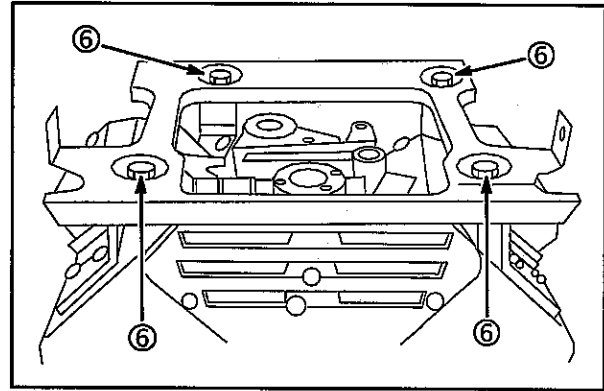


Fig. 2

8. If necessary remove 4 screws and 2 PTO side fuel tank base supports (7), Fig. 3.

NOTE: Do not disturb the governor controls.

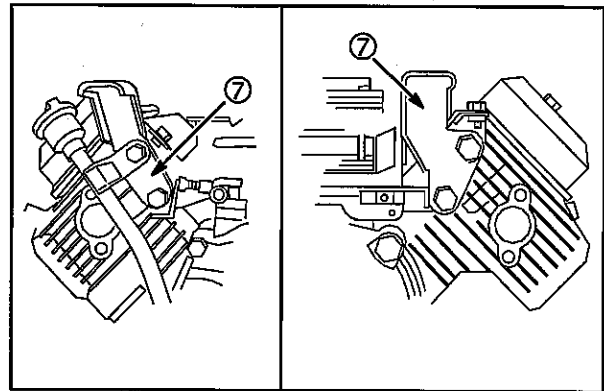


Fig. 3

9. If necessary remove 4 screws and 2 flywheel side fuel tank base supports (8), Fig. 4.

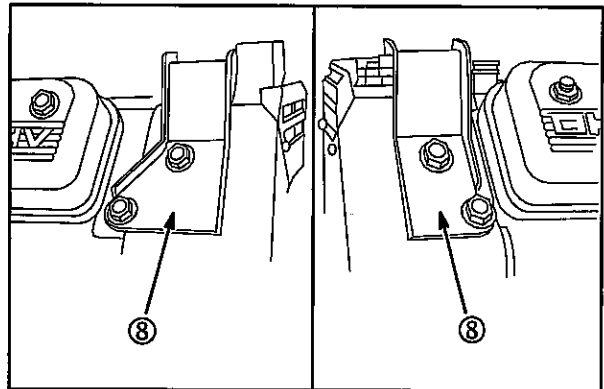


Fig. 4

Installation

1. Install 2 flywheel side fuel tank base supports (8), Fig. 4. Torque screws to 140 in. lbs. (16 Nm).
2. Install 2 PTO side fuel tank base supports (7), Fig. 3. Torque screws to 140 in. lbs. (16 Nm).

NOTE: Install the supports over the governor control bracket, one side at a time to avoid disturbing the governor adjustment. Install the screws in the same order as removed.

3. Install the fuel tank base plate. Torque screws to **140 in. lbs. (16 Nm)**.
4. Install the air cleaner base. Torque screws (1), **Fig. 5 to 60 in. lbs. (7 Nm)**. Connect the breather tube.

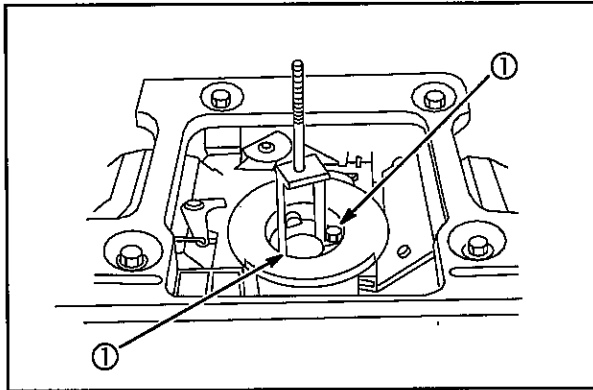


Fig. 5

5. Connect the fuel line to the carburetor. Install the fuel tank. Torque screws (2) and shoulder bolts (3) (PTO side) to **140 in. lbs. (16 Nm)**, **Fig. 6**.

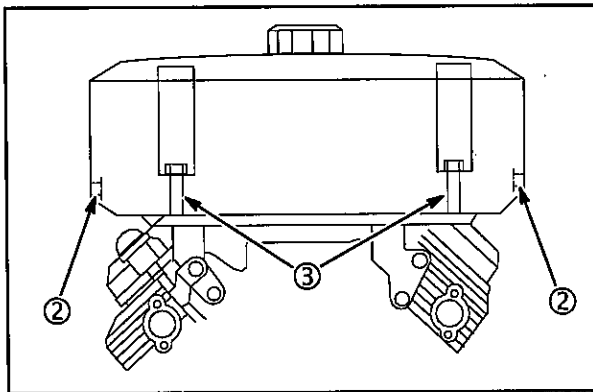


Fig. 6

6. Connect the fuel shut-off valve link. Slide the looped end of the link over the knob on the fuel valve. Tighten the screw securely.
7. Install the air cleaner element, top plate and nut.
8. Install the top cover plate and knob.

9 Quart Fuel Tank

Removal

1. Remove air cleaner cover knobs (1) and cover (2), **Fig. 7**.

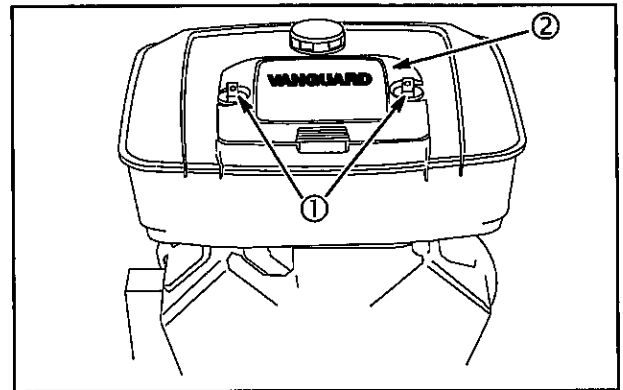


Fig. 7

2. Remove air cleaner nut (3), top plate (4) and air cleaner element, **Fig. 8**.

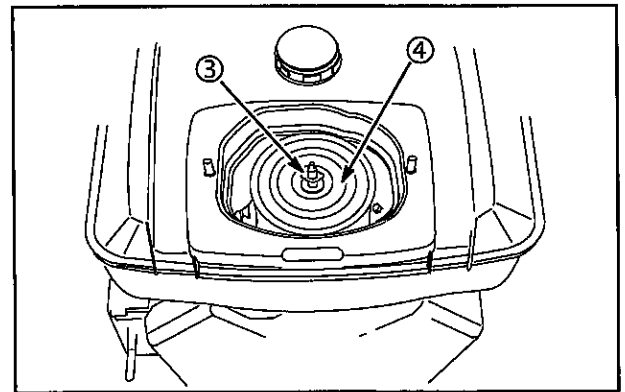


Fig. 8

3. Turn the fuel shut-off to the OFF position.
4. Remove 2 shoulder bolts (5) from each side of the fuel tank, **Fig. 9**.

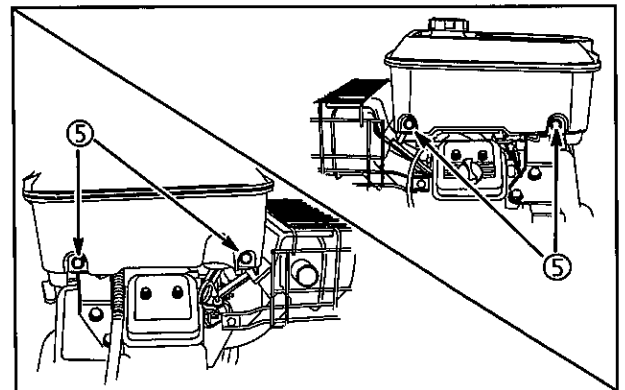


Fig. 9

- Lift the fuel tank. Disconnect the fuel hose from the carburetor fuel inlet (6), **Fig. 10**. Remove the fuel valve shut-off knob from the shut-off link (7).

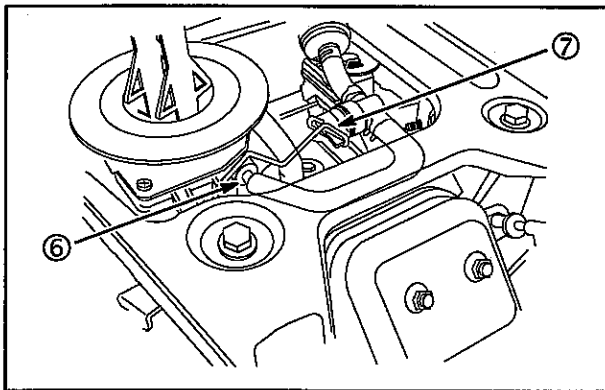


Fig. 10

- Remove the fuel tank.

Installation

- Hold the fuel tank above the engine. Connect the fuel hose to the carburetor fuel inlet. Insert the fuel valve shut-off knob to the shut-off link.
- Put the fuel tank in position. Install 2 shoulder bolts to each side of the tank. Torque the shoulder bolts to **140 in. lbs. (16 Nm)**.
- Install the air cleaner element, top plate and nut.
- Install the air cleaner cover. Secure the cover with the air cleaner cover knobs.

Fuel Pump

General Information

NOTE: Some applications use an OEM supplied remote fuel pump. These engines are manufactured without a fuel pump.

The fuel pump allows for remote fuel tank installations. Fuel pressure is **1.5 psi (0.1 Bar)**. The pump will prime at **12" (30.5 cm)** maximum lift.

CAUTION: Excessive fuel pressure can result in an over-rich carburetor mixture and ultimately cylinder scoring and/or other engine damage, resulting from gasoline diluting the crankcase oil. **FUEL PUMP PRESSURE MUST NOT EXCEED 1.5 psi (0.1 Bar)**.

All Except Models 540000, 610000

The fuel pump is actuated by pulsating crankcase vacuum from the engine. The vacuum pulse fitting (2), **Fig. 11** is installed on the No. 1 cylinder valve cover.

NOTE: A leak at the vacuum pulse hose or its connections will result in improper fuel flow.

Inspect the fuel hose from the fuel tank (3), the fuel hose to the carburetor (1) and the vacuum pulse hose. Replace any hose that is stiff or brittle.

NOTE: The fuel pump is available only as an assembly.

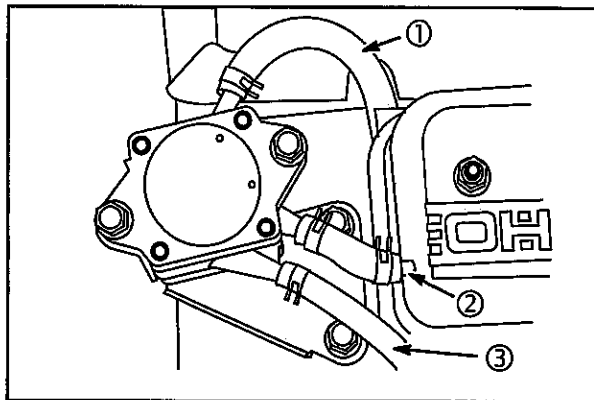


Fig. 11

Models 540000, 610000

The fuel pump (3), **Fig. 12**, is actuated by a lobe on the camshaft. Inspect the fuel hose (2) from the fuel tank to the pump and the hose from the pump to the carburetor (1). Replace fuel hoses if stiff or brittle.

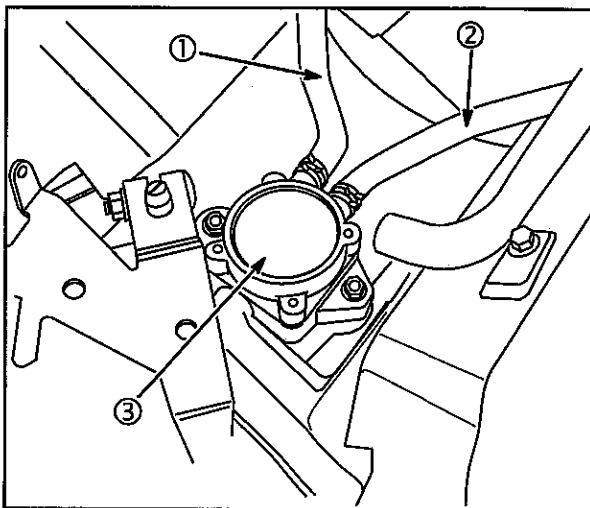


Fig. 12

NOTE: Parts removed for clarity. The fuel pump is available only as an assembly.

Fuel Filter

Replace the inline fuel filter yearly or every 100 hours, whichever occurs first. Replace the filter if dirt or water are present. See the IPL for correct fuel filter.

Inspect the carburetor connection (6) and fuel shut-off valve (5) for leaks or damage, **Fig. 13**.

Inspect the tie wrap (2) securing the shut-off valve, replace as required.

- **CAUTION:** When replacing fuel filter (3) on Vanguard™ engines with the 9 quart fuel tank (4), the fuel hose from the carburetor (1) must be routed **OVER** the fuel shut-off rod (7) if engine is equipped with a Mikuni carburetor, or **UNDER** the fuel shut-off rod if engine is equipped with Nikki carburetor, **Fig. 13**.

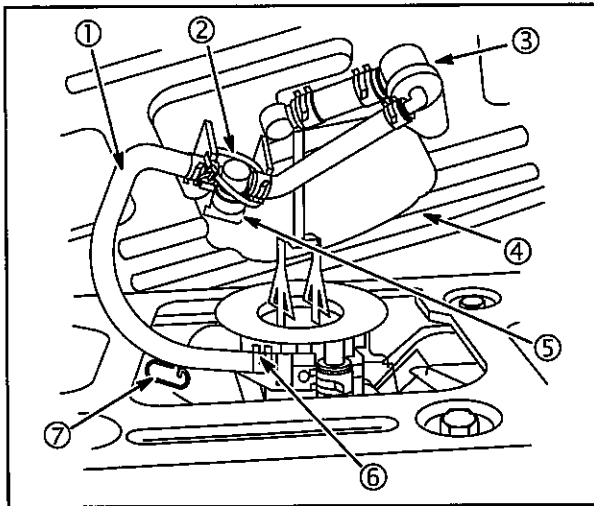


Fig. 13

Early (8) and current (9) style fuel filter assemblies for Vanguard™ engines with the 9 quart fuel tank shown in **Fig. 14**.

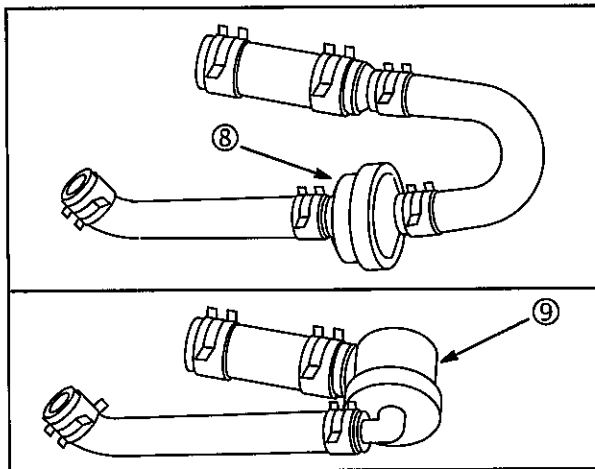


Fig. 14

Fuel Shut-Off Valve

Engines equipped with an optional fuel tank will also have a fuel shut-off valve, **Fig. 15**. Inspect valve for ease of operation and leakage. Replace valve if operation is difficult or if valve leaks.

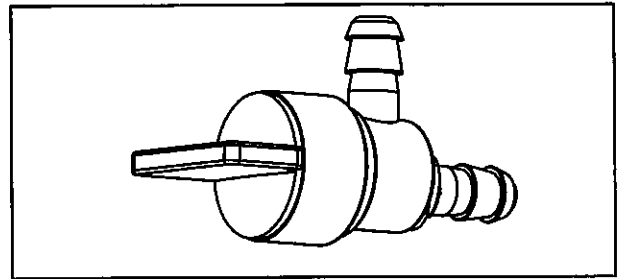


Fig. 15

4

CARBURETION

NOTE: Some Briggs & Stratton V-Twin engines operate on gaseous fuels. Information on the gaseous fueled engines is in Troubleshooting, Section 2.

NOTE: If the engine has an anti-afterfire solenoid, remove blower housing so the solenoid wire can be properly routed during reassembly. Disconnect anti-afterfire solenoid wire from equipment wire.

Carburetor Identification

Three types of carburetors are used on gasoline Vanguard™ OHV V-Twin engines:

- One-piece Flo-Jet side-draft on **Models 290700, 294700, 303700, 350700, 351400, 351700, 380400 and 380700.**
- Two-piece Flo-Jet down-draft on **Models 290400, 303400 and 350400.**
- Fixed jet Flo-Jet side draft two barrel on **Models 540000, 610000.**

Carburetor Removal

Typical

Remove carburetor, spacer (3) and gaskets (2) from manifold (1), **Fig. 16**.

Discard gaskets.

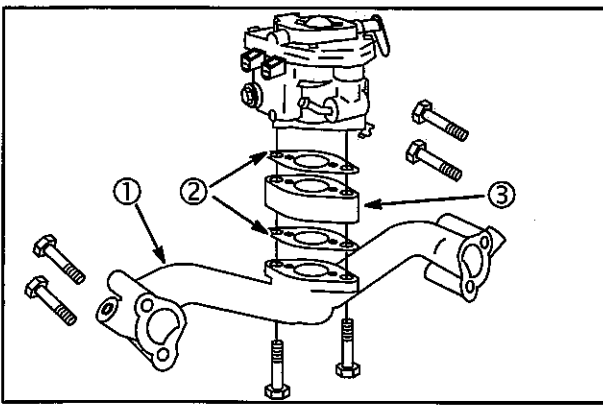


Fig. 16

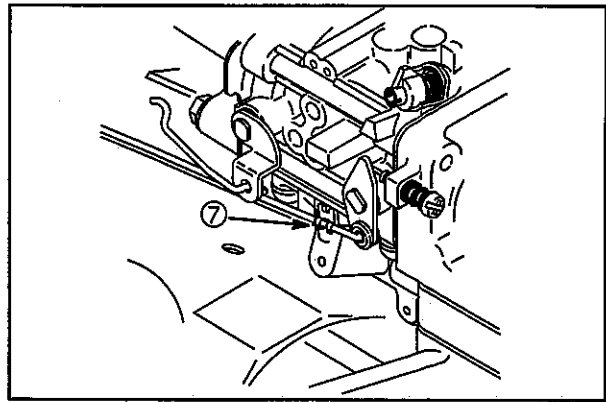


Fig. 18

4

Models 351400 and 380400

The blower housing must be removed so that anti-afterfire solenoid wire can be properly routed during reassembly.

1. Disconnect fuel line at carburetor.
2. Remove anti-afterfire solenoid ground wire (5).
3. Remove choke control bracket (6) and disconnect link (4), Fig. 17.

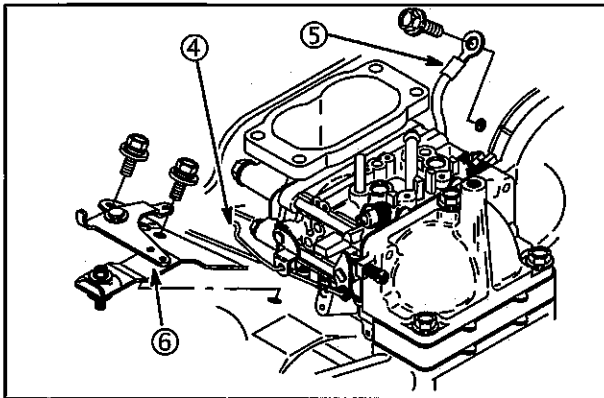


Fig. 17

4. Unhook governor link spring (7) from throttle lever. Disconnect governor link, Fig. 18.

5. Remove air cleaner elbow support screw (8), Fig. 19.
6. Remove 3 intake elbow screws and carburetor assembly.
7. Remove carburetor spacer (10) and gaskets (9).

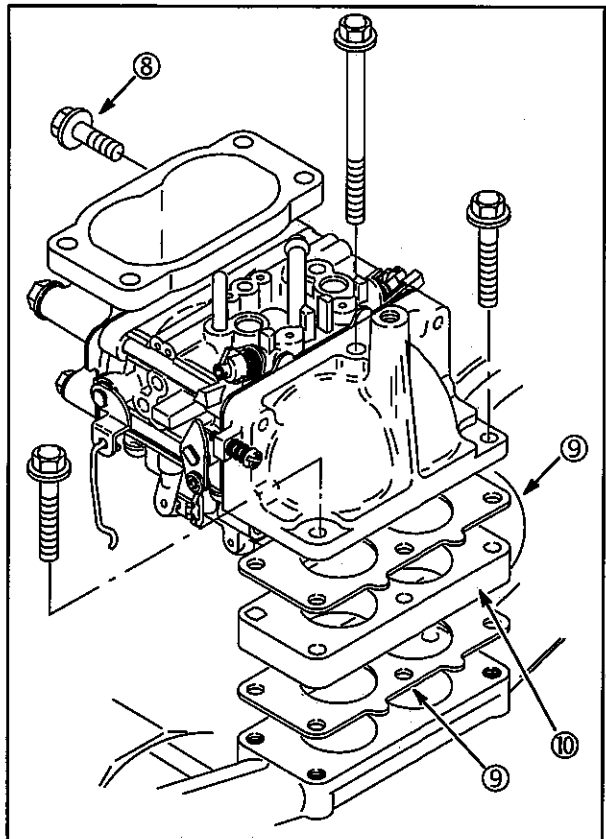


Fig. 19

8. Remove two nuts (13) and two screws (14). Separate air cleaner elbow (12) and intake elbow (15) from carburetor, Fig. 20.
9. Discard gaskets (11).

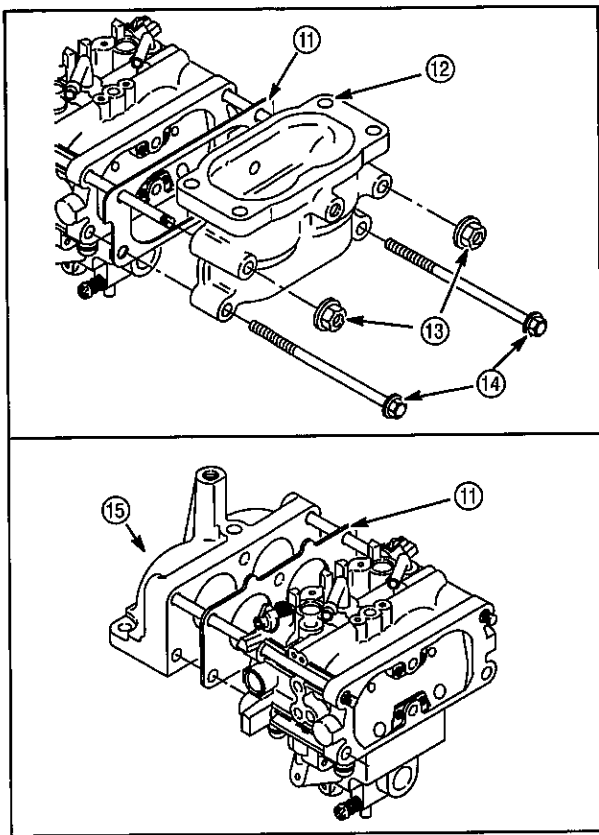


Fig. 20

Carburetor Service

Aisan Carburetor

Models 290700, 303700, 350700
(After 950930xx)

Check Throttle, Choke Shaft and Body For Wear

NOTE: The measurement in Step 1 is taken with the carburetor off of the intake manifold.

1. Lay carburetor on flat surface and check throttle and choke shaft clearance (1) as shown, **Fig. 21**.

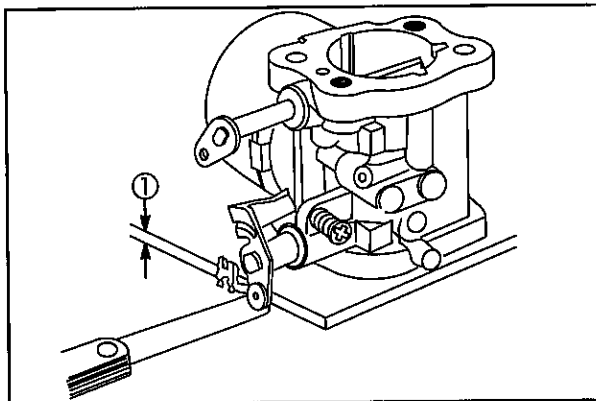


Fig. 21

Throttle shaft and choke shaft clearance must not exceed **0.010" (0.25 mm)**.

NOTE: The inspection in Step 2 is performed after the carburetor has been disassembled.

2. Inspect throttle shaft and choke shaft for wear (2), **Fig. 22**.

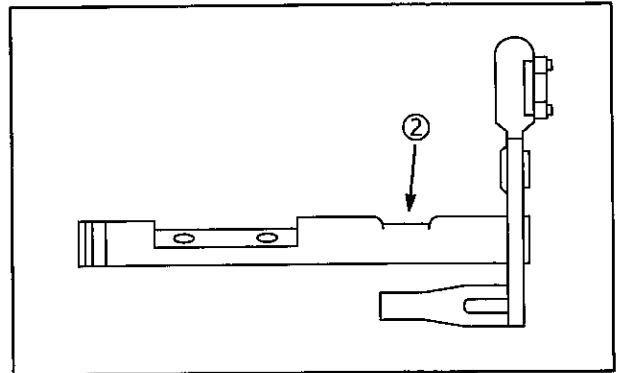


Fig. 22

Replace either shaft if worn.

Replace the carburetor if the body is worn or if either shaft clearance exceeds **0.010" (0.25 mm)** when a new shaft is used.

Disassemble

1. Remove anti-afterfire solenoid (1) or bowl screw (5) and washer (4), **Fig. 23**.
2. Remove float bowl (3). Discard bowl gasket (2).

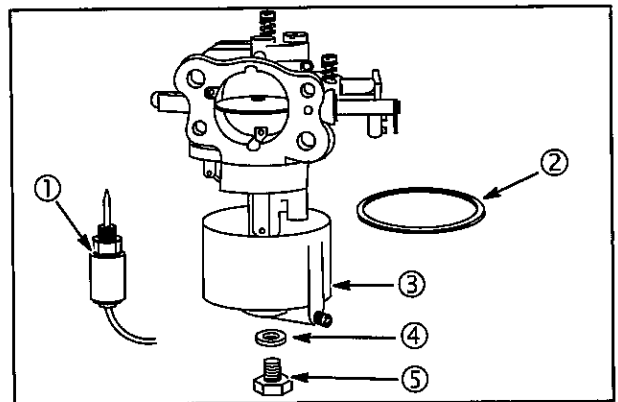


Fig. 23

3. Remove float hinge pin (6), float and inlet needle, **Fig. 24**.

CAUTION: Float hinge pin is a press fit. Use care when removing.

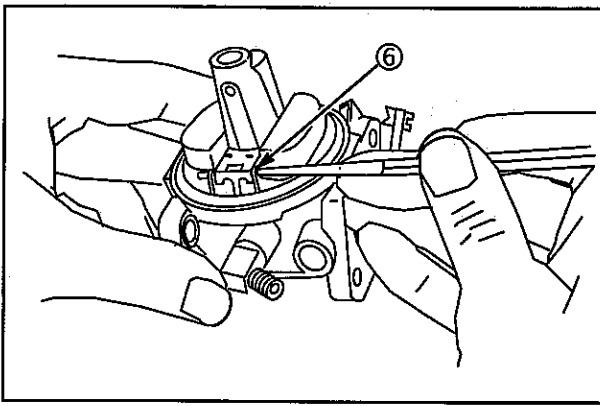


Fig. 24

4

4. Remove fixed main jet (7) using Screwdriver #19062, Fig. 25.
5. Reach into carburetor throat with flat blade screwdriver and push down on end of emulsion tube (8).

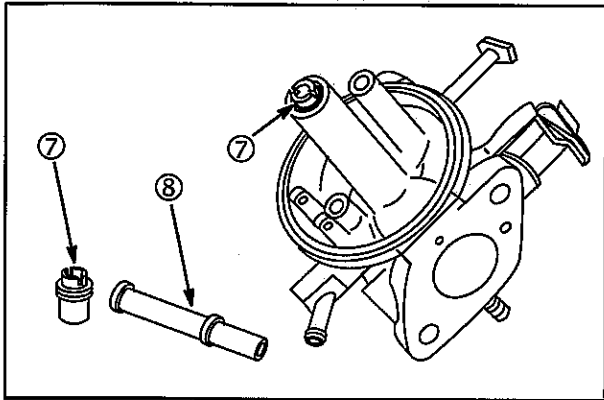


Fig. 25

NOTE: Consult the IPL to get the high altitude jet part number if required.

6. Remove idle jet plug (10) and idle jet (9), Fig. 26.

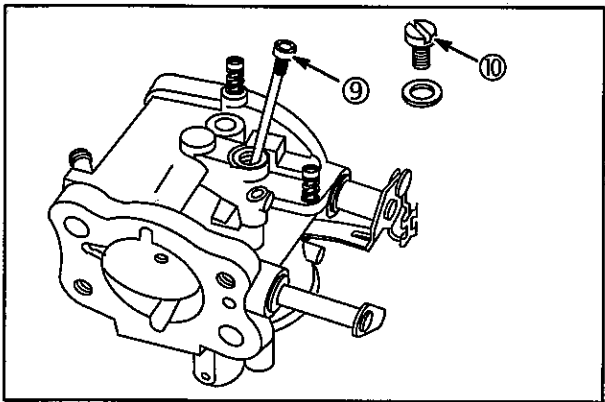


Fig. 26

7. Use a pliers to remove the idle mixture screw adjustment limiter cap (11) if equipped, Fig. 27.

8. Remove the idle mixture screw (12).

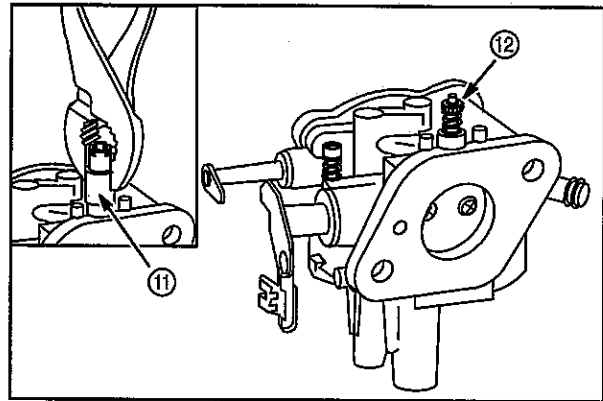


Fig. 27

9. The top and bottom edges of the throttle plate are beveled. Mark throttle plate (13) before removing to ensure reinstallation in the original position, Fig. 28.

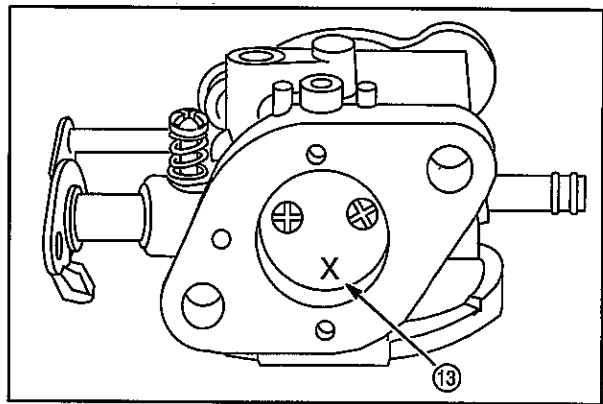


Fig. 28

10. Use a punch as shown and remove throttle shaft welch plug (14), Fig. 29.

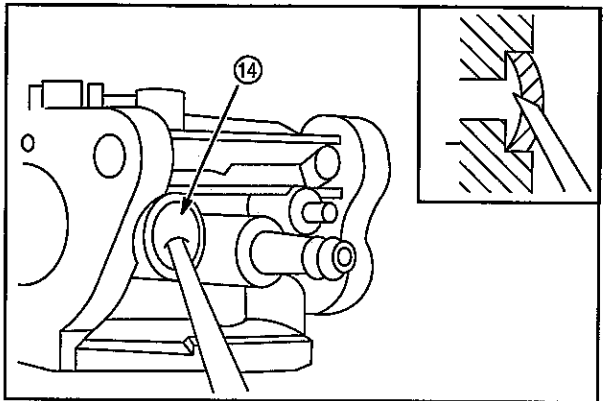


Fig. 29

11. Remove snap ring (16) and washer (15), Fig. 30.
12. Remove throttle shaft, collar (17) and seal (18).

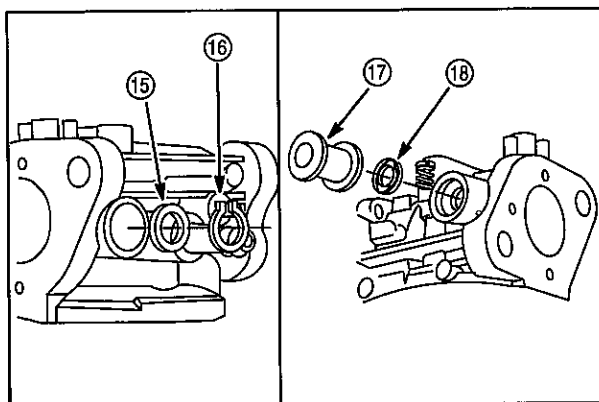


Fig. 30

13. Remove screw (25) and choke plate (24), Fig. 31.

	CAUTION
	AVOID EYE INJURY!
<ul style="list-style-type: none"> • Carburetor body has a detent ball (19) and spring (20) that keeps tension on choke shaft. Wear eye protection. • Use caution when removing shaft! 	

14. Remove E-ring (23), washer (22) choke shaft and seal (21).

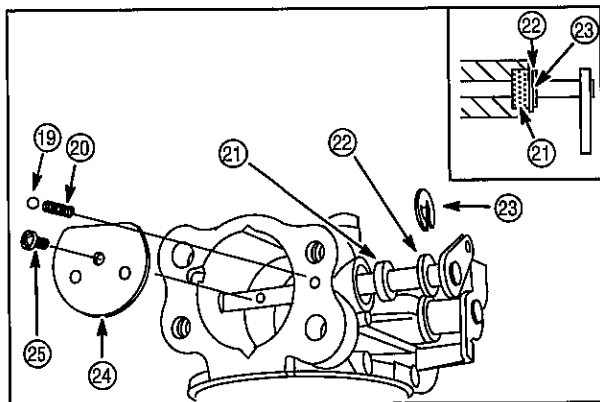


Fig. 31

15. Use a punch (26) to remove transitional hole welch plug (27) from top of carburetor, Fig. 32.

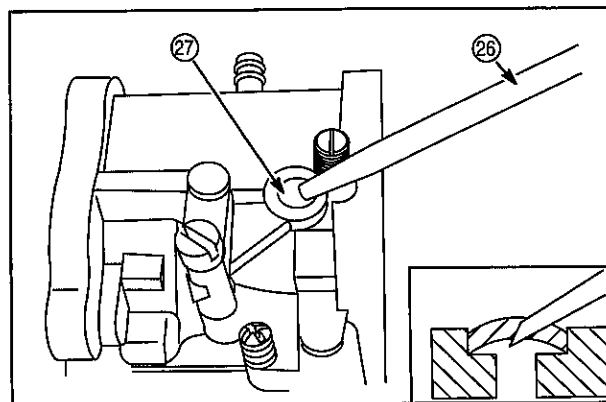


Fig. 32

This completes the carburetor disassembly procedure.

Clean Carburetor

1. Disassemble carburetor.
2. Remove and discard all old gaskets, seals and sealing material.

	CAUTION
	AVOID INJURY!
<ul style="list-style-type: none"> • Wear suitable protection when using cleaners. Follow instructions on container. 	

3. Use commercial carburetor cleaning solvents (such as Briggs & Stratton Spray Cleaner, Part #100041 or #100042) to clean carburetor parts and body.
4. When cleaning non-metallic parts (plastic, nylon, Minlon™, etc.), do not leave in commercial carburetor cleaner more than 15 minutes.

NOTE: Parts containing rubber, such as seals, O-rings, inlet needles, seats or pump diaphragms should never be placed in commercial carburetor cleaner.

	CAUTION
	AVOID EYE INJURY!
<ul style="list-style-type: none"> • Wear eye protection whenever using compressed air to clean parts. 	

5. Use only compressed air (blowing in both directions) to clean out all openings and passages.

NOTE: Do not use wire, drills or other mechanical devices to clean out metering holes or passages.

Inspect Carburetor

Inspect all parts for wear, cracks, nicks and burrs. Inspect float for leaks. Replace damaged parts.

Assemble

When assembling carburetor, use new seals and gaskets.

1. Install new transitional hole idle port welch plug (1), **Fig. 33**.
2. Use a round punch (2). Tap in plug until it is flat.
3. Seal the outside diameter of plug with Permatex® #2 or nail polish to prevent air leaks.

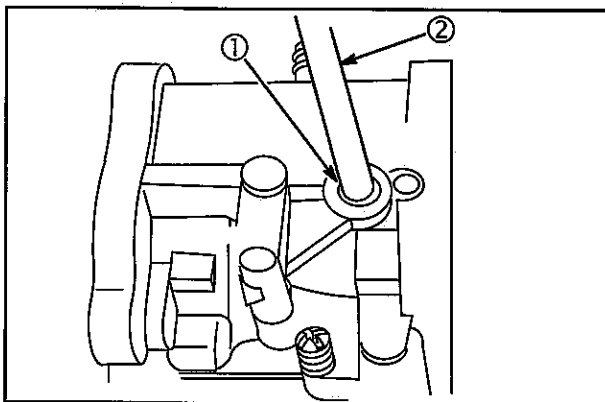


Fig. 33

4. Assemble new throttle shaft seal (4) with sealing lip out, **Fig. 34**.
5. Install throttle shaft with collar (3).
6. Install washer (5) and snap ring (6).

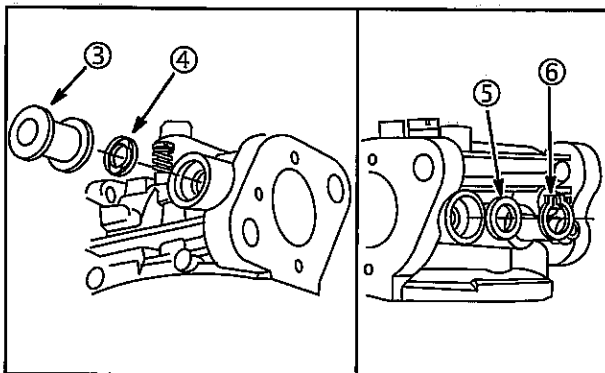


Fig. 34

7. Install throttle plate.

NOTE: Use LOCTITE® 222 on screw threads.

8. Install new throttle shaft welch plug. Use round punch and tap in plug until it is flat.
9. Use sealant on outside diameter of welch plug to prevent leaks.
10. Install new "E" ring (11), washer (10) and felt seal (9) onto choke shaft, **Fig. 35**.
11. Insert spring (8) and check ball (7) in to spring pocket. Compress with a small round punch.

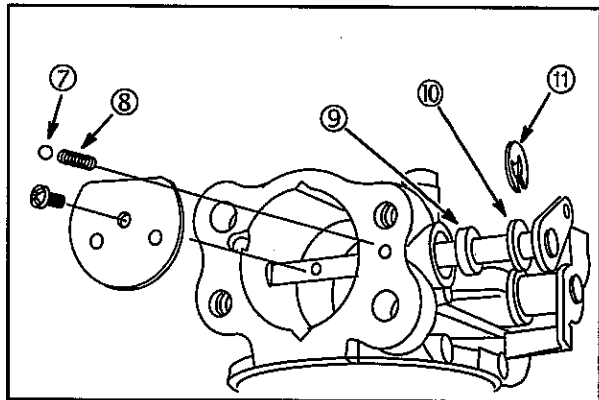


Fig. 35

12. Install choke shaft.
13. Install choke plate as shown, **Fig. 35**.

NOTE: Use LOCTITE® 222 on screw threads.

14. Assemble inlet needle retainer (12) to inlet needle (13). Assemble to float, **Fig. 36**.
15. Install float.
16. Install emulsion tube (15) and fixed main jet (14).

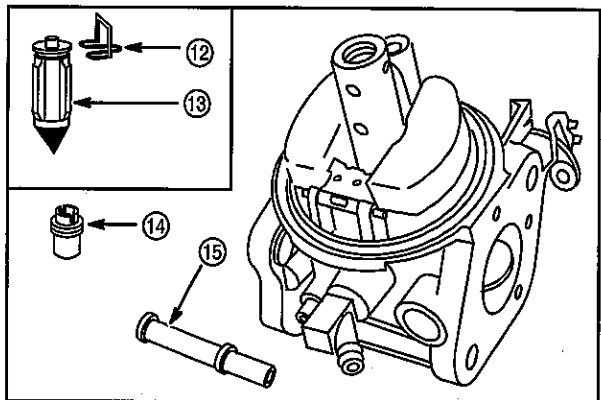


Fig. 36

17. Check float adjustment, **Fig. 37**.
 - a. Hold carburetor in vertical position with float hinge up as shown.
 - b. Float should be parallel (17) to bowl mounting surface.
 - c. Bend tang (16) if required.

NOTE: DO NOT press on float to adjust.

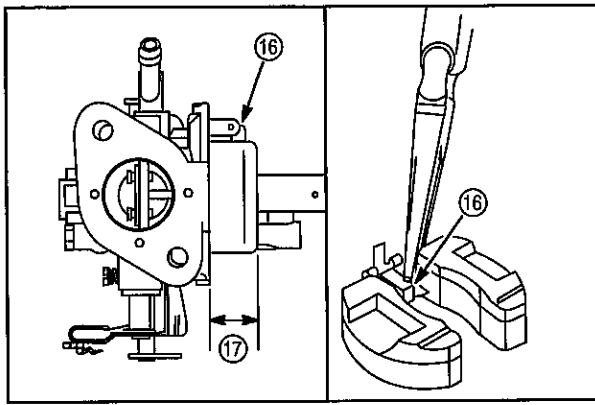


Fig. 37

18. Install idle jet (18), plug (19) and gasket (20), Fig. 38.

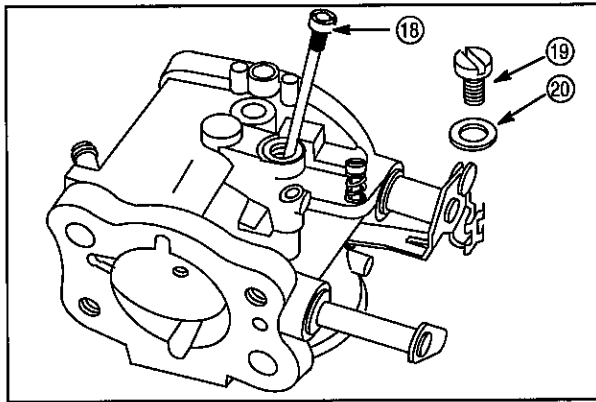


Fig. 38

19. Install idle mixture screw (21) and spring (22), Fig. 39.

NOTE: DO NOT tighten screw. DO NOT install the limiter cap at this time.

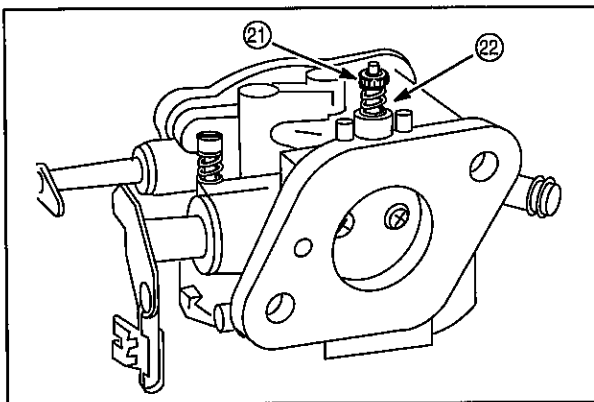


Fig. 39

20. Install bowl gasket (24), float bowl (25), washer (26) and screw (27) or anti-afterfire solenoid (23), if equipped, Fig. 40.

21. Position bowl drain as shown.

22. Torque screw or solenoid to 45 in. lbs. (5 Nm).

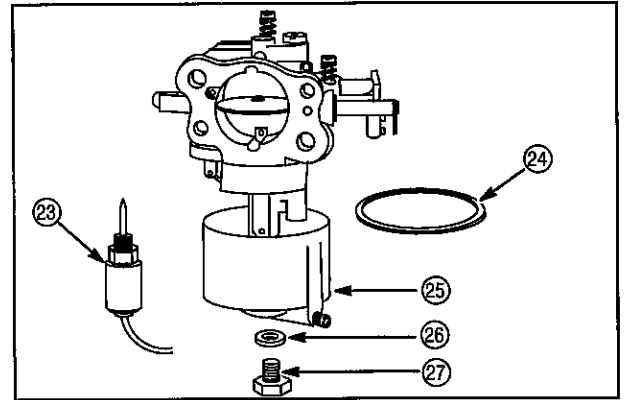


Fig. 40

Mikuni Carburetor

Models 290700, 303700, 350700 (Before 951001xx)

Check Throttle, Choke Shaft and Body For Wear

NOTE: The measurement in Step 1 is taken with the carburetor off of the intake manifold.

1. Lay carburetor on flat surface. Use a feeler gauge (1) to check throttle and choke shaft clearance as shown in Fig. 41.

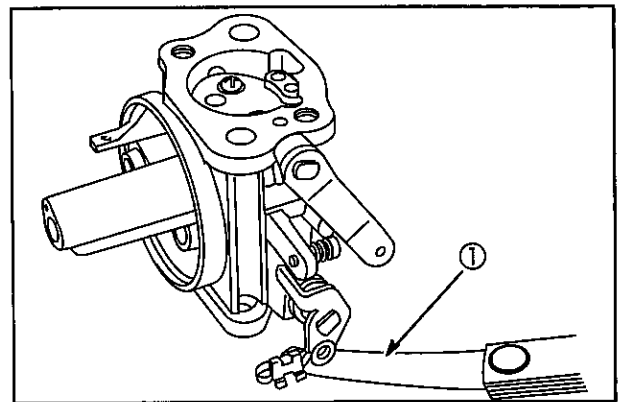


Fig. 41

Throttle shaft and choke shaft clearance must not exceed 0.010" (0.25 mm).

NOTE: The inspection in Step 2 is performed after the carburetor has been disassembled.

2. Inspect throttle shaft and choke shaft for wear (2), Fig. 42.

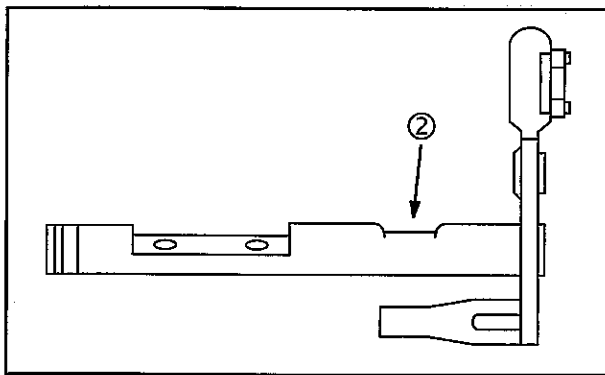


Fig. 42

4

Replace either shaft if worn.

Replace the carburetor if the body is worn or if either shaft clearance exceeds **0.010" (0.25 mm)** when a new shaft is used.

Disassemble

1. Remove anti-afterfire solenoid (2) or bowl screw (1), washer and bowl (3), **Fig. 43**. Remove bowl gasket (4).

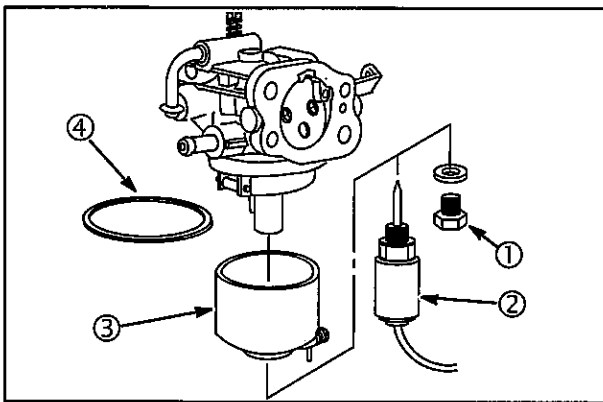


Fig. 43

2. Remove fixed main jet (7) using Screwdriver #19061, **Fig. 44**.
3. Remove float (5) and inlet needle (6).

NOTE: Float hinge pin (8) is swaged on one end. Drive hinge pin out from side opposite swage.

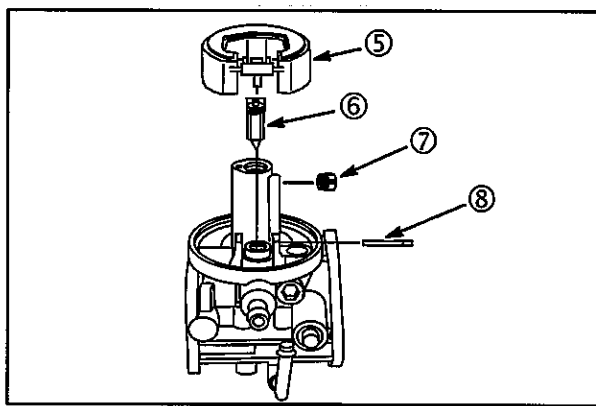


Fig. 44

4. Remove emulsion tube (10), **Fig. 45**.

NOTE: If carburetor is equipped with solenoid, remove solenoid seat (9) first, then remove emulsion tube.

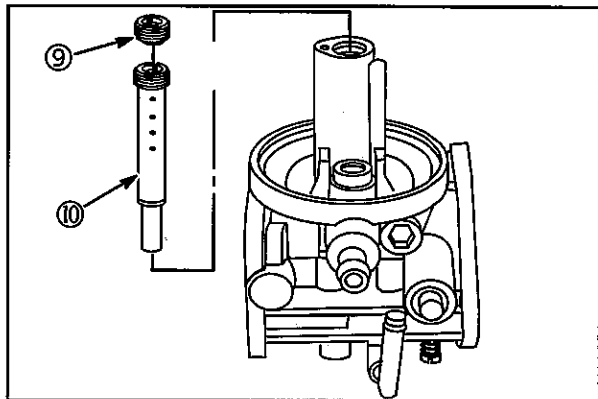


Fig. 45

5. Use a pliers to remove the idle mixture screw adjustment limiter cap (14) if equipped, **Fig. 46**.
6. Remove idle mixture screw (11) and spring (12).
7. Remove pilot jet (13).

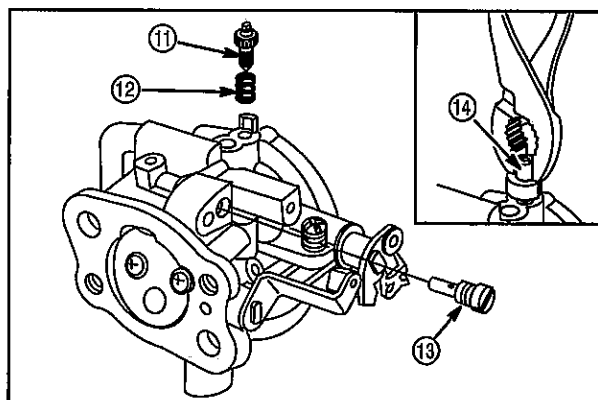


Fig. 46

8. Remove two screws (18) and the throttle plate (17), **Fig. 47**.

NOTE: The top and bottom edges of the throttle plate are beveled. Mark throttle plate before removing to ensure reinstallation in the original position.

9. Remove retainer (15).
10. Remove throttle shaft and spacer (19).
11. Remove seals (14) and foam seals (16).

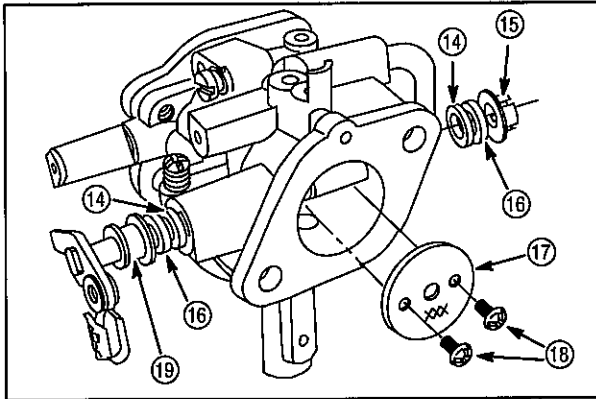




Fig. 47

12. Remove two screws (20), choke plate (21), shaft, seal (24) and washer (25), **Fig. 48**.

	 <p>CAUTION</p>
<p>AVOID EYE INJURY!</p>	
<ul style="list-style-type: none"> • Carburetor body has a detent ball (22) and spring (23) that keeps tension on choke shaft. Wear eye protection. • Use caution when removing shaft! 	

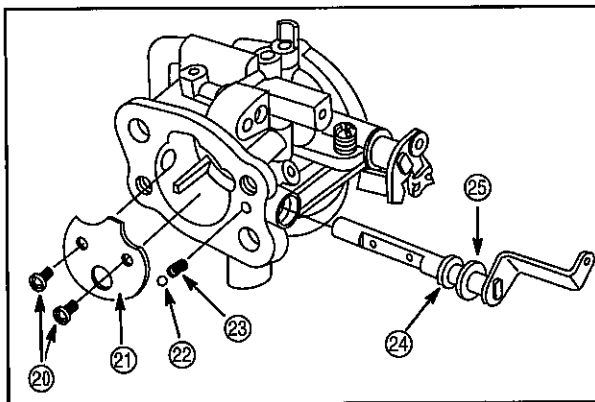


Fig. 48

Remove Fuel Inlet Body and Seat

The fuel inlet body must be removed before the inlet seat can be removed.

1. Use Screw #93029 (1) from Flywheel Puller, #19165. Thread screw into seat body 3 - 4 turns, **Fig. 49**. Remove the screw from the seat body.

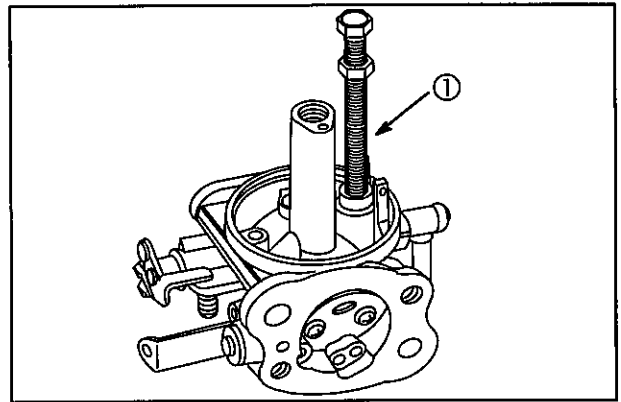


Fig. 49

2. Install 1/4" x 20 Nut #92278 (2) and Washer #224061 (3) from #19332 Tool Kit onto screw, **Fig. 50**.
3. Place a 1/4" drive 9 mm (3/8") socket (4) over seat body.
4. Install screw, washer and nut. Thread nut down on washer.
5. Continue turning until seat body is removed. Remove fuel inlet seat (5).

This completes the carburetor disassembly procedure.

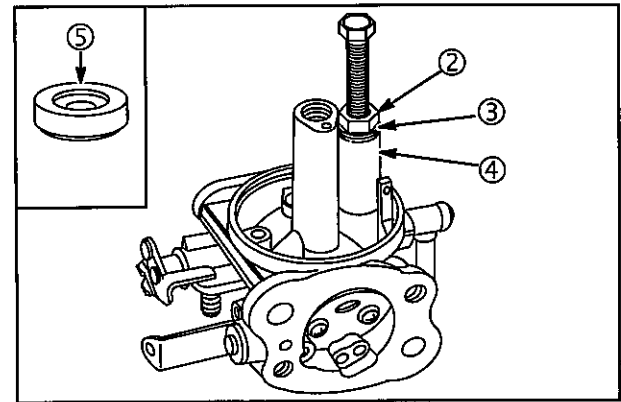
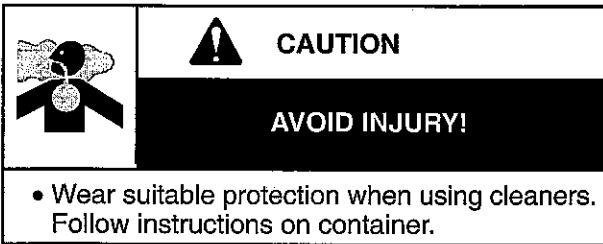


Fig. 50

Clean Carburetor

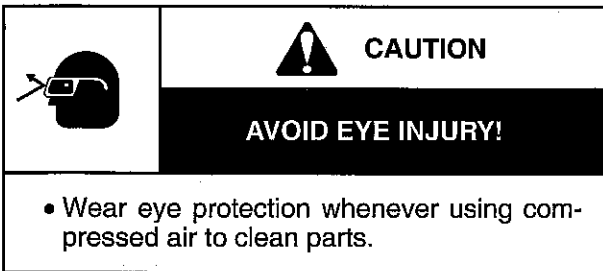
1. Disassemble carburetor.
2. Remove and discard all old gaskets, seals and sealing material.



4

3. Use a commercial carburetor cleaner (such as Briggs & Stratton Spray Cleaner #100041 or #100042) to clean carburetor parts and body.
4. When cleaning non-metallic parts (plastic, nylon, Minlon™, etc.), do not leave in commercial carburetor cleaner more than 15 minutes.

NOTE: Do not use commercial carburetor cleaners on parts containing rubber, such as seals, O-rings, inlet needles, seats or pump diaphragms.



5. Use only compressed air (blowing in both directions) to clean out all openings and passages.

NOTE: Do not use wire, drills or other mechanical devices to clean out metering holes or passages.

Inspect Carburetor

Inspect all parts for wear, cracks, nicks and burrs. Inspect float for leaks. Replace damaged parts.

Assemble Carburetor

When assembling carburetor, use new seals and gaskets.

Install Fuel Inlet Seat and Body

1. Install new inlet seat (1) with chamfered end down, **Fig. 51**.
2. Press in new body (3) using Knockout Pin #19135 (2).

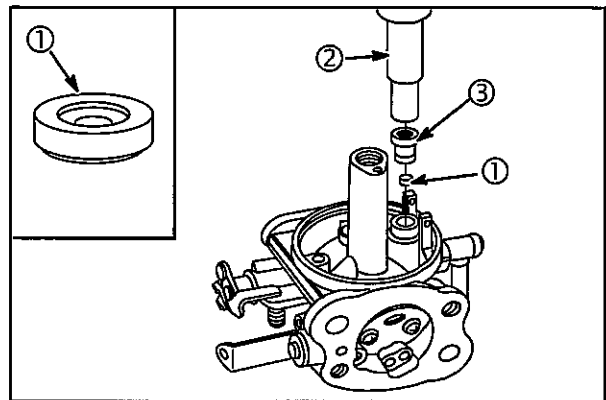


Fig. 51

3. Install new throttle shaft seals (4) with sealing lip out, **Fig. 52**.
4. Install throttle shaft with foam seal (10) and spacer (9).
5. Install foam seal (6) and retainer (5).
6. Install throttle plate (7) with numbers down.

NOTE: Use LOCTITE® 222 on screw (8) threads.

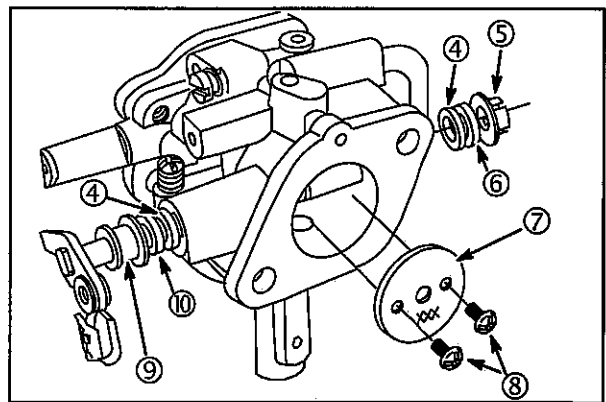


Fig. 52

7. Install new choke shaft seal (16) with sealing lip out, **Fig. 53**.
8. Assemble washer (15) onto choke shaft.
9. Insert spring (12) and check ball (13) in to spring pocket. Compress with a small round punch (14).
10. Push choke shaft into hole until ball engages groove in choke shaft, **inset, Fig. 53**.
11. Install choke plate (11) as shown.

NOTE: Use LOCTITE® 222 on screw threads.

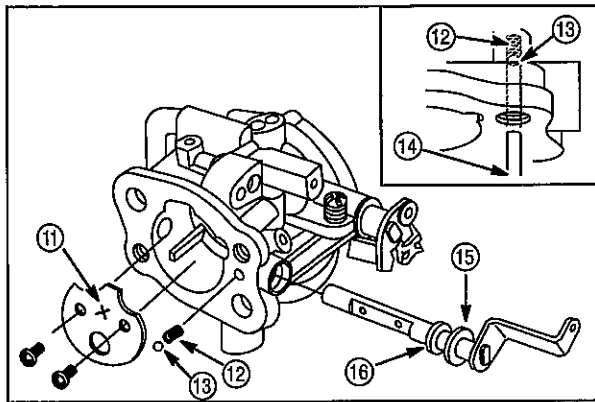


Fig. 53

- 12. Assemble inlet needle retainer (19) to inlet needle (18). Assemble to float (17), **Fig. 54**.
- 13. Install float to carburetor body. Install float hinge pin (20) with swaged end out.

NOTE: Float level is not adjustable.

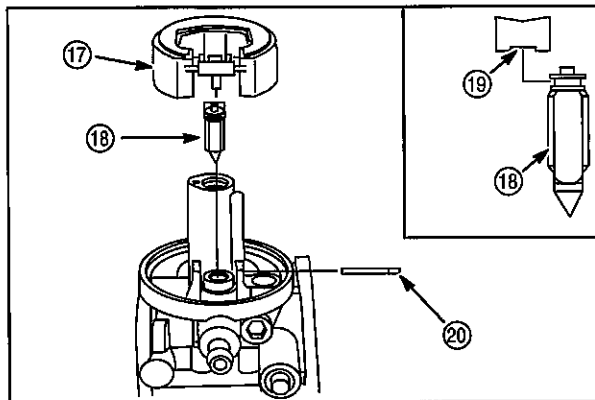


Fig. 54

- 14. Install pilot jet (23), **Fig. 55**.
- 15. Install idle mixture screw (21) and spring (22).

NOTE: DO NOT tighten screw. DO NOT install limiter cap at this time.

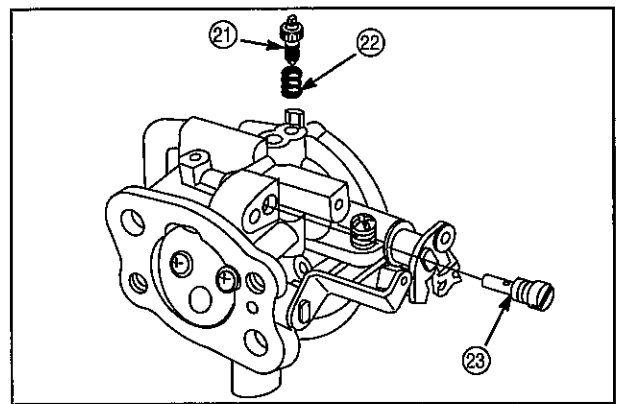


Fig. 55

- 16. Install emulsion tube (24), **Fig. 56**, using Screwdriver #19062.
- 17. If carburetor is equipped with anti-afterfire solenoid, install solenoid seat (25).
- 18. Install fixed main jet (26) using Screwdriver #19061.

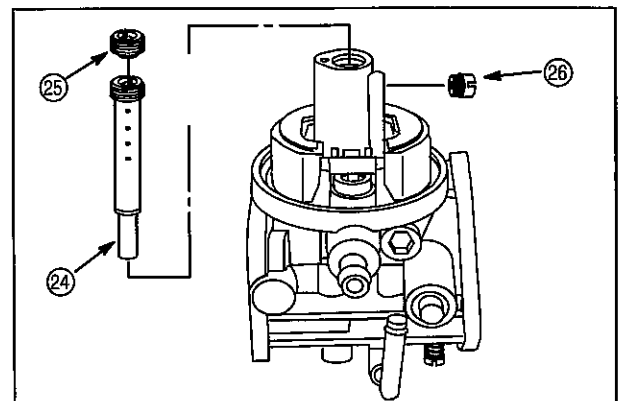


Fig. 56

- 19. Install bowl gasket (28), float bowl (27), washer and screw (29) or anti-afterfire solenoid (30), if equipped, **Fig. 57**.
- 20. Position bowl drain as shown. Torque screw or solenoid to 45 in. lbs. (5 Nm).

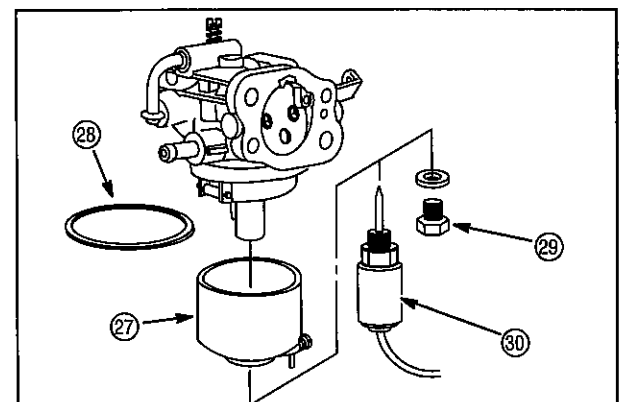


Fig. 57

4

Nikki Carburetor

Models 351700, 351400, 380700, 380400

Check Throttle, Choke Shaft and Body For Wear

NOTE: The measurement in Step 1 is taken with the carburetor off of the intake manifold.

1. Lay carburetor on 1/4" (6.35 mm) raised flat surface (1). Check throttle and choke shaft clearance with a feeler gauge (2) as shown in Fig. 58.

Throttle shaft and choke shaft clearance must not exceed **0.010" (0.25 mm)**.

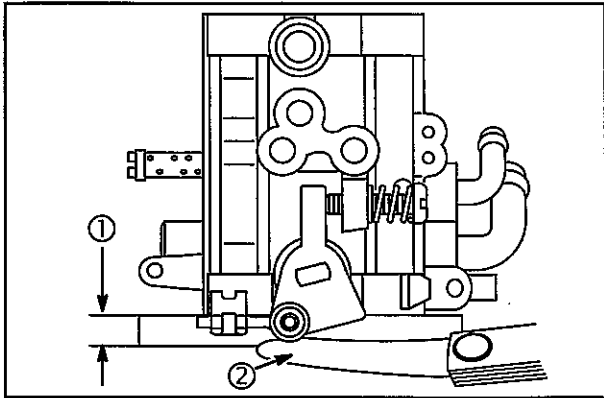


Fig. 58

NOTE: The inspection in Step 2 is performed after the carburetor has been disassembled.

2. Inspect throttle shaft and choke shaft for wear (3). Replace if worn, Fig. 59.

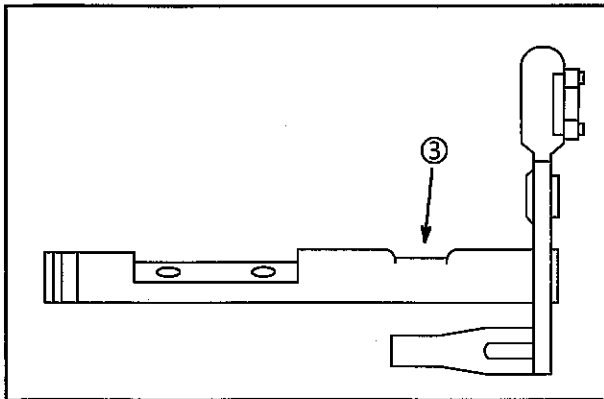


Fig. 59

Replace either shaft if worn.

Replace the carburetor if the body is worn or if either shaft clearance exceeds **0.010" (0.25 mm)** when a new shaft is used.

Disassemble

NOTE: The carburetors used on vertical crankshaft Models 351700 and 380700, and horizontal crankshaft Models 351400 and 380400 are similar enough that the disassembly and reassembly procedures can be considered the same. The only significant differences in the carburetors are the location of the idle mixture screws and the fixed main jet orifice sizes.

1. Remove anti-afterfire solenoid (1) with washer (2), Fig. 60.
2. Remove fixed main jet plugs (3) with washers (4).

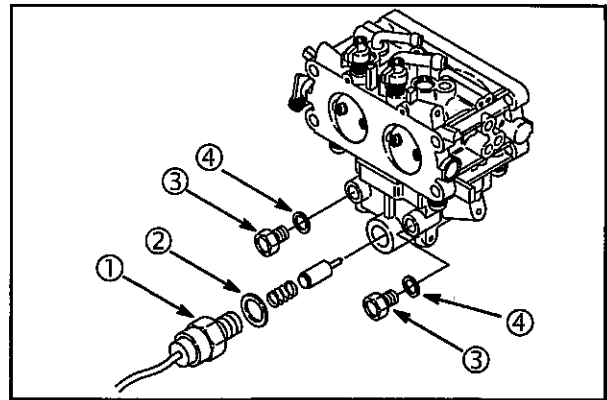


Fig. 60

3. Remove fixed main jets (7, 8), Fig. 61.

NOTE: The carburetor is equipped with a different size fixed main jet for each cylinder. The carburetor is marked **L** (6) for the #1 cylinder and **R** (5) for the #2 cylinder.

The carburetor is marked in the upper body near the choke jet plate and the lower body near the main jet plugs. See Fig. 61.

Fixed Main Jet Sizes

Model 351700

Left (#1) cylinder is equipped with #98 main jet.
Right (#2) cylinder is equipped with #100 main jet.

Model 351400

Left (#1) cylinder is equipped with #94 main jet.
Right (#2) cylinder is equipped with #98 main jet.

Model 380700

Left (#1) cylinder is equipped with #118 main jet.
Right (#2) cylinder is equipped with #116 main jet.

Model 380400

Left (#1) cylinder is equipped with #110 main jet.
Right (#2) cylinder is equipped with #114 main jet.

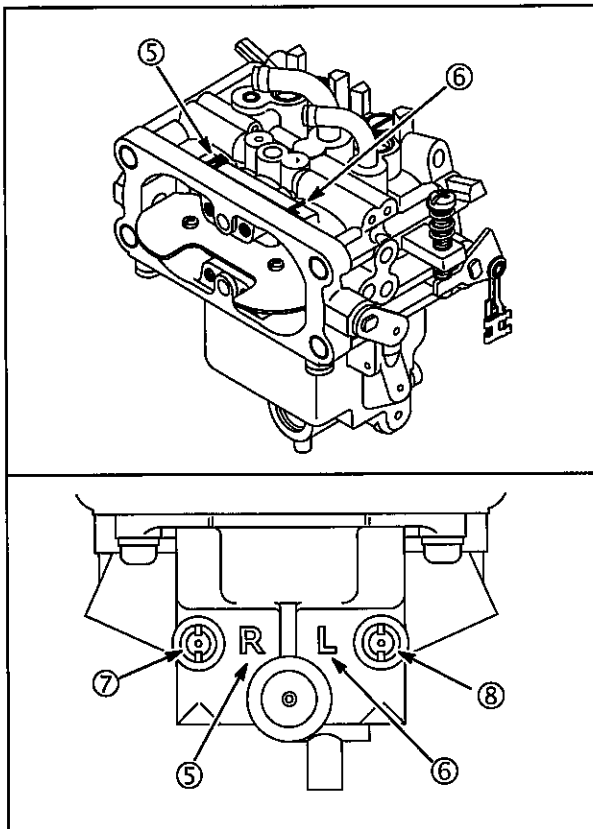


Fig. 61

4. Remove carburetor lower body screws (9). Lift lower body straight away from upper body, Fig. 62. Discard gasket (10).

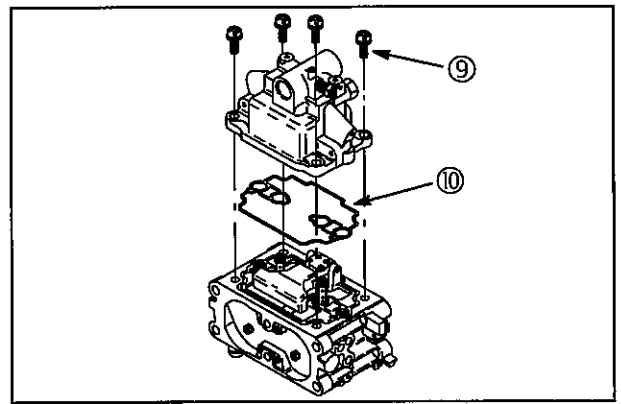


Fig. 62

5. Remove pilot jets (11), Fig. 63.
6. Remove float bowl drain screw (13) and spring (12).

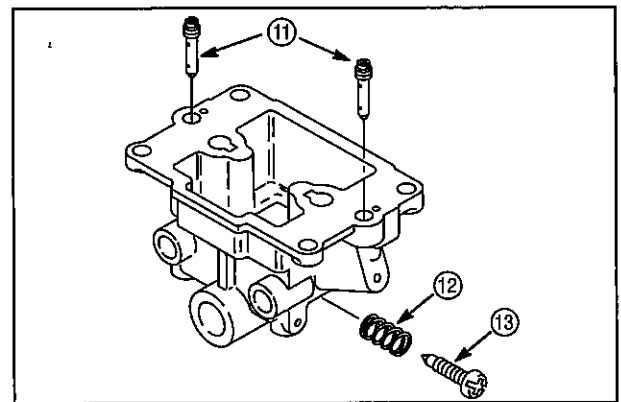


Fig. 63

7. Drive out float hinge pin (16) from side OPPOSITE throttle lever (17). Remove float (14) and fuel inlet needle (15) assembly, Fig. 64.
8. Remove and discard throttle shaft and choke shaft welch plugs.

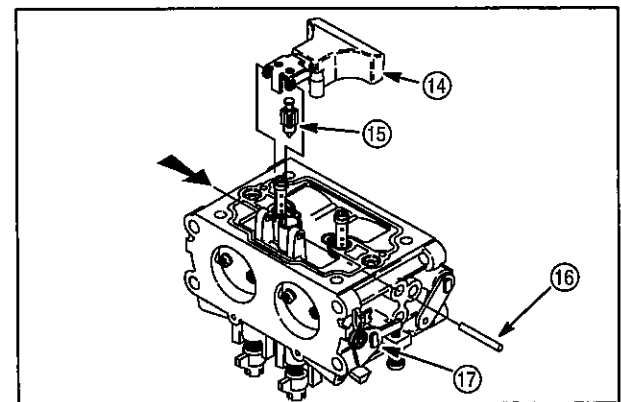


Fig. 64

9. Remove idle mixture screws (19) and springs (20), Fig. 65.

NOTE: If idle mixture screws are equipped with adjustment limiter caps, remove the caps (18) BEFORE removing idle mixture screws, inset, Fig. 65.

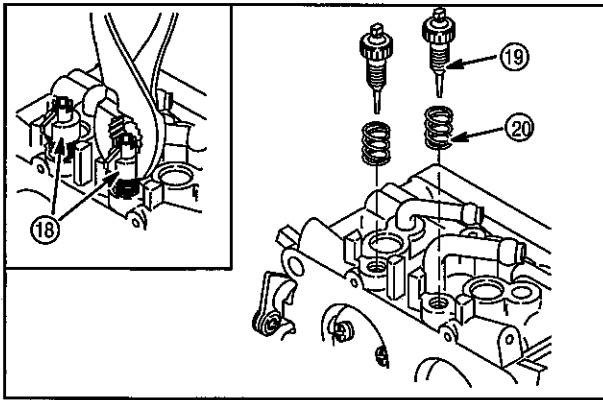


Fig. 65

10. Mark throttle plates (24) before removing to ensure reinstallation in the original position, Fig. 66.

11. Remove throttle shaft (22), spacer (21) and seal (23).

NOTE: Do not remove throttle shaft welch plug.

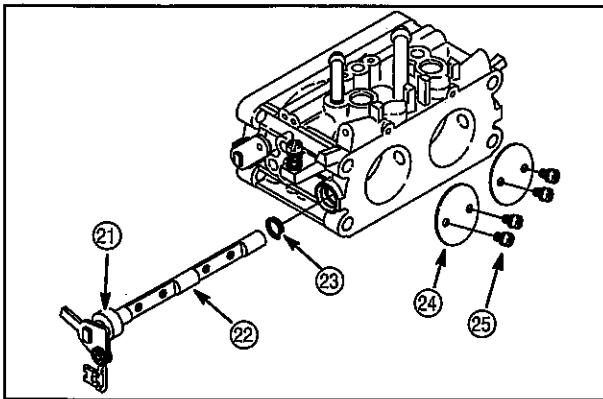


Fig. 66

12. Mark choke plate (26) before removing to ensure reinstallation in the original position, Fig. 67.

13. Remove choke shaft (27) and seal (28).

This completes the carburetor disassembly procedure.

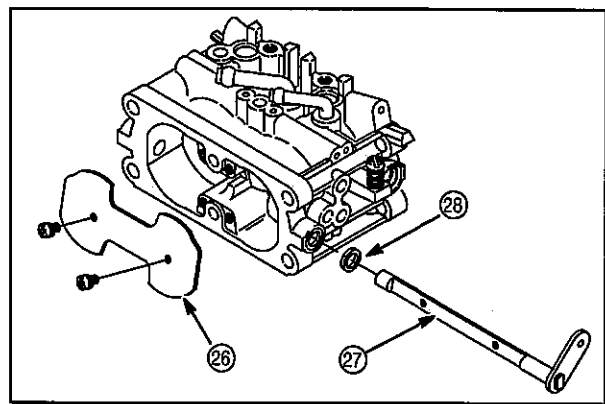


Fig. 67

Clean Carburetor

1. Disassemble carburetor.
2. Remove and discard all old gaskets, seals and sealing material.

	CAUTION
	AVOID INJURY!
<ul style="list-style-type: none"> • Wear suitable protection when using cleaners. Follow instructions on container. 	

3. Use a commercial carburetor cleaner (such as Briggs & Stratton Spray Cleaner, Part #100041 or #100042) to clean carburetor parts and body.
4. When cleaning non-metallic parts (plastic, nylon, Minlon™, etc.), do not leave in commercial carburetor cleaner more than 15 minutes.

NOTE: Do not use commercial carburetor cleaners on parts containing rubber, such as seals, O-rings, inlet needles, seats or pump diaphragms.

	CAUTION
	AVOID EYE INJURY!
<ul style="list-style-type: none"> • Wear eye protection whenever using compressed air to clean parts. 	

5. Use only compressed air (blowing in both directions) to clean out all openings and passages.

NOTE: Do not use wire, drills or other mechanical devices to clean out metering holes or passages.

Inspect Carburetor

Inspect all parts for wear, cracks, nicks and burrs. Inspect float for leaks. Replace damaged parts.

Assemble Carburetor

When assembling carburetor, use new seals and gaskets.

1. Install new throttle shaft seal (3) with sealing lip out, **Fig. 68**.
2. Install throttle shaft (2) with spacer (1).

NOTE: Install one throttle plate (4) at a time. Check throttle shaft for freedom of operation after installing each throttle plate.

NOTE: Use LOCTITE® 222 on screw threads (5).

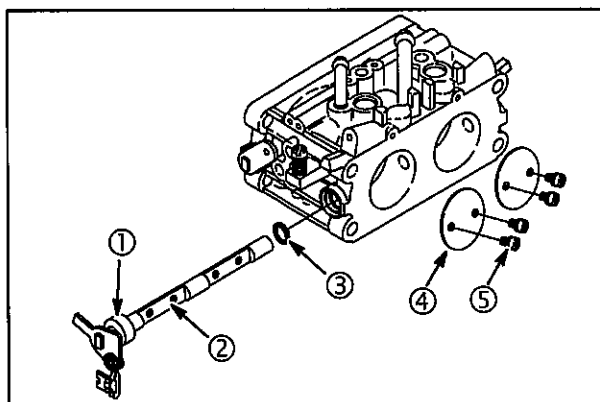


Fig. 68

3. Install new choke shaft seal (9), **Fig. 69** with sealing lip out.
4. Install choke shaft (8).
5. Install choke plate (7).

NOTE: Check shaft for freedom of operation after installing plate.

NOTE: Use LOCTITE® 222 on screw threads (6).

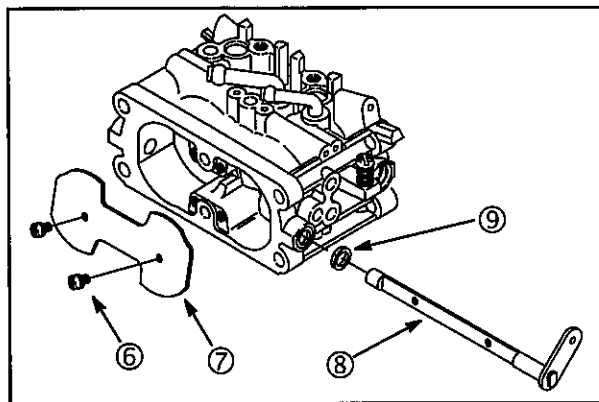


Fig. 69

6. Assemble inlet needle (11) to float (10). Install float assembly to carburetor body, **Fig. 70**. Install float hinge pin (12) from throttle lever (13) side.

NOTE: Be sure float hinge pin is flush with float support or hinge pin will interfere with lower body.

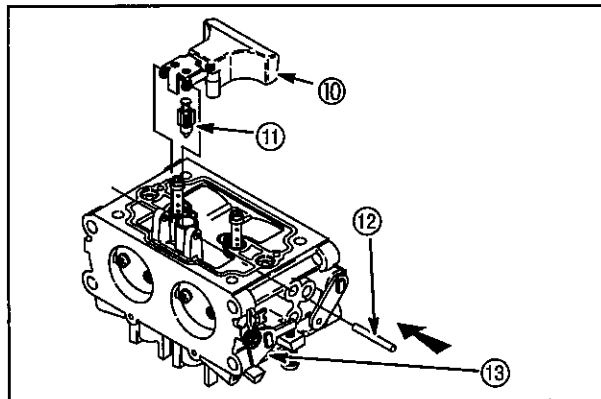


Fig. 70

7. Install new welch plugs (16) with 5/16" (8 mm) punch, **Fig. 71**.
8. Use a sealant such as Permatex® #2 or nail polish on outside diameter of plug to prevent air leaks.
9. Install idle mixture screws (14) and springs (15).

NOTE: DO NOT tighten screws. DO NOT install limiter caps at this time.

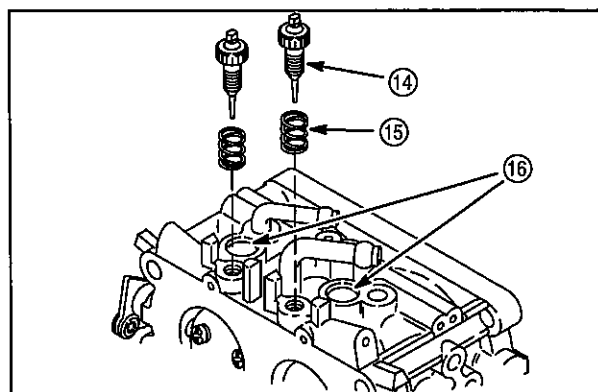


Fig. 71

10. Install pilot jets (17), **Fig. 72**.
11. Install fuel bowl drain screw (19) and spring (18).

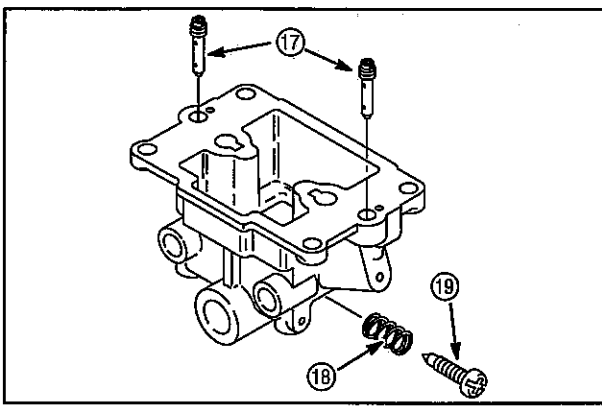


Fig. 72

12. Install fixed main jets (20), **Fig. 73**, plugs and washers.

Model 351700

Left (#1) cylinder is equipped with #98 main jet.
Right (#2) cylinder is equipped with #100 main jet.

Model 351400

Left (#1) cylinder is equipped with #94 main jet.
Right (#2) cylinder is equipped with #98 main jet.

Model 380700

Left (#1) cylinder is equipped with #118 main jet.
Right (#2) cylinder is equipped with #116 main jet.

Model 380400

Left (#1) cylinder is equipped with #112 main jet.
Right (#2) cylinder is equipped with #114 main jet.

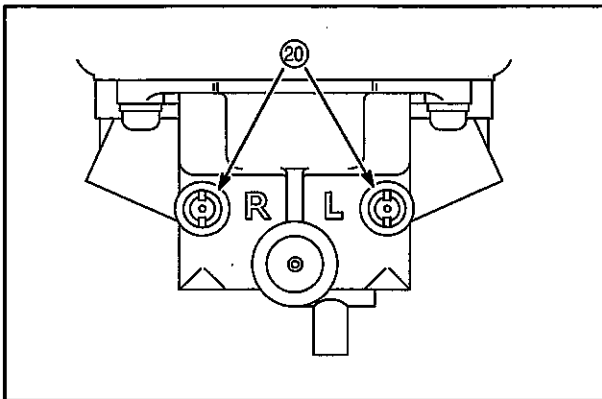


Fig. 73

13. Install lower body gasket (21), **Fig. 74**. Make sure gasket does not twist or kink.

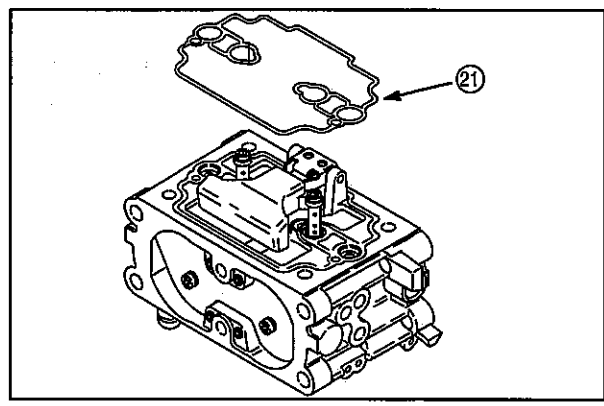


Fig. 74

14. Assemble lower body with main jet plugs (23) facing throttle shaft side (24) of carburetor. Make sure gasket remains in position, **Fig. 75**. Tighten screws (22) securely.

15. Install anti-afterfire solenoid with washer. Torque to 90 in. lbs. (10 Nm).

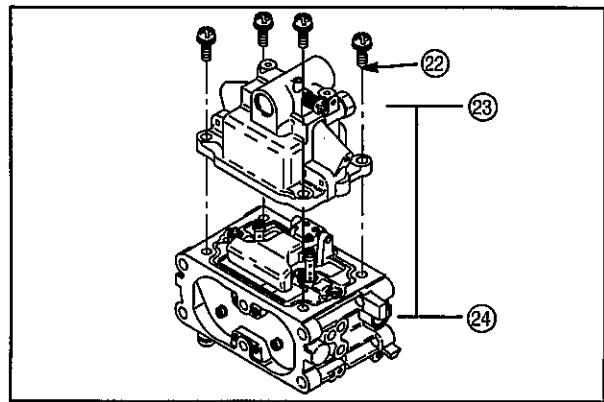


Fig. 75

Nikki Carburetor

Models 290400, 303400, 350400 (After 950731xx)

Check Throttle, Choke Shaft and Body For Wear

NOTE: The measurement in Step 1 is taken with the carburetor off of the intake manifold.

1. Lay carburetor on 1/4" (6.35 mm) raised flat surface (1). Use a feeler gauge (2) to check throttle and choke shaft clearance as shown in **Fig. 76**.

Throttle shaft and choke shaft clearance must not exceed 0.010" (0.25 mm).

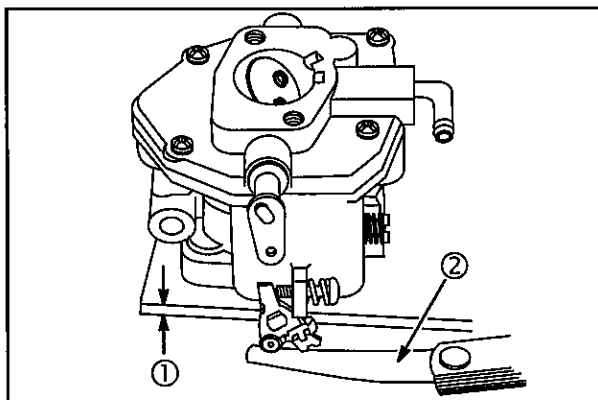


Fig. 76

NOTE: The inspection in Step 2 is performed after the carburetor has been disassembled.

2. Inspect throttle shaft and choke shaft for wear (3), Fig. 77. Replace if worn.

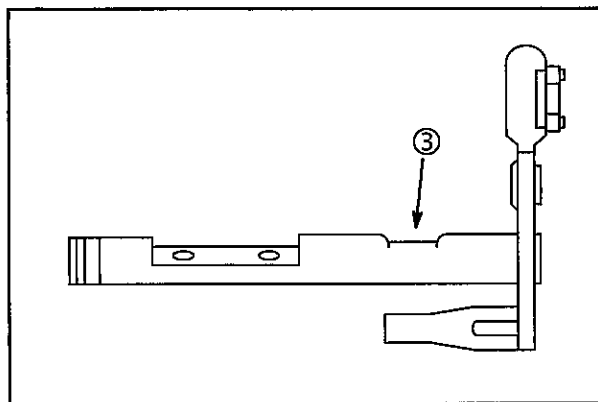


Fig. 77

Replace either shaft if worn.

Replace the carburetor if the body is worn or if either shaft clearance exceeds **0.010" (0.25 mm)** when a new shaft is used.

Disassemble

1. Remove four screws and upper body (1), Fig. 78. Do not damage emulsion tube (2) in upper body.

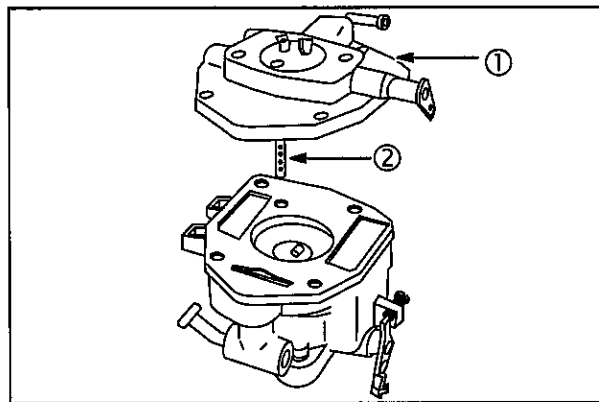


Fig. 78

2. Remove and discard gasket.

3. Remove float and inlet needle.

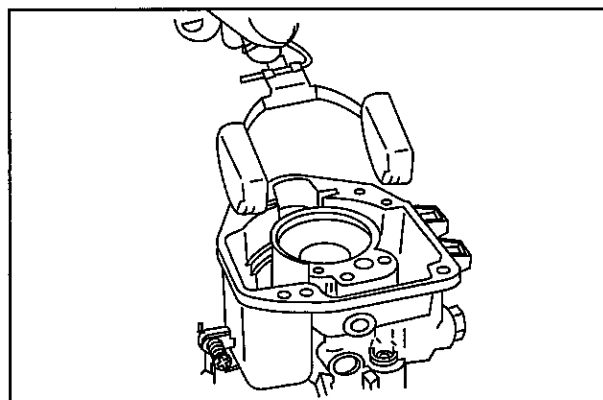


Fig. 79

If idle mixture screw is equipped with adjustment limiter cap (9), use a pliers to remove it before removing idle mixture screw (inset), Fig. 80.

4. Remove idle mixture screw (3) and spring (4), Fig. 80.
5. Remove anti-afterfire solenoid (8), if equipped, or plug (7) and washer (6).
6. Remove fixed main jet (5) using Screwdriver, #19062.

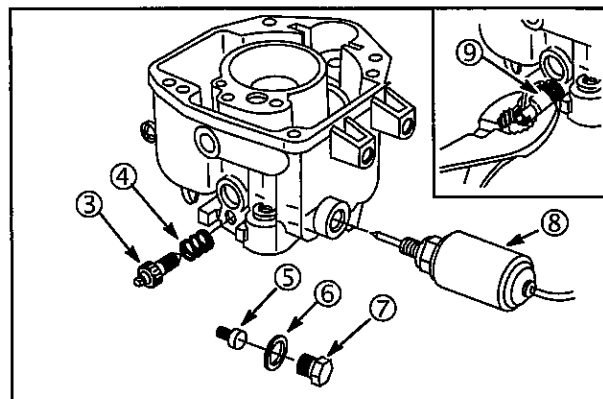


Fig. 80

7. Remove pilot jet (10) using Screwdriver #19061, Fig. 81.

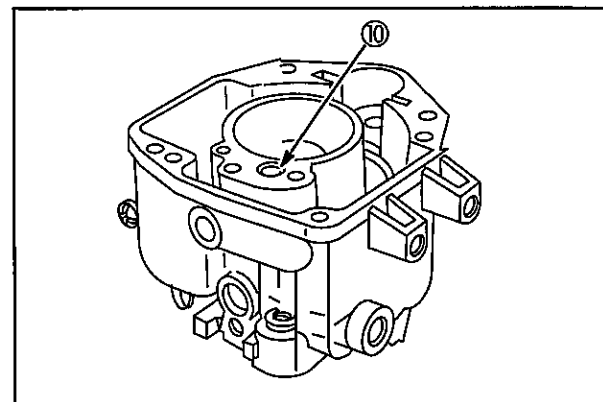


Fig. 81

8. The top and bottom edges of the throttle plate are beveled. Mark throttle plate (11), **Fig. 82** before removal to ensure reinstallation in the original position.
9. Remove throttle shaft (13) and spacer (14).
10. Remove throttle shaft seal (12).

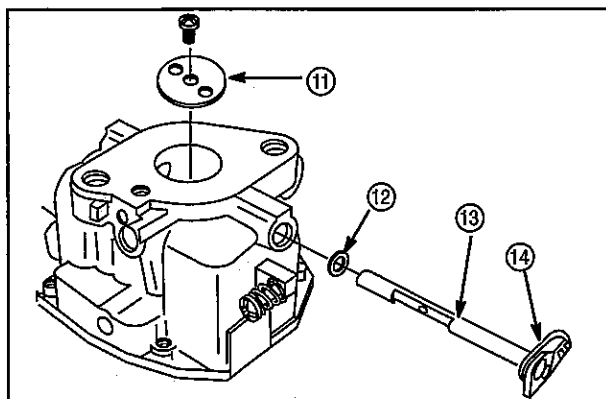


Fig. 82

Support upper body on a vise or wood block so that emulsion-tube (19) will not be damaged, **Fig. 83**.

11. Mark choke plate (15) before removal to ensure reinstallation in the original position.
12. Remove choke shaft (18) and spacer (17).
13. Remove seal (16).

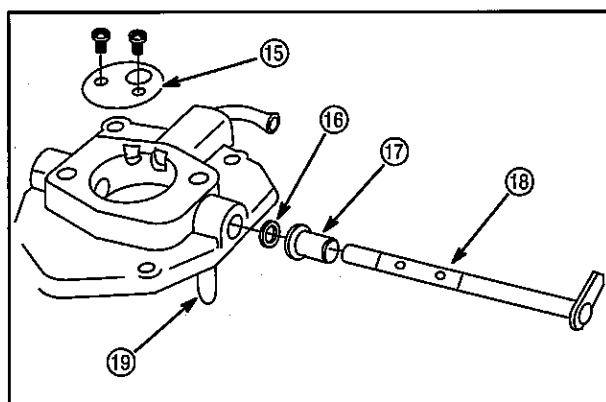


Fig. 83

14. Remove transitional hole Welch plug (20) with a punch as shown, **Fig. 84**.

This completes the carburetor disassembly procedure.

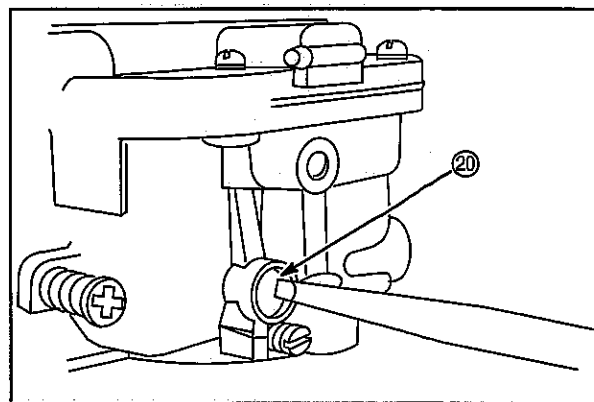


Fig. 84

Clean Carburetor

1. Disassemble carburetor.
2. Remove and discard all old gaskets, seals and sealing material.

	CAUTION
	AVOID INJURY!
<ul style="list-style-type: none"> • Wear suitable protection when using cleaners. Follow instructions on container. 	

3. Use a commercial carburetor cleaner (such as Briggs & Stratton Spray Cleaner, #100041 or #100042) to clean carburetor parts and body.

NOTE: Do not use commercial carburetor cleaners on parts containing rubber, such as seals, O-rings, inlet needles, seats or pump diaphragms.

Do not leave non-metallic parts (plastic, nylon, Minlon™, etc.) in commercial carburetor cleaner more than 15 minutes.

	CAUTION
	AVOID EYE INJURY!
<ul style="list-style-type: none"> • Wear eye protection whenever using compressed air to clean parts. 	

4. Use only compressed air (blowing in both directions) to clean out all openings and passages.

NOTE: Do not use wire, drills or other mechanical devices to clean out metering holes or passages.

Inspect Carburetor

Inspect all parts for wear, cracks, nicks and burrs. Inspect float for leaks. Replace damaged parts.

Assemble Carburetor

When assembling carburetor, use new seals and gaskets.

1. Install new transitional hole welch plug (1), **Fig. 85**.
2. Use a round punch (2). Tap in plug until it is flat.
3. Use a sealant such as Permatex® #2 or nail polish on outside diameter of plug to prevent air leaks.

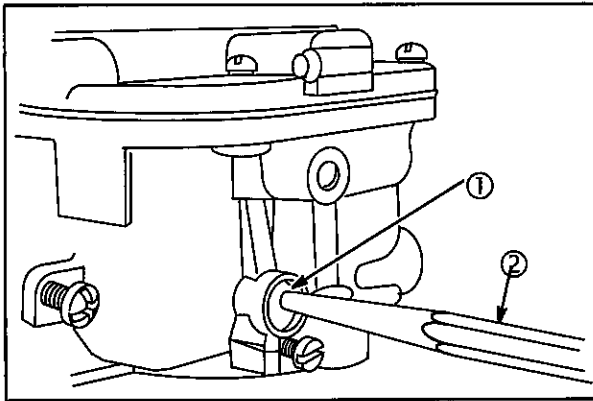


Fig. 85

4. Install new choke shaft seal with sealing lip in.
5. Install choke shaft and spacer (5), **Fig. 86**.
6. Install choke plate (3) with vent hole facing bowl vent nipple (4).

NOTE: Use LOCTITE® 222 on screw threads.

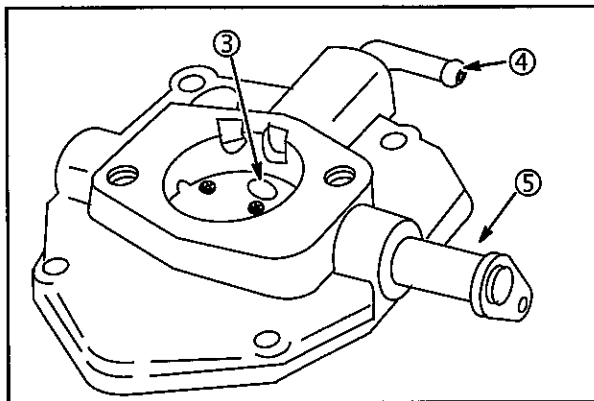


Fig. 86

7. Install new throttle shaft seal (6) with sealing lip in, **Fig. 87**.
8. Install throttle shaft (7) and spacer (8).
9. Install throttle plate (9) to throttle shaft.

NOTE: Use LOCTITE® 222 on screw threads (10).

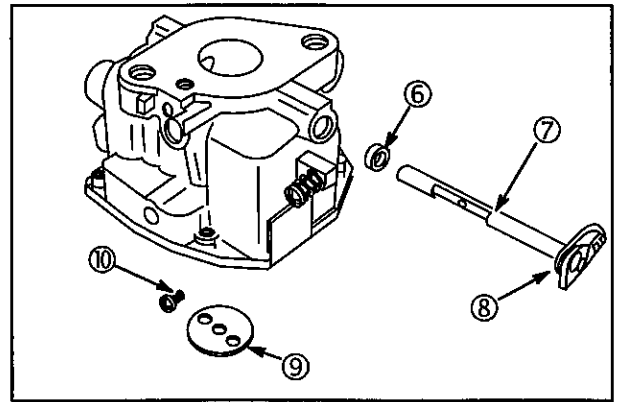


Fig. 87

10. Install pilot jet (11) using Screwdriver #19061, **Fig. 88**.

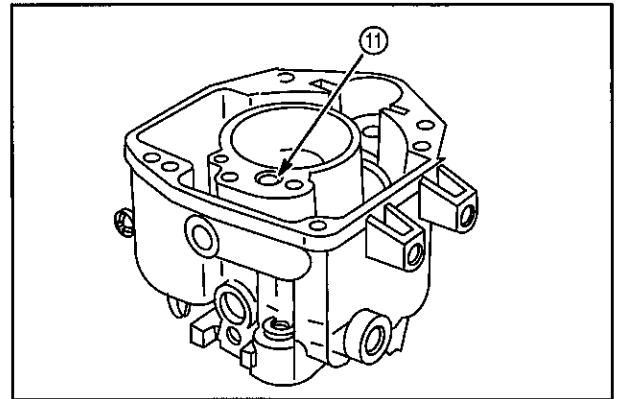


Fig. 88

11. Install fixed main jet (14) using Screwdriver #19062, **Fig. 89**.
12. Install washer (15) and plug (16) or anti-afterfire solenoid (17). Torque to 45 in. lbs. (5 Nm).
13. Install idle mixture screw (13) and spring (12).

NOTE: DO NOT tighten screw. DO NOT install limiter cap at this time.

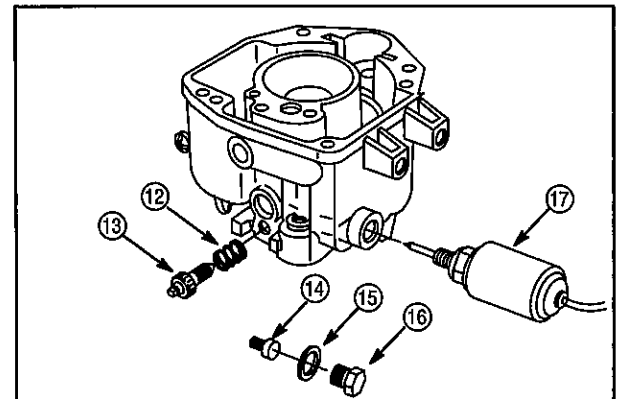


Fig. 89

14. Assemble inlet needle to float. Install float assembly (18), **Fig. 90**.

NOTE: Use brass inlet needle for fuel pump carburetors. Use aluminum inlet needle for gravity feed carburetors.

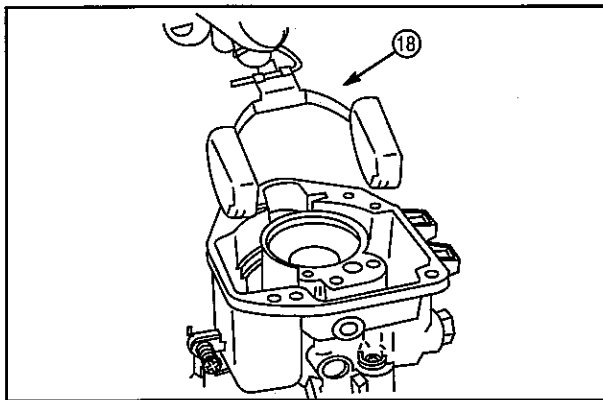


Fig. 90

The fuel inlet seat orifice size and inlet needle are different, depending upon the type of fuel delivery system used. The carburetor bodies and inlet needles are not interchangeable.

A color code on the side of the carburetor (19) is used to identify the carburetor by engine model and fuel delivery system, **Fig. 91**.

NOTE: See the "Fuel System Identification Table" in the Appendix for information.

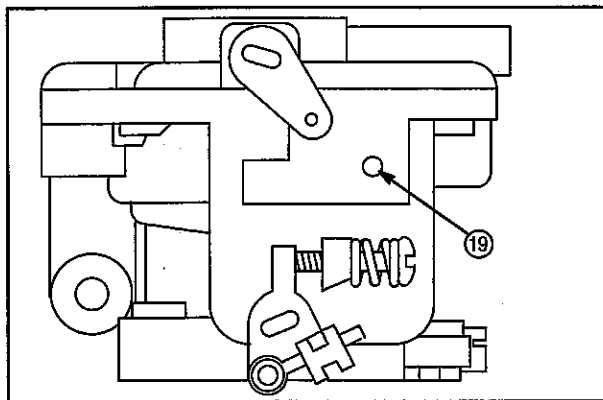


Fig. 91

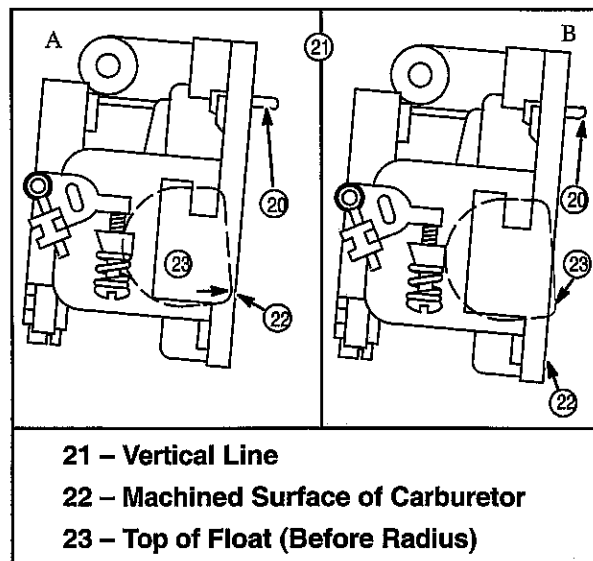
Set Float Height

The float height setting on Nikki carburetors depends upon whether the engine uses a fuel pump (illustration **A**) or gravity feed fuel delivery system (illustration **B**), **Fig. 92**. The procedure for checking the float height setting is unique to each carburetor.

1. Hold the carburetor in one hand and place the index finger on the float hinge pin (20).
2. While holding the float hinge pin down, turn the carburetor to a position PAST VERTICAL (21)

as shown in **Fig. 92**. This allows the weight of the float to close the inlet needle.

3. The float height is the dimension between the top flat area of the float just before the radius (23) and the machined surface of the carburetor (22).
 - a. Float height for fuel pump carburetors (A) is **1/16" (1.6 mm) BELOW** machined surface (22).
 - b. Float height for gravity feed carburetors (B) is **3/32" (2.4 mm) ABOVE** machined surface (22).



- 21 – Vertical Line
- 22 – Machined Surface of Carburetor
- 23 – Top of Float (Before Radius)

Fig. 92

To adjust float level, hold float arm at (26) with needle nose pliers, **Fig. 93**. Carefully bend tang **CLOCKWISE** (25) to raise the float level, **COUNTER-CLOCKWISE** (28) to lower the float level. **DO NOT** collapse hooked end of float tang (27).

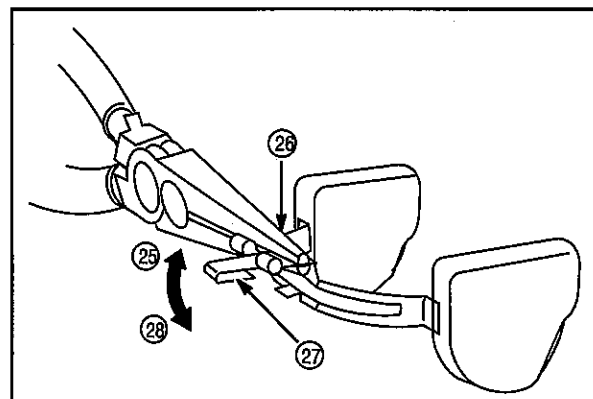


Fig. 93

4. Place new gasket (31) on lower carburetor body (32). Make sure holes in body line up with holes in gasket, **Fig. 94**.
5. Install upper carburetor body (30). Tighten screws (29) securely.

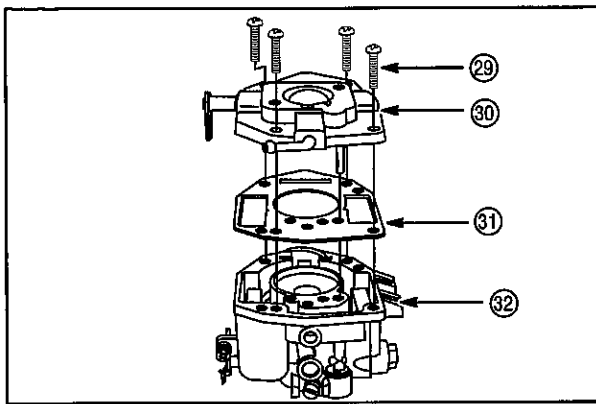


Fig. 94

Mikuni Carburetor

Models 290400, 303400, 350400 (Before 950801xx)

Carburetor Identification

Two carburetor bodies are used, depending upon the use of a fuel pump (illustration A) or gravity feed (illustration B) fuel delivery system, Fig. 95. Besides a change in jetting, the end of the discharge nozzle is machined at a different angle. Since the discharge nozzle is an integral part of the carburetor body the carburetor bodies are not interchangeable. The carburetor bodies can be identified by looking down the carburetor throat and comparing the end of the discharge nozzle (1) in relation to the choke shaft (2), Fig. 95. On a fuel pump carburetor the end of the nozzle is at approximately a 20° angle (3) to the choke shaft (2). On a gravity feed carburetor the end of the nozzle is approximately parallel (4) to the choke shaft. The fixed main jet used with a fuel pump system is numbered 110. The fixed main jet used with a gravity system is numbered 117.5.

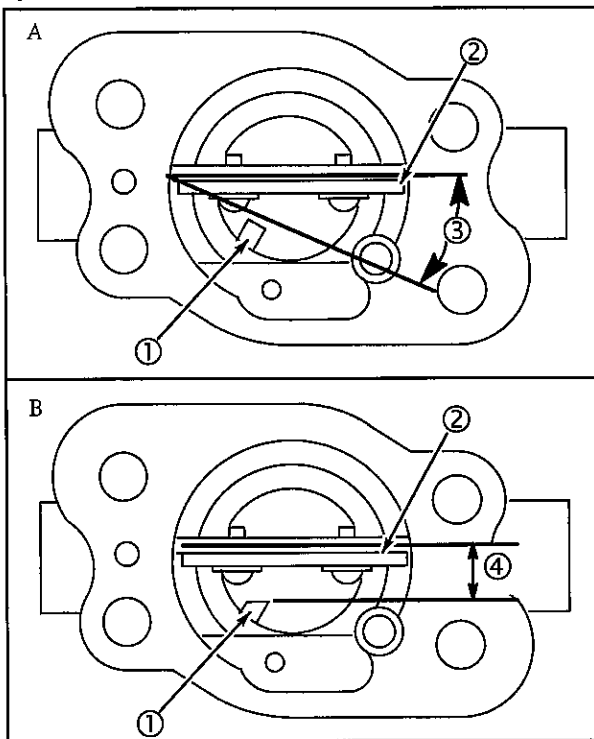


Fig. 95

Check Throttle, Choke Shaft and Body For Wear

NOTE: The measurement in Step 1 is taken with the carburetor off of the intake manifold.

1. Lay carburetor on 1/8" (3 mm) raised flat surface (1). Use a feeler gauge (2) to check throttle and choke shaft clearance as shown in Fig. 96.

Throttle shaft and choke shaft clearance must not exceed 0.010" (0.25 mm).

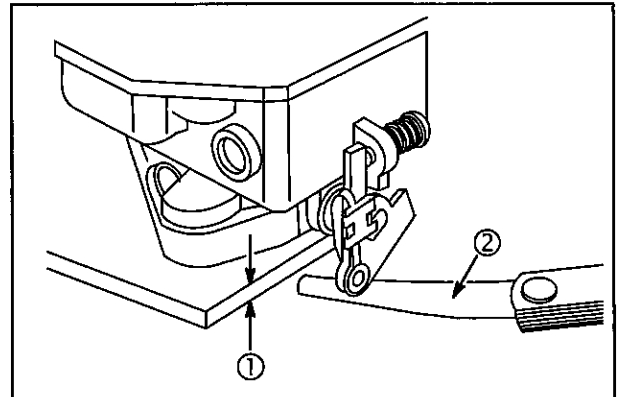


Fig. 96

NOTE: The inspection in Step 2 is performed after the carburetor has been disassembled.

2. Inspect throttle shaft and choke shaft for wear (3), Fig. 97. Replace if worn.

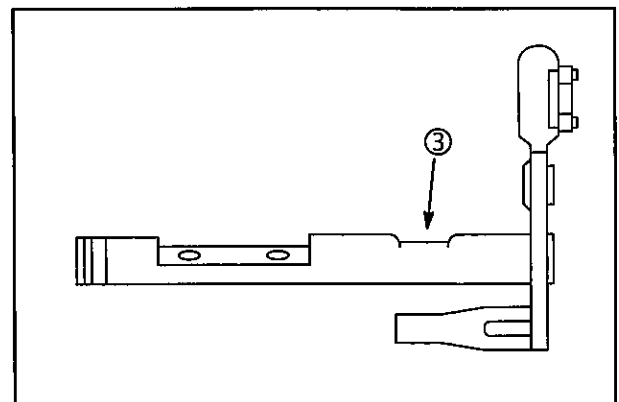


Fig. 97

Replace either shaft if worn.

Replace the carburetor if the body is worn or if the clearance on either shaft exceeds 0.010" (0.25 mm) when a new shaft is used.

Disassemble

1. Remove pilot jet (1), Fig. 98.
2. Remove four screws (2) and upper body (3). Discard gasket (4).

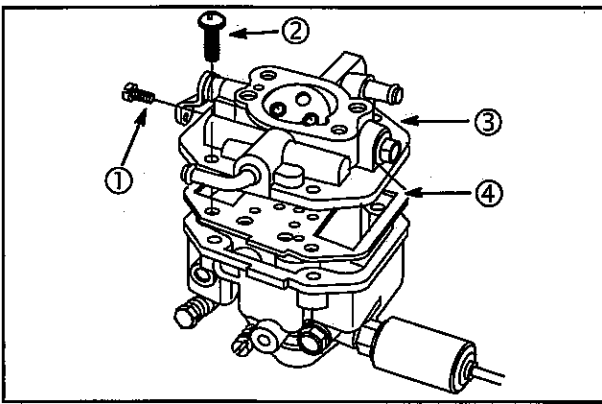


Fig. 98

3. Remove float (5) and fuel inlet needle (6), Fig. 99.

NOTE: Float hinge pin (7) is swaged on one end. Drive hinge pin out from side opposite swage.

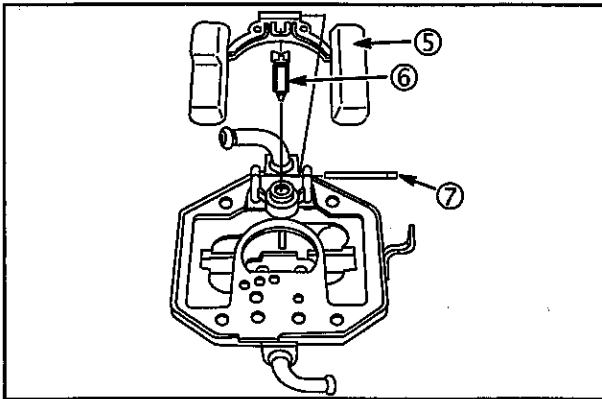


Fig. 99

4. Remove anti-afterfire solenoid (10) or plug (9), Fig. 100.
5. Remove fixed jet plug (13) and washer (12).
6. Remove fixed main jet (11) with Jet Screwdriver #19062.
7. Remove emulsion tube (8).

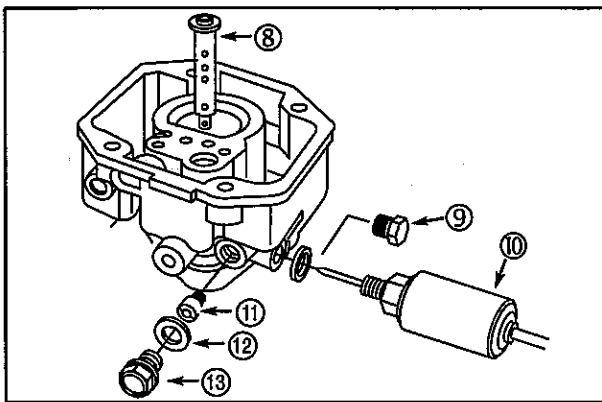


Fig. 100

If equipped, remove adjustment limiter cap (14) with a pliers (inset) before removing idle mixture screw, Fig. 101.

8. Remove idle mixture screw (16) and spring.
9. Remove fuel bowl drain screw (15) and spring.

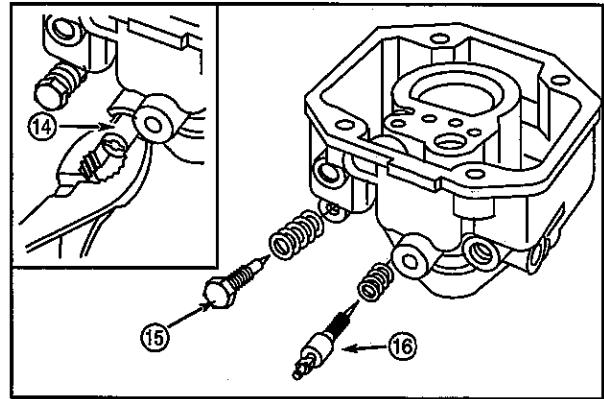


Fig. 101

10. Mark throttle plate (21), Fig. 102, before removing to ensure re-installation in the original position. Top and bottom edges are beveled. Remove screws (20) and throttle plate.
11. Remove retainer (22).
12. Remove throttle shaft with foam seals (18) and spacer (17).
13. Remove seals (19).

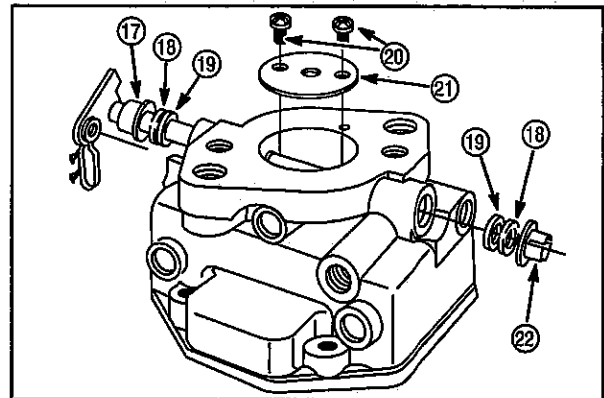


Fig. 102

14. Mark choke plate before removal to ensure re-installation in the original position. Top and bottom edges are beveled. Remove screws (27) and choke plate (28), Fig. 103.
15. Remove retainer (29).
16. Remove choke shaft (23) and spacer (24).
17. Remove seals (25).

NOTE: Carburetor body has a ball and spring (26) that keeps tension on choke shaft. Use care when removing choke shaft.

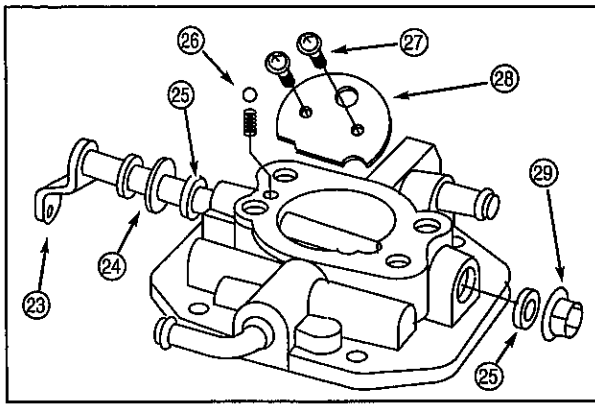


Fig. 103

Remove Fuel Inlet Body and Seat

The fuel inlet body must be removed before the inlet seat can be removed.

1. Use self-threading screw #93029 (1) from Fly-wheel Puller #19165. Thread screw into seat body (2) 3 - 4 turns, Fig. 104.
2. Back the screw out of the seat body.

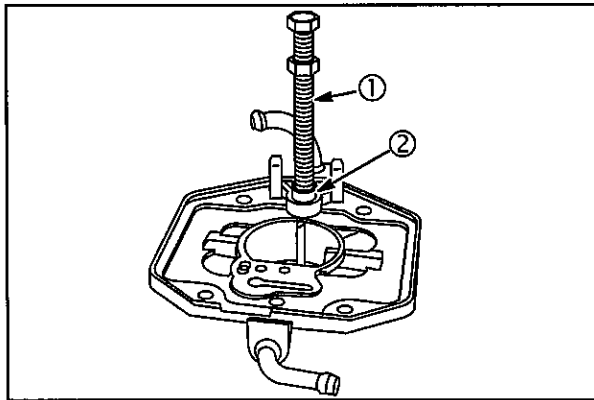


Fig. 104

3. Install 1/4" x 20 Nut #92278 (6) and Washer #224061 (5) from Tool Kit #19332 onto screw, Fig. 105.
4. Place a 1/4" drive 3/8" (9 mm) socket (4) over seat body.
5. Install screw, washer and nut to seat body. Thread nut down on washer.
6. Continue turning until seat body is removed.
7. Remove fuel inlet seat (3).

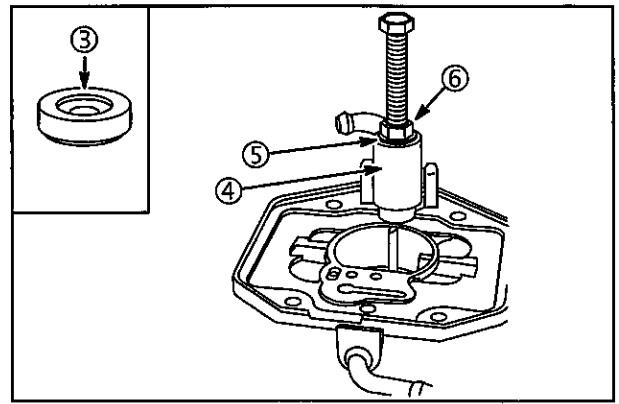


Fig. 105

This completes the carburetor disassembly procedure.

Clean Carburetor

1. Disassemble carburetor.
2. Remove and discard all old gaskets, seals and sealing material.

	CAUTION
	AVOID INJURY!
<ul style="list-style-type: none"> • Wear suitable protection when using cleaners. Follow instructions on container. 	

3. Use a commercial carburetor cleaner (such as Briggs & Stratton Spray Cleaner, #100041 or #100042) to clean carburetor parts and body.

NOTE: Do not leave non-metallic parts (plastic, nylon, Minlon™, etc.), in commercial carburetor cleaner more than 15 minutes. Do not use commercial carburetor cleaners on parts containing rubber, such as seals, O-rings, inlet needles, seats or pump diaphragms.

	CAUTION
	AVOID EYE INJURY!
<ul style="list-style-type: none"> • Wear eye protection whenever using compressed air to clean parts. 	

4. Use only compressed air (blowing in both directions) to clean out all openings and passages.

NOTE: Do not use wire, drills or other mechanical devices to clean out metering holes or passages.

Inspect Carburetor

Inspect all parts for wear, cracks, nicks and burrs. Inspect float for leaks. Replace damaged parts.

Assemble Carburetor

When assembling carburetor, use new seals and gaskets.

Install Fuel Inlet Seat and Body

1. Install new inlet seat (3) with chamfered end down, **Fig. 106**.
2. Press in new body (2) using Tool #19135 (1).

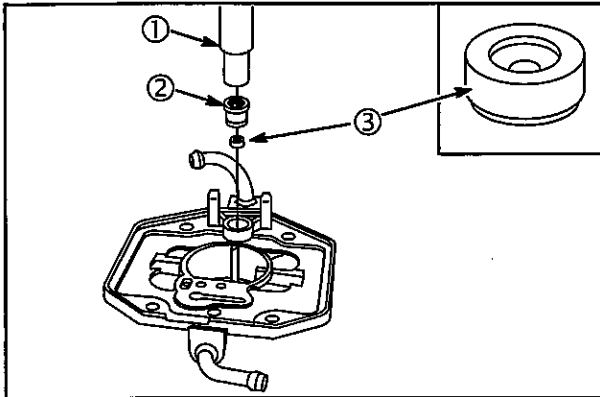


Fig. 106

3. Install new throttle shaft seals (5) with sealing lip out, **Fig. 107**.
4. Install throttle shaft with spacer (4) and foam seal (8).
5. Install foam seal (7) and retainer (6).
6. Install throttle plate.

NOTE: Use LOCTITE® 222 on screw threads.

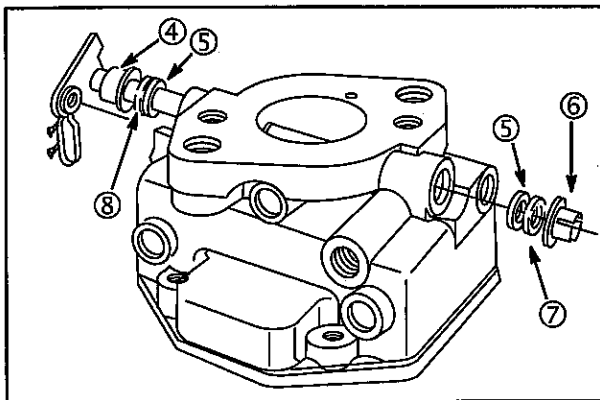


Fig. 107

7. Install new choke shaft seals (10) with sealing lip out, **Fig. 108**.

8. Assemble spacer (9) onto choke shaft.
9. Insert spring and check ball (11) in to spring pocket. Compress with a small round punch.
10. Push choke shaft into hole until ball engages groove in choke shaft.
11. Install retainer (12) to shaft.
12. Install choke plate.

NOTE: Use LOCTITE® 222 on screw threads.

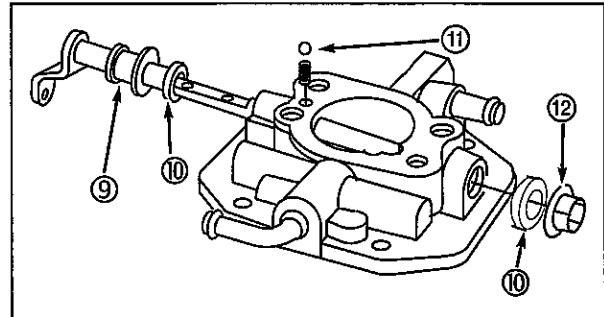


Fig. 108

13. Install fixed main jet (16) with Jet Screwdriver #19062 (18), **Fig. 109**.
14. Install washer (15) and plug (14).
15. Install emulsion tube (17).

NOTE: Fixed main jets are numbered (13) for the type of fuel delivery system used. Install #110 jet if engine is equipped with a fuel pump. Install #117.5 jet if engine is equipped with a gravity fuel tank.

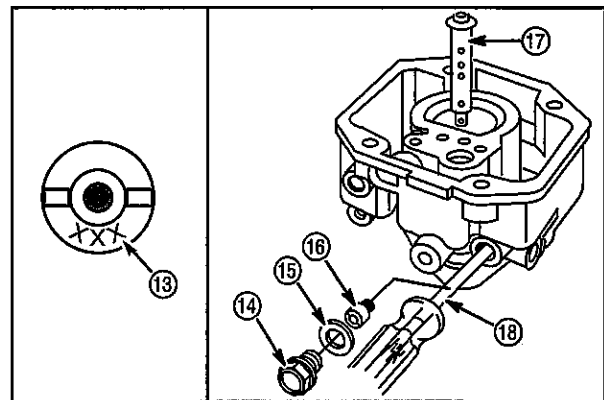


Fig. 109

16. Install bowl drain screw (19) and spring, **Fig. 110**.
17. Install idle mixture screw (20) and spring.
DO NOT tighten screw.
DO NOT install limiter cap at this time.

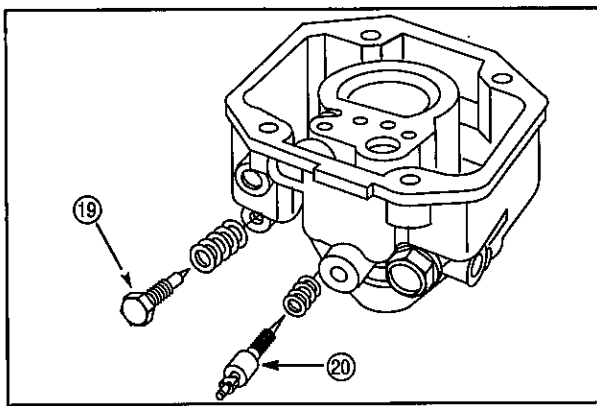


Fig. 110

18. Assemble inlet needle retainer (21) to inlet needle (22). Assemble to float (23), **Fig. 111**.
19. Install float (23) and needle to upper carburetor body. Insert hinge pin (24).

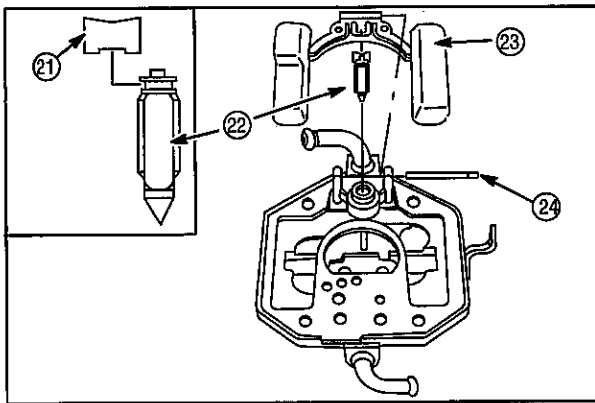


Fig. 111

20. Invert upper carburetor body as shown in **Fig. 112**.
 - The float should be parallel (25) with carburetor bowl mounting surface.
 - If not, use a small screw driver to bend tang (26) and lower (27) or raise (28) the float level as shown.

CAUTION: DO NOT press on float to adjust.

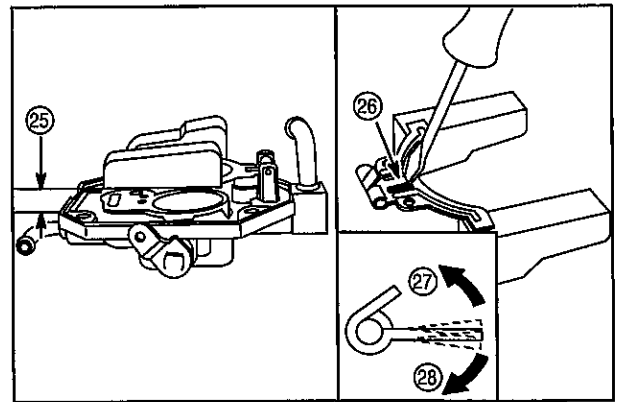


Fig. 112

21. Place new gasket (31) on lower carburetor body. Make sure holes in body line up with holes in gasket, **Fig. 113**.
22. Install upper carburetor body. Tighten screws (30) securely.
23. Install pilot jet (29).
24. Install washer (34) and plug (35) or anti-afterfire solenoid (33). Torque to **45 in. lbs. (5 Nm)**.

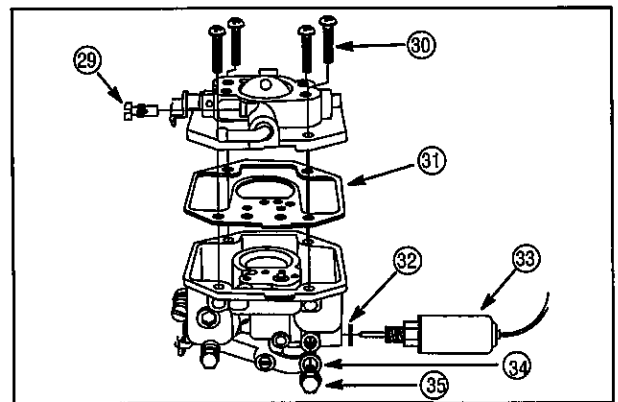
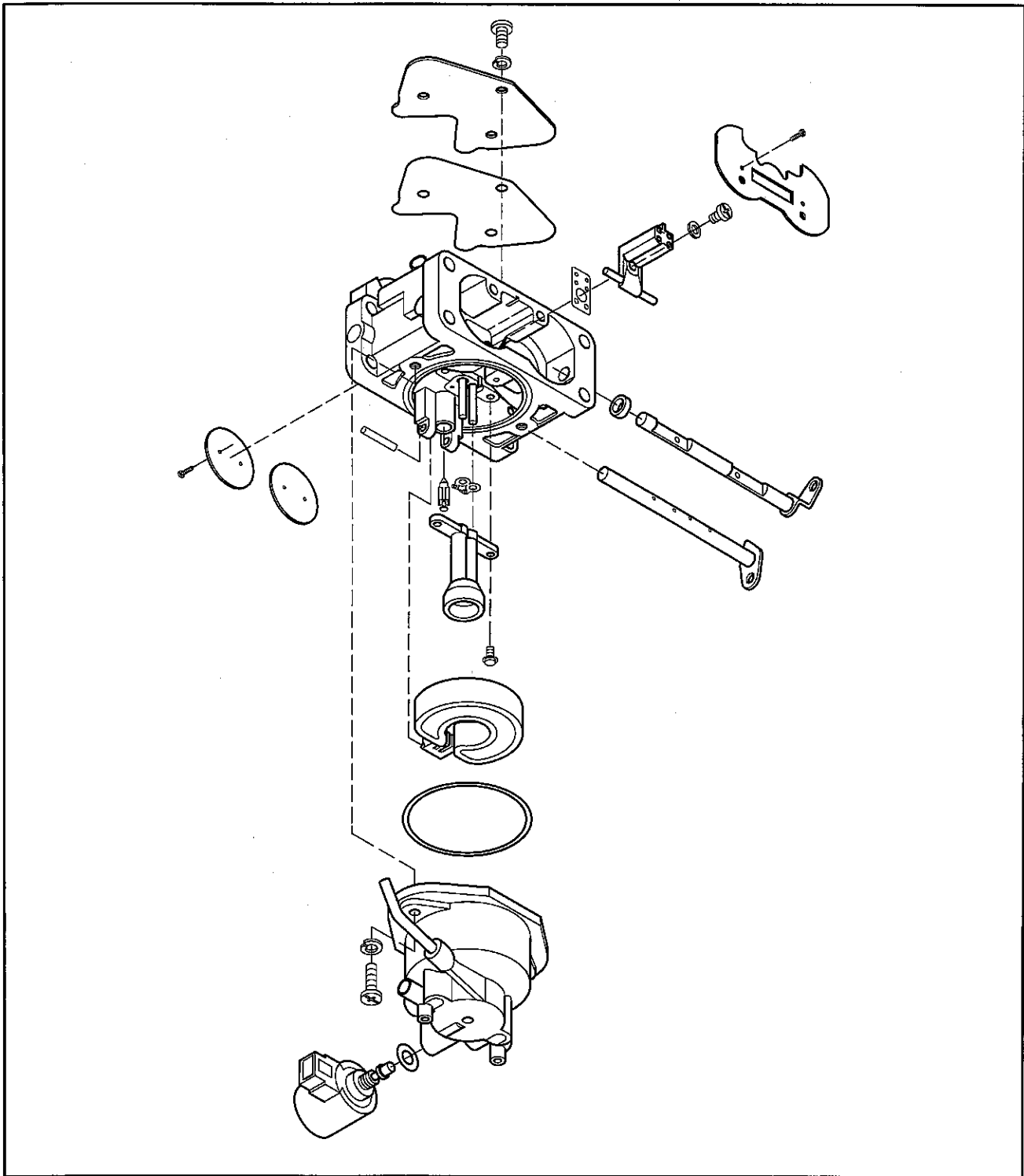


Fig. 113

4



General Information

The Vanguard™ Model 540000 OHV V-Twin utilizes a fixed jet, two barrel, side draft, flo-jet carburetor. Except for idle speed, the carburetor is non-adjustable. The carburetor incorporates a fuel shut-off (anti-afterfire) solenoid that controls fuel flow to the fuel metering system. The solenoid is controlled by the ignition switch.

Remove Carburetor from Manifold

Remove carburetor gaskets (2) and spacer (1), **Fig. 114**. Discard carburetor gaskets.

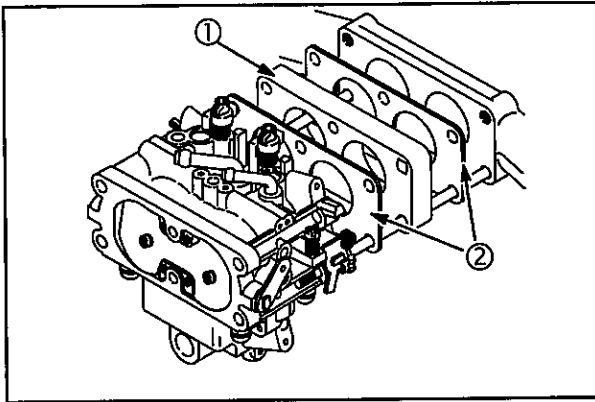


Fig. 114

Check Throttle, Choke Shaft and Body

NOTE: The measurement in Step 1 is taken with the carburetor off of the intake manifold.

1. Lay carburetor on flat surface and check throttle and choke shaft clearance as shown in **Fig. 115**.

Throttle shaft and choke shaft clearance (1) must not exceed **0.010" (0.25 mm)**.

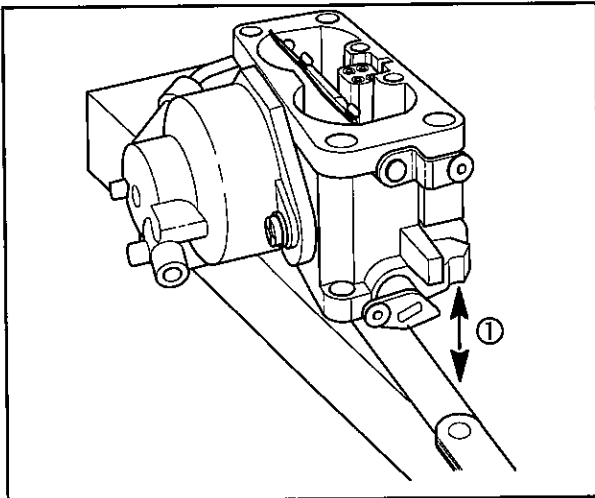


Fig. 115

NOTE: The inspection in Step 2 is performed after the carburetor has been disassembled.

2. Inspect throttle shaft and choke shaft for wear on the shaft bore surfaces (2), **Fig. 116**.

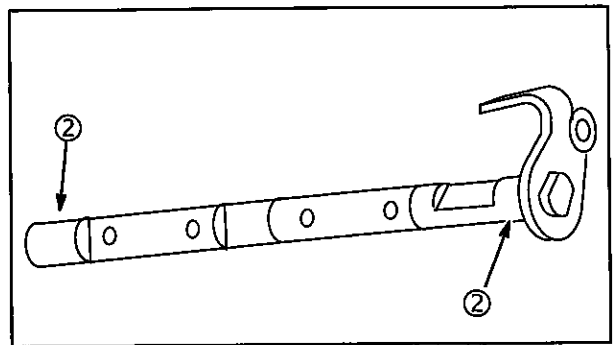


Fig. 116

Replace either shaft if worn.

Replace the carburetor if the body is worn or if either shaft clearance exceeds **0.010" (0.25 mm)** when a new shaft is used.

Disassemble

1. Remove carburetor, see Section 3.
2. Remove two screws and float bowl (2), **Fig. 117**. Discard O-ring.
3. Use **13 mm** thin profile wrench to remove fuel solenoid (1) from float bowl. Discard gasket (3).

CAUTION: Do not damage fixed main jet and housing when removing solenoid.

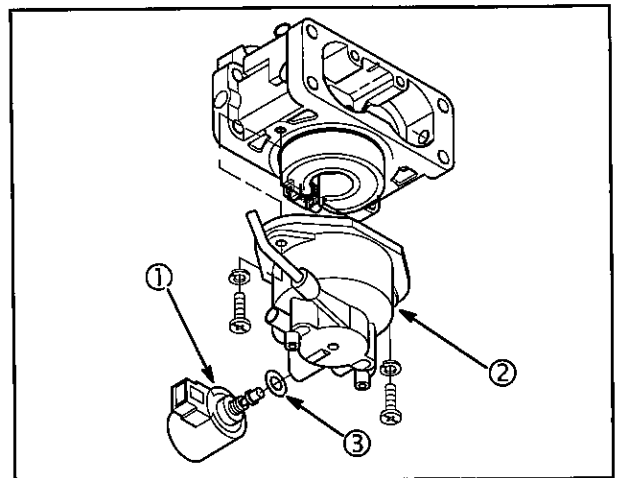


Fig. 117

4. Remove main jet from carburetor body.
5. Remove float hinge pin (5), float (8) and inlet needle (4), **Fig. 118**.
6. Remove emulsion tube body (7) and gasket (6). Discard gasket.

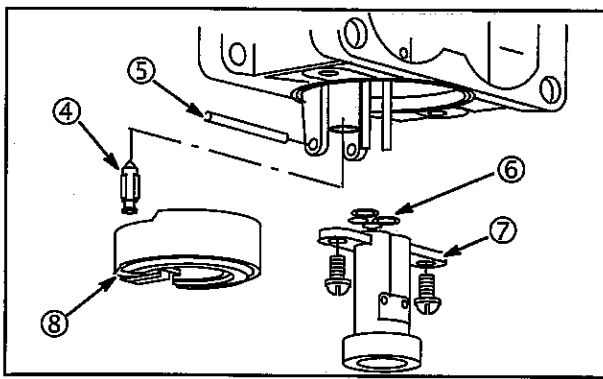


Fig. 118

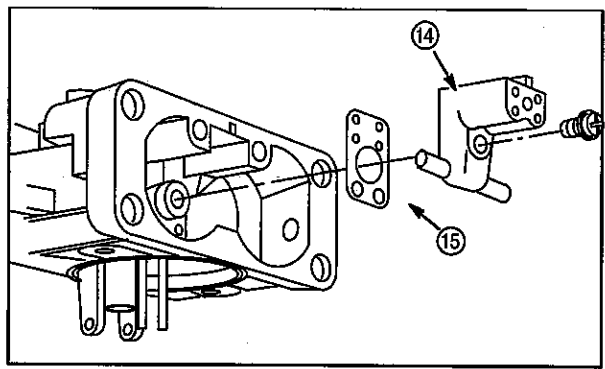


Fig. 121

4

- Remove cover plate (10). Discard gasket (11), Fig. 119.

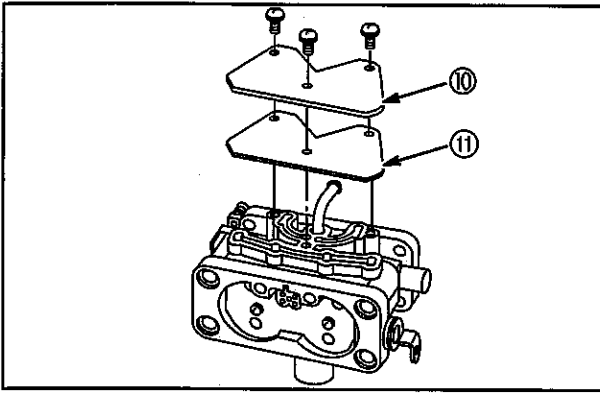


Fig. 119

- Remove screws and choke plate (12), Fig. 120.
- Remove choke shaft. Discard seal (13).

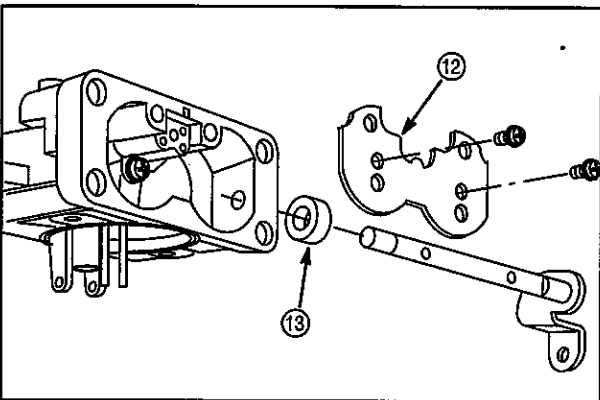


Fig. 120

- Remove nozzle body (14), Fig. 121. Discard gasket (15).

- Mark throttle plates (16), Fig. 122, before removal so they will be re-installed in the original position. Sides of throttle plate are beveled.

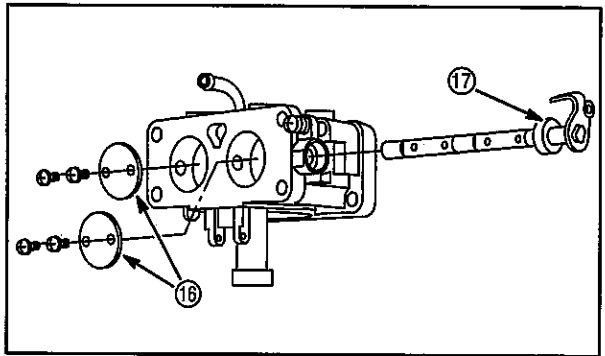


Fig. 122

- Remove screws, throttle plates and throttle shaft with seal. Discard seal (17).

This completes the carburetor disassembly procedure.



Clean Carburetor

- Disassemble carburetor.
- Remove and discard all old gaskets, seals and sealing material.

	CAUTION
	AVOID INJURY!
<ul style="list-style-type: none"> Wear suitable protection when using cleaners. Follow instructions on container. 	

- Use a commercial carburetor cleaner (such as Briggs & Stratton Spray Cleaner, #100041 or 100042) to clean carburetor parts and body.

NOTE: Parts containing rubber, such as seals, O-rings, inlet needles, seats or pump diaphragms should not be placed in commercial carburetor cleaner. Do not leave non-metallic parts (plastic, nylon, Minlon™, etc.), in commercial carburetor cleaner more than 15 minutes.

	 CAUTION
AVOID EYE INJURY!	
<ul style="list-style-type: none"> • Wear eye protection whenever using compressed air to clean parts. 	

4. Use only compressed air (blowing in both directions) to clean out all openings and passages.

NOTE: Do not use wire, drills or other mechanical devices to clean out metering holes or passages.

Inspect Carburetor

Inspect all parts for wear, cracks, nicks and burrs. Inspect float for leaks. Replace damaged parts.

Assemble Carburetor

When assembling carburetor, use new seals and gaskets.

1. Assemble new seal (2) to throttle shaft and insert into carburetor body, **Fig. 123**.

NOTE: Install one throttle plate (1) at a time. Check throttle for freedom of operation before installing other throttle plate. Use LOCTITE® 222 on screw threads.

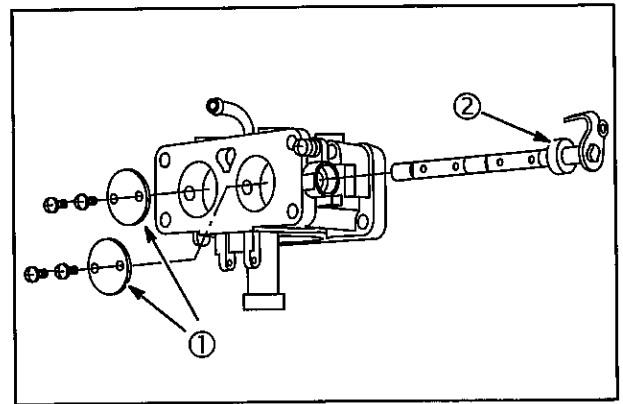


Fig. 123

2. Install cover plate (3) with new gasket, **Fig. 124**.

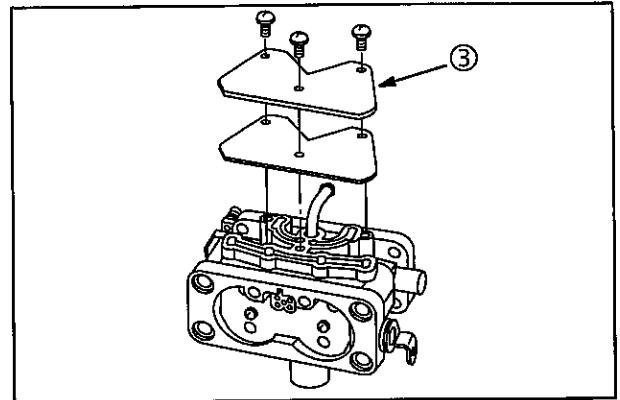


Fig. 124

3. Install nozzle body (4) with new gasket (5), **Fig. 125**. Tighten screw securely.

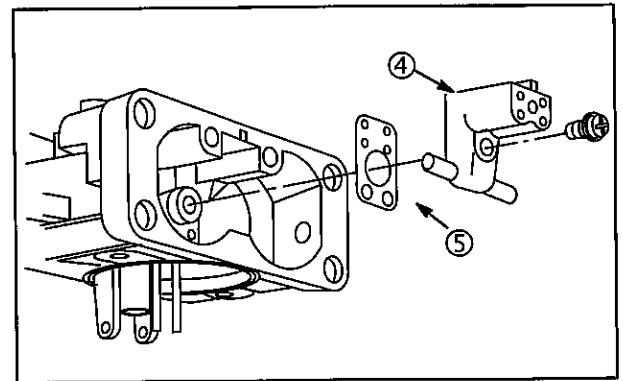


Fig. 125

4. Assemble new seal (7) to choke shaft and insert into carburetor body, **Fig. 126**.
5. Install choke plate (6).

NOTE: Use LOCTITE® 222 on screw threads.

4

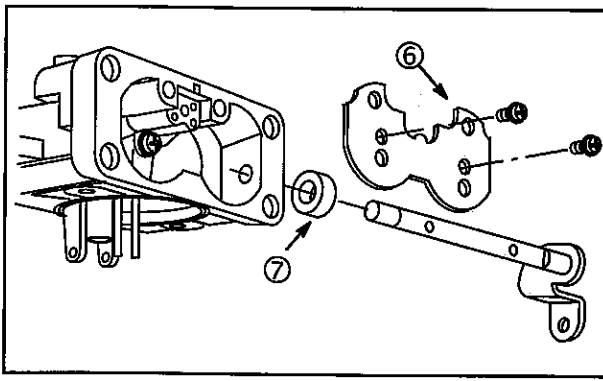


Fig. 126

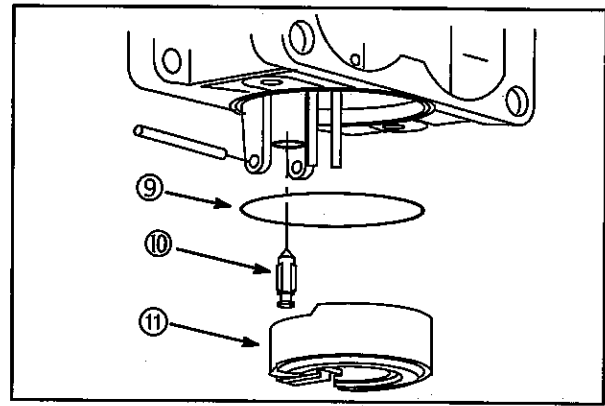


Fig. 128

4

6. Install emulsion tube body (8) with new gasket (19), **Fig. 127**. Tighten screw securely.

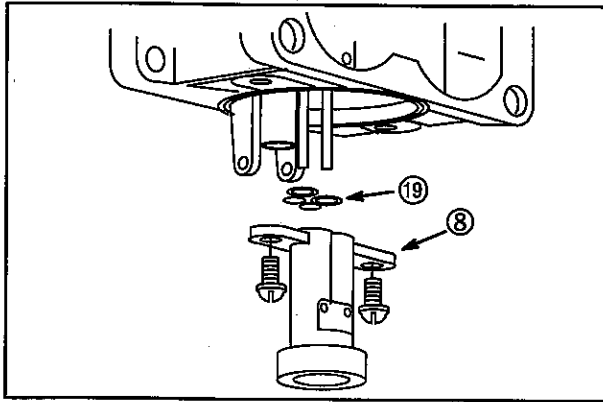


Fig. 127

7. Assemble inlet needle (10) to float (11) and install float, **Fig. 128**.

8. Assemble bowl gasket (9) to body.
9. Install main jet, according to engine model.
10. Install the float bowl assembly to the carburetor body.
11. Assemble fuel solenoid (13) to float bowl (12), **Fig. 129**. Use a 13 mm thin profile wrench to tighten the solenoid.

CAUTION: Use care when tightening solenoid to prevent damage to fixed main jet and housing.

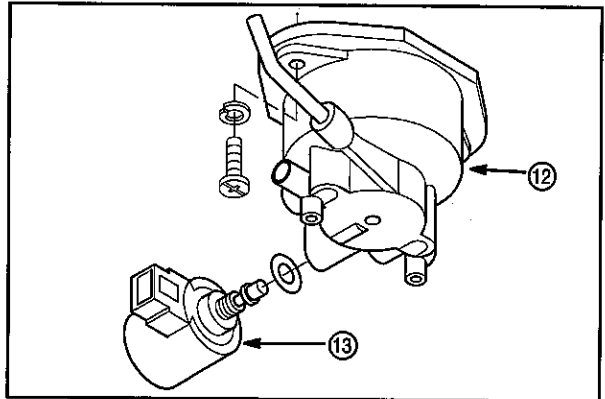
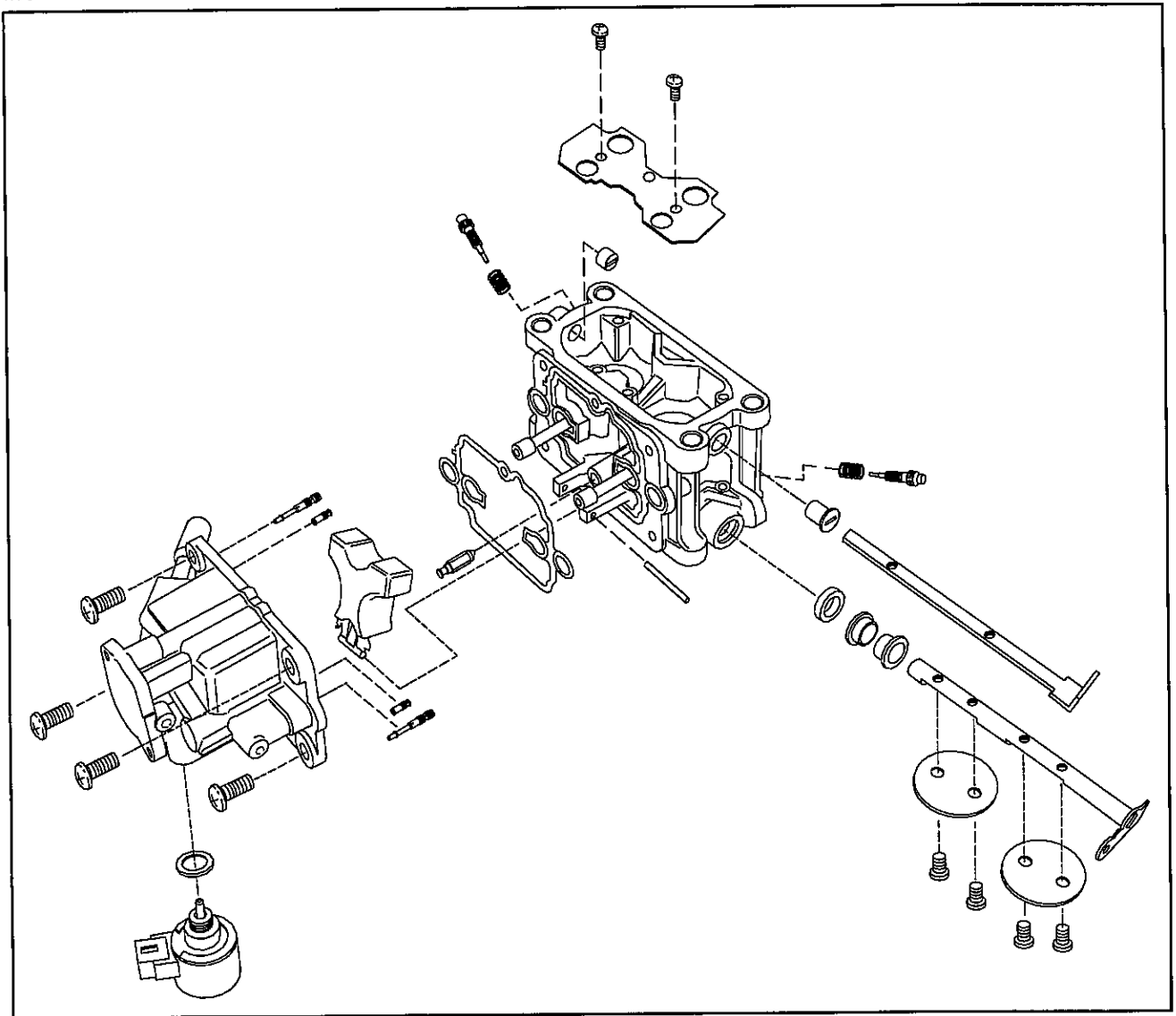


Fig. 129

12. Assemble float bowl to carburetor body.



General Information

The Vanguard™ Model 610000 OHV V-Twin utilizes a fixed jet, two barrel, side draft, flo-jet carburetor. The carburetor incorporates a fuel shut-off (anti-afterfire) solenoid that controls fuel flow to the fuel metering system. The solenoid is controlled by the ignition switch.

Disassemble Carburetor

1. Remove four screws (1) and float bowl (2), **Fig. 130**. Discard gasket.
2. Use **13 mm** thin profile wrench to remove fuel solenoid (3) from float bowl. Discard gasket.

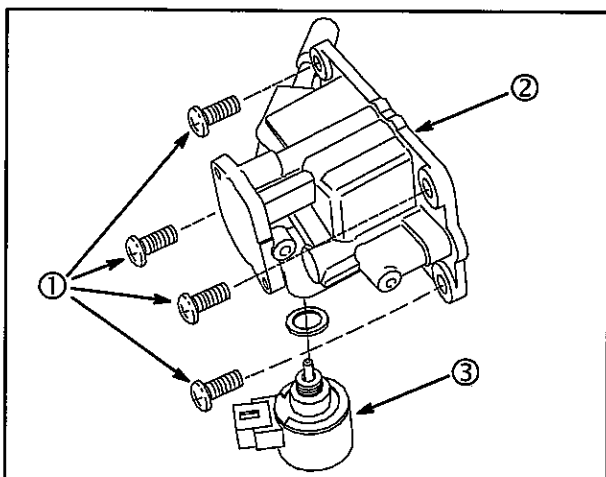


Fig. 130

3. Remove main jets (4) from float bowl, **Fig. 131**.

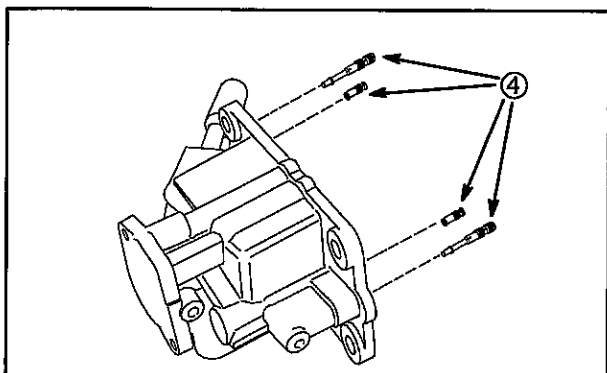


Fig. 131

4. Remove float hinge pin (18), float (5) and inlet needle (6) from carburetor body, **Fig. 132**.
5. Remove limiter caps (8) and mixture adjustment screws (7).
6. Remove screws (9) and choke plate (10).
7. Remove choke shaft (13) and bushings (11, 12) from carburetor body.
8. Mark throttle plates (15) before removal so they will be re-installed in the original position. Sides of throttle plate are beveled.
9. Remove screws (9), throttle plates and throttle shaft (14) with bushings (16) and seal (17). Discard seal.

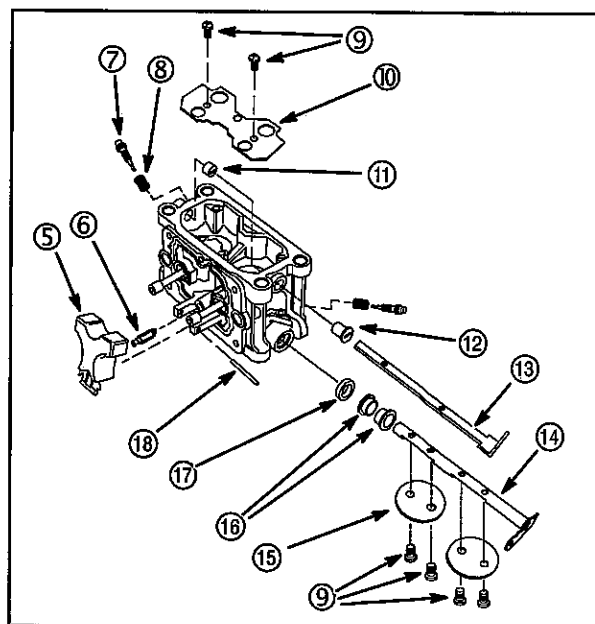


Fig. 132

This completes the carburetor disassembly procedure.

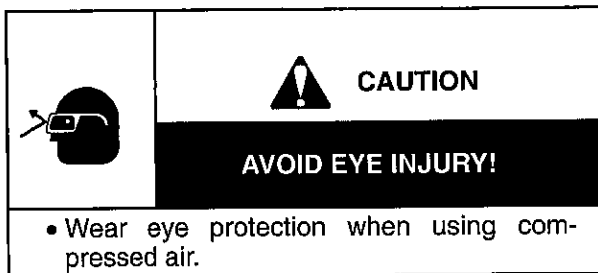
Clean Carburetor

1. Disassemble carburetor.
2. Remove and discard all old gaskets, seals and sealing material.

	CAUTION
AVOID INJURY!	
• Wear suitable protection when using cleaners. Follow instructions on container.	

3. Use a commercial carburetor cleaner such as Briggs & Stratton Spray Cleaner **#100041** or **#100042** to clean carburetor parts and body.

NOTE: Parts containing rubber, such as seals, O-rings, inlet needles, seats or pump diaphragms should not be placed in commercial carburetor cleaner. Do not leave non-metallic parts (plastic, nylon, Minlon™, etc.), in commercial carburetor cleaner more than 15 minutes.



- Use only compressed air (blowing in both directions) to clean out all openings and passages.

NOTE: Do not use wire, drills or other mechanical devices to clean out metering holes or passages.

Inspect Carburetor

Inspect all parts for wear, cracks, nicks and burrs. Inspect float for leaks. Replace damaged or worn parts.

Assemble Carburetor

Use new seals and gaskets when assembling carburetor.

- Assemble new seal and bushings to throttle shaft. Insert into carburetor body.

NOTE: Install one throttle plate at a time. Check throttle for freedom of operation before installing other throttle plate.

Use LOCTITE® 222 on screw threads.

- Insert bushings and choke shaft into carburetor body.
- Install choke plate.

NOTE: Use LOCTITE® 222 on screw threads.

- Assemble inlet needle to float. Install float, **Fig. 133**.

- Assemble bowl gasket to groove in body.

NOTE: The tab on the float bowl gasket (1) goes in the slot in the float bowl carburetor body (2).

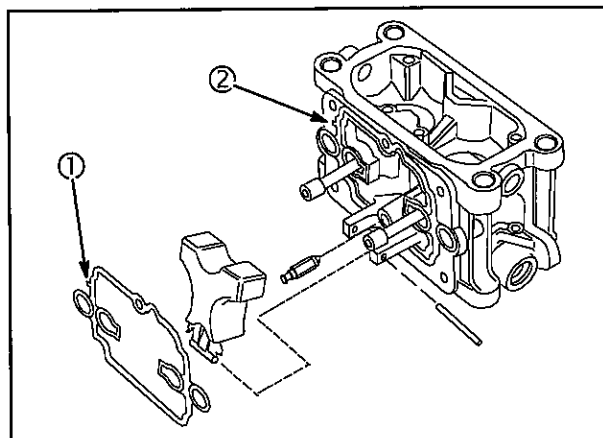


Fig. 133

- Install the carburetor jets to the float bowl.
- Install the float bowl assembly to the carburetor body.

NOTE: The float hinge pin is not secured in the hinge pin posts. Be sure the hinge pin remains in the posts until the float bowl is installed.

- Assemble fuel solenoid to float bowl.

CAUTION: Do not damage the float bowl when tightening the solenoid. Do not overtighten.

