ORIGINAL
BRIGGS & STRATTON
SERVICE PARTS

1984
UPDATE SEMINAR

CONTENTS

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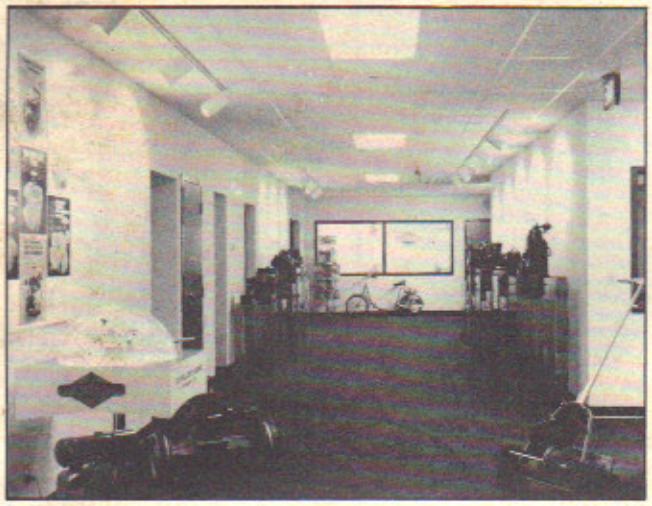
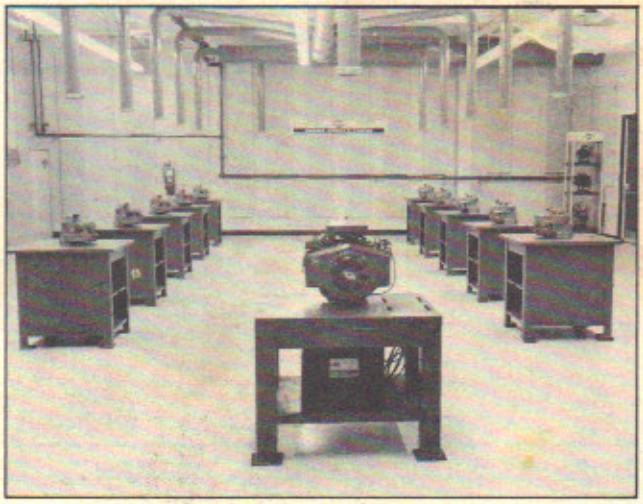
FORM MS-8[illegible]

BRIGGS & STRATTON RELOCATES CORPORATE SERVICE TRAINING FACILITY



Lobby — Foyer Entrance



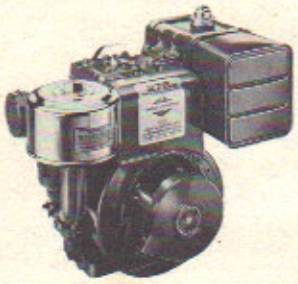
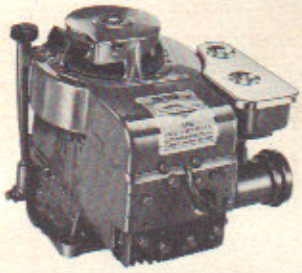
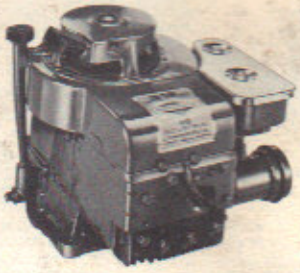
Engine Test Room

In August 1983, the Briggs & Stratton Corporate Service Training Facility was relocated to the Company's Service Distribution Center in Menomonee Falls, Wisconsin. The new training facility has been enlarged to further meet the ongoing demand for service education.

Individual rooms such as the workshop, classrooms and the audio-visual room have been enlarged. The major expansion in the new facility has been the engine test room. The test room has been increased from 300 square feet (27.9 square meters) having three test stands to 1800 square feet (167.2 square meters). The larger room accommodates ten test stands permitting more individualized attention when running engines. The new facility occupies 15,000 square feet (1393.5 square meters), a 25% increase over the previous facility.

Briggs & Stratton's commitment to increasing technical competence within the industry is not only exemplified through the construction of a larger training facility, but also through making available various training programs for service dealers, vocational education instructors and representatives from original equipment manufacturers.

NEW INDUSTRIAL/COMMERCIAL ENGINE MODELS

	SERIES 171400	SERIES 192700	SERIES 193700
			
HORSEPOWER BORE STROKE DISPLACEMENT	**7.0 HP @ 3600 RPM** **3.0" (76.2 mm)** **2-3/8" (60.3 mm)** **276 cc (16.79 cu. in.)**	**8.0 HP @ 3600 RPM** **3.0" (76.2 mm)** **2-3/4" (69.8 mm)** **319 cc (19.44 cu. in.)**	**8.0 HP @ 3600 RPM** **3.0" (76.2 mm)** **2-3/4" (69.8 mm)** **319 cc (19.44 cu. in.)**
AIR CLEANER	Dual Element	Dual Stage with Paper Cartridge (Reverse Flow)	Dual Stage with Paper Cartridge (Reverse Flow)
BEARINGS	Ball - Magneto Side Ball - P.T.O. Side	DU™ - Magneto Side Aluminum - P.T.O. Side	DU™ - Magneto Side Aluminum - P.T.O. Side
CARBURETOR	Flo-Jet	Flo-Jet	Flo-Jet
CYLINDER	Aluminum Cylinder with Cast Iron Sleeve	Aluminum Cylinder with Cast Iron Sleeve	Aluminum Cylinder with Cast Iron Sleeve
MUFFLER (ALUMINIZED)	Round Lo-Tone	Round Lo-Tone	Round Lo-Tone
GOVERNOR	Mechanical	Mechanical	Mechanical
IGNITION	MAGNETRON®	MAGNETRON®	MAGNETRON®
PISTON RINGS	Cast Iron	Cast Iron	Cast Iron
SYNCHRO-BALANCED®	Not Available	Not Available	Standard
VALVES	Cobalite* Hard Faced Exhaust and Seat with Rotator	Cobalite* Hard Faced Exhaust and Seat with Rotator	Cobalite* Hard Faced Exhaust and Seat with Rotator

*Formerly called Stellite®. This is a name change only.

INTERCHANGEABILITY BETWEEN NEW I/C SERIES ENGINES AND SIMILAR SERVICE REPLACEMENT ENGINES

	NEW I/C SERIES ENGINES FOR SERVICE REPLACEMENT PURPOSES	SIMILAR TO THESE SERVICE REPLACEMENT ENGINES
	MODEL - TYPE	MODEL - TYPE
I/C SERIES 171400 7.0 HP HORIZONTAL CRANKSHAFT	171432 - 0035	170432 - 2035/1535
	171432 - 0070	170432 - 2070/1570
	171452 - 0049	170452 - 2049/1549
I/C SERIES 192700 8.0 HP VERTICAL CRANKSHAFT	192702 - 0015	190702 - 2015/1015 2017/1017 5715/5515 5717/5517
	192707 - 0025	190707 - 2025/1025 5725/5525
I/C SERIES 193700 8.0 HP VERTICAL CRANKSHAFT SYNCHRO-BALANCED®	193702 - 0015	191702 - 5715/5515
	193707 - 0025	191707 - 2025/1025 5725/5525

INTERCHANGEABILITY BETWEEN STANDARD SERVICE REPLACEMENT ENGINES/ SHORT BLOCKS AND I/C SERIES ENGINES/SHORT BLOCKS

STANDARD ENGINE MODEL - TYPE	STANDARD ALUMINUM BORE SHORT BLOCK	I/C CAST IRON SLEEVE BORE ENGINE MODEL - TYPE	I/C CAST IRON SLEEVE BORE SHORT BLOCK
*80232 - 1535/0035	*295345	•81232 - 2035	•394124
*80232 - 1536/0036	*295339	•81232 - 2036	•394120
*80232 - 8544	N.A.	•81232 - 8044	N.A.
80252 - 1549/0049	295340	£81252 - 2049	£394123
*80332 - 1535/0035	*298647	•81332 - 2535	•394125
*80332 - 1537/0037	*295345	•81332 - 2537	•394124
80352 - 1549/0049	295340	£81352 - 2549	£394123
92902 - 5015/0515		£114902 - 0025	
92902 - 5016/0516		£114902 - 0025	
92902 - 5017/0517		£114902 - 0027	I/C CAST IRON
92902 - 5019/0519	STANDARD	£114902 - 0029	SLEEVE BORE
92908 - 5071/0571	ALUMINUM BORE	£114908 - 0015	SHORT BLOCKS
92908 - 5072/0572	SHORT BLOCKS	£114908 - 0016	WILL BE
92908 - 5074/0574	ARE AVAILABLE	£114908 - 0018	AVAILABLE FOR
94908 - 0515/0015	FOR THESE	£114908 - 0015	THESE ENGINES
94908 - 0516/0016	ENGINES.	£114908 - 0016	BUT THEY WILL
94908 - 0518/0018	FOR REPLACE-	£114908 - 0018	NOT BE INTER-
110902 - 1025	MENT SHORT	£114902 - 0025	CHANGEABLE
110902 - 1026	BLOCKS, REFER	£114902 - 0027	WITH THE
110902 - 1028	TO SERVICE	£114902 - 0029	STANDARD
110908 - 1015/0015	ENGINE SALES	£114908 - 1015	ALUMINUM BORE
110908 - 1016/0016	MANUAL MS-4052	£114908 - 1016	SHORT BLOCK
110908 - 1018/0018		£114908 - 1018	
113908 - 0515/0015		£114908 - 1015	
113908 - 0516/0016		£114908 - 1016	
113908 - 0518/0018		£114908 - 1018	

*Ball bearing PTO side only.

•Needle bearing or DU™ bearing magneto side, ball bearing PTO side.

N.A.-Not available.

£DU™ bearing magneto side only.

★Dual ball bearing magneto and PTO sides.

■Ball bearing magneto side only.

INTERCHANGEABILITY BETWEEN STANDARD SERVICE REPLACEMENT ENGINES/ SHORT BLOCKS AND I/C SERIES ENGINES/SHORT BLOCKS

STANDARD ENGINE MODEL - TYPE	STANDARD ALUMINUM BORE SHORT BLOCK	I/C CAST IRON SLEEVE BORE ENGINE MODEL - TYPE	I/C CAST IRON SLEEVE BORE SHORT BLOCK
*130232 - 1535/0035	*299252	★131232 - 2035	★394131
*130232 - 1536/0036	*299251	★131232 - 2036	★394130
*130232 - 1538/0038	*299253	★131232 - 2038	★394132
130252 - 1549/0049	299254	■131252 - 2049	■394133
130902 - 1015/0015	298850	■131922 - 2015	■394135
130902 - 1016/0016	298851	■131922 - 2016	■394136
130902 - 1017/0017	298852	■131922 - 2017	■394137
*170432 - 2035/1535	*299772	★171432 - 0035	N.A.
*170432 - 2070/1570	*299774	★171432 - 0070	N.A.
170452 - 2049/1549	299773	■171452 - 0049	N.A.
*190432 - 2535/1535	*390632	★195432 - 2035	★394141
*190432 - 2537/1537	*390631	★195432 - 2037	★394140
*190432 - 2547/1547	★394144	★195432 - 2047	★394144
*190432 - 2570/1570	*390634	★195432 - 2070	★394142
190452 - 2549/1549	390633	■195452 - 2049	■394143
190702 - 2015/1015	390640	£192702 - 0015	N.A.
190702 - 2017/1017	390640	£192702 - 0015	N.A.
190702 - 5715/5515	390640	£192702 - 0015	N.A.
190702 - 5717/5517	390640	£192702 - 0015	N.A.
190707 - 2025/1025	390640	£192707 - 0025	N.A.
190707 - 5725/5525	390640	£192707 - 0025	N.A.
191702 - 5715/5515	390649	£193702 - 0015	N.A.
191707 - 2025/1025	390649	£193707 - 0025	N.A.
252702 - 0515/0015	391935	£253702 - 0015	£396610
252702 - 0516/0016	391935	£253702 - 0016	£396610
252707 - 0526/0026	391935	£253707 - 0026	£396610
252707 - 0528/0028	391935	£253707 - 0028	£396610

*Ball bearing PTO side only.

•Needle bearing or DU™ bearing magneto side, ball beaing PTO side.

N.A.-Not available.

£DU™ bearing magneto side only.

★Dual ball bearing magneto and PTO sides.

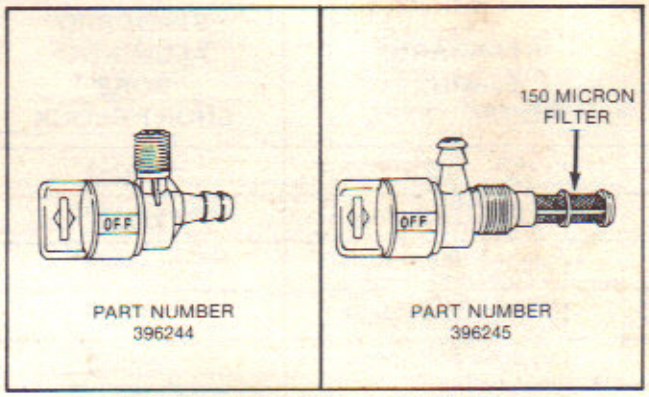
■Ball bearing magneto side only.

NEW ENGINE FEATURES

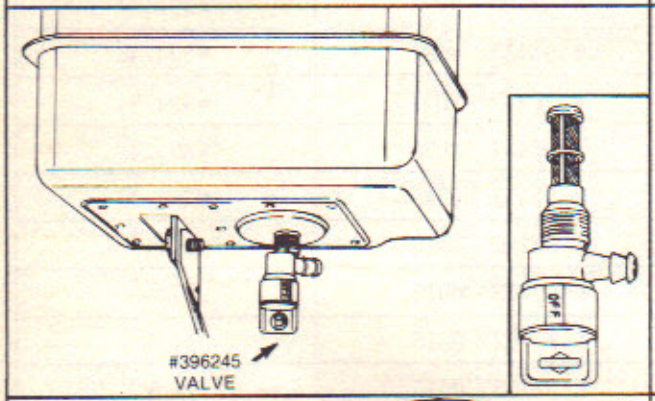
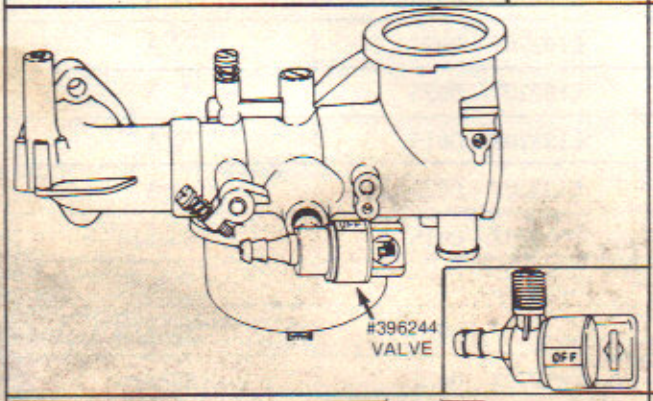
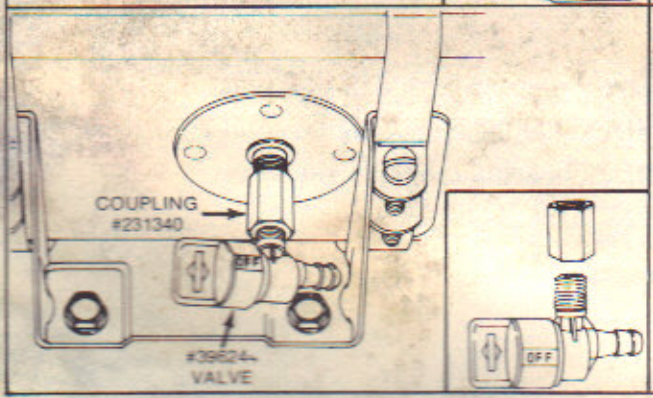
NYLON FUEL SHUT-OFF VALVE

Single cylinder engines, equipped with float type carburetors, will feature as standard equipment a new nylon fuel shut-off valve. The valve features a larger surface to grasp, making it easier to open and close the fuel supply. Another advantage of the new valve is its quick response as only a 1/4 turn is required to either open or close the fuel supply.

Any existing metal shut-off valve can be serviced with the new nylon fuel shut off valve. Refer to the chart below.



Nylon Fuel Shut-off Valves

FUEL SHUT-OFF VALVE TYPES	ENGINE MODEL SERIES	SERVICING GUIDELINES
	80300 81300 82300 131400 132400	• Use on engines with small two piece flo-jet carburetor. • Install directly to fuel tank with internal fuel filter.
	170000 190000 220000 250000	• Use on vertical crankshaft engines. • Install directly to one piece flo-jet carburetor. • Use in-line fuel filter.
	170000 190000 200000 220000 230000 240000 250000 300000 320000	• Use on horizontal crankshaft engines. • Must use #231340 coupling to adapt fuel shut-off valve to tank nipple. Order coupling separately. • Use in-line fuel filter.

TWIN CYLINDER CARBURETOR WITH FIXED MAIN JET AND INTEGRAL SOLENOID

TWIN CYLINDER CARBURETOR WITH FIXED MAIN JET

The twin cylinder carburetor has been redesigned with a fixed main jet, figure 1. The fixed main jet will eliminate the need for adjusting the high speed needle valve. This new feature will insure a more consistent fuel-air mixture and reduce the possibility of a "too lean" or "too rich" condition.

There are two (2) fixed jets available, each differing in orifice size. The difference in orifice size allows for a change of fuel flow to compensate for a major change in altitude, insuring satisfactory engine performance, figure 2.

Standard Jet - Less than 5,000 feet (1,524 meters) above sea level.

High Altitude Jet - Greater than 5,000 feet (1,524 meters) above sea level.

All twin cylinder carburetors are manufactured with the Standard Fixed Jet. This fixed jet must be replaced with a High Altitude Jet if equipment is to be operated at altitudes greater than 5,000 feet (1,524 meters) above sea level.

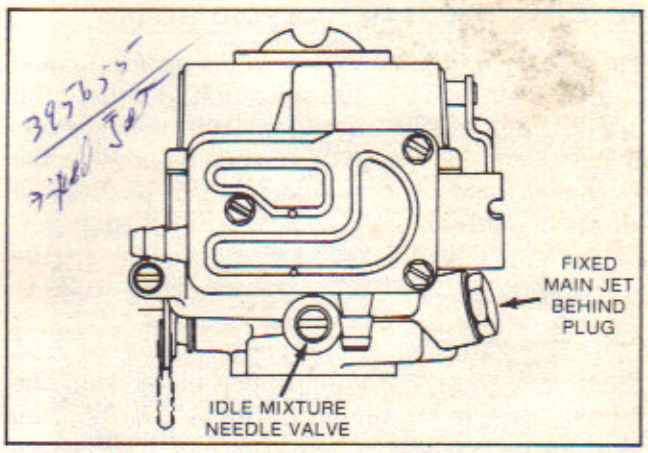


Figure 1

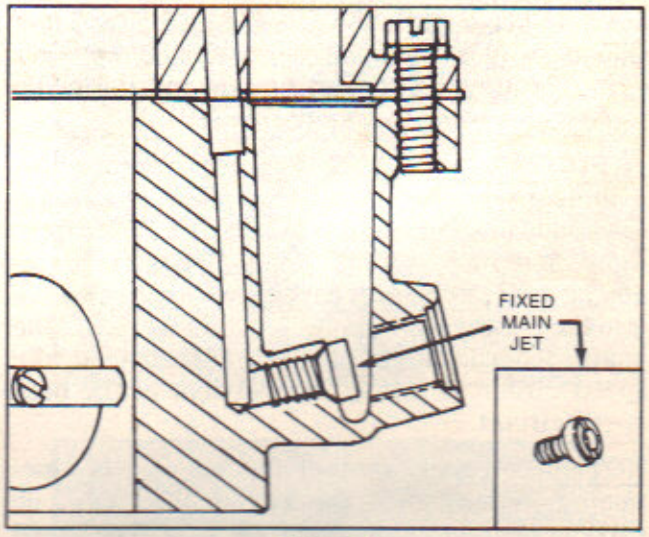


Figure 2

TWIN CYLINDER CARBURETOR WITH INTEGRAL SOLENOID (Figure 3)

The integral solenoid has been developed to eliminate the "after-fire" that occurs in some instances, on twin cylinder engines. The following describes the usual sequence of events causing the "after-fire" to occur:

1) When the keyswitch is turned "off" and the speed control lever is in the "fast" position, the engine coasts down to a stop.
2) During the coasting time, unburned fuel enters the "hot" muffler.
3) The unburned fuel is then ignited by the "hot" muffler, causing "after-fire" to occur.

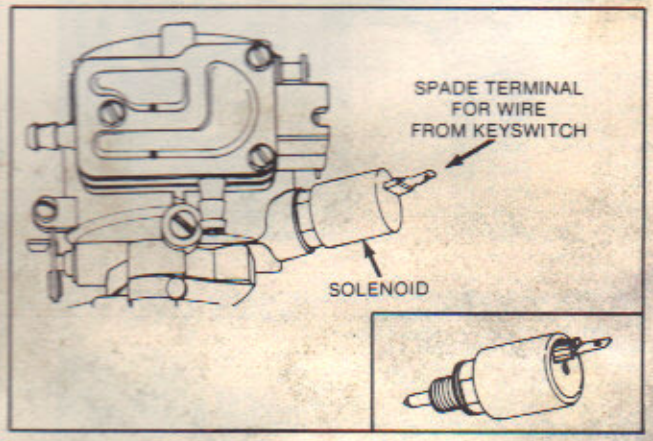


Figure 3

TWIN CYLINDER CARBURETOR WITH FIXED MAIN JET AND INTEGRAL SOLENOID

HOW THE INTEGRAL SOLENOID WORKS

The integral solenoid contains a spring-loaded plunger that has a viton tip much like the viton tipped inlet needle in a float type carburetor. When there is no electrical current supplied to the solenoid, the spring-loaded plunger pushes the viton tip against the inlet of the fixed main jet, figure 4. To supply electrical current to the solenoid, a special INDAK keyswitch (#3H463A) is used. When the keyswitch is in the "ON" or "START" position, current activates the solenoid, pulling the viton tipped plunger off the inlet of the fixed main jet, figure 5. This will then allow proper fuel flow for starting and continuous running. When the keyswitch is turned to the "OFF" position, current is interrupted to the solenoid. This will allow the spring-loaded viton tipped plunger to seal against the fixed main jet, eliminating fuel from entering the muffler while the engine coasts to a stop.

IMPORTANT: A twin cylinder carburetor, equipped with the integral solenoid, requires a continuous power supply from a 12 volt battery, figure 6. If the battery is "dead," the solenoid can not be activated, preventing fuel from flowing into the high speed circuit. If "jump started," the engine will run only at idle speed because the idle speed circuit is totally independent of the high speed circuit.

NOTE: To check whether the solenoid is functioning, simply turn the key to the "ON" or "RUN" position. A distinct "click" will be heard indicating that the solenoid is being activated.

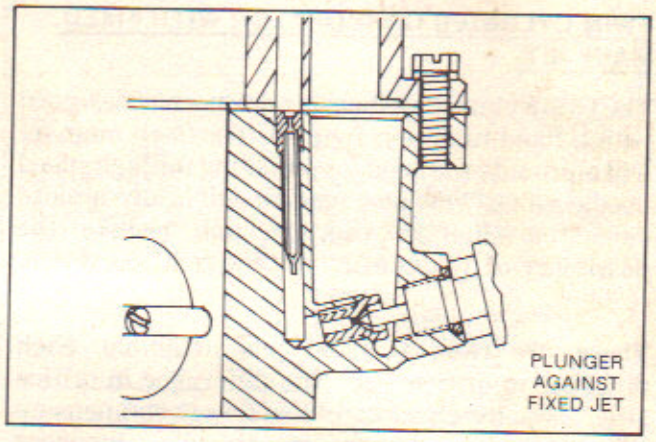


Figure 4

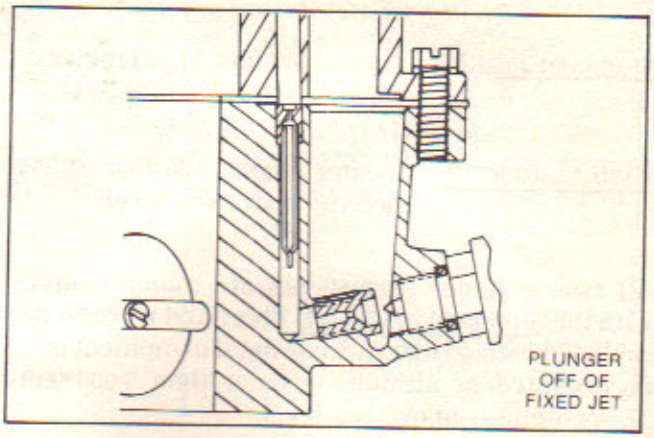


Figure 5

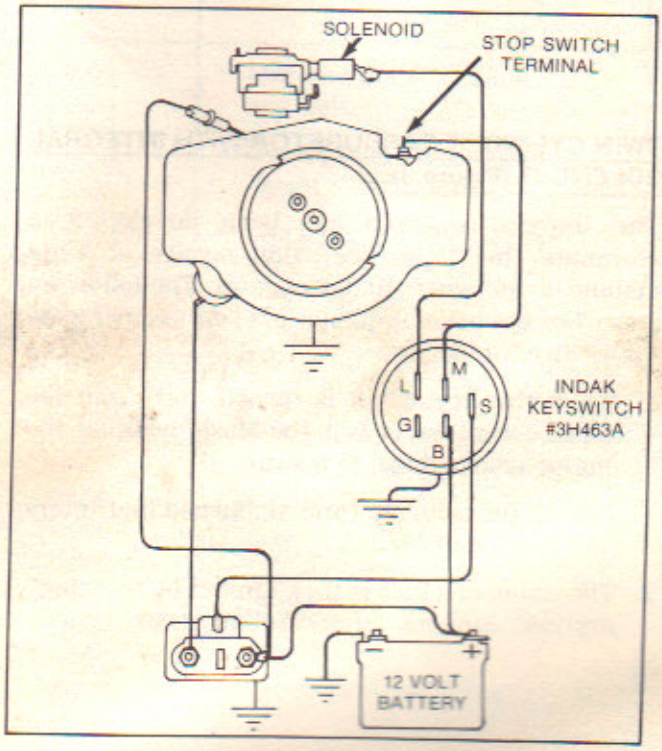


Figure 6

IMPROPERLY/INFREQUENTLY SERVICED AIR CLEANER

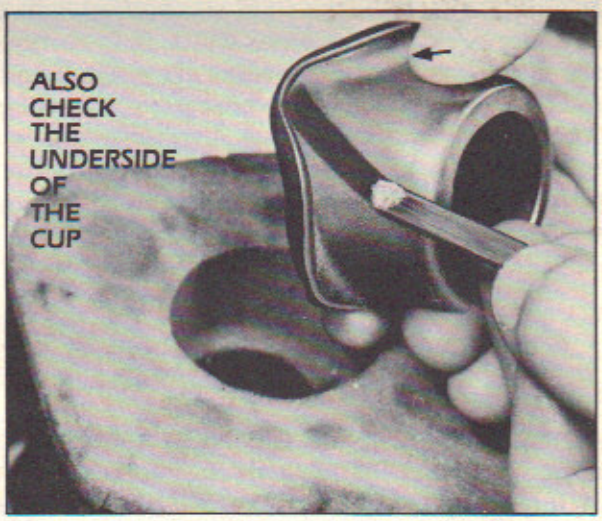
Abrasive grit can enter an engine at nearly 25 MPH (40 KM/H) if the air cleaner is improperly/infrequently serviced. When this occurs, an examination of the air cleaner assembly will reveal the presence of the abrasive at these areas:

A) Air cleaner stud's threads

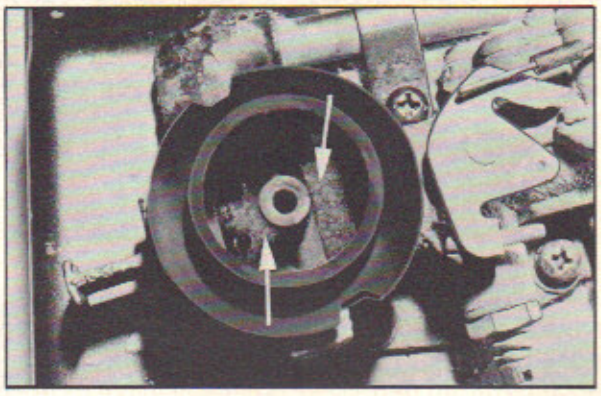
B) Underside surface of air cleaner cover

C) Air cleaner spacer cup

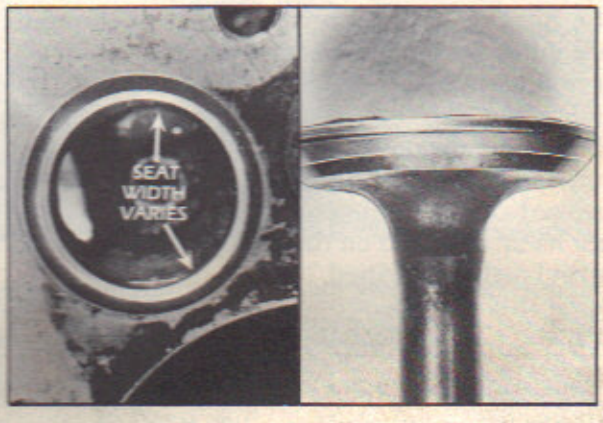
If the air cleaner had been regularly and properly maintained, an abrasive would not be detected on these parts.



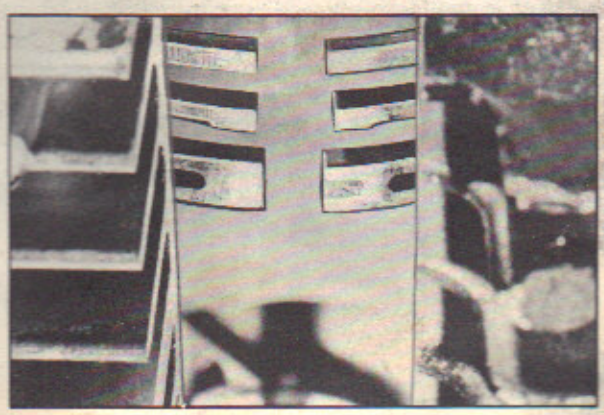
Next, the abrasive grit travels through the carburetor and tends to accumulate on internal carburetor parts, such as the choke and throttle plates. In addition, it is not unusual to detect excessive wear at the choke and throttle shafts.



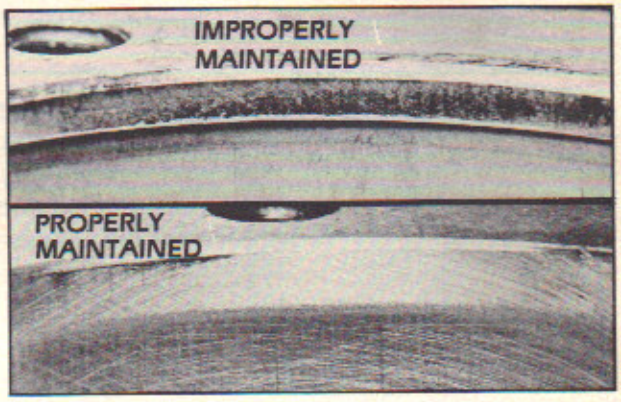
One of the most distinctive signs that abrasive grit passed through the air intake system is the unique wear pattern found on the intake valve. Each time the intake valve opens and closes, some of the incoming abrasive is caught and crushed between the valve face and seat. Soon, the valve seat wears wider (cylinder bore side) and a groove develops on the valve face. Further, some of the abrasive is dragged down the intake valve guide, and eventually, the guide becomes worn.



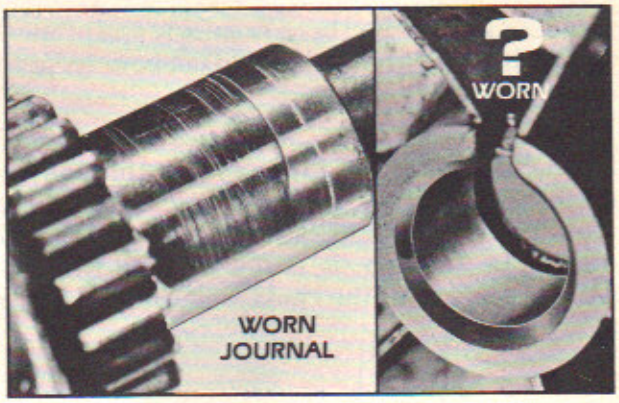
Once through the intake valve port, the abrasive grit is now drawn into the cylinder bore. At 3600 RPM, the piston assembly changes its direction of travel 120 times each second. When an abrasive is present, the rings wear rapidly resulting in excessive ring end gaps.



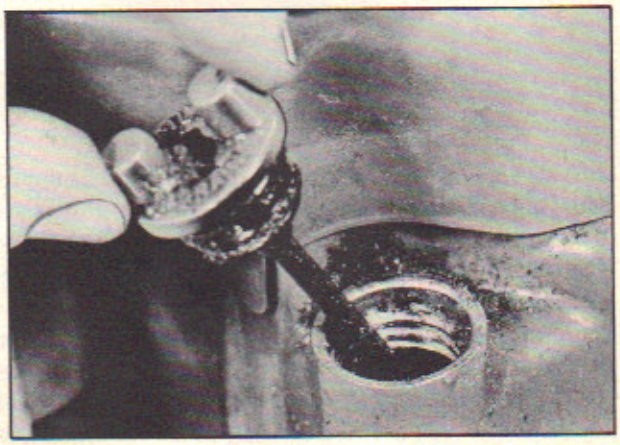
In addition to the piston rings sustaining wear, the cylinder bore also becomes worn. In the process, the bore's crosshatch patterns are erased, and at the top of ring travel in the bore, a ridge develops. An engine which receives regular and proper maintenance will continue to show crosshatch patterns even after hundreds of hours of rugged use.



Additional destruction caused by the incoming abrasive grit is further evident upon examining all internal parts, such as the crankshaft journals and main bearings. Performing only a visual inspection of these parts often produces deceiving results. Precision and accurate measuring tools, like plug gauges, dial caliper (micrometer), etc. are required when assessing the true extent of wear.

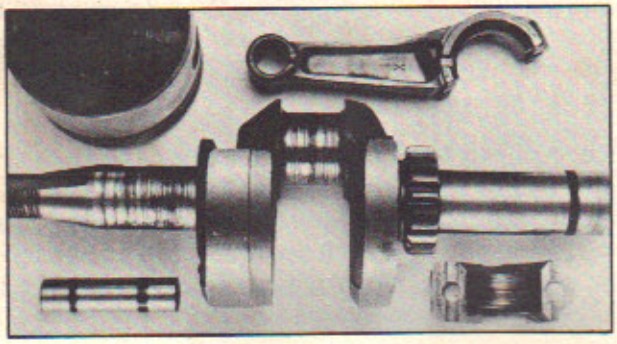


Abrasive grit can also gain entrance into the engine at the time the oil level is checked, or oil is added. Inspect the area around the oil filler plug for a build-up of dirt, or other abrasive material. Remove the oil filler plug and inspect the threads for abrasives. Any abrasive entering through the oil filler opening will also produce destructive premature wear affecting all internal parts, including the cylinder bore and piston rings. Since the abrasive does not pass through the air intake system, an air cleaner inspection should reveal proper maintenance, and there should be no wear detected on the intake valve and seat as previously described.

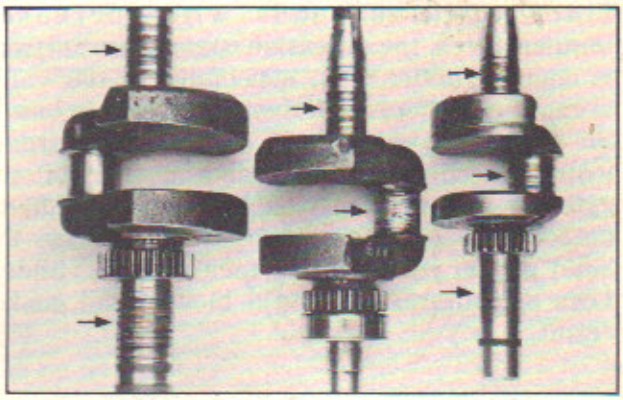


INSUFFICIENT AMOUNT OF LUBRICATION (OIL)

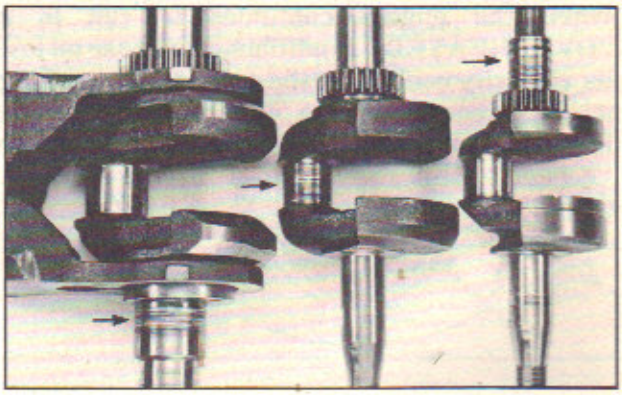
Operating an engine with an insufficient (not enough) amount of lubrication causes temperatures to increase beyond what the engine can tolerate. Excessive temperatures cause discoloration of internal parts. Parts most commonly found discolored are the connecting rod, crankshaft journals, main bearings, piston pin, piston skirt and the cylinder bore.



Besides discoloring parts, the increased operating temperatures also change the working clearances between the crankshaft journals and their respective mating bearings, resulting in scored bearing surfaces. WHEN TWO OR MORE CRANKSHAFT JOURNAL BEARING SURFACES ARE SCORED, THE ENGINE HAS USUALLY BEEN RUN, AT SOMETIME, WITH AN INSUFFICIENT AMOUNT OF LUBRICATION.

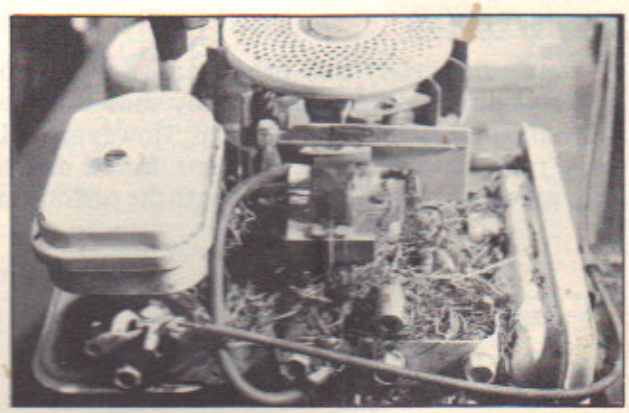


When scoring is isolated to a single crankshaft journal bearing surface, the cause can usually be attributed to: (A) a manufacturing defect involving that bearing surface, or (B) the manner in which the engine had been mounted to the application, as example: excessive belt tension, misalignment between engine and equipment, etc.

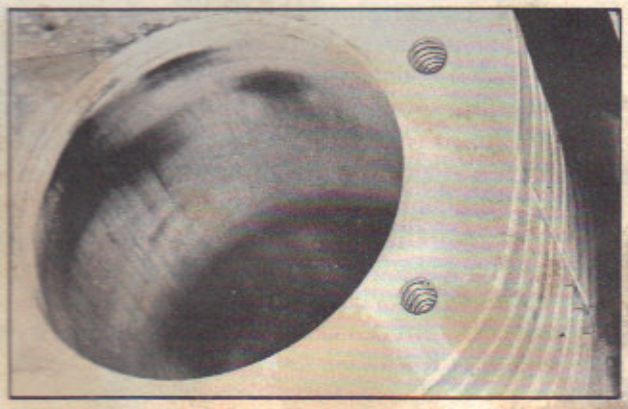


OVERHEATING

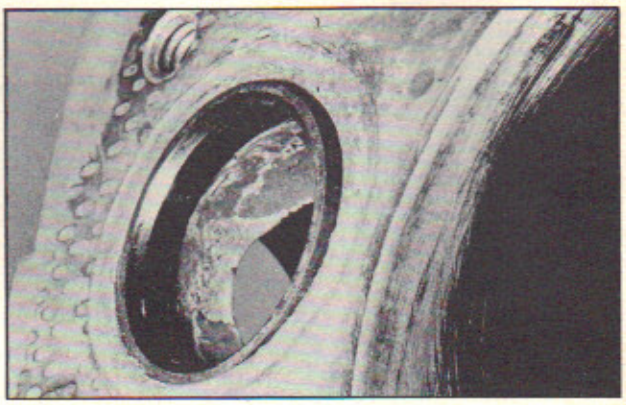
An accumulation of debris within the cylinder fins prevents the circulation of air and the cooling of critical engine areas. A partial restriction of the cylinder fins is sufficient to increase the operating temperatures of the engine above normal. When this condition occurs, damage can result.



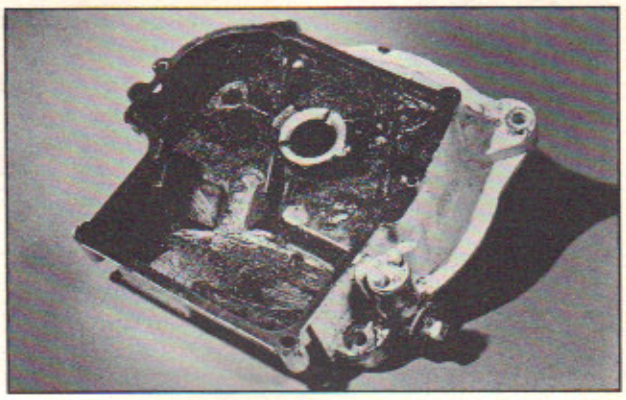
Excessive engine operating temperatures produce "HOT SPOTS" within the cylinder bore. It is these same higher temperatures which can also cause the cylinder bore to fluctuate in size, preventing proper conforming and sealing of the piston rings. Excessive oil consumption and smoking result.



Since metal expands with increased temperatures, the excessive heat generated from plugged cylinder fins, especially in the valve area, can produce sufficient expansion to loosen the exhaust valve seat. In some extreme instances, the exhaust valve corner of the cylinder may warp. This condition can be detected by placing a straight edge across the head gasket mounting surface on the cylinder. Loss of compression and a blown head gasket result.

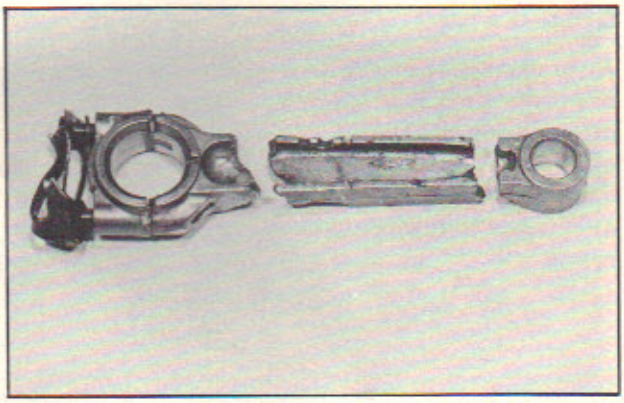


When the engine continues to run in an "OVERHEATED" condition, crankcase oil loses its viscosity because of the continuous "cooking" it experiences at the higher temperatures. Besides losing effective lubrication, the "cooked" oil is reduced to a tar-like substance within the crankcase.

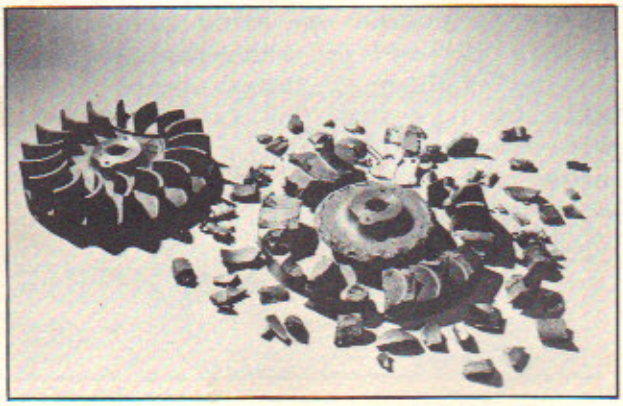


OVERSPEEDING

A connecting rod that breaks as a result of overspeeding may not necessarily show signs of discoloration, scoring or seizure. However, it is very typical of a rod which has failed due to overspeeding to break very close to the piston pin.



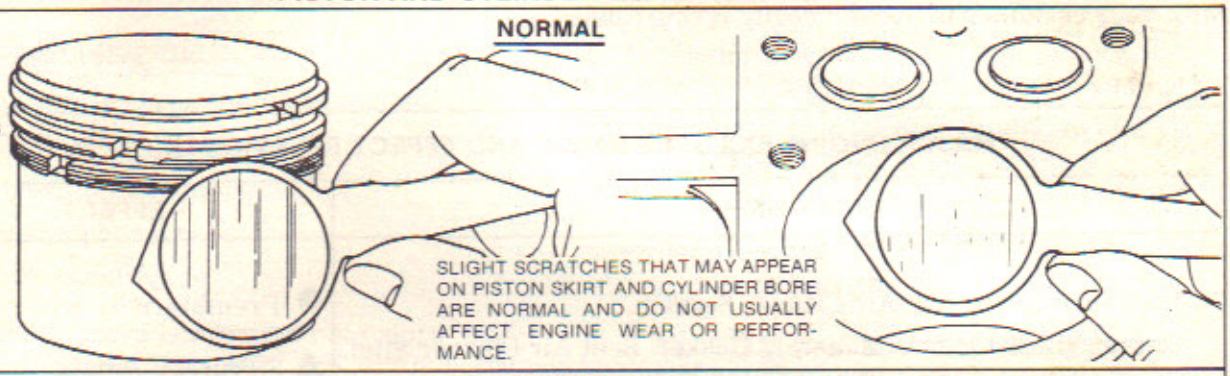
The real potential "DANGER" of an overspeeding condition is the flywheel exploding. This occurrence is not usually considered by most individuals, even those with many years of engine experience. As engine speed increases, centrifugal forces working upon the flywheel also rapidly increase. Sufficient forces can be obtained causing the flywheel to explode. Removing a flywheel by striking it with a hammer, or prying underneath it with a screwdriver, increases someone's chances of experiencing a flywheel exploding.



MAJOR ENGINE FAILURE ANALYSIS

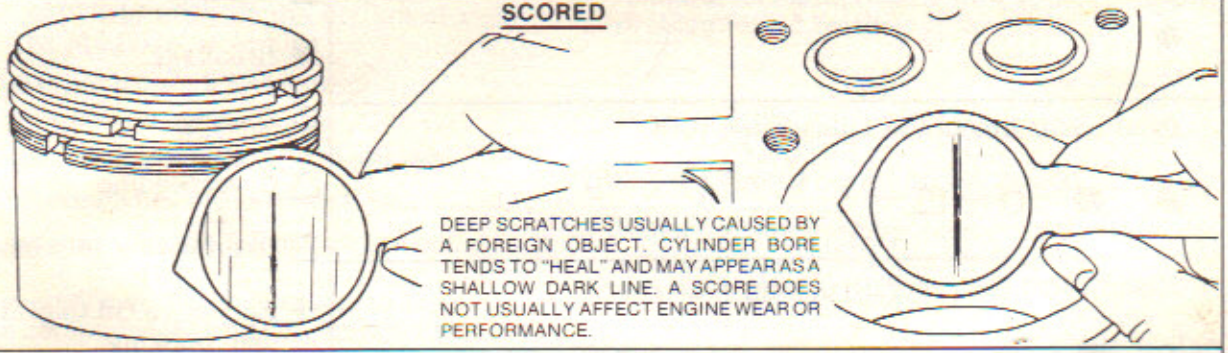
PISTON AND CYLINDER BORE ANALYSIS

NORMAL



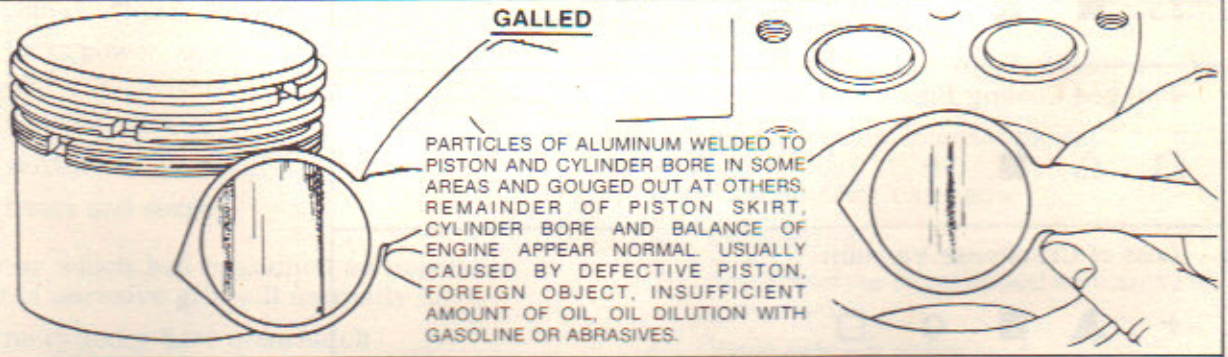
SLIGHT SCRATCHES THAT MAY APPEAR ON PISTON SKIRT AND CYLINDER BORE ARE NORMAL AND DO NOT USUALLY AFFECT ENGINE WEAR OR PERFORMANCE.

SCORED



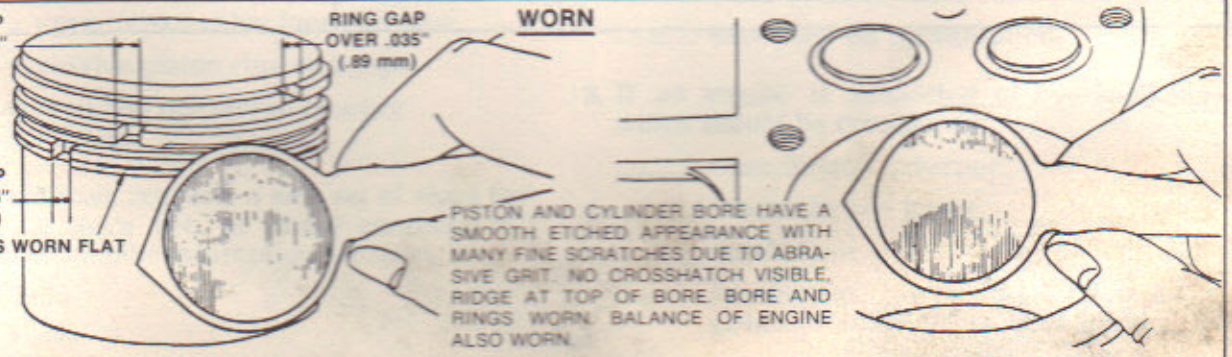
DEEP SCRATCHES USUALLY CAUSED BY A FOREIGN OBJECT. CYLINDER BORE TENDS TO "HEAL" AND MAY APPEAR AS A SHALLOW DARK LINE. A SCORE DOES NOT USUALLY AFFECT ENGINE WEAR OR PERFORMANCE.

GALLED



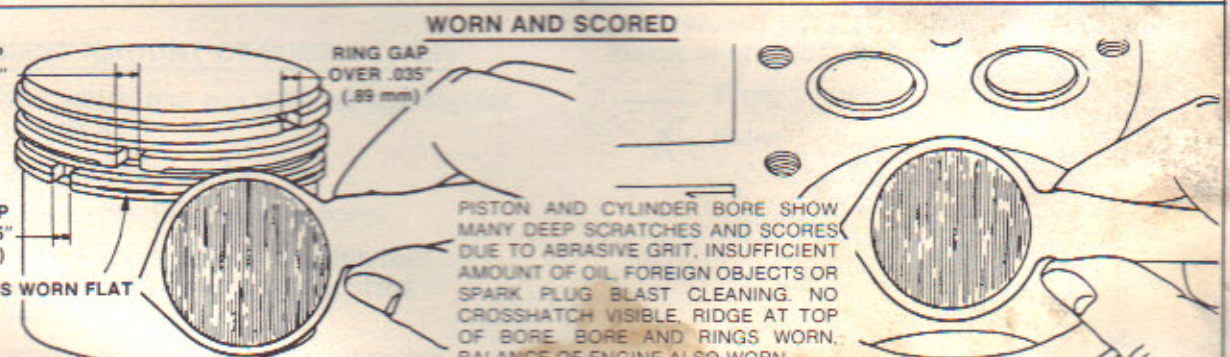
PARTICLES OF ALUMINUM WELDED TO PISTON AND CYLINDER BORE IN SOME AREAS AND GOUGED OUT AT OTHERS. REMAINDER OF PISTON SKIRT, CYLINDER BORE AND BALANCE OF ENGINE APPEAR NORMAL. USUALLY CAUSED BY DEFECTIVE PISTON, FOREIGN OBJECT, INSUFFICIENT AMOUNT OF OIL, OIL DILUTION WITH GASOLINE OR ABRASIVES.

WORN



PISTON AND CYLINDER BORE HAVE A SMOOTH ETCHED APPEARANCE WITH MANY FINE SCRATCHES DUE TO ABRASIVE GRIT. NO CROSSHATCH VISIBLE. RIDGE AT TOP OF BORE. BORE AND RINGS WORN. BALANCE OF ENGINE ALSO WORN.

WORN AND SCORED



PISTON AND CYLINDER BORE SHOW MANY DEEP SCRATCHES AND SCORES DUE TO ABRASIVE GRIT, INSUFFICIENT AMOUNT OF OIL, FOREIGN OBJECTS OR SPARK PLUG BLAST CLEANING. NO CROSSHATCH VISIBLE. RIDGE AT TOP OF BORE. BORE AND RINGS WORN. BALANCE OF ENGINE ALSO WORN.

MAJOR ENGINE FAILURE ANALYSIS

Knowing the causes of engine failures can save you time and allows you to discuss the reason for failure with your customer to avoid a costly reccurrence.

MAJOR ENGINE FAILURES CAUSE AND EFFECT RELATIONSHIPS	
CAUSE	**EFFECT**
Improper/Infrequent Air Cleaner Service. Damaged Air Cleaner Mounting Gasket, Bent Air Cleaner Stud. ● +	● Premature wear. ▲ Seizure. ■ Breakage. ○ Scoring. △ Overspeeding. □ Overheating (discoloration.) + Excessive Oil Consumption/ and Smoking.
Insufficient Amount of Lubrication (Oil). ▲ ■ ○ □	
Misadjusted Governor/Bypassing Governor. △ ■ ▲	
Plugged Cooling Fins. □ △ ■ +	
Loss of Crankcase Vacuum. + ▲ ■ ○ □	

MAJOR ENGINE FAILURE ANALYSIS

REVIEW QUESTIONS
(MORE THAN ONE ANSWER MAY APPLY)

WEAR — ABRASIVE GRIT

1. Engine wear is normally associated with:
   - ✓ dirt or similar abrasive.
   - _____ insufficient amount of oil.
   - _____ overspeeding.
   - _____ overheating.

2. The cylinder bore is worn over standard .002" (.05 mm) at the top; .003" (.08 mm) at the center; .005" (.13 mm) at the bottom of ring travel. The abrasive probably:
   - _____ entered through an improperly serviced air cleaner.
   - _____ passed through the P.T.O. oil seal.
   - ✓ entered when crankcase oil was added.
   - _____ entered through a loose intake elbow.

3. When an engine becomes worn due to abrasive grit, the complaint that usually occurs first is: The engine -
   - ✓ lacks power, smokes and uses too much oil.
   - _____ runs too fast.
   - _____ seizes.
   - _____ hunts and surges.

4. An engine which has consumed an excessive amount of abrasive grit will normally have:
   - _____ no cylinder bore crosshatch.
   - _____ a worn intake valve face and seat.
   - _____ excessive piston ring end gaps.
   - _____ scored and discolored bearing surfaces.

5. If the customer requests a new set of rings to replace a worn set, he could continue to experience an oil consumption problem.
   - ✓ True
   - _____ False

INSUFFICIENT AMOUNT OF LUBRICATION

1. An engine which has run with an insufficient amount of oil will:
   - _____ always break a rod.
   - _____ score only the cylinder bore.
   - ✓ cause internal discoloration and scoring of two or more bearing surfaces.
   - _____ cause cylinder bore discoloration.

2. An engine has seized due to an insufficient amount of lubrication. The cause could be:
   - ✓ high oil consumption due to excessive cylinder bore and ring wear.
   - _____ damaged breather.
   - _____ restricted air cleaner assembly.
   - _____ worn valve guides.

3. If an engine scores at one bearing surface, a manufacturing defect or an engine mounting problem could be the cause.
   - ✓ True
   - _____ False

OVERHEATING AND OVERSPEEDING

1. When a connecting rod breaks due to overspeeding, it will usually:
   - _____ score and turn black.
   - ✓ not discolor, but break close to the piston wrist pin.
   - _____ not discolor, but break closer to the crankshaft journal.
   - _____ damage other internal parts.

2. Plugged cooling fins can cause:
   - ✓ overheating.
   - ✓ overspeeding (if equipped with air vane governor).
   - ✓ loose exhaust valve seat.
   - ✓ excessive oil consumption.

3. If an engine is suspected of overspeeding, which should be considered:
   - _____ misadjusted governor.
   - _____ where the rod broke.
   - _____ insufficient oil level.
   - _____ insufficient torque on nut that holds governor shaft to governor lever.

4. A stretched governor spring (no tension) will cause overspeeding.
   - _____ True
   - ✗ False

MAJOR ENGINE FAILURE ANALYSIS

SPECIAL BRIGGS & STRATTON ENGINE INSPECTION REPORT

Service account making report _____ City _____ State _____

Engine Identification No's.: Model _____ Type _____ Code _____ Hrs. Run _____

Engine Owner: _____ Street _____

City _____ State _____ Zip Code _____

End Product (Lawn Mower, Tractor, Pump, Etc.) _____ Manufacturer's Name _____

Condition of End Product: New _____ Good _____ Worn _____

WHEN EXAMINING ENGINE, DESCRIBE CONDITION OF PARTS AND GIVE DIMENSIONS AS INDICATED

If Parts are Broken or Cracked, Mark Location of Break on Drawing

(Report Condition of Engine with Check (✓) Mark Where Possible)

1. AIR CLEANER

ELEMENT

_____ Dry _____

_____ Clean _____

_____ Dirty _____

MOUNTING GASKET:

Missing ____ Worn _____

AIR CLEANER STUD:

Bent ____ Broken _____

2. CYLINDER

Fins: Clean ____ Clogged ____

Bore: Scored ____ Worn _____

*Bore Size:

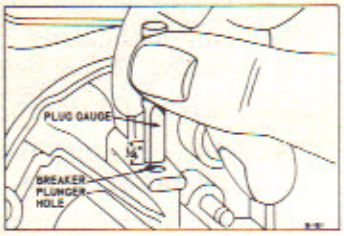
Top _____

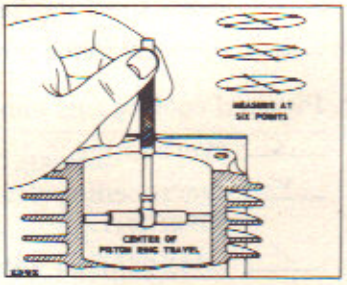
Center _____

Bottom _____

CONTACT PLUNGER HOLE:

OK _____ Worn _____





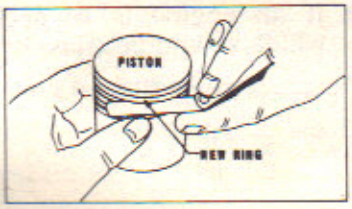
3. PISTON

Scored ____ Scratched _____

Ring Groove: Worn _____

Galled _____

Broken _____



4. PISTON RINGS

Top Ring Gap _____

Ctr. Ring Gap _____

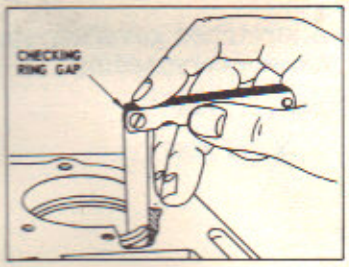
Oil Ring Gap _____

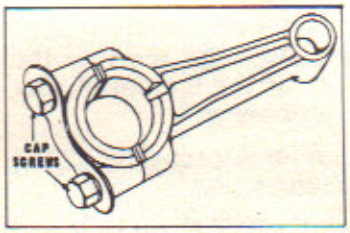
_____

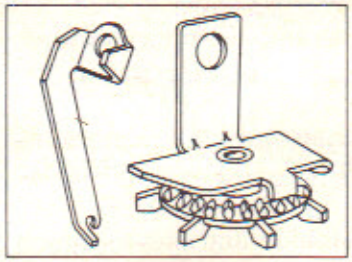
_____

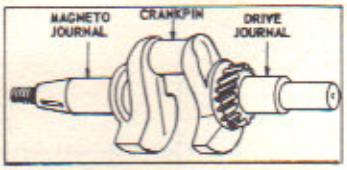
_____

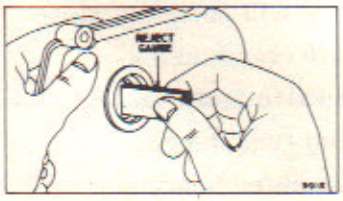
_____

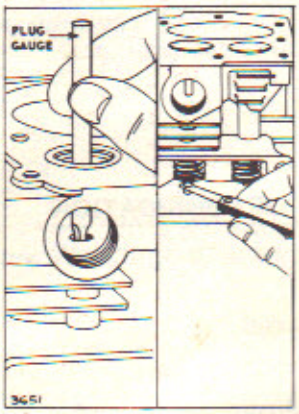












5. CONNECTING ROD

Discolored _____

Broken _____

Bearing Scored _____

Cap Screws Loose _____

DIPPER:

Bent _____

Broken _____

6. OIL SLINGER

Describe damage _____

_____

_____

7. CRANKSHAFT

MAGNETO JOURNAL:

Worn _____ Scored _____

*Size _____

CRANKPIN:

Worn _____ Scored _____

*Size _____

DRIVE JOURNAL:

Worn _____ Scored _____

*Size _____

P.T.O.:

Bent _____ Broken _____

8. MAIN BEARINGS

DRIVE SIDE MAG. SIDE

_____ Worn _____

_____ Scored _____

_____ *Size _____

9. VALVES

Face Burned EX. ___ INT. ___

Guide Worn? EX. ___ INT. ___

Clearance

INT. _____

EX. _____

10. OIL LEVEL

Sufficient _____

Insufficient _____

Is there evidence of dirt entering engine in: Air Cleaner Elbow _____, Carburetor Air Horn _____, Breather _____ Dipstick _____, Oil Filler Opening _____, Oil Seals _____.

Note Combustion Chamber deposits: Light _____ Heavy _____ Color _____.

***Refers to Micrometer Measurements**

G-3752 REV. 5

ALTERNATOR SYSTEMS — TROUBLESHOOTING

Over the years, Briggs & Stratton has introduced various alternator systems providing a reliable source of electrical current to meet the required needs of equipment manufacturers. A basic understanding of these alternator systems will minimize time spent in troubleshooting complaints like, "THE BATTERY IS DEAD," or "THE LIGHTS DON'T WORK." When troubleshooting any one of these alternator systems, let the following systematic approach be your guideline:

A) Identify type of alternator system.

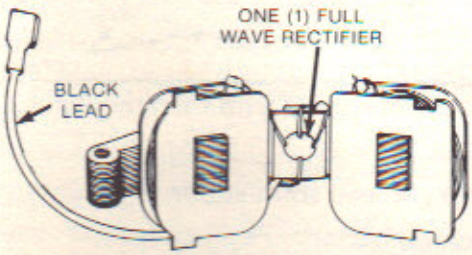
B) Test alternator output.

C) Identify additional possible causes of alternator related problems.

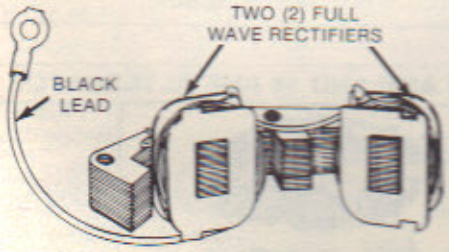
IDENTIFYING TYPE OF ALTERNATOR SYSTEM

Currently, there are nine (9) basic alternator systems being used on Briggs & Stratton engines. The following illustrates each system including the color coding to identify each system. Both the lead wire from the stator assembly and the connector are color coded. To identify a particular alternator system, simply look at the colors of the stator lead wire and the connector.

"SYSTEMS 3 & 4" ALTERNATOR



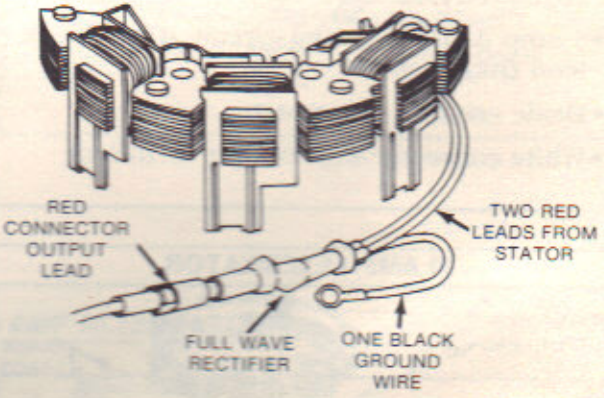
EARLY STYLE — TWO LEG STATOR



LATER STYLE — FOUR LEG STATOR

- Used for charging 6 volt battery.
- One black lead from stator.
- Uses either a spade terminal or eyelet connector.
- Early style stator uses one (1) full wave rectifier.
- Later style stator uses two (2) full wave rectifiers.
- Stator is mounted external to the flywheel.

1.5 AMP DC UNREGULATED

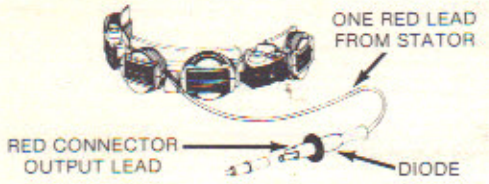


- Used on engine Model Series 130000.
- Two red wires from stator.
- One black ground wire.
- Full wave rectifier.
- Red connector output lead.

ALTERNATOR SYSTEMS — TROUBLESHOOTING

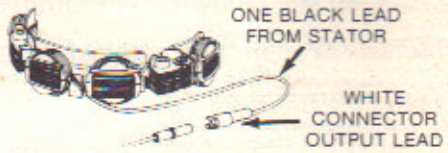
IDENTIFYING TYPE OF ALTERNATOR SYSTEM

DC ONLY ALTERNATOR



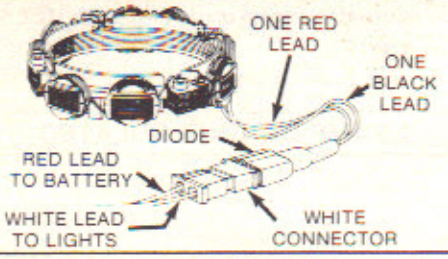
- 3 amp DC unregulated for charging battery.
- One red lead from stator.
- Diode encased at connector.
- Red connector output lead.

AC ONLY ALTERNATOR



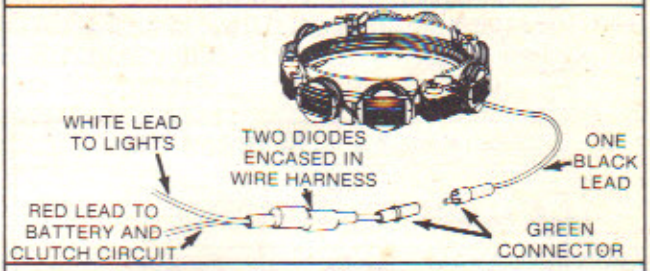
- 5 amp AC for lighting circuit.
- One black lead from stator.
- White connector output lead.

DUAL CIRCUIT ALTERNATOR



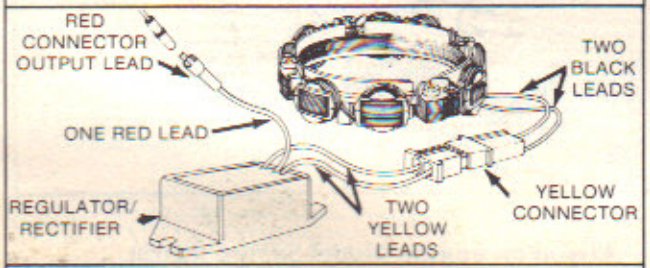
- 3 amp DC unregulated for charging battery (ONE red lead from stator).
- 5 amp AC for lighting circuit (ONE black lead from stator).
- Diode encased at connector.
- White connector with two pin terminals.

TRI-CIRCUIT ALTERNATOR



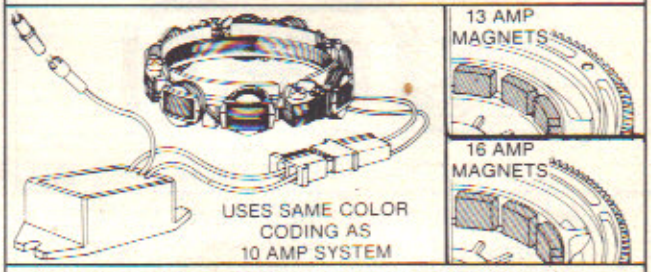
- Used on an engine with electric clutch.
- 10 amp AC.
- One black lead from stator.
- Green connector.
- Two diodes encased in wire harness.
- Red and white output leads.

10 AMP ALTERNATOR



- 10 amp DC regulated for charging battery.
- Two black leads from stator.
- Yellow connector with two pin terminals.
- Two yellow leads to regulator - rectifier.
- One red lead from regulator - rectifier to red connector output lead.

13 AMP AND 16 AMP ALTERNATOR



- Used only on twin cylinder engines.
- Both systems use the same stator and regulator-rectifier as the 10 amp system.
- Both systems also use the same color coding as the 10 amp system.
- Flywheel alternator magnets are larger than the 10 amp system for greater output.
- 13 amp system has 1-1/16" x 11/16" magnets (26.9 mm x 17.5 mm)
- 16 amp system has 1-1/16" x 15/16" magnets (26.9 mm x 23.8 mm)

ALTERNATOR SYSTEMS — TROUBLESHOOTING

TESTING ALTERNATOR OUTPUT

Test the alternator's output using the instructions given below. In order to perform these tests, it is important to use a good VOA meter, such as the #19236 meter supplied by Briggs & Stratton or one which is comparable. While only one engine model is shown in the test instructions, the procedures are basic and can be applied to other alternator equipped engines.

IMPORTANT

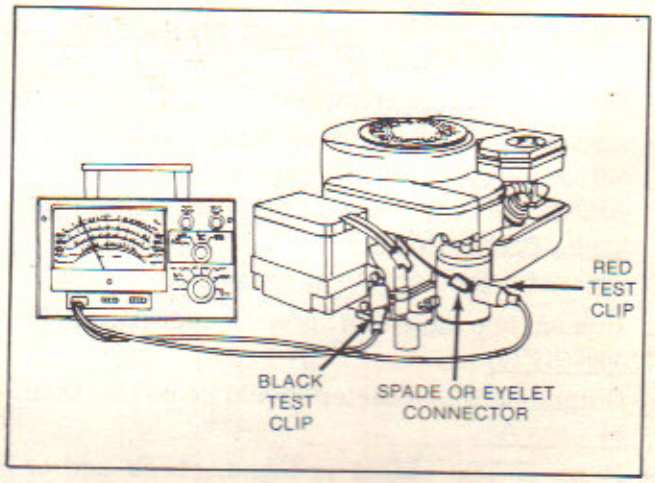
A) Whenever testing the DC amp output of an alternator, a battery in good condition must be used in series with the meter for an accurate reading (see exception under SYSTEMS 3 & 4 Alternator).

B) Before testing the alternator's output (volts, amps), first use an accurate tachometer and temporarily adjust the engine speed to the RPM specified in the test instructions. Upon completion of the alternator output test, always readjust the engine RPM to its CORRECT TOP NO-LOAD GOVERNED SPEED as found in the Service Engine Sales Manual, MS-4052, and yellow bar microfiche cards.

TEST PROCEDURE — "SYSTEM 3 & 4" ALTERNATOR

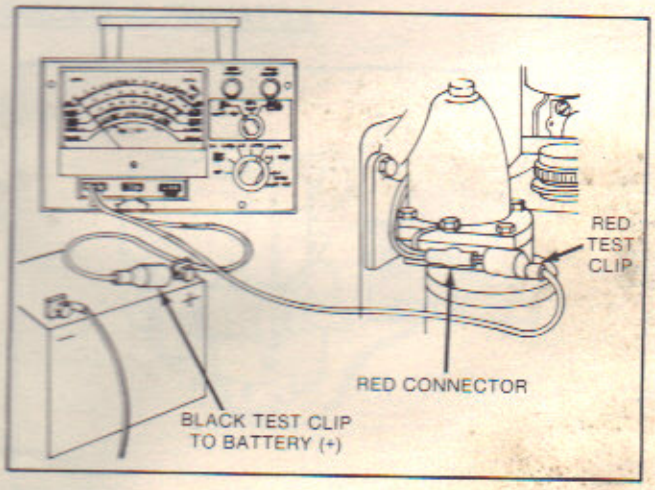
1. Disconnect either the spade terminal or eyelet connector.
2. Attach red test clip from VOA meter to either spade terminal or eyelet connector. Attach black test clip from VOA meter to a good ground surface.
3. Set meter for DC amps position, 16 V-A range.
4. Run engine, adjusting speed to approximately 2800 RPM.
5. Output shown on meter should be no less than .6 amps DC.
6. If less than .6 amps DC or no output is shown, replace stator assembly.

NOTE: On engines using the later style stator, check the stator air gap clearance if output is less than .6 amps DC. The air gap clearance should be .015" (.38 mm).



TEST PROCEDURE — 1.5 AMP ALTERNATOR

1. Disconnect red connector.
2. Attach red test clip from VOA meter to charging pin terminal within red connector. Attach black test clip from VOA meter to positive (+) battery terminal.
3. Set meter for DC amps position, 16 V-A range.
4. Run engine, adjusting speed to approximately 3600 RPM.
5. Output shown on meter should be between 1 to 2 amps DC.
6. If no or low output is found, check and/or replace either the full wave rectifier harness or stator assembly.

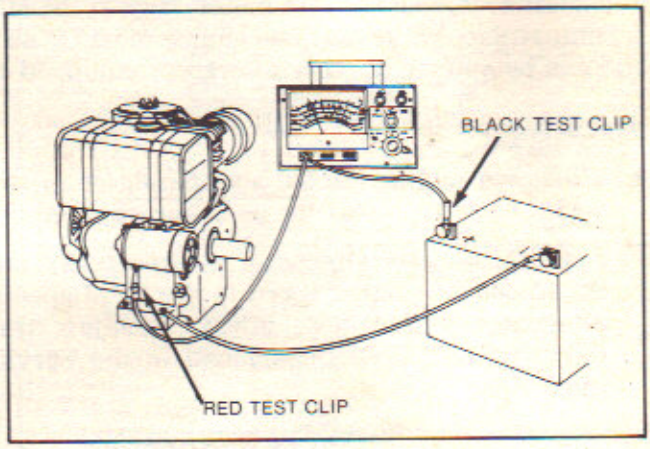


ALTERNATOR SYSTEMS — TROUBLESHOOTING

TESTING ALTERNATOR OUPTUT

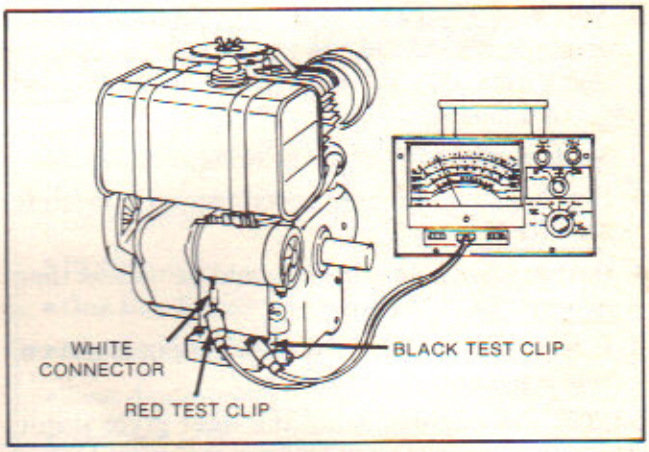
TEST PROCEDURE — DC ONLY ALTERNATOR

1. Disconnect red connector.
2. Attach red test clip from VOA meter to DC output pin terminal within red connector. Attach black test clip from VOA meter to positive (+) battery terminal.
3. Set meter for DC amps position, 16V-A range.
4. Run engine, adjusting speed to approximately 3600 RPM.
5. Output shown on meter should be between 2 to 4 amps DC.
6. If no or low output is found, check and/or replace diode harness or stator assembly.



TEST PROCEDURE — AC ONLY ALTERNATOR

1. Disconnect white connector.
2. Attach red test clip from VOA meter to AC output pin terminal within white connector. Attach black test clip from VOA meter to a good ground surface.
3. Set meter for AC volts position, 16V-A range.
4. Run engine, adjusting speed to approximately 3600 RPM.
5. Output shown on meter should be no less than 14 volts AC.
6. If no or low output is found, check and/or replace stator assembly.



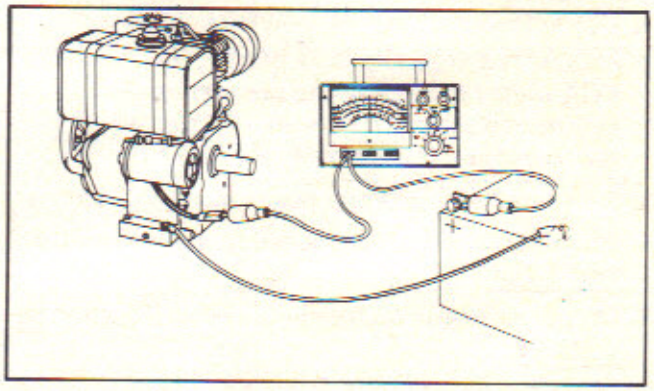
ALTERNATOR SYSTEMS — TROUBLESHOOTING

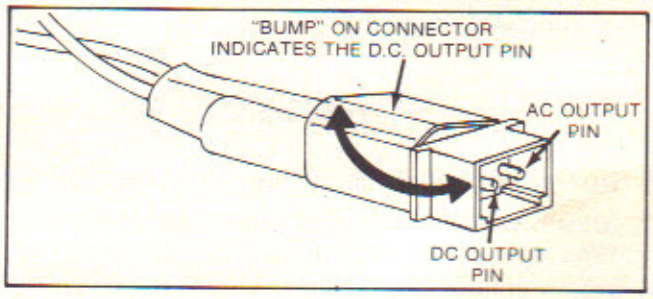
TESTING ALTERNATOR OUTPUT

TEST PROCEDURE — DUAL CIRCUIT ALTERNATOR

DC OUTPUT TEST

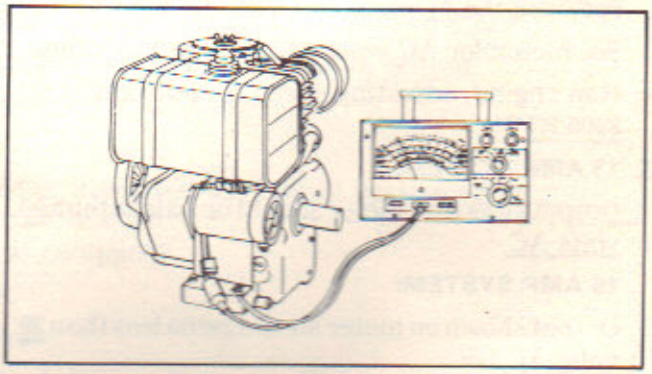
1. Disconnect white connector.
2. Attach red test clip from VOA meter to charging pin terminal within white connector (refer to illustration). Attach black test clip from VOA meter to positive (+) battery terminal.
3. Set meter for DC amps position, 16 V-A range.
4. Run engine, adjusting speed to approximately 3600 RPM.
5. Output shown on meter should be between 2 to 4 amps DC.
6. If no or low output is found, check and/or replace diode harness or stator assembly.





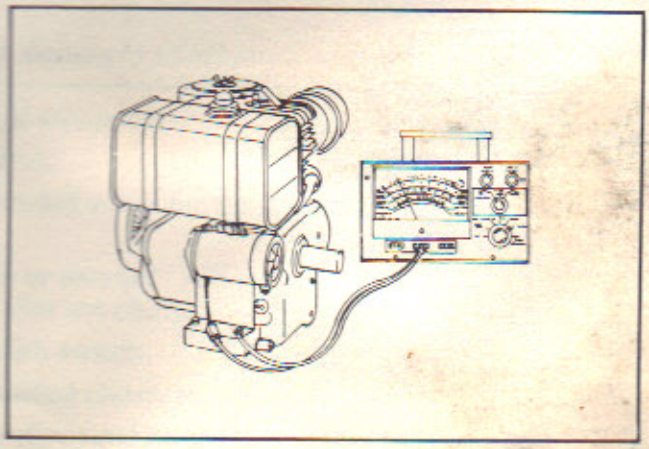
AC OUTPUT TEST

1. Disconnect white connector.
2. Attach red clip from VOA meter to AC output pin terminal within white connector. Attach black test clip from VOA meter to a good ground surface.
3. Set meter for AC volts position, 16 V-A range.
4. Run engine, adjusting speed to approximately 3600 RPM.
5. Output shown on meter should be no less than 14 volts AC.
6. If no or low output is found, check and/or replace stator assembly.



TEST PROCEDURE — TRI-CIRCUIT ALTERNATOR

1. Disconnect green connector.
2. Attach red test clip from VOA meter to pin terminal within green connector. Attach black test clip from VOA meter to a good ground surface.
3. Set meter for AC volts position, 40 V-A range.
4. Run engine, adjusting speed to approximately 3600 RPM.
5. Output shown on meter should be no less than 28 volts AC.
6. If no or low output is found, check and/or replace stator assembly.

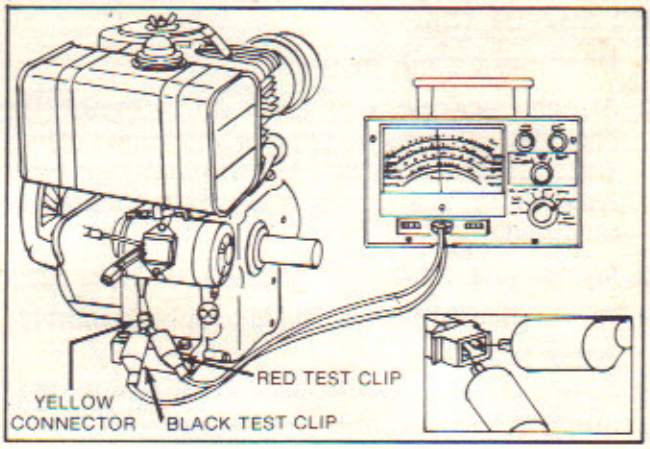


ALTERNATOR SYSTEMS — TROUBLESHOOTING

TESTING ALTERNATOR OUTPUT

TEST PROCEDURE — 10 AMP ALTERNATOR

1. Disconnect yellow connector.
2. Attach red test clip and black test clip from VOA meter to each of the pin terminals within yellow connector. (It doesn't matter which pin receives the black or red test clip.)
3. Set meter for AC volts position, 40 V-A range.
4. Run engine, adjusting speed to approximately 3600 RPM.
5. Output shown on meter should be no less than 20 volts AC.
6. If no or low output is found, check and/or replace stator assembly.



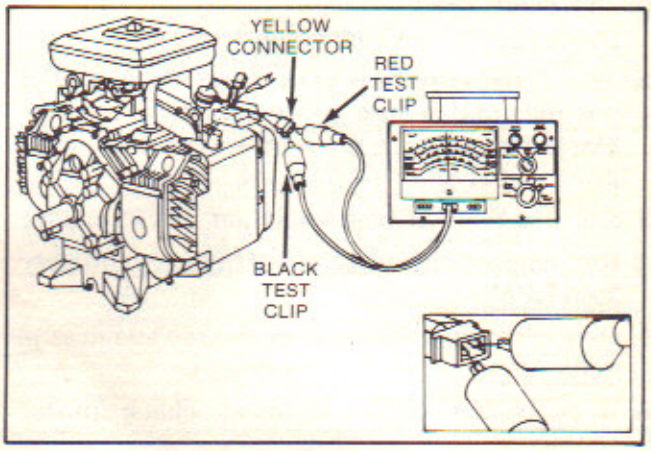
TEST PROCEDURE — 13 AMP AND 16 AMP ALTERNATOR

1. Disconnect yellow connector.
2. Attach red test clip and black test clip from VOA meter to each of the pin terminals within yellow connector. (It doesn't matter which pin receives the black or red test clip.)
3. Set meter for AC volts position, 40 V-A range.
4. Run engine, adjusting speed to approximately 3600 RPM.
5. **13 AMP SYSTEM:**

   Output shown on meter should be no less than 20 volts AC.

   16 AMP SYSTEM:

   Output shown on meter should be no less than 30 volts AC.
6. If no or low output is found, check and/or replace stator assembly.



ALTERNATOR SYSTEMS — TROUBLESHOOTING

IDENTIFYING ADDITIONAL POSSIBLE CAUSES OF ALTERNATOR RELATED PROBLEMS

If the tested output of the alternator is according to the rated specifications, this indicates that the system is functioning correctly, at least to the color coded connector. This also means that the alternator related problem has now been isolated to an area beyond the connector. To further troubleshoot the problem, refer to the following chart.

COMPLAINT	ADDITIONAL POSSIBLE CAUSES
"Battery not charging."	•Inline fuse "blown" (if equipped). •Defective battery. •Loose or corroded battery ground leads. •Loose 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 in state of overcharge."	•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. •1 ohm resistor shorted or grounded (tri-circuit system only).
"Headlamps not working."	•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 system only)	•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.

For detailed wiring diagrams on alternator systems, refer to Section 7C of the Service and Repair Instruction Manual, Part Number 270962.

"POWER TUNE-UP" MAGNETRON® EQUIPPED ENGINES

Over a period of running ANY engine for hundreds of hours, the horsepower of the engine very gradually declines (see chart below). The decline in horsepower continues until the engine can no longer perform acceptably and a tune-up is required. The rate at which the horsepower declines depends upon several factors, including: type of fuel, engine load, engine operating temperatures, maintenance and other conditions under which the engine operates. This loss of horsepower, or engine efficiency, is a characteristic common to all engines, and is more the result of combustion deposits accumulating within the combustion chamber, than caused by wearing down of the ignition system. Like most mechanical devices, ALL engines require periodic maintenance, whether equipped with breaker point ignition or the MAGNETRON® ignition system.

Question #1: Will performing an ignition tune-up (breaker point replacement) restore the lost engine horsepower?

Answer: No. Simply replacing the breaker points will not restore the lost engine horsepower. A "POWER TUNE-UP" is required.

Question #2: Does this mean that a MAGNETRON® equipped engine will also experience the same gradual loss of horsepower over time?

Answer: Yes. A MAGNETRON® equipped engine will also experience the same horsepower loss over a period of time. The loss of horsepower is the result of combustion deposits accumulating within the combustion chamber and not related to the type of ignition system.

Question #3: Does this mean that a MAGNETRON® equipped engine will also require a "POWER TUNE-UP"?

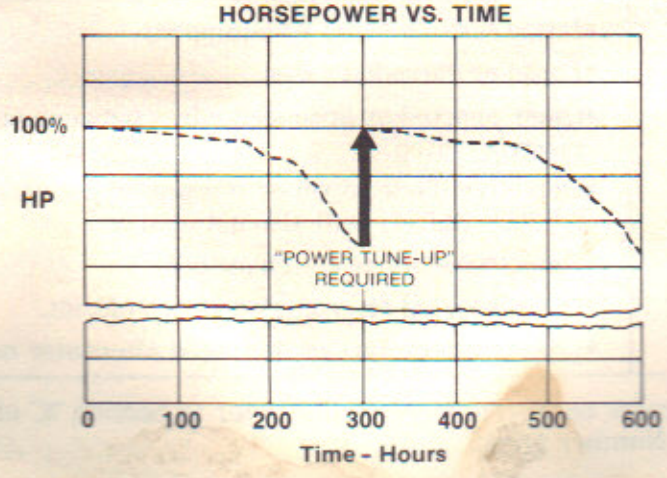
Answer: Yes. Even a MAGNETRON® equipped engine will also require a "POWER TUNE-UP" after a period of time.

Question #4: What is a "POWER TUNE-UP"?

Answer: A) The "POWER TUNE-UP" concept includes removing the cylinder head, and wire brushing the combustion deposits from the cylinder, cylinder head, top of piston and around the valves.

IMPORTANT: PERFORM THIS SERVICE AFTER EVERY 100 TO 300 HOURS OF OPERATION. ON ENGINES POWERING APPLICATIONS SUCH AS GENERATORS AND WATER PUMPS, CLEAN OUT THE COMBUSTION CHAMBER EVERY 100 HOURS. THESE ENGINES RUN FOR EXTENDED PERIODS AT CONSTANT SPEEDS AND LOADS WHICH TEND TO PRODUCE COMBUSTION DEPOSITS MORE RAPIDLY THAN ENGINES WHICH RUN AT VARYING SPEEDS AND LOADS.

B) In general, a "POWER TUNE-UP" also includes: Inspecting valves and refacing/reseating if required, adjusting carburetor, checking governor operation, adjusting idle speed and top no-load governed speed, cleaning cylinder cooling fins, replacing spark plug, checking armature air gap, servicing air cleaner, changing oil and test running engine.



"POWER TUNE-UP" MAGNETRON® EQUIPPED ENGINES

MAGNETRON® RETRO-FITTING

A) LIMITED TIME OPPORTUNITY . . .

The maximum potential number of engine which can be retro-fitted to MAGNETRON® is currently estimated in excess of 50 MILLION engines. This number represents engines built between 1963 when the two leg ignition armature was introduced to 1982 when MAGNETRON® became the standard ignition system on all Briggs & Stratton engines. With the passing of each day, this number decreases for some of these engines are being retro-fitted while some are being replaced with newer engines which include MAGNETRON® as a standard feature. The time to retro-fit is NOW while the quantity of potential engines is at its highest number. Don't let this limited opportunity pass you by.

B) GREATER PROFIT OPPORTUNITY FOR SHOP TIME SPENT . . .

Today, with higher shop labor rates, it becomes increasingly more important to use shop time more effectively to maximize profit. Approximately the same amount of shop labor time is required whether installing MAGNETRON® or breaker points. Since the labor time is about the same to install either ignition system, it is installing MAGNETRON® that most effectively maximizes profit for the amount of shop time spent. IT TAKES SELLING MORE THAN FOUR SETS OF #294628 BREAKER POINTS TO EQUAL THE SAME PROFIT AS SELLING ONE MAGNETRON® IGNITION KIT. Because there is no guarantee that you will have the opportunity to continue replacing breaker points on any one engine, installing MAGNETRON® becomes the most logical choice, taking advantage of the immediate greater profit opportunity.

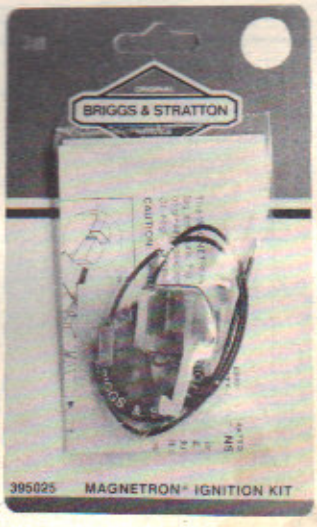
C) LABOR SAVING ADVANTAGES . . .

Use MAGNETRON® —

- When breaker point plunger hole wears (eliminates removing crankshaft to install breaker point plunger bushing).
- When breaker point plunger wears (eliminates replacing breaker point plunger).
- When breaker point plunger flat on crankshaft rusts or corrodes (eliminates removing crankshaft for cleaning).
- When a worn cylinder magneto bearing affects breaker point operation . . . magneto bearing wear must not exceed .005" (.13 mm). (Eliminates removing crankshaft to install magneto bushing.)
- To prevent expensive downtime, especially for industrial, commercial and rental users.
- On those applications requiring extensive labor to remove the engine, or component parts, to gain access to the breaker points. Eliminates expensive labor charges that would have been charged, if equipped with breaker point ignition.

PART NUMBER 395025 MAGNETRON® KIT

Fits all single cylinder aluminum engines (2 through 11 HP) built since 1963 — like part number 394970 in standard parts box. Special display package pricing available. Contact your Briggs & Stratton source of supply.

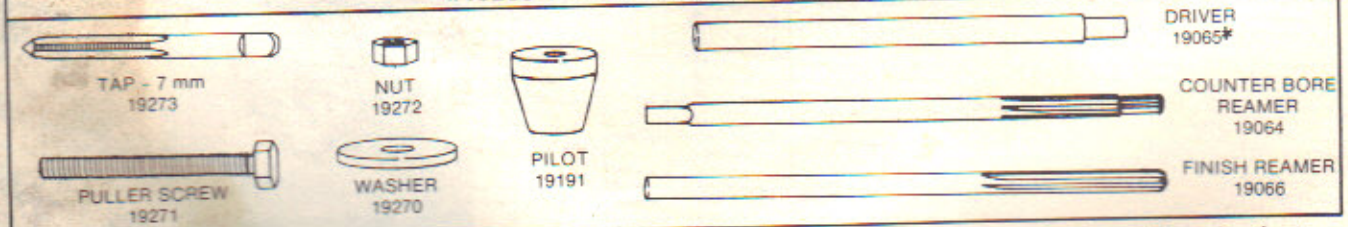


SERVICING 1/4" (6.35 mm) VALVE GUIDES/BUSHINGS

Servicing all 1/4" (6.35 mm) valve guides/bushings can be accomplished using the part number 19269 Valve Guide Repair Kit. Attention must first be given to identifying each type of guide/bushing in order to follow the proper servicing procedure for its repair. The counterbore reaming procedure has been eliminated in all guide/bushing repairs except those involving aluminum guides (no bushings) and cast iron cylinders. For further instructions, refer to Section 6 of the Service and Repair Instruction Manual, or the instructions included with the valve guide repair kit.

IDENTIFICATION & DESCRIPTION	SERVICING PROCEDURE
3/4" (19.05 mm) — Sintered Material (Gray Color) Original Production — O.D. .377 (9.57 mm)	Use #19269 Kit. Tap old bushing with #19273 (7 mm) Tap. Remove bushing with #19271 Bushing Puller Screw, #19272 Nut and #19270 Washer. Drive in #262001 Bushing with #19065* Driver. Finish ream using #19191 Pilot and #19066 Finish Reamer.
3/4" (19.05 mm) — Sintered Material (Copper Color) Service Bushing #262001 — O.D. .378" (9.60 mm)	
3/4" (19.05 mm) — Brass Material (One Groove) Original Production — O.D. .308" (7.82 mm)	Use #19269 Kit. Tap old bushing with #19273 (7 mm) Tap. Remove Bushing with #19271 Bushing Puller Screw, #19272 Nut and #19270 Washer. Drive in #231348 Bushing with #19065 Driver. Finish ream using #19191 Pilot and #19066 Finish Reamer.
3/4" (19.05 mm) — Brass Material (Two Grooves) Service Bushing #231348 — O.D. .309" (7.85 mm)	
1-1/16" (26.99 mm) — Brass Material (One Groove) Original Production — O.D. .308" (7.82 mm)	Use #19269 Kit. Tap old bushing with #19273 (7 mm) Tap. Remove bushing with #19271 Bushing Puller Screw, #19272 Nut and #19270 Washer. Drive in #231349 Bushing with #19065 Driver Finish ream using #19191 Pilot and #19066 Finish Reamer. NOTE: Used only on vertical crankshaft engine model series 110000.
1-1/16" (26.99 mm) — Brass Material (Two Grooves) Service Bushing #231349 — O.D. .309" (7.85 mm)	
3/4" (19.05 mm) — Brass Material (No Grooves) Service Bushing #63709 — O.D. .283" (7.19 mm)	Use #19269 Kit. Tap old bushing with #19273 (7 mm) Tap. Remove bushing with #19271 Bushing Puller Screw, #19272 Nut and #19270 Washer. Drive in #63709 Bushing with #19065 Driver. Finish ream using #19191 Pilot and #19066 Finish Reamer.
Aluminum Material (No Bushing) and Cast Iron Cylinders	Use #19269 Kit and #63709 Bushing. Ream guide to depth equal to the length of #63709 using #19191 Pilot and #19064 Counterbore Reamer. Drive in #63709 Bushing with #19065 Driver. Finish ream using #19191 Pilot and #19066 Finish Reamer.

#19269 VALVE GUIDE REPAIR KIT



*All #19065 Drivers purchased before October 1, 1983 must be modified by reducing driver's tip to a .240" (6.09 mm) diameter when using with sintered bushing.

NOTE: Servicing procedures involving tapping, counterbore reaming or finish reaming should be performed using liberal amounts of kerosene or engine oil to lubricate and flush away chips.

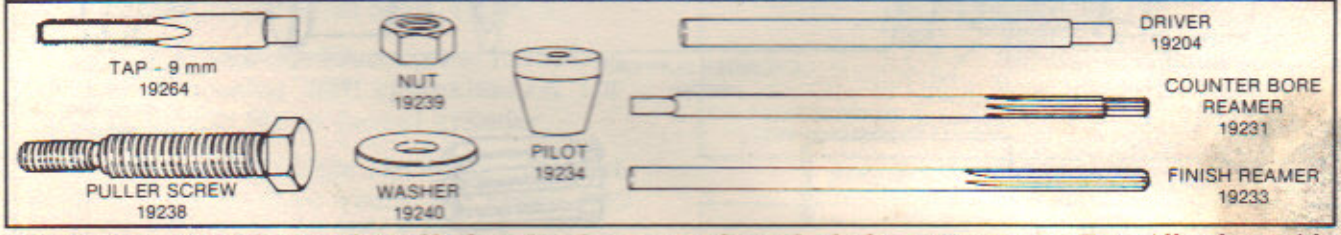
SERVICE TOOL KITS

SERVICING 5/16" (7.94 mm) VALVE GUIDES/BUSHINGS

Servicing all 5/16" (7.94 mm) valve guides/bushings can be accomplished using the part number 19232 Valve Guide Repair Kit. Attention must first be given to identifying each type of guide/bushing in order to follow the proper servicing procedure for its repair. The counterbore reaming procedure has been eliminated in all guide/bushing repairs except those involving aluminum guides (no bushings) and cast iron cylinders. For further instructions, refer to Section 6 of the Service and Repair Instruction Manual, or the instructions included with the valve guide repair kit.

IDENTIFICATION & DESCRIPTION	SERVICING PROCEDURE
 Sintered Material (Gray Color) Original Production O.D. .440" (11.18 mm)	Use #19232 Kit. Tap old bushing with #19264 (9 mm) Tap. Remove bushing with #19238 Bushing Puller Screw, #19239 Nut and #19240 Washer. Drive in #261961 Bushing with #19204 Driver. Finish ream using #19234 Pilot and #19233 Finish Reamer.
 Sintered Material (Copper Color) Service Bushing #261961 O.D. .441" (11.20 mm)	
 Brass Material (One Groove) Original Production O.D. .366" (9.30 mm)	Use #19232 Kit. Tap old bushing with #19264 (9 mm) Tap. Remove bushing with #19238 Bushing Puller Screw, #19239 Nut and #19240 Washer. Drive in #231218 Bushing with #19204 Driver. Finish ream using #19234 Pilot and #19233 Finish Reamer.
 Brass Material (Two Grooves) Service Bushing #231218 O.D. .367" (9.32 mm)	
 Brass Material (No Grooves) Service Bushing #230655 O.D. .379" (9.63 mm)	Use #19232 Kit. Tap old bushing with #19264 (9 mm) Tap. Remove bushing with #19238 Bushing Puller Screw, #19239 Nut and #19240 Washer. Drive in #230655 Bushing with #19204 Driver. No finish reaming required. NOTE: Engine previously serviced with #230655 Bushing must continue to be serviced with the same.
 Aluminum Material (No Bushing) and Cast Iron Cylinders	Use #19232 Kit and #231218 Bushing. Ream guide to depth equal to the length of #231218 Bushing. Drive in #231218 bushing with #19204 Driver. Finish ream using #19234 Pilot and #19233 Finish Reamer.

#19232 VALVE GUIDE REPAIR KIT



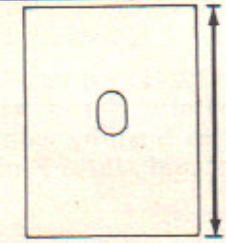
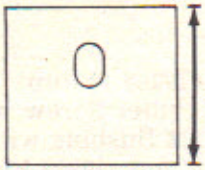
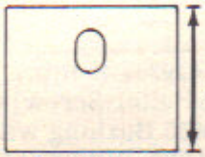
NOTE: All #19232 Kits purchased before October 1, 1983 do not include #19264 (9 mm) Tap. All valve guide kits purchased after that date will include #19264 (9 mm) Tap which is necessary for replacing a sintered valve guide with a sintered bushing.

NOTE: Servicing procedures involving tapping, counterbore reaming or finish reaming should be performed using liberal amounts of kerosene or engine oil to lubricate and flush away chips.

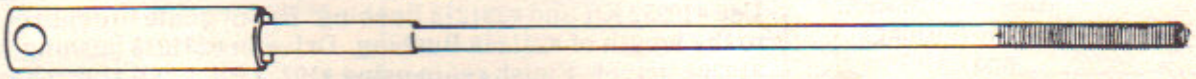
SERVICE TOOL KITS

SERVICING ALUMINUM MAIN BEARINGS AND DU™ BEARINGS USING THE PART NUMBER 19228 MAIN BEARING TOOL KIT

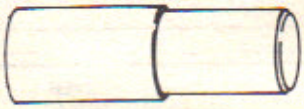
Engine Model Series 220000, 250000, 400000 and 420000, equipped with aluminum main bearings or DU™ bearings, can be serviced using the part number 19228 main bearing tool kit. The procedure for servicing an aluminum main bearing is to install a DU™ bearing. Select the appropriate DU™ bearing from the chart below, and follow the servicing procedures on the next page.

REPLACEMENT DU™ BEARINGS, PART NUMBERS AND SIZES	ENGINE MODEL SERIES	DU™ BEARING	
		MAGNETO SIDE	P.T.O. SIDE
 1-31/32" (50.0 mm) PART NUMBER 231180	222400, 251400, 252400, 253400	#261623	#231180
 1-3/8" (34.93 mm) PART NUMBER 231181	220700, 251700, 252700, 253700	#261623	#231181
	401400, 402400, 421400	#261623	#231181
 1-3/16" (30.16 mm) PART NUMBER 261623	401700, 402700, 421700, 422700	#261623	#231180

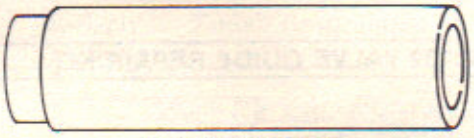
#19228 MAIN BEARING TOOL KIT



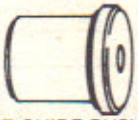
REAMER PILOT
19223



BUSHING DRIVER
19226

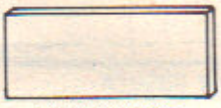


CYLINDER SUPPORT
19227••

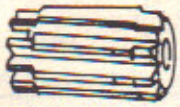


PILOT GUIDE BUSHING
19220

REAMER GUIDE BUSHING
19222



PLUG GAUGE
19219



COUNTER BORE REAMER
19224

••19227 Cylinder Support can also be used on Engine Model Series 170000 and 190000.

SERVICING ALUMINUM MAIN BEARINGS AND DU™ BEARINGS

SERVICING PROCEDURES

ALUMINUM MAIN BEARING — MAGNETO SIDE

1. Remove oil seal from cylinder. Install #19222 reamer guide bushing.
2. Assemble sump/crankcase to cylinder.
3. Place #19220 pilot guide bushing in sump/crankcase cover. NOTE: For P.T.O. ball bearing equipped engines, use plain bearing crankcase cover to hold pilot guide bushing while counterbore reaming.
4. Place #19224 counterbore reamer on #19223 pilot and insert into cylinder, figure 1.
5. Position springs, washers and wing nut, figure 1. (Parts not included in tool kit.)
6. Turn reamer clockwise until completely through bearing using liberal amounts of kerosene or Stoddard solvent.
7. Complete servicing procedure as described in "To Install DU™ Bearing — Magneto Side."

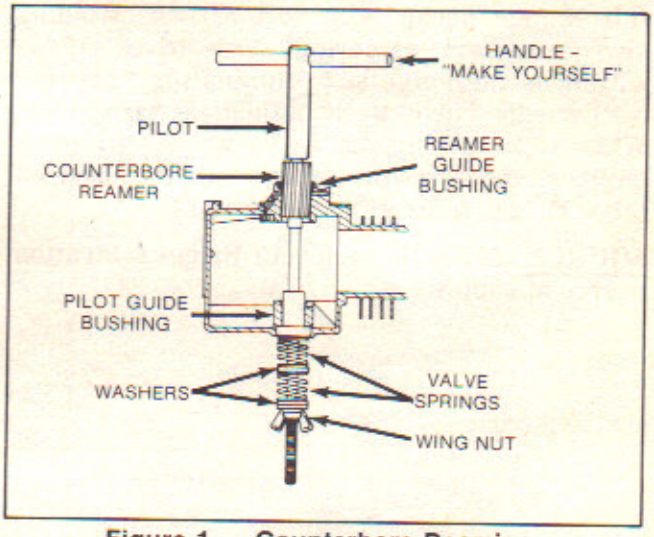


Figure 1 — Counterbore Reaming

DU™ BEARING — MAGNETO SIDE

1. Place cylinder on stepped end of #19227 cylinder support.
2. Insert #19226 bushing driver into damaged bearing. Press out bearing into recess of #19227 cylinder support, figure 2.
3. Complete servicing procedure as described in "To Install DU™ Bearing — Magneto Side."

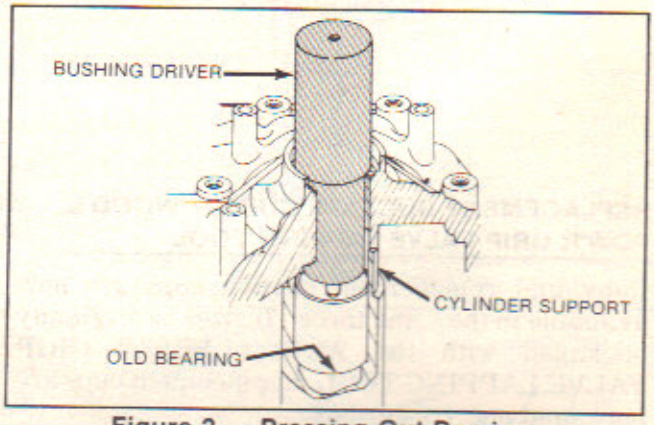


Figure 2 — Pressing Out Bearing

TO INSTALL DU™ BEARING — MAGNETO SIDE

1. Place cylinder on stepped end of #19227 cylinder support.
2. Place replacement DU™ bearing in cylinder bearing hole, aligning oil holes, figure 3.
3. Using #19226 bushing driver, press in replacement DU™ bearing until approximately 1/8" (3.18 mm) from thrust face of cylinder.
4. Stake DU™ bearing at top and bottom, figure 4, using 1/4" (6.35 mm) round pin punch. NO FINISH REAMING IS NECESSARY.
5. Press in new oil seal.

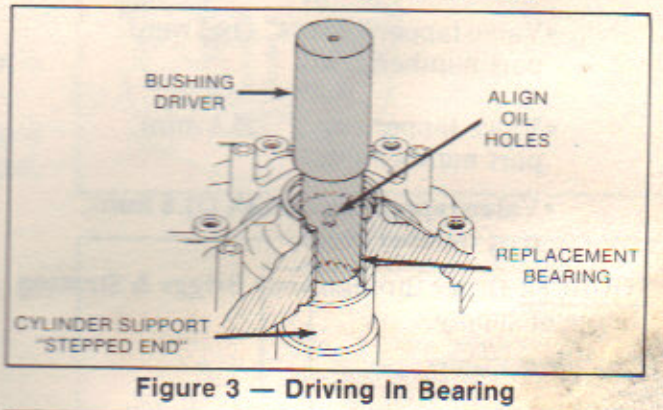


Figure 3 — Driving In Bearing

ALUMINUM MAIN BEARING OR DU™ BEARING PTO SIDE

The oil sump or crankcase cover main bearing can be serviced in the same manner as the magneto side. However, one bearing should be completely serviced before repairing the other bearing. Press in new oil seals only after both bearings have been completely serviced.

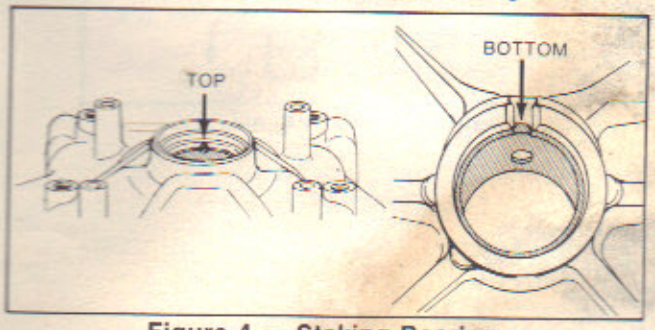
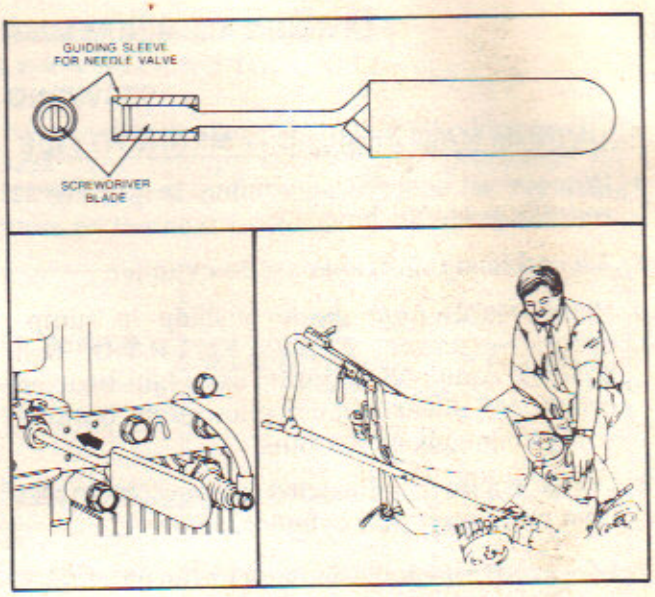


Figure 4 — Staking Bearing

CARBURETOR ADJUSTMENT SCREWDRIVER BRIGGS & STRATTON PART NUMBER 19263

Carburetor adjustments are made easier with this unique pocket size screwdriver. Guiding sleeve assists in "centering" screwdriver's blade within needle valve slot, eliminating "slipping off" needle valve while adjusting carburetor. While especially useful on rotary lawn mower engines, the screwdriver can also be used on other Briggs & Stratton carburetors.

SOURCE: Order through your Briggs & Stratton source of supply.

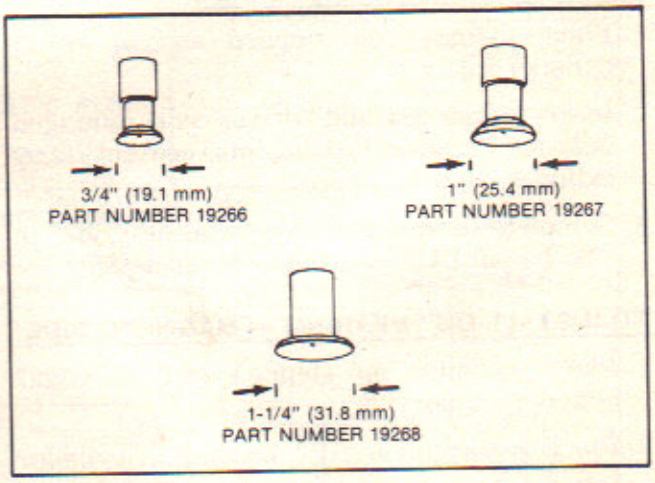


REPLACEMENT SUCTION CUPS — WOOD'S POW'R GRIP VALVE LAPPING TOOL

Individual replacement suction cups are now available in the same three (3) sizes as originally packaged with the WOOD's POW'R GRIP VALVE LAPPING TOOL. Replacement cups are packaged one (1) per box.

- Valve lapper cup 3/4" (19.1 mm), part number 19266.
- Valve lapper cup 1" (25.4 mm), part number 19267.
- Valve lapper cup 1-1/4" (31.8 mm), part number 19268.

SOURCE: Order through your Briggs & Stratton source of supply.



Electric motors may require servicing after extended use. In most instances, only the brushes require replacing as described below.

WARNING: TO PREVENT ACCIDENTAL STARTING OR ELECTRICAL SHOCK, disconnect the extension cord (power supply) while servicing the electric motor.

Disassembly

1. Disconnect motor from electric cord (power supply) at connector, Fig. 1 inset "A".
2. Remove nuts (2) and washers (2) from thru bolts.
3. Hold connector down in brush box while removing end cap.
4. Observe routing and location of wires, Fig. 5.

To Check Brushes and Brass Holders

1. Brass brush holders must be positioned completely down in brush box retainer slots.
2. Brushes must move freely in brass holders. If one or more brushes do not move freely or wear is not approximately equal, check the following:
   a. Check brass brush holders for distortion or damage. Note: Improperly located wires may become pinched under the brass brush holder retainer bosses in end cap causing holder distortion. Replace brass holder if damaged.
   b. If brush does not move freely in brass holder or brush wear is not equal, the holder may be held too tightly in brush box slot. Scrape or file side of brush box slot lightly to remove high spots as shown in Fig. 2.
   c. If one or more brushes are worn more than shown in Fig. 3, replace.
3. Check for crushed or broken brush wires or damaged wire insulation. Replace brush assembly if damaged. See: To Replace Brushes and Brass Holders.

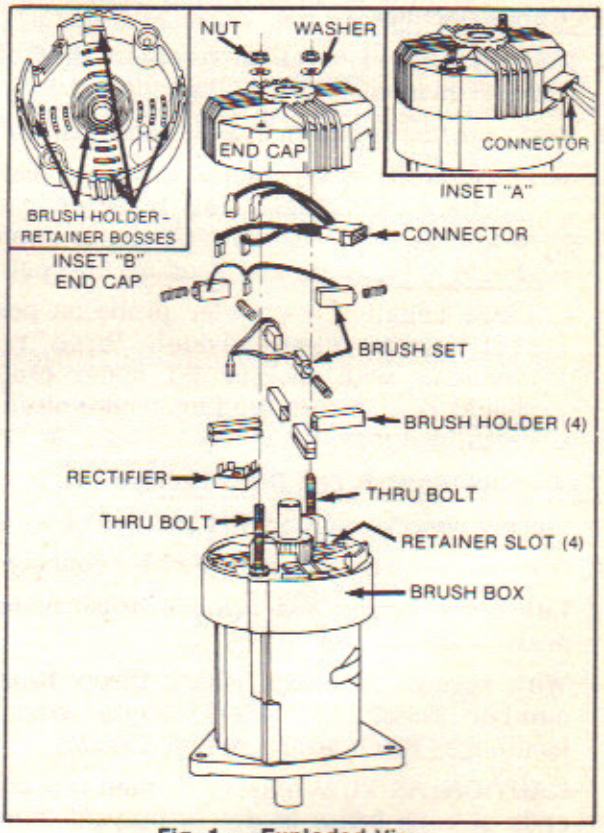


Fig. 1 — Exploded View

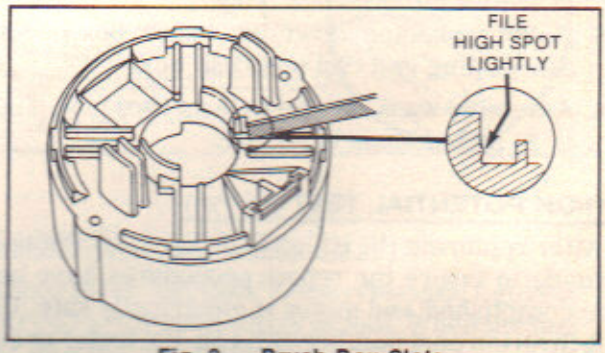


Fig. 2 — Brush Box Slots

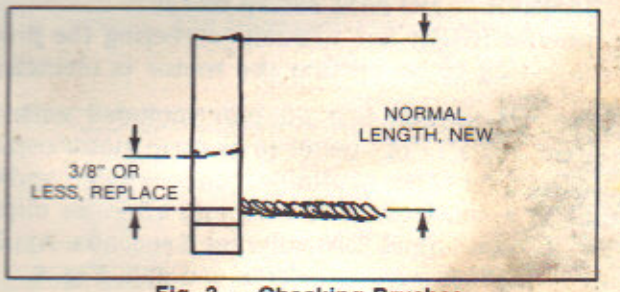


Fig. 3 — Checking Brushes

To Check Rectifier

1. Note location of wires on rectifier, then disconnect from terminals.
2. Test rectifier as shown in Fig. 4 and described below:
   a. Place positive (+) meter probe on positive (+) rectifier terminal. Touch three remaining terminals with negative (–) meter probe. There should NOT be a meter reading (no continuity).
   b. Place negative (–) meter probe on positive (+) rectifier terminal. Touch three remaining terminals with positive (+) meter probe. There should be a meter reading (continuity). Replace rectifier if it fails this test.

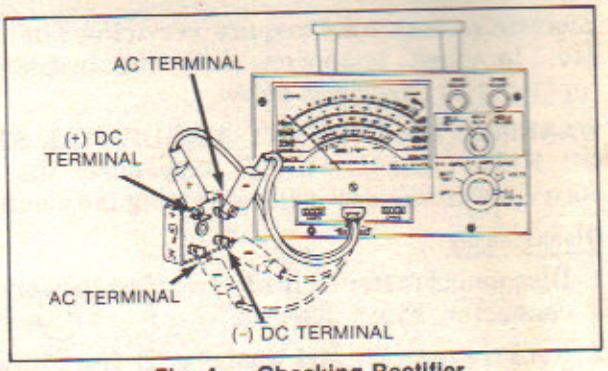


Fig. 4 — Checking Rectifier

To Replace Brushes and Brass Holders

1. Closely observe routing and location of wires.
2. Disconnect brush wires at rectifier connectors.
3. Lift brass holder and remove brush using care to prevent spring loss.
4. With springs in brass holder, insert brushes, part number 395467, in holders. Route wires in same location as when disassembled. Fig. 5.

   CAUTION: All wires must be located 1/4" in from both ends of each brass holder to prevent damage from brush holder retaining bosses located in end cap.
5. Hold connector down in brush box locator while assembling end cap on brush box.
6. Assemble washers and nuts on thru bolt. Tighten nuts to 20 inch pounds of torque.

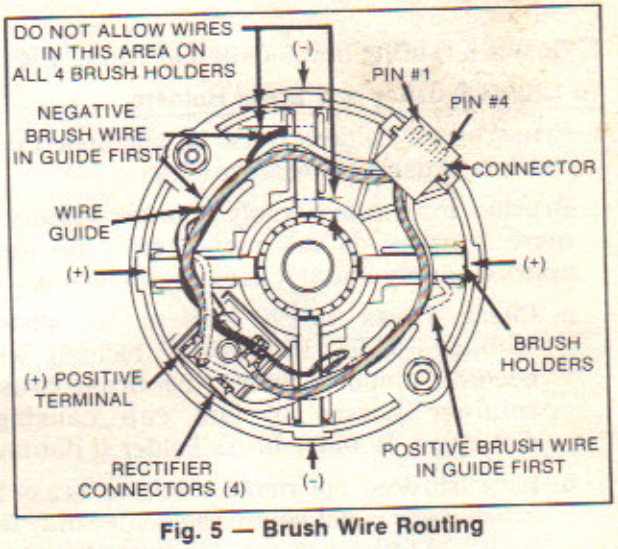


Fig. 5 — Brush Wire Routing

HIGH POTENTIAL TEST (Hi-Pot)

After repairing the Electric Motor, a Hi-Pot test must be made to insure the repair procedures have been safely accomplished and motor is electrically safe. Use Briggs & Stratton part number 19254 Hi-Pot tester or equivalent.

DANGER — DO NOT return motor to customer that has failed a Hi-Pot test without correcting the problem and re-testing to be certain the motor is electrically safe.

Connect special test adaptor included with Briggs & Stratton "Hi-Pot" tester to electric motor connector. (If an adpater is not available, connect pins 1 and 4 together using a short piece of wire and alligator clips.) Motor MUST withstand 2500 volts for 5 seconds. Apply voltage to connector wire and drive end cap, Fig. 6.

If a Hi-Pot tester is not available, take the electric motor to a qualified electric motor repair shop for testing. After Hi-Pot test is passed, the electric motor is ready for use. Connect motor to power supply at connector.

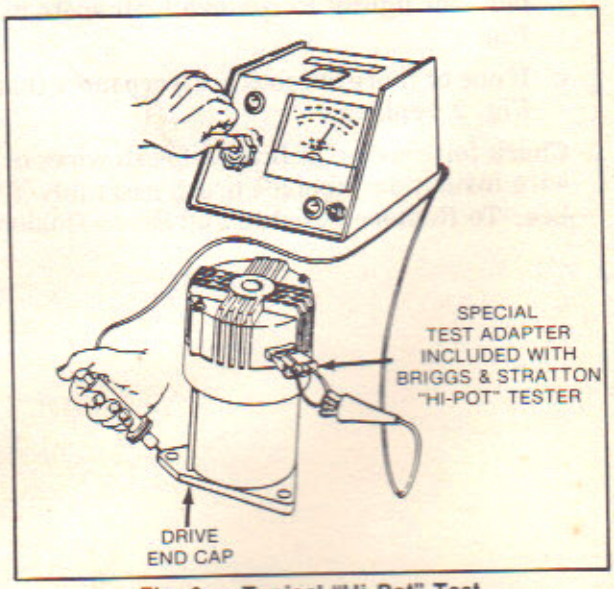


Fig. 6 — Typical "Hi-Pot" Test

PULSA-JET AND VACU-JET CARBURETOR FUEL TANK CHANGES

An engine, equipped with a band brake stopping mechanism, can expect to be stopped, and then restarted, on a more frequent basis. This means that the engine must start easily each time. One of the newer developments resulting in easier engine starting is the ALL-TEMPERATURE BI-METAL AUTOMATIC CHOKE CARBURETOR. This feature improves engine starting under all operating temperatures. More recently, however, are two additional developments, each also contributing to improved starting characteristics. The following describes these two latest developments:

1) VACUUM METERING

The pulsa-jet and vacu-jet carburetors both rely on vacuum for proper automatic choke operation. The "V" notch channel in the fuel tank top regulates the necessary amount of vacuum underneath the diaphragm. To obtain a more precise method of metering this vacuum, a drilled hole (.014"/.36 mm diameter orifice) has replaced the "V" notch, figure 1.

ADVANTAGE — Vacuum is more accurately metered assuring consistent automatic choke operation for easier and quicker starting.

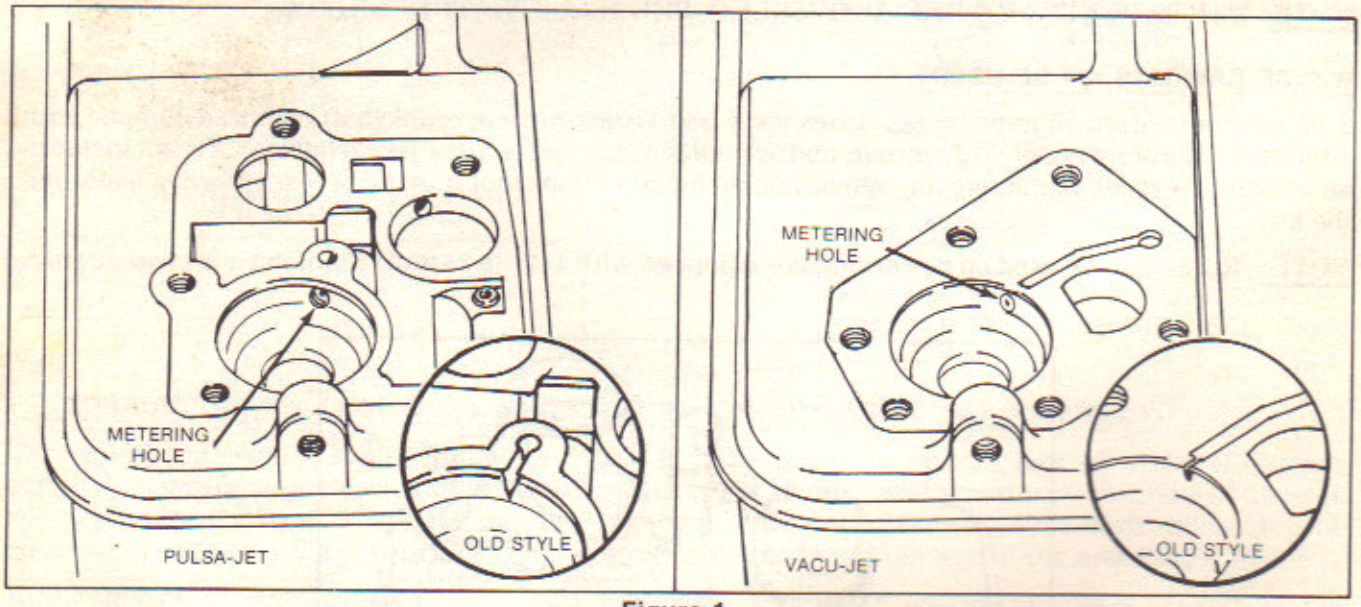


Figure 1

2) "PRIMING" FUEL RESERVOIR CUP (PULSA-JET CARBURETOR FUEL TANK)

A .046" (1.17 mm) diameter hole has been strategically placed in the fuel tank's reservoir cup, figure 2. When an engine runs out of fuel, both the tank and reservoir cup are nearly empty of fuel. When the fuel tank is filled to a level above this hole, fuel will transfer into the reservoir cup.

ADVANTAGE — Reduces the number of pulls required to "prime" the reservoir cup, allowing for quicker and easier starting.

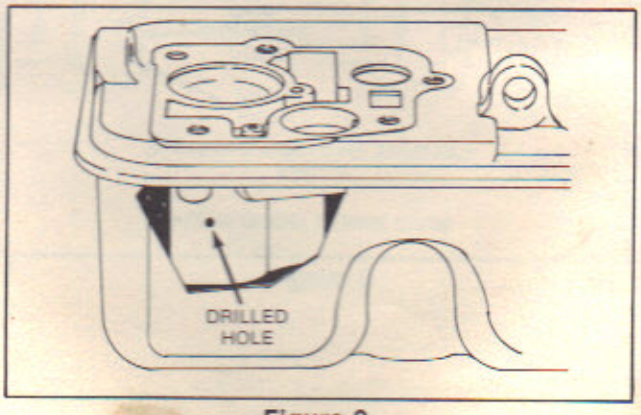


Figure 2

CARBURETOR/FUEL TANK KIT

On a regular basis, service accounts have requested that one standardized carburetor/fuel tank kit be made available for servicing both the model series 90000 and 110000 vertical crankshaft engines. A kit of this type offers a service account several advantages such as a savings in cost and time when replacing the carburetor and fuel tank either individually or together.

Part Number 396893 Carburetor/Fuel Tank Kit Includes:

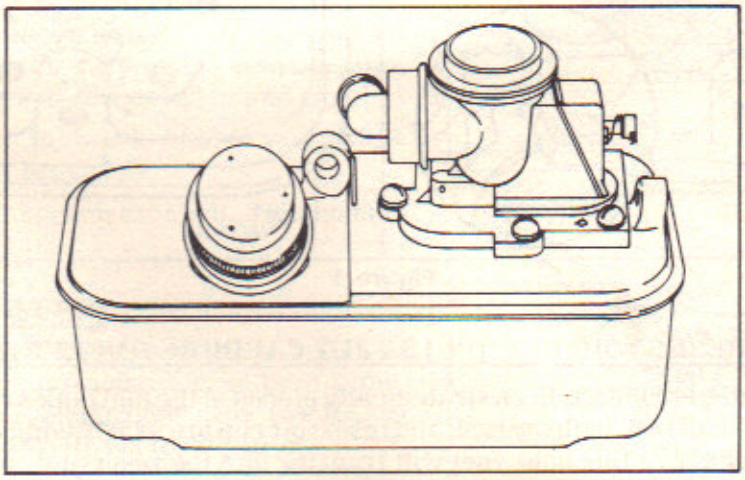
- Part number 395957 pulsa-jet carburetor — This is an 11 cubic inch ALL-TEMPERATURE BI-METAL AUTOMATIC CHOKE METAL CARBURETOR. Includes part number 391643 diaphragm assembly.
- Part number 271139 air cleaner mounting gasket.
- Part number 280368 breather grommet.
- Part number 391694 fuel tank assembly. Includes part number 298425 fuel cap.
- Instruction sheet.

NOTE: PARTS IN KIT ARE PRE-ASSEMBLED. SEE ILLUSTRATION BELOW.

WHERE CAN THIS KIT BE USED?

This kit can be used on most model series 90000 and 110000 vertical crankshaft engines equipped with either air vane or mechanical governor, and with either pulsa-jet or vacu-jet carburetor. The kit includes an instruction sheet explaining any minor engine modifications that may be necessary when installing the kit.

NOTE: Kit cannot be used on newer engines equipped with 1/4" (6.35 mm) diameter air cleaner stud.

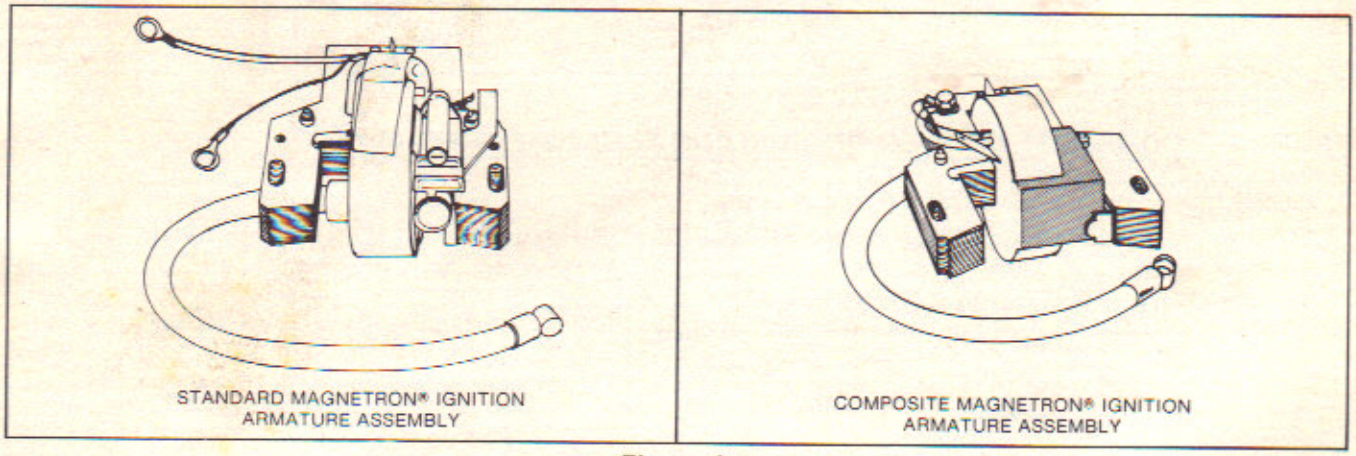


PART NUMBER 396893 CARBUETOR/FUEL TANK KIT

MISCELLANEOUS SUBJECTS

COMPOSITE MAGNETRON® IGNITION ARMATURE ASSEMBLY

An ignition armature assembly equipped with the MAGNETRON® module is undergoing an appearance change, figure 1. The change in appearance is NOT the result of changing the MAGNETRON® principle of operation, but is the result of encasing the MAGNETRON® transistor and inductor coil in the same "potting" material that is used around the ignition coil body. The composite MAGNETRON® ignition armature assembly further increases the already proven high quality and reliability of the ignition system.



STANDARD MAGNETRON® IGNITION ARMATURE ASSEMBLY

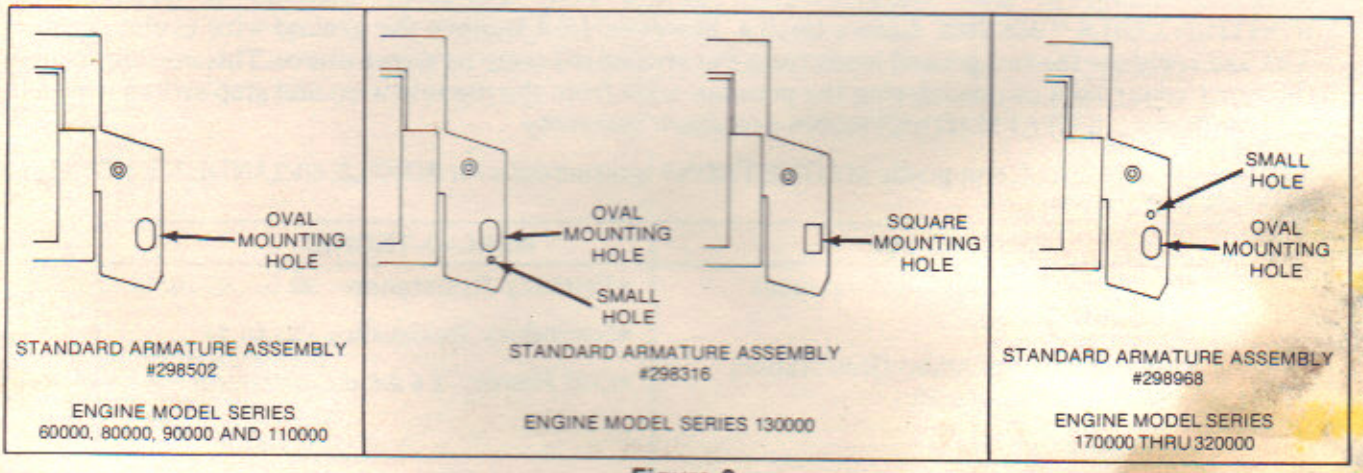
COMPOSITE MAGNETRON® IGNITION ARMATURE ASSEMBLY

Figure 1

STANDARDIZATION — COMPOSITE MAGNETRON® IGNITION ARMATURE ASSEMBLY

Throughout the current Briggs & Stratton SINGLE CYLINDER engine line, four (4) styles of ignition armature assemblies are used. One of the basic differences among these armatures is number of turns of wire within the coil body. This difference is only noticed when testing the coils since each one has its own separate set of test values. Other basic differences are found upon the legs of the armatures, figure 2.

In the interest of standardization, ALL composite MAGNETRON® ignition armature assemblies for SINGLE CYLINDER ENGINES include the SAME ignition coil body. The legs of the armatures will continue to retain their same distinctiveness for easy identification.



STANDARD ARMATURE ASSEMBLY #298502

ENGINE MODEL SERIES 60000, 80000, 90000 AND 110000

STANDARD ARMATURE ASSEMBLY #298316

ENGINE MODEL SERIES 130000

STANDARD ARMATURE ASSEMBLY #298968

ENGINE MODEL SERIES 170000 THRU 320000

Figure 2

COMPOSITE MAGNETRON® IGNITION ARMATURE ASSEMBLY

TWO STYLES — COMPOSITE MAGNETRON® IGNITION ARMATURE ASSEMBLY

In figure 3, two (2) styles of the composite MAGNETRON® ignition armature assembly are shown. The test procedures for both are identical.

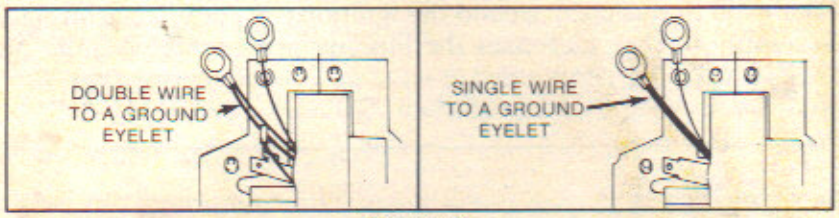


Figure 3

TESTING — COMPOSITE MAGNETRON® IGNITION ARMATURE ASSEMBLY

1) IDENTIFY IGNITION COIL'S LEAD WIRES

Before testing, first identify the composite ignition coil's lead wires, figure 4, and notice the likeness to the standard MAGNETRON® armature. The ground wires have been lifted from the armature frame for easier identification.

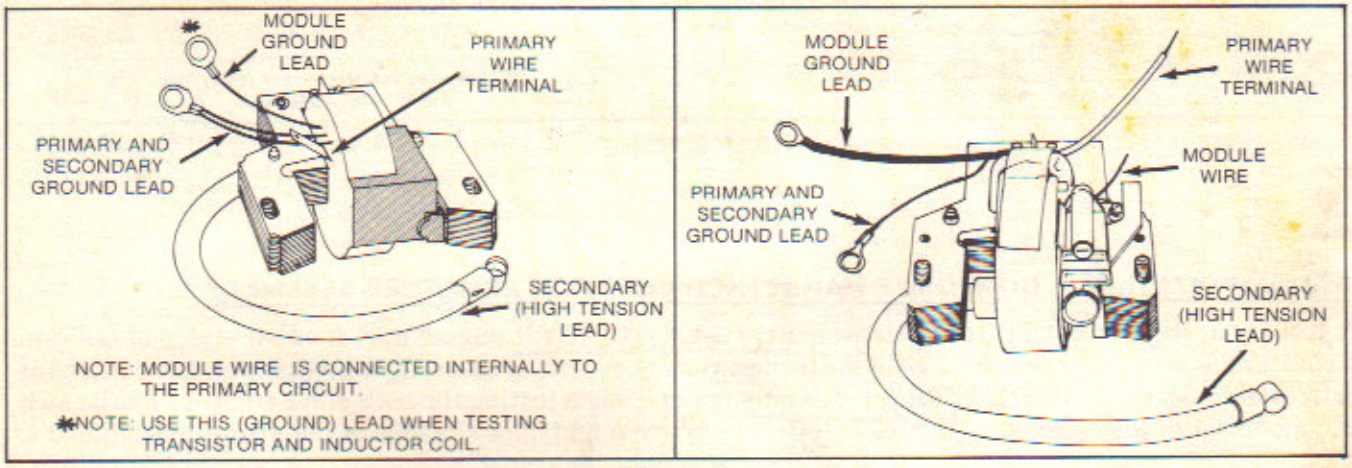


Figure 4

2) TESTING IGNITION COIL

Test the ignition coil with either the GRAHAM LEE or MERC-O-TRONIC coil analyzer following the directions found in the "INSTRUCTION BOOK FOR TESTING BRIGGS & STRATTON IGNITION COILS," MS-7862. Before testing, however, first remove the ground wire eyelet screw. Lift and separate the two ground leads from the armature frame as shown above. This accomplishes the same separation as unsoldering the primary wire from the module wire and stop switch wire as done with the standard MAGNETRON® armature assembly.

The test values for ALL composite MAGNETRON® ignition coils for SINGLE CYLINDER ENGINES ARE AS FOLLOWS:

GRAHAM LEE	MERC-O-TRONIC
•Primary Continuity (Resistance) 1.0 ohms maximum •Secondary Continuity (Resistance) 5000 ohms maximum •Coil Test - 16 •Coil Index - 50 •Gap Index - 60	•Primary Resistance - .20 to .35 ohms •Secondary Resistance - 25 to 44 •Coil Power - 1.6 amps minimum

3) TESTING MAGNETRON® TRANSISTOR AND INDUCTOR COIL

Follow the same directions found in the "INSTRUCTION BOOK FOR TESTING BRIGGS & STRATTON IGNITION COILS," MS-7862.