SECTION 1 ONLY

EVINRUDE & JOHNSON

'74

snowmobile

service manual

SECTION 7

THIS SUPPLEMENT
REPLACES SECTION 7
IN ORIGINAL MANUAL

45 HP MODELS: E-264RC
J-264RC

SNOWMOBILE DIVISION/OUTBOARD MARINE CORPORATION, 3031 NORTH 114th STREET, MILWAUKEE, WISCONSIN 53222
OUTBOARD MARINE CORPORATION OF CANADA LTD., PETERBOROUGH, CANADA.

PART NO. 406239

SECTION 7
IGNITION AND ELECTRICAL SYSTEMS

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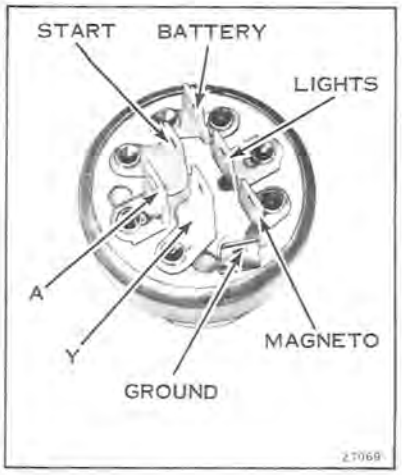

Figure 7-1

Figure 7-2

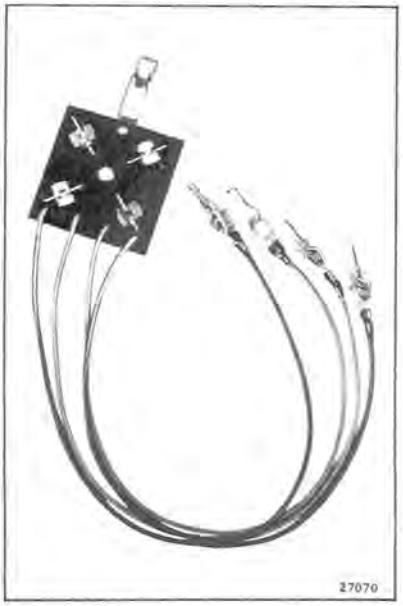

Figure 7-3

DESCRIPTION

The ignition system is made up of the following major components:

1. Flywheel assembly
2. Sensor rotor
3. Stator and charge coil assembly
4. Sensor assemblies (ignition and overspeed)
5. Power Pack RB assembly
6. Ignition coil

The electrical system consists of the alternator coils, headlamp, taillamp, stoplamp, ignition switch, kill button, dimmer switch, wiring, storage battery, electric starting motor, starter solenoid, and rectifier. The alternator coils produce alternating current which changes in frequency and voltage in proportion to engine speed. This alternating current output is rectified (changed to direct current) by a full wave diode bridge rectifier and used to charge the battery. Direct current is then used to power the headlamp and taillamp and the electric starter motor. See wiring diagram at the end of manual.

IGNITION

The magneto capacitor discharge (C.D.) ignition system generates a high voltage electric current which jumps the spark plug gap and thus ignites the compressed fuel-air mixture.

The following sequence of events will illustrate how this system works.

The flywheel rotates around the stator and charge coil assembly. (See Figure 3-7.) The magnets in the flywheel and the (2) charge coils generate a voltage. This voltage (A.C.) flows into Power Pack RB. Here it is changed to D.C. and stored in a capacitor. At the same time the sensor rotor rotates by the sensor coil and a smaller A.C. voltage is generated. This smaller voltage flows into Power Pack RB and causes an electronic switch in the Power Pack RB to turn on allowing the voltage stored in the capacitor to discharge into the primary of the ignition coil.

LIGHTING SYSTEM

The lighting system coils produce alternating current which changes in frequency and voltage in proportion to the engine speed.

The alternating current output is converted to direct current by a diode bridge rectifier and used to charge the battery. Direct current from the battery is then used to power the headlight, taillight, and the electric starter motor.

The alternator output is automatically increased to maximum charge when lights are turned on.

Figure 7-4

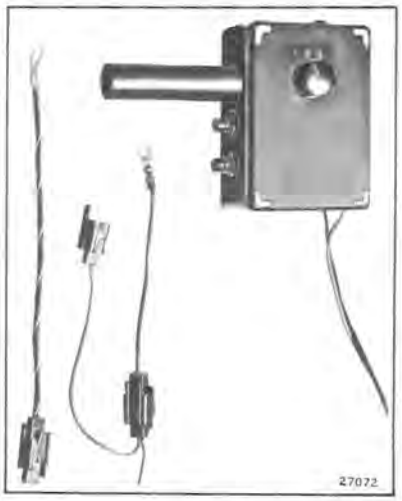

Figure 7-5

TEST EQUIPMENT

The test procedures outlined in this section require the use of the following equipment.

1. Multimeter (see Figure 7-2) or an ohmmeter.
2. Needle point spark checker, gap set to 7/16". See Figure 7-3.
3. Neon test light M-80 (Figure 7-4) or S-80 (Figure 7-5).
4. Timing light. See Figure 7-6.
5. Ignition coil analyzer. See Figures 7-7, 7-8 and 7-9.
6. A.C.-D.C. meter. See Figure 7-9A.
7. Peak reading Kilovolt meter model 172 MERC-O-TRONIC. See Figure 7-9B (OPTIONAL).

NOTE

DO NOT use a test instrument having more than a 12 volt source to check rectifier diodes.

Figure 7-6

Figure 7-7

MERC-O-TRONIC

Figure 7-8

C.D. IGNITION SYSTEM TROUBLE SHOOTING

INTRODUCTION

An understanding of the theory of the C.D. ignition system is an invaluable asset in following the C.D. ignition trouble shooting procedure. See Section 3 for a discussion of the C.D. ignition theory. All the following tests can be conducted without the removal of the flywheel.

C.D. IGNITION SYSTEM DO'S AND DONT'S

1. Do make sure that all connections are clean and tight, especially ground connections. Poor connections mean problems.
2. Do make sure that all plug-in connectors are fully engaged and free of corrosion. Loose or corroded connectors mean problems.
3. Do make sure that all wiring is located properly so there is no chance of rubbing against any edges that can cause wear and insulation breakdown. This can create a difficult service problem.
4. Do make sure test equipment is in good working order before trouble shooting the system. Poor test equipment will not solve a problem.
5. Do use proper tools when working on system components. Wrong tools could damage components.

Figure 7-9B

Figure 7-9A

STEVENS

Figure 7-9

SAFETY WARNINGS (6 AND 7)

6. Do return key switch to OFF position after each test before touching any system leads. This will discharge capacitor in Power Pack RB and prevent a possible high voltage electric shock.
7. Don't hold spark plug wire in your hand while checking for spark. A severe electrical shock could result. Use insulated pliers designed for this purpose.
8. Don't remove potting compound from Power Pack, as this will void any warranty.
9. Don't pull on high tension lead at the ignition coil. You might break the insulation or connection.
10. Don't open or close any plug-in connectors while the engine is running. You might cause damage to the system.
11. Don't attempt any tests other than those listed in the trouble shooting procedure. You might cause damage to the system.
12. Don't connect an electric tachometer into ignition system. You might damage the system.
13. Don't connect this system to any voltage source other than what is specified. You might damage the system.

NOTE

When connecting test equipment leads or reconnecting engine wiring leads to Power Pack RB always refer to the diagram provided. You must connect leads in the correct location or possible damage to system will result.

When removing Power Pack RB cover plate, make sure you place it alongside Power Pack RB in same direction it was removed.

NOTE

Always disconnect positive battery lead when making continuity checks.

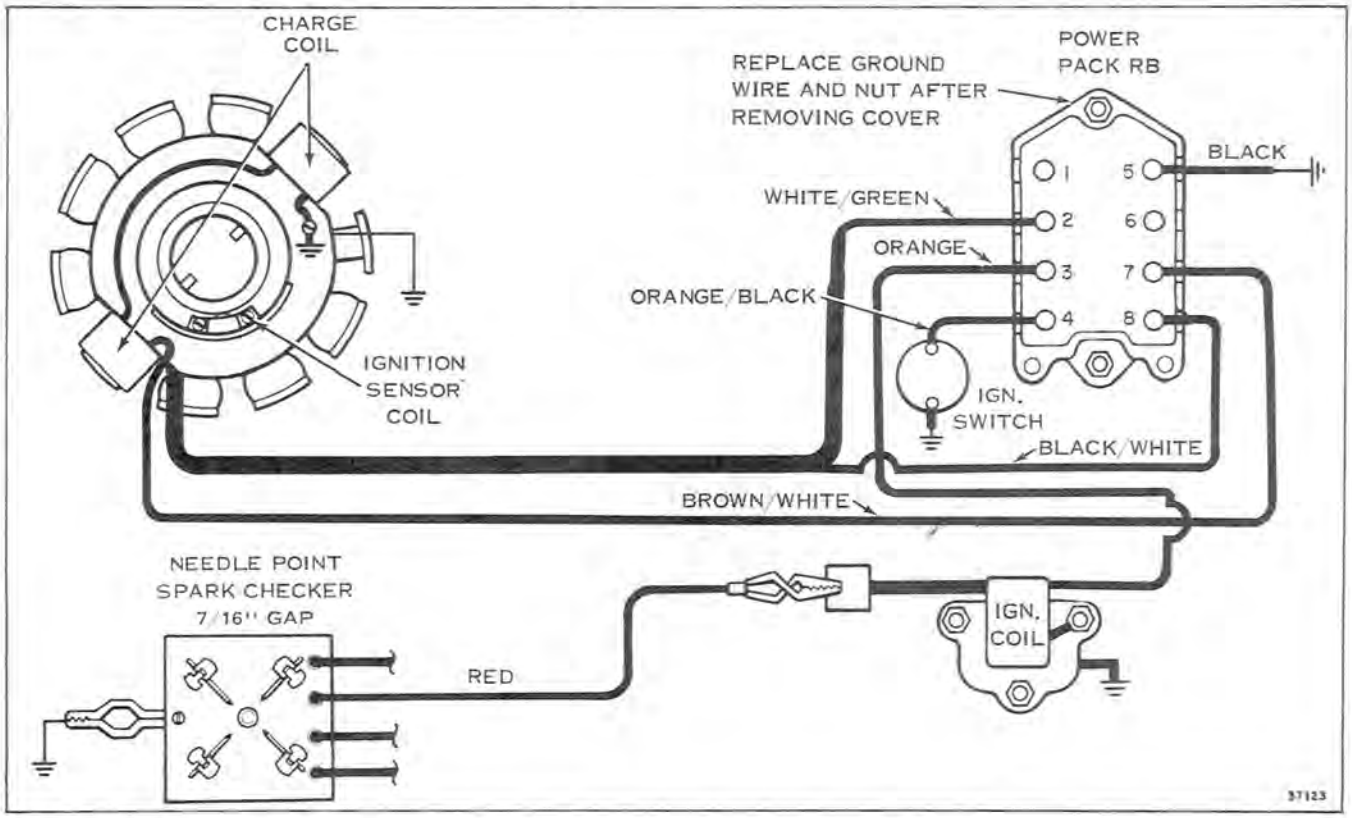

Figure 7-10

NOTE

The following are the recommended test procedures. This will assure correct terminal identification. Also, replace black (ground) wire and nut to Power Pack RB after cover is removed before conducting following tests.

NOTE

When connecting neon test light lead to Power Pack RB be sure to use spade terminal to ensure good connection.

NOTE

Ignition Test Recommendations are as follows:

TEST #1 IGNITION COIL OUTPUT CHECK

A. Pull high tension lead off spark plug.
B. Connect spark gap checker with 7/16" gap. See Figure 7-10. Remove spark plug. (See optional Kilovolt Test page 7-26.)
C. Crank engine with starter. If cranking manually, put ignition switch in "Run" position and use rewind starter. See Figure 7-10.
   1. Strong steady spark from ignition coil, system is good. Check spark plug. Then refer to fuel system section.
   2. Weak, erratic or no spark from coil, go to next test (#2).

TEST #2 IGNITION SWITCH CHECK

A. Put ignition switch in "Run" position for manual cranking. Crank engine with starter (or recoil starter) and observe spark.
B. If weak, erratic, or no spark, disconnect ignition switch lead on Power Pack terminal #4. See Figure 7-11. Repeat test, cranking engine with rope.
C. If spark is strong and steady, check leads going to ignition switch for grounds and perform ignition switch continuity check, test #2-A.

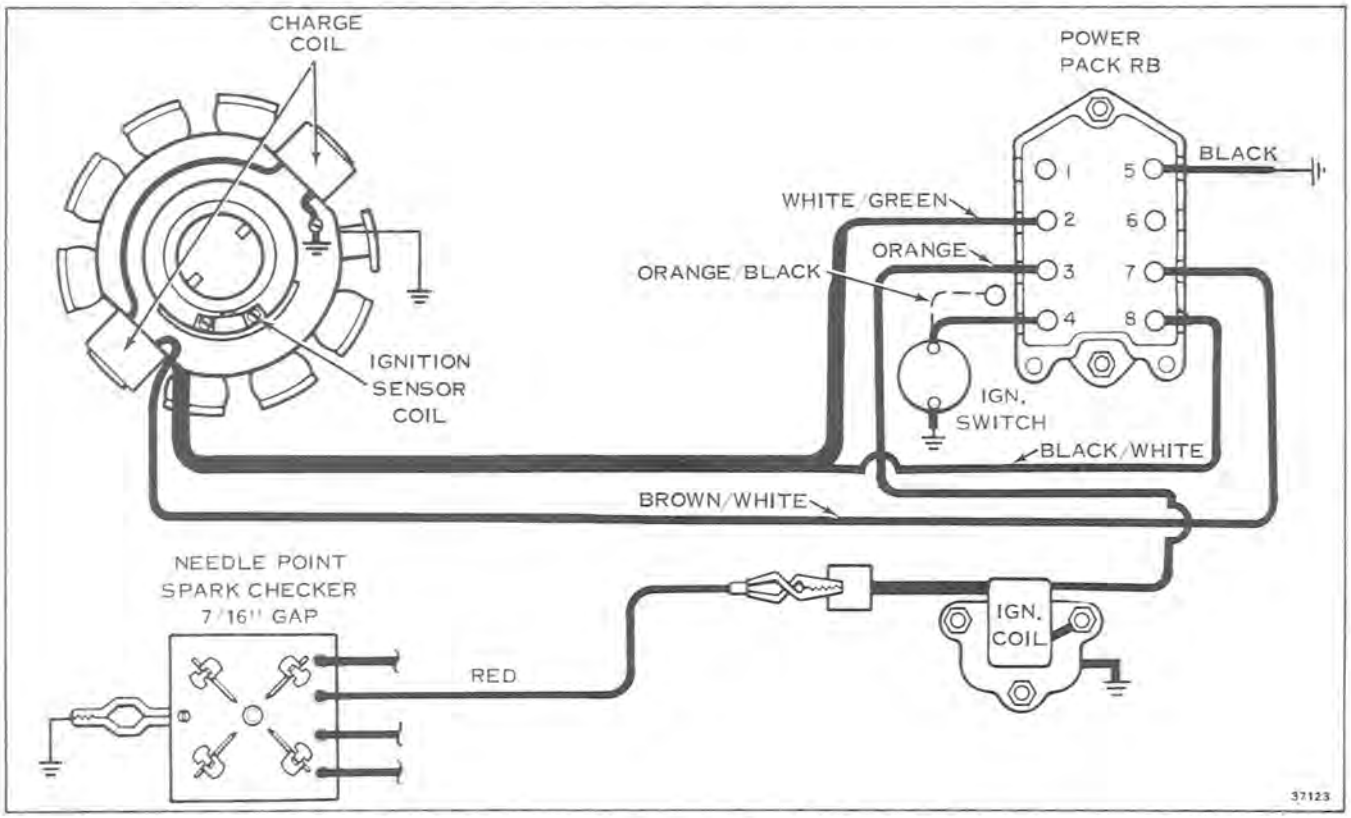

Figure 7-11

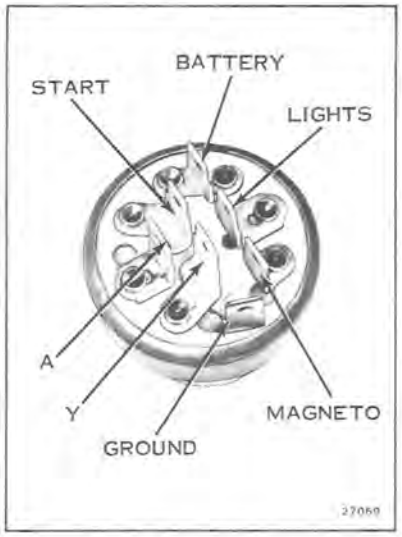

Figure 7-12

TEST #2A IGNITION SWITCH CONTINUITY CHECK

A. Disconnect orange/black lead from Power Pack terminal #4. See Figure 7-13.

B. With ignition key in "RUN" position, check from orange/black lead to engine ground with ohmmeter set on Hi ohm scale. There should be an infinite reading on the meter indicating ignition switch not shorted and lead not grounded.

C. If less than 500k ohm reading, remove terminal connectors from ignition switch (see Figure 7-12) and remove ignition switch from dash panel. Turn ignition key to "RUN" position and take a resistance reading across the magneto and ground terminal of the ignition switch. See Figure 7-12. Use high ohm scale for test #2A.

D. If infinite reading indicated switch is ok, look for problem in orange/black stripe lead.

E. If less than 500k ohm reading indicated, replace ignition switch.

F. Reconnect key switch lead to terminal #4 on Power Pack RB.

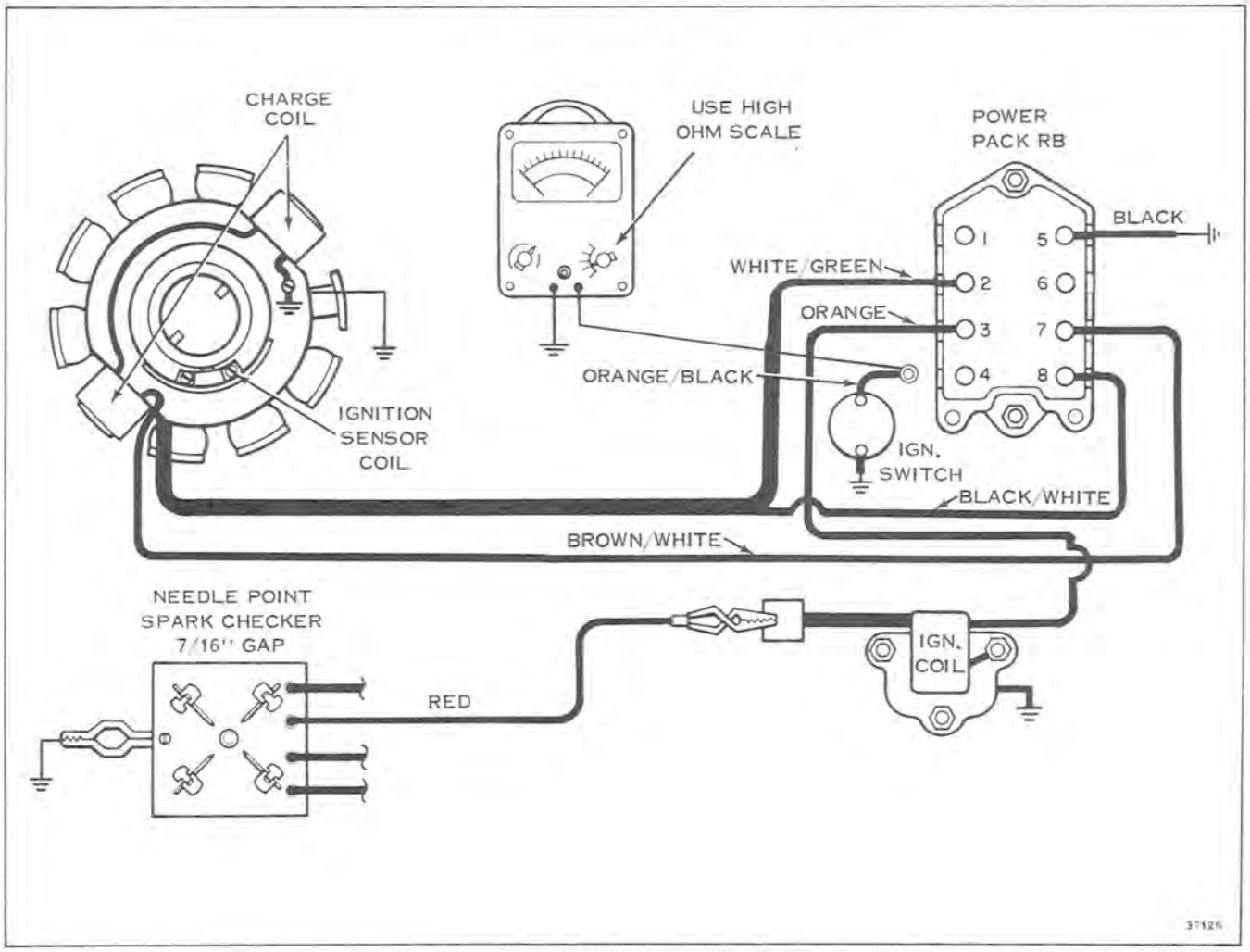

Figure 7-13

TEST #3 POWER PACK RB OUTPUT CHECK

A. Remove ignition coil orange primary lead from terminal 3 of Power Pack RB.

B. Use neon tester S80 or M80. Set rotary switch on tester to position #1. Hook tester black lead to Power Pack RB terminal #3, and tester blue lead to engine ground. See Figure 7-14.

C. Put ignition switch in "RUN" position for manual cranking.

D. Hold load button "A" and crank engine with starter (or recoil starter) and observe neon light. See Figure 7-14.

1. If light, check ignition coil, test #10.

2. If no light, reconnect ignition coil primary lead to terminal #3 on Power Pack RB and go to next test #4.

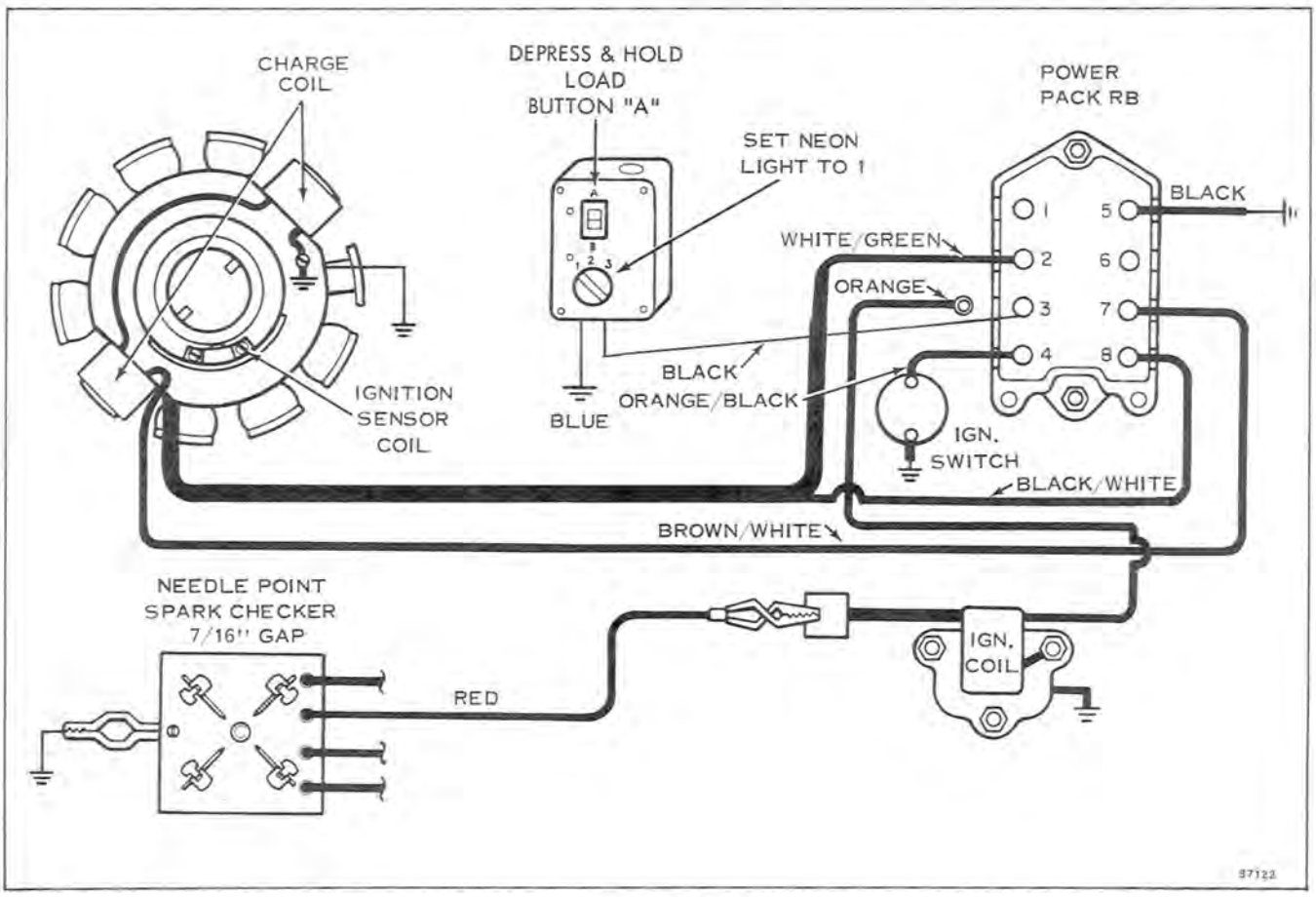

Figure 7-14

TEST #4 CHARGE COIL OUTPUT CHECK

A. Remove charge coil lead from Power Pack terminal No. 7.

B. Use Neon tester S80 or M80. Connect neon tester black lead to charge coil brown/white stripe lead and tester blue lead to engine ground. See Figure 7-15.

C. Put ignition switch in "RUN" position for manual cranking.

D. Set neon tester rotary switch to position #2. Hold load button "B."

E. Crank engine with starter (or recoil starter) and observe tester neon light. See Figure 7-15.

1. If light, charge coils are good.

2. If no light, check for grounding or open leads to charge coils. Also check charge coils for correct resistance (Test #9).

F. Reconnect charge coil lead to terminal #7 on Power Pack RB.

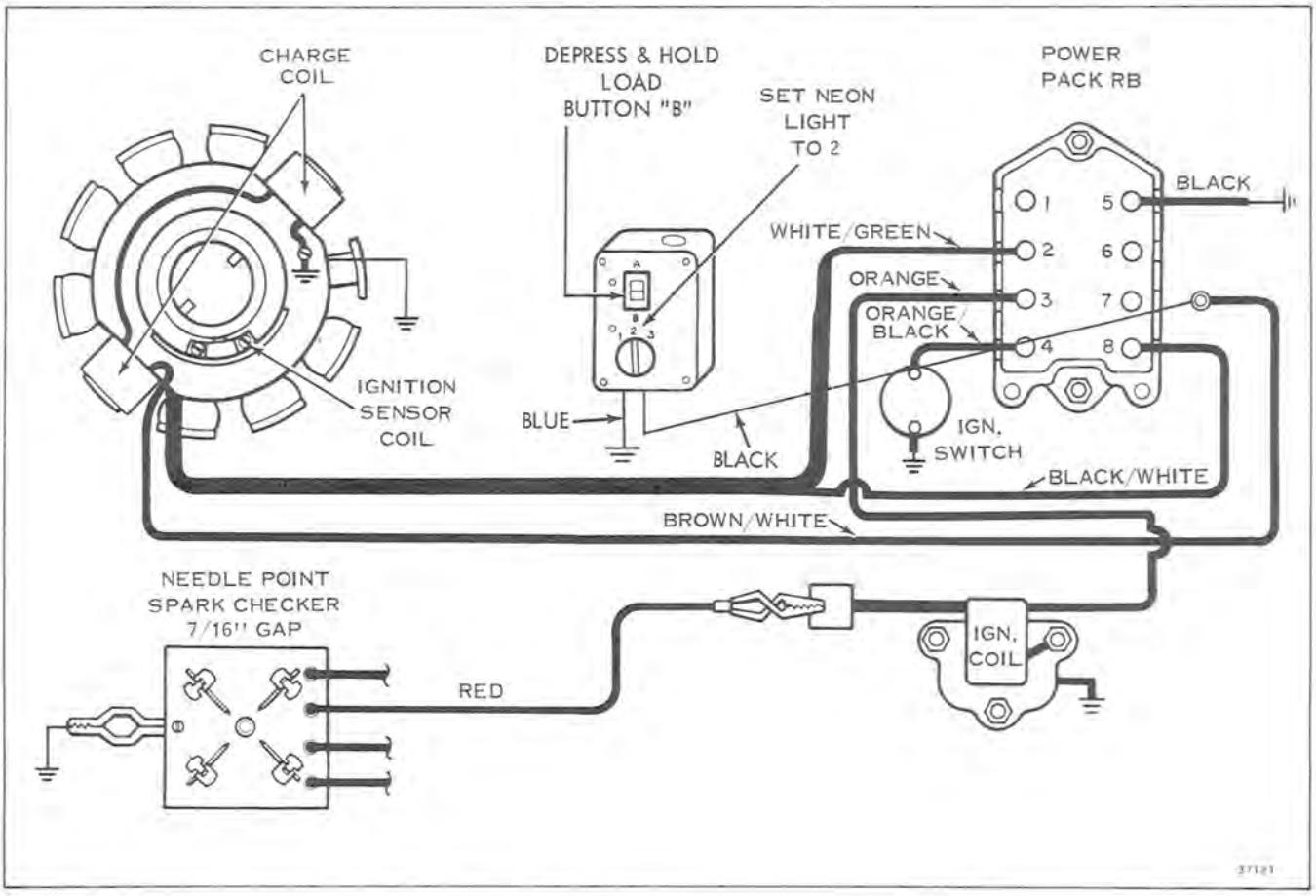

Figure 7-15

TEST #5 IGNITION SENSOR COIL INPUT CHECK

A. Remove ignition sensor white/green stripe lead from terminal #2 and black/white stripe from terminal #8 of Power Pack RB. (Do not allow leads to touch ground.)

NOTE

Test voltage output of S80 or M80. Battery output must be above one volt.

S80 or M80 Internal Battery Test

1. Set rotary switch to position #3.
2. Use a voltmeter.
3. Connect positive lead of voltmeter to black lead of S80 or M80.
4. Connect negative lead of voltmeter to blue lead of S80 or M80.
5. Depress load button "B" on S80 or M80. Output must be above one volt.

B. Connect S80 or M80 tester black lead to Power Pack RB terminal #2 and blue lead to terminal #8. Set tester selector switch to position #3.

C. Put ignition switch in "Run" position for manual cranking.

D. Crank engine with ignition switch or rope, and at same time rapidly tap neon tester load button "B." See Figure 7-16.

1. If there is spark across gap, check ignition sensor leads for shorting to ground and check ignition sensor coil for correct resistance; test #7.
2. If there is no spark from coil, Power Pack is defective.

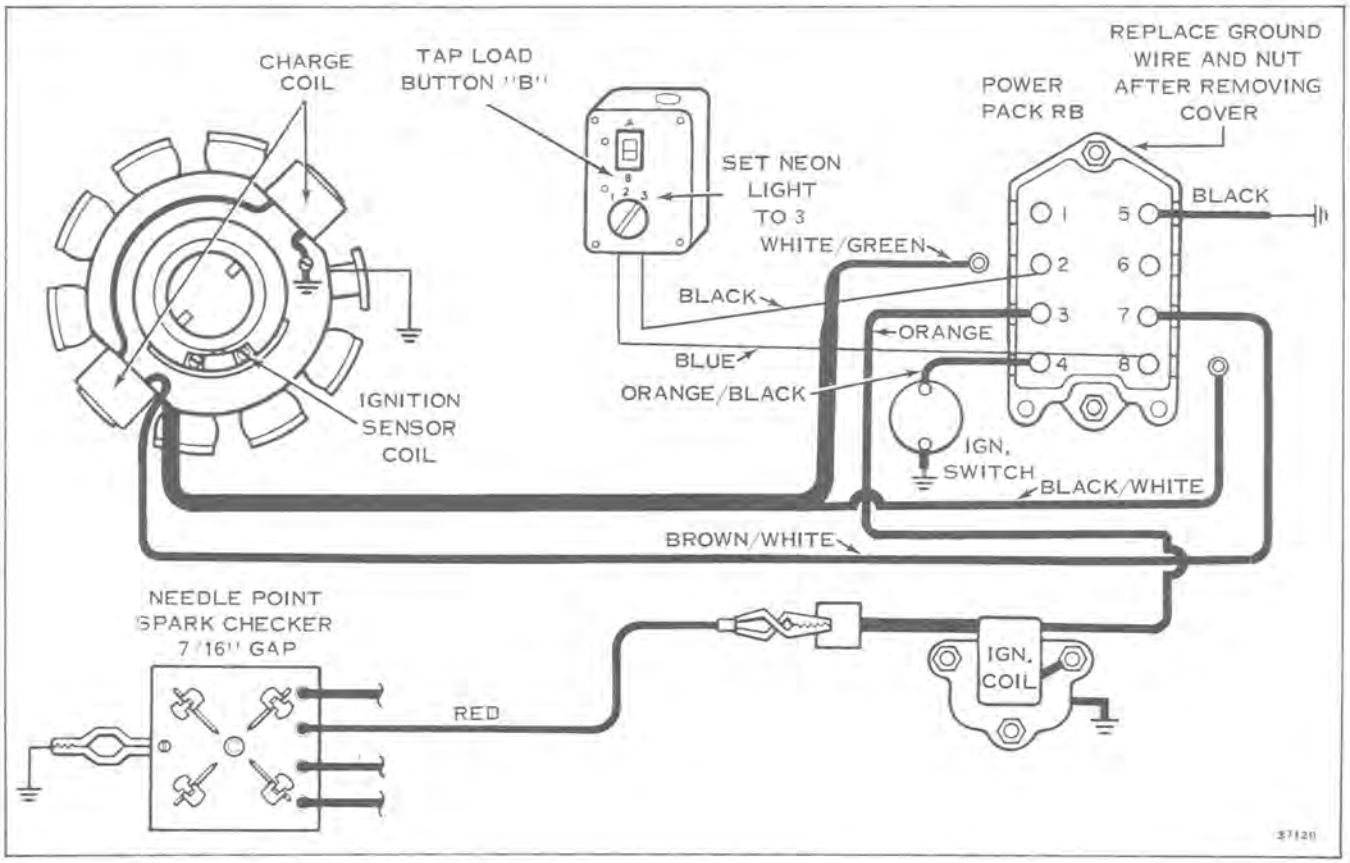

Figure 7-16

TEST #6 IGNITION SENSOR COIL RESISTANCE CHECK

A. Remove the white/green stripe lead from terminal #2 and the black/white stripe lead from terminal #8. Check for 26 to 30 ohms resistance between leads #2 and #8. See Figure 7-17. If ignition sensor coil resistance does not come within these tolerances, it must be replaced. Check on low ohms scale.

B. Ignition sensor coil or lead must not be shorted to ground. On ohmmeter high ohms scale, check for a reading of infinity from both coil leads to ground. If there is a leakage to ground, check sensor coil and leads and insulate area of leakage with tape, or replace ignition sensor and lead assembly.

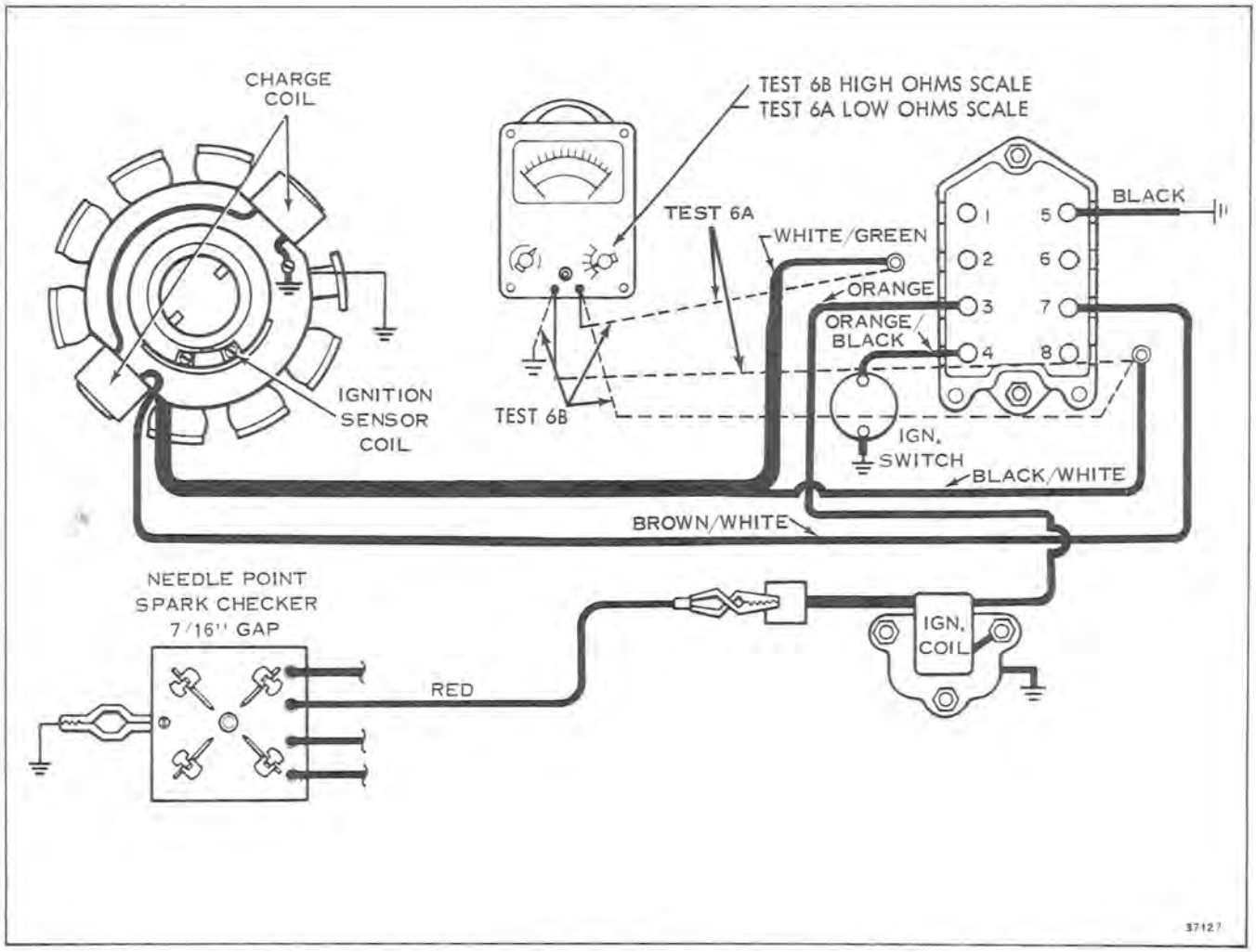

Figure 7-17

TEST #7 CHARGE COIL RESISTANCE CHECK

A. Remove the brown/white stripe lead from Power Pack RB terminal #7. Check for a total resistance of the two charge coils from lead to ground of 875 ± 75 ohms. See Figure 7-18. If resistance of the charge coils does not come within these tolerances, they must be replaced.

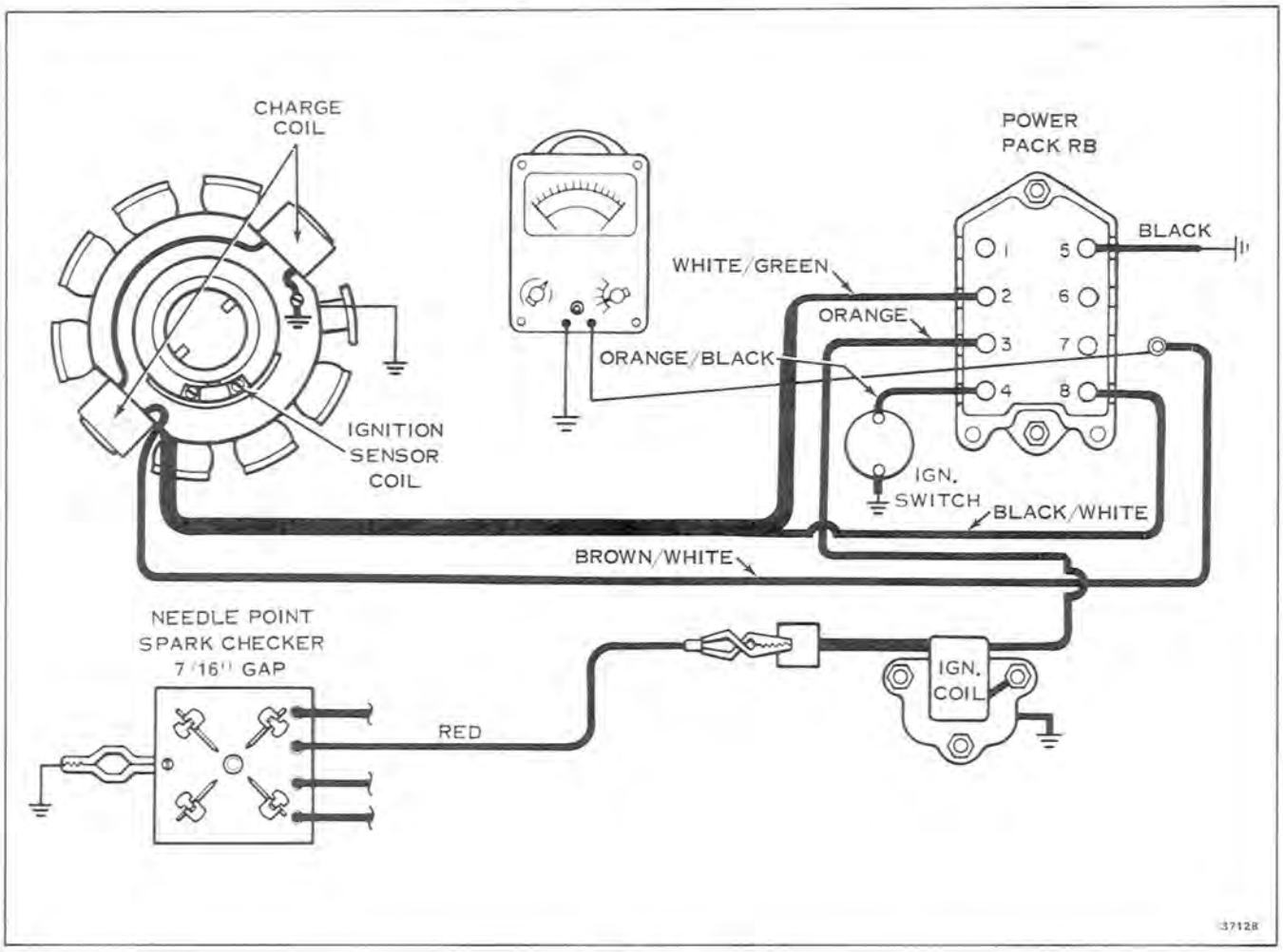

Figure 7-18

TEST #8 IGNITION COIL CONTINUITY, POWER AND INSULATION CHECKS

To determine accurately the condition of the ignition coil, an ignition analyzer should be used. Without the use of test equipment, coil may be replaced needlessly. A wide variety of ignition analyzers are available from various manufacturers. In addition, some automotive testers having the proper specifications can be used. The use of the Graham, Merc-O-Tronic, or Stevens ignition analyzers, and their adapter for C.D. ignition are particularly recommended. See Figures 7-7, 7-8 and 7-9.

Detailed instructions for the use of any tester are provided with the unit; therefore, only general information is given here. All components of the ignition system should be checked, even though replacing a single part seems to have corrected the trouble.

Figure 7-18A

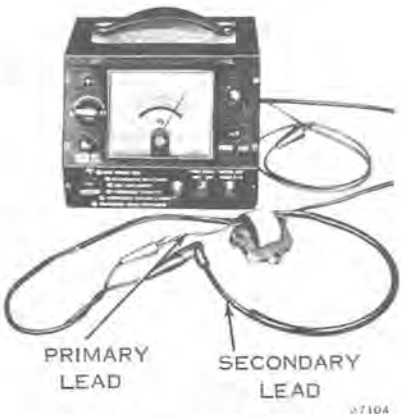

Figure 7-19

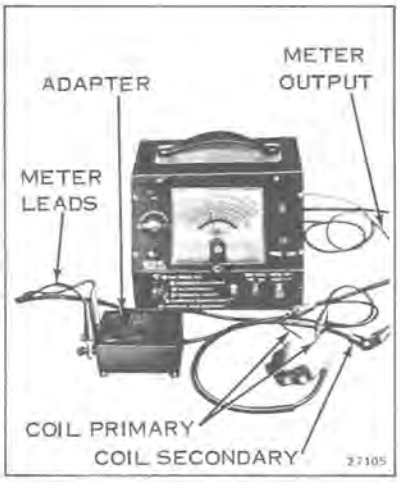

Figure 7-20

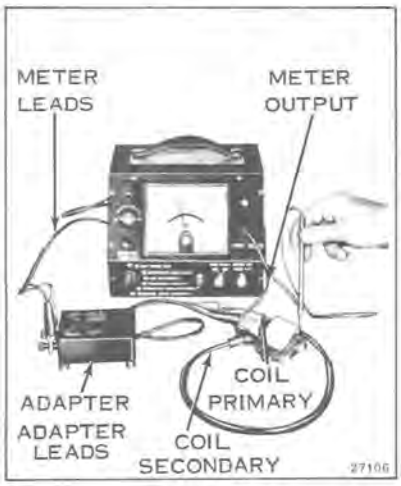

Figure 7-21

The following values are provided for checking the ignition coil 581024.

Graham Tester Model 51

Maximum Secondary	3,000
Coil Index	60
Minimum Coil Test	9
Gap Index	50

Merc-O-Tronic

Secondary Continuity	22 to 26 (index number)

Stevens Tester Model MA75

Switch A Index Reading	20

SAFETY WARNING

Perform all tests on a wooden or insulated bench top to prevent leakage or shock hazards. Follow the equipment manufacturer's instructions. A low reading on the tester indicates a weak coil which must be replaced. No attempt should be made to improve this spark by increasing primary current; a coil is defective if it cannot be made to give a good reading on the specified primary current.

A. CONTINUITY TEST (using MERC-O-TRONIC TESTER)
Remove ignition coil. Connect meter leads to coil primary and secondary leads and turn meter selector switch to "Coil Continuity." See Figure 7-19. Index reading should be between 22 and 26.

B. POWER TEST (using MERC-O-TRONIC TESTER)
Connect meter leads to adapter, adapter red lead to coil ground lead, adapter black lead to coil primary. See Figure 7-20. Connect coil high tension lead to meter output lead. Turn meter selector to "Coil Power Test" and apply power to coil. Secondary voltage should produce a steady spark at meter spark gap at 1.4 amps (black figures on number 1 scale). Check insulation by probing the coil and entire secondary lead with the grounded test probe, meter output lead should be disconnected. See Figure 7-21. Arcing will be apparent wherever the insulation has broken down, due to moisture or carbon trails.

C. INSULATION TEST (using MERC-O-TRONIC TESTER)
Connect meter leads to adapter, adapter leads to coil primary and disconnect meter output to coil secondary. Probe the coil and entire secondary lead with the grounded test probe. See Figure 7-21. Arcing will be apparent wherever the insulation has broken down, due to moisture or carbon trails.

NOTE

1. Do not permit test probe to linger too long at any point while conducting this test.
2. Complete test as rapidly as possible, as this is a severe test on a coil.

ALTERNATOR

TROUBLE SHOOTING

Failure in the alternator charging circuit will usually show up when the battery fails to retain a charge sufficient to start the engine consistently. To determine the cause of trouble, check the condition of the battery and electrical connections throughout the circuit, before proceeding with electrical testing. A visual inspection may be all that is required to locate the trouble.

NOTE

Disconnect battery leads before tightening or changing any connections, to avoid the possibility of shorting out the electrical system.

a. Battery. Check condition as described under Battery Testing, Battery Inspection, and Battery Care.

b. Wiring. The importance of connections which are good electrically and mechanically throughout the circuit cannot be overemphasized. The largest percentage of electrical system failures are caused by one or more loose or dirty connections. Check for corroded or loose connections, and for worn or frayed insulation. Check the battery cables for possible reverse polarity.

c. Connections. Although connections are easily made, care must be used when fastening terminals together. If connectors are not assembled properly, one or more of the terminals may back out of the housing, preventing one or more of the electrical circuits from operating. To eliminate problems due to improper connections, examine the terminals on both halves of the connectors after assembly to be sure that all terminal ends are in place.

If a visual inspection of the electrical system shows all components to be in good condition, an electrical inspection will be necessary to determine which component of the charging system is the cause of trouble.

ALTERNATOR COIL RESISTANCE TESTS

NOTE

Do not take resistance test at rectifier.

A. Disconnect the stator three way twin lock connector (curved connector) behind belt guard. See Figure 7-22.

B. Set ohmmeter on low ohms or R x 1 scale and check the resistance between yellow and yellow/gray stripe leads. This reading should be .91 ohms ±10%.

C. Leave ohmmeter set as in (B) above with one lead attached to yellow/gray stripe lead and connect other meter lead to green wire. This reading should be .38 ohms ± 10%.

D. Set the ohmmeter to high ohms position and check between each of the above wires and ground for shorts to ground. Replace the wires to the correct positions.

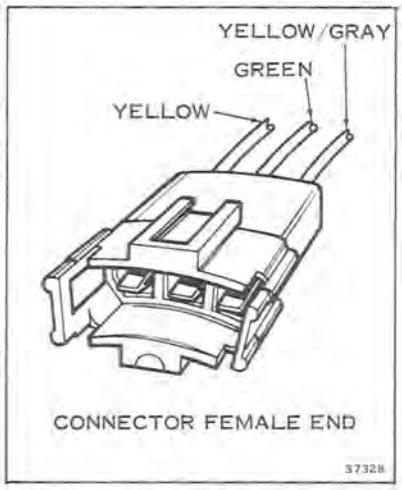

Figure 7-22

IGNITION KEY SWITCH CHECK

A. Pull quick disconnect from back of key switch.
B. Connect ohmmeter or continuity light to A & Y terminal.
C. Put ignition switch in Lights/Run position - full continuity.
D. Key switch in any other position - no continuity.

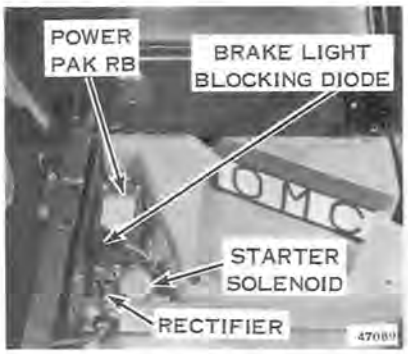

Figure 7-23

ALTERNATOR COIL OUTPUT TEST

A. Remove yellow lead from positive terminal of rectifier.

B. Connect one D.C. amp meter lead to positive terminal of rectifier.

C. Connect other amp meter lead to yellow lead removed in step (A). Run engine to 4500 RPM with key switch in "Run" position. Amp meter should read 4 amps. Turn ignition switch to lights position, amp meter should read 11 amps at 4500 RPM. If amp meter hand deflects to left in above test reverse amp meter leads.

STOP SWITCH TEST

Pull connector apart and connect continuity meter across two stop switch leads.

1. Depress Button - "Off position" - full continuity

2. Depress Button - "Run position" - no continuity

DIMMER SWITCH TEST

1. Depress Button - "high beam" - full continuity
2. Depress Button - "low beam" - no continuity

BLOCKING DIODE TEST (See Figure 7-23)

A. Remove diode leads and connect continuity meter (HI ohms scale) between gray and yellow lead. Reverse leads and note reading. Meter should read in one direction only.

B. Repeat blocking diode test on gray and blue lead. Meter should read in one direction only.

C. Repeat blocking diode test on yellow and blue lead. Meter should read in both directions.

BRAKELAMP SWITCH TEST

A. Pull connectors apart (near brake switch).

B. Connect continuity meter to each of the terminals.

C. Pull up on switch plunger - full continuity.

D. Release plunger - no continuity.

NOTE

If brake is not properly adjusted, brake switch will not function properly.

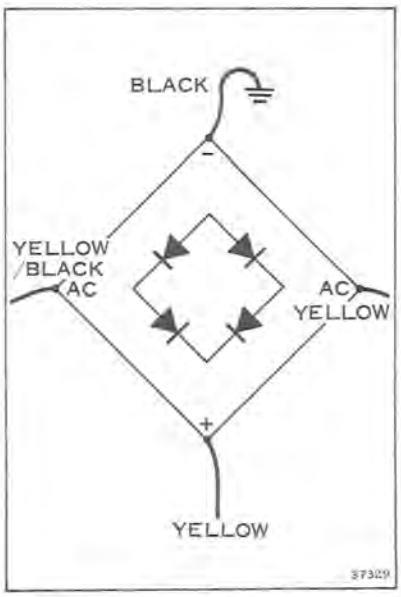

Figure 7-23A

CHECKING RECTIFIER DIODES

Use an ohmmeter (HI ohms scale) to check for shorted or open diodes. This is basically a continuity test.

Disconnect all leads from rectifier assembly. Check a diode by connecting test leads to adjacent terminals on rectifier assembly and note the reading. Reverse the test leads and again note the reading. A good diode will give a reading in one direction only.

Repeat the test procedure for the other diodes by connecting the test leads between adjacent terminals.

Connect leads to correct terminals. See Figure 7-23A.

IGNITION SYSTEM REPAIR

DISASSEMBLY

1. Remove primary drive. See Section 10.
2. Cut the electrical wiring tie straps and remove the electrical wire clips securing the electrical wiring to the flywheel side housing.
3. Remove three screws and lockwashers securing the alternator and charge coil assembly. Remove screw holding wiring harness.- See Figure 7-24.
4. Remove the ignition sensor and shield assembly held with four screws and two clamp screws. See Figure 7-25.

Figure 7-24

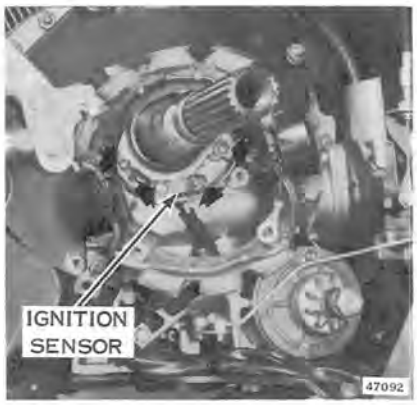

Figure 7-25

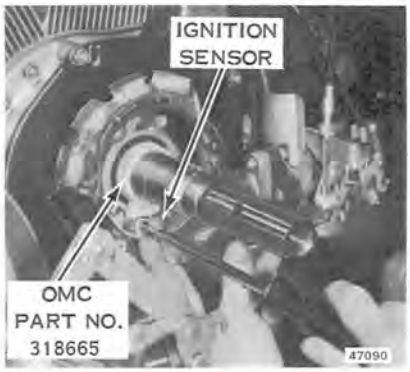

Figure 7-26

REASSEMBLY

1. Install the ignition sensor coil and shield assembly to the flywheel end side housing.

NOTE

The tolerances in the bearings make it necessary to push down on the crankshaft when setting the ignition sensor.

2. Position the sensor using the sensor gauge assembly and snug the sensor screws to 10-12 in. lbs. See Figure 7-26. Use Loctite Retaining Compound TL242.
3. Install the stator and coil assembly to the flywheel end housing.
4. Secure the stator and coil assembly wires and the sensor wires with the proper wiring clamps and ties.
5. Replace flywheel and primary drive. See Section 10. Clean flywheel of dirt or metal filings which may have accumulated on magnets before installing. See Figure 7-27.

Figure 7-27

IGNITION TIMING

Ignition timing is fixed. It can be checked, using a timing light aimed at the flywheel advance mark and minor axis thru bolt. See Figure 7-28. If they are not in alignment, there are several possible reasons:

1. Sensor leads wired to wrong terminals on Power Pack RB.
2. Sheared key or missing key on flywheel.

Figure 7-28

SPARK PLUGS

The only spark plug approved for use in your engine is the Champion UP-77V. See Figure 7-29. To remove spark plug for inspection, pull off rubber covered spark plug terminal with a slight counterclockwise twist. Remove spark plug.

NOTE

Care should be taken to avoid over torqueing the spark plug when the engine is hot. A spark plug installed in a hot engine at the torque figure below may be very difficult to remove when cold, and could result in damage to the rotor housing threads.

If center electrode is badly worn, or plug is badly carboned it must be replaced. Recommended torque is (12-15 ft. lbs. Cold). DO NOT EXCEED 15 FT. LBS. If 15 ft. lbs. is exceeded, severe engine damage could occur which may require replacement of rotor housing. Spring inside rubber covered spark plug terminal must fit securely over spark plug terminal.

Figure 7-29

DO NOT clean plugs on abrasive blasting machines. This type of cleaning tends to remove the hard, smooth finish from the insulator tip and reduces the tip's resistance to the formation of combustion deposits.

Poor engine performance and premature spark plug failure may result from improper spark plug installation. Before installing the plug, be sure the plug seat in the cylinder head is cleaned and free from obstructions. Clean and inspect spark plug hole threads.

Improper installation is one of the greatest single causes of unsatisfactory spark plug performance. Improper installation is the result of one or more of the following:

1. Installation of plugs with insufficient torque to correctly compress the gasket.
2. Installation of plugs using excessive torque can strip the threads in the rotor housing.
3. Installation of plugs on dirty gasket seal.
4. Installation of plugs in corroded spark plug hole threads.

BATTERY

NOTE

Electric start model snowmobiles should not be started and operated with battery not connected in circuit. Operation without battery can damage rectifier and tachometer. If snowmobile must be operated without battery, disconnect the stator three way twin lock connector (curved connector) behind belt guard, (see Figure 7-23) and turn ignition switch to "Run."

DESCRIPTION

The battery's primary function is to provide power to operate the starting motor; however, the battery also supplies power to operate the lights when the engine is not running at higher speeds. The storage battery is a secondary chemical generator - one that produces an

electric current by chemical action after having been charged from an outside source. Each cell in the storage battery consists of a negative plate of sponge lead and a positive plate of lead peroxide immersed in a solution of water and sulphuric acid. After being charged, each cell will produce a voltage of about 2.1 volts. Six cells, connected in series, are assembled in a case to make up a 12-volt battery.

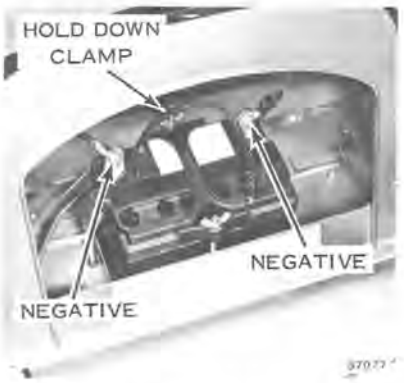

Figure 7-30

SPECIFICATIONS

Due to the extreme weather and temperature conditions under which the battery must operate, proper battery selection is very important. The battery recommended for best performance is a 12-volt, 32 ampere hour battery, or better, with a minimum of 2.2 minutes cold starting capacity at 150 amperes discharge, 0° Fahrenheit, and a 5-second voltage reading of 7.8 volts. It is important to remember that a customer's complaint of poor starting may be traceable to a battery not having these recommended specifications. The dimensions are 7-3/4" long x 5-1/8" wide x 7-1/4" high (to top of terminals).

The Prestolite brand battery, which is included with this vehicle, is recommended and is manufactured for snow vehicle use. Anchored elements reduce the possibility of vibration damage. This battery is manifold vented. It does not have vented cell caps, and vented caps should not be used on this battery. A vent tube from the battery manifold exits through the snowmobile chassis. The dangerously explosive hydrogen gases generated when charging or jumping a battery are therefore vented a safe distance from the hazard of spark at the battery terminals. Check vent tube periodically to make sure that it is not pinched, clogged, or ruptured. The battery is shipped dry. It is activated with dry charge electrolyte available locally. Replacement battery is Prestolite (Part No. 2920 Canada) (Part No. 9955X U.S.A.)

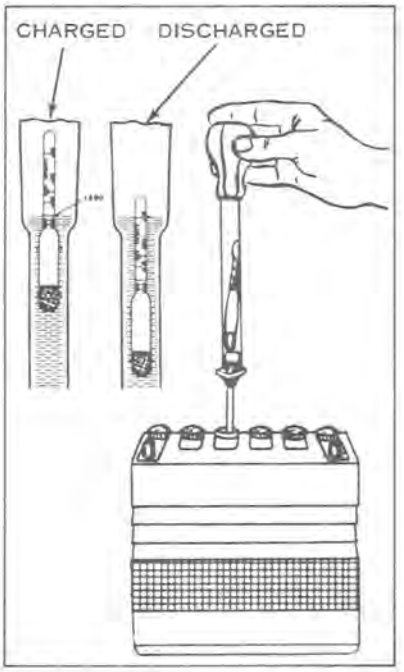

Figure 7-31

INSTALLATION

NOTE

Push manifold vent tube up until properly seated.

Filler caps must be tight and plastic tube outlet extended below battery for manifold system to function correctly.

The hold down clamp should be tight enough to hold the battery, but should not exert undue force on the case. If the clamp is too tight, distortion and damage to battery case will result. See Figure 7-30.

SAFETY WARNING

Battery Electrolyte is a strong acid solution and should be handled with care. If Electrolyte is spilled or splashed on any part of the body, IMMEDIATELY flush the exposed area with liberal amounts of water and obtain medical aid as soon as possible.

Connect battery cables, making sure clamps are tight on battery posts to insure good contact. Apply a coat of petroleum jelly to exposed areas of the battery posts and clamp connectors to retard corrosion.

NOTE

Correct battery polarity is extremely important. Battery must be connected with negative (-) post (black lead) to ground and positive (+) post (red lead) to starter solenoid. If positive (+) post is connected to ground, damage to the charging system will result.

BATTERY SERVICING

Check outside of battery for damage or signs of abuse such as broken case or broken cover. Check inside of battery by removing vent caps and inspecting for low electrolyte level. If battery shows signs of serious damage or abuse, it should be replaced. Visually inspect the battery for the following:

1. Corrosion
2. Frayed or broken cables
3. Cracked case or cell covers
4. Loose hold down clamps
5. Low or overfilled electrolyte

BATTERY CARE

Check the following at regular intervals:

1. Clean battery top and terminals by washing with a solution of ammonia or baking soda. Keep caps tight so that solution does not enter cells. After washing, flush top of battery with clean water.
2. Keep battery terminal connections tight and free from corrosion. If corroded, clean cable terminals and battery posts separately with a soda solution and a wire brush. Inspect cables for fraying or broken strands.
3. Keep electrolyte above the plates and separators at all times. Adhere to manufacturer's instructions for maintaining fluid level. Check electrolyte and add distilled water as necessary at weekly or semi-monthly intervals. Never add acid except when it is definitely known that some has been lost by spilling. If water is added in freezing weather, charge the battery to full charge at once. Charging the battery will mix the water with the electrolyte and prevent water freezing in the battery. CAUTION: Do not overfill. Spilled acid may damage surrounding parts.
4. Keep the battery nearly fully charged at all times. Check the state of charge at frequent intervals by making specific gravity readings with a battery hydrometer (see Figure 7-31). Note that a hydrometer reading is not accurate if water has been added recently, due to the fact that the water may not be mixed with the electrolyte.

Self-discharge will cause storage batteries to become discharged and sulphated if they are not properly maintained in storage. To minimize self-discharge, store batteries in as cool a place as possible, so long as the electrolyte does not freeze. A battery which has been allowed to stand idle for a long period of time may be so badly damaged by sulphation that it can never be restored to a normal charge condition. Batteries should be recharged every 30 days to prevent this damage. Disconnect one of the battery leads before charging battery. If storage temperature is hot, more frequent charging will be necessary. Add water if necessary before charging, to bring electrolyte to proper level. Fully charged batteries have been known to withstand temperatures as low as -90°F.; a discharged battery will freeze at about -19°F., perhaps causing bursting of both the cell and battery cases.

5. Check manifold vent hose to see that it is not blocked.

BATTERY TESTING

a. Make sure battery is fully charged as described under SLOW CHARGING. Hydrometer readings taken on partially charged batteries are unreliable for the following test.

b. Measure specific gravity of electrolyte in each cell and compare readings with the following; if cell readings are between 1.250 and 1.290, the battery is ready for use. Any variation in the specific gravity between cells within this range does not indicate a defective battery. Readings should be corrected to 80° Fahrenheit for comparison. If this specific gravity of any cell falls outside this range (1.250 to 1.290), replace the battery.

BATTERY CHARGING

SAFETY WARNING

Gases given off by a battery being charged or jumped are highly explosive. Keep battery in a ventilated area and away from cigarettes and open flames when charging or jumping. Turn off battery charger before removing cables from battery. Remove cables from good battery first, when jumping.

For best performance a good battery should be fully charged before being returned to service. DO NOT recharge the battery by the fast charge method. This method does not restore the full charge and also shortens the life of the battery.

SLOW CHARGING

Battery is kept charged by alternator coils located beneath flywheel. It may be necessary to use a separate 12 volt battery charger occasionally to keep battery fully charged during long storage periods, or in extreme cold weather if engine is started repeatedly. Battery should be removed from compartment for charging and initial filling. Prior to removing battery from compartment, disconnect vent tube. Pull tube straight down to remove it from the battery. Reconnect vent tube when battery is replaced in vehicle. Push tube straight up into battery until it is seated. Adjust electrolyte to proper level by adding water, then charge battery at a maximum rate of 4 amperes until fully charged. Leave caps on battery while charging. Battery is fully charged when hydrometer scale shows a corrected reading of 1.260 and does not change after three hourly readings. Cells will gas freely when fully charged.

PRESTOLITE BATTERY WARRANTY

Warranty on Prestolite batteries used in this snowmobile is covered directly by Prestolite, through their authorized battery service stations, for a period of 18 months in the United States and 9 months in Canada. Should a battery fail, due to inherent defects, during the first three (3) months of service, it will be replaced on a no-charge basis. Batteries that fail during the balance of the warranty period (15 months) in the U.S. and (6 months) in Canada will be replaced on a prorata basis.

In Canada Prestolite warranty should be handled through the dealer from whom the snowmobile was purchased or through a Prestolite battery depot.

The warranty period starts on the date the snowmobile is delivered to the original owner.

Figure 7-32

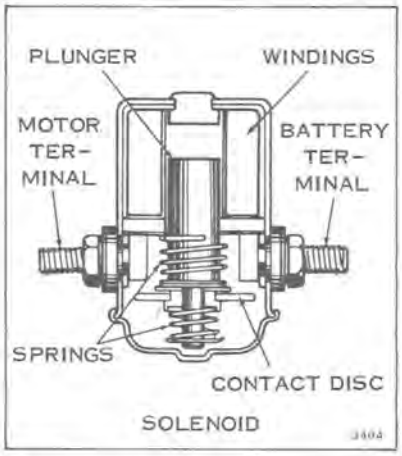

Figure 7-33

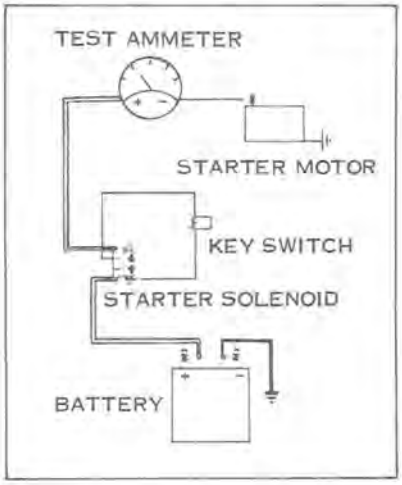

Figure 7-34

STARTER SYSTEM

DESCRIPTION (See Figure 7-32)

The electric starter system consists of the starter motor, starter solenoid, and the necessary cables and wires with their connectors. The starter motor converts electrical energy from the battery into mechanical power which is transmitted to the engine through the starter pinion gear. The starter switch controls the operation by activating the starter solenoid which makes and breaks the high current circuit between the battery and the starter motor.

The starter solenoid (see Figure 7-33) closes the circuit through a movable contact disc which strikes two terminal contacts that are connected to the starter motor circuit. The solenoid winding, when energized, exerts a magnetic pull on the solenoid plunger, causing it to move the contact disc against the terminal contacts.

MAINTENANCE

The outside of the starter motor and drive should be cleaned periodically. Every 50 hours of operation, the helix should be cleaned and lubricated with Lubriplate 777 on both sides of the drive gear. No periodic lubrication of the starter motor or solenoid is required. Starter motor need be removed for reconditioning only every 1000 hours or if the following tests indicate that the starter is not operating properly. If the starter motor does not crank the engine or if it cranks too slowly, check the battery, cables, and connections. Inspect all wiring connections in the starter circuit to insure that they are clean and tight. Proceed with the following tests if additional troubleshooting is necessary.

STARTER SYSTEM TESTING

The following tests fall into two groups, starter circuit tests and starter motor tests. Starter circuit testing is a quick means of pinpointing causes of hard starting which may result from a faulty electrical component in the starter circuit, and can be performed without removing any components from the engine. NOTE: All starter circuit testing must be done with a fully charged, 12-volt battery.

STARTER CIRCUIT TESTING

Starter Motor Amperage Draw Test

a. Ground spark plug high tension leads so that engine can be cranked without firing. Place clamp-on D.C. ammeter capable of reading at least 200 amperes around starter motor lead (see Figure 7-34).

b. Turn ignition switch to START and observe amperage reading with engine cranking. Current should be between 75 amperes minimum and 140 amperes maximum after initial surge.

NOTE

DO NOT operate starter motor for more than thirty seconds at a time without pausing to allow motor to cool for at least two minutes.

Starter Motor Available Voltage Test

a. Inspect battery and cables to make sure that battery has ample capacity for cranking. NOTE: Engine must be at normal operating temperature when test is made.

b. Ground spark plug high tension lead so that engine can be cranked without firing.

c. Connect a voltmeter across starter motor (see Figure 7-35), with positive (+) lead to starter motor terminal, and negative (-) lead to ground on starter frame.

d. Turn ignition switch to START to crank engine and observe voltmeter reading as quickly as possible.

NOTE

Avoid running starter motor continuously for more than 30 seconds during test to prevent overheating. Allow ample time between tests for starter motor temperature to normalize. Voltmeter readings will rise as starter temperature increases.

e. If starter motor turns engine at normal cranking speed with a voltage reading between 9.5 volts minimum and 10.5 volts maximum, starter motor is satisfactory. If available voltage reading at the starter motor is low, review the following chart for probable causes.

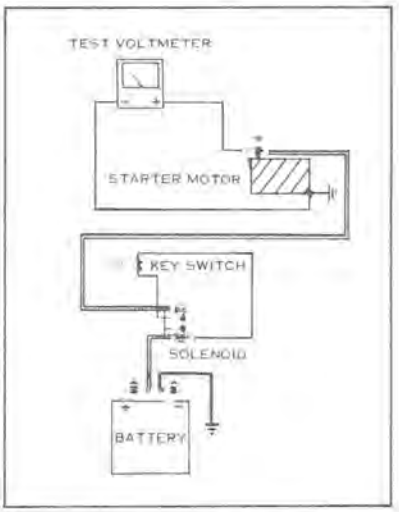

Figure 7-35

Starter System Voltage Drop Test

a. By making a systematic check from the positive battery terminal, through the starting circuit and back to the negative battery terminal, any component or electrical connection having excessive resistance, thus causing high voltage drop and subsequent hard starting, can be pinpointed (see Figure 7-36).

b. Ground spark plug high tension lead so that engine can be cranked without firing. Connect voltmeter and turn ignition switch to START to crank engine. NOTE: By placing voltmeter leads against battery, solenoid, and starter motor terminals rather than against connecting cable ends, each connection can be tested for high resistance along with component.

c. Clean and retighten, or replace, any connection, cable, or component having greater than specified voltage drop.

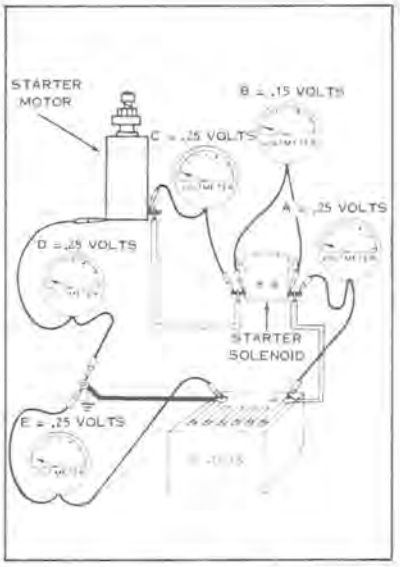

Figure 7-36

STARTER MOTOR TESTING

The no-load test is used to determine quickly the general mechanical and electrical condition of the starter motor. The stalled torque test is used to determine whether or not the starter motor has sufficient torque to crank the engine for fast starting.

No-Load Test

a. Connect starter, with an ammeter in series, to a 12-volt source (see Figure 7-37). Use a tachometer or rpm indicator to indicate armature speed.

b. Ammeter should indicate 32 amperes maximum; rpm indicator should indicate 5,750 to 8,000 RPM. If readings are not as specified, check for binding in starter or failure of windings. NOTE: If starter motor turns slowly, smokes after a very few seconds of running, or gets hot instantly, stop testing. Disassemble starter and check for shorts.

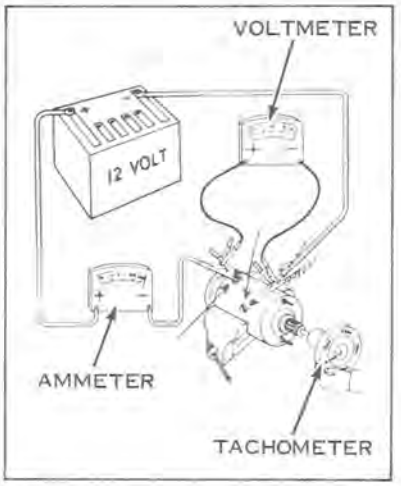

Figure 7-37

Stalled Torque Test

a. Connect a voltmeter between the starter terminal (+) and motor frame (-). Using a torque wrench to stall motor armature (see Figure 7-38), connect starter motor through an ammeter to a 12-volt battery.

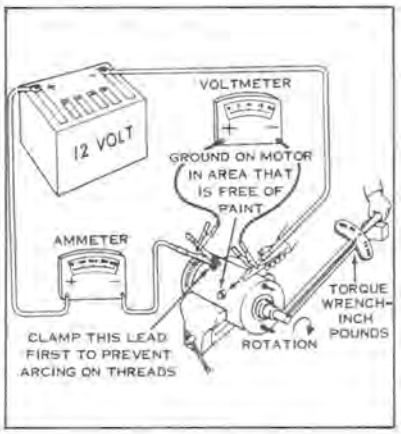

Figure 7-38

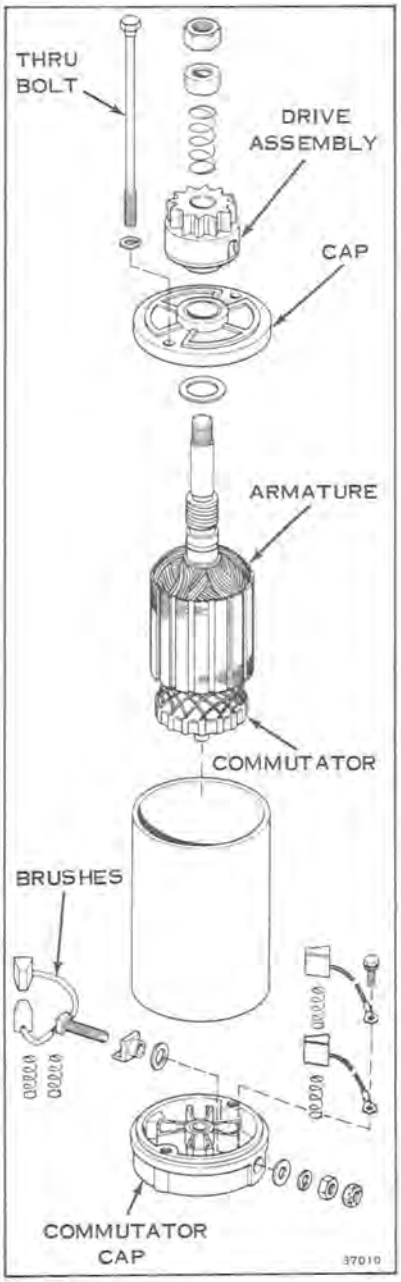

Figure 7-39

b. Voltmeter reading should be approximately 10 volts during this test. Torque should be a minimum of 4.0 ft. lbs. and current should be a maximum of 512 amperes.

NOTE

If motor smokes or gets hot instantly, stop testing, disassemble starter and check for shorts. Use only a fully charged 12-volt battery when making stalled torque test. Obtain readings as rapidly as possible to prevent starter overheating. Allow sufficient time for starter to return to room temperature if it is necessary to repeat stalled torque test.

c. Check each armature coil for open circuits by rotating torque wrench handle through a 180 degree arc after initial torque reading has been noted. This must be done quickly. Torque should be uniform through this arc, although reading will decrease slightly each time brush moves from one commutator segment to another. If an appreciably wide area is found in which torque is very low, disassemble starter and check armature.

INSPECTION OF STARTER MOTOR (See Figure 7-39)

a. Check armature on a growler for shorted turns. NOTE: Follow operating instructions furnished with armature growler for proper test procedures. Clean between commutator segments of armature and recheck armature on growler. If shorted turns are still indicated, replace armature.

b. Check armature for grounded windings. Rotate one lead of continuity tester (test light or meter) around circumference of commutator while holding other continuity meter leads on the armature core or shaft. An indication of continuity means that the armature windings are grounded and armature must be replaced.

c. Check armature for open windings by using an ohmmeter. Measure resistance between adjacent commutator segments, using LO OHMS scale. Rotate leads around entire circumference of commutator. An open winding is indicated if any one reading is much higher (three times higher or more) than the average reading.

d. Inspect commutator segments. If they are dirty or show signs of wear, turn commutator in a lathe until surface is clean and smooth.

e. After turning commutator, undercut insulation between commutator segments to a depth of approximately 1/32 inch. The undercut must be flat at the bottom and should extend beyond the brush contact area for the full length of each insulated groove (see Figure 7-40).

f. After commutator has been undercut, sand lightly with No. 00 sandpaper to remove burrs left during the undercutting process. After sanding, clean commutator thoroughly, removing all traces of metal chips or sanding grit, and recheck armature on growler.

g. Inspect armature insulation for indications of overheating or damaged windings. Clean off any deposits of carbon which may contribute to later failure of the windings. NOTE: Starter motor components should not be washed off in cleaning solvents. Most solvents will soften varnish insulation used on armature and field windings. All starter motor components can be cleaned adequately with a clean cloth or soft brush. Cleaning end heads in solvent may dissolve the oils that have impregnated into the armature shaft bearings. If these oils are removed, bearing or armature shaft wear can be expected. Cleaning of armature in solvent will leave oily residue on the commutator segments, causing arcing between the commutator and brushes.

Brushes

a. Inspect the brushes; replace if worn to one-third their original 3/8" length, or if damaged or cracked. Replace brush springs if weak.

b. Inspect brush springs. Springs should have a pressure of 35 to 90 ounces when compressed to 9/32 inch. Measure brush tension with scale hook under brush screw or under bend in brush spring, and take reading as brush just leaves commutator. Pull off spring scale must be directly opposite line of force exerted by brush spring.

Figure 7-40

ALTERNATOR

TROUBLE SHOOTING

Failure in the alternator charging circuit will usually show up when the battery fails to retain a charge sufficient to start the engine consistently. To determine the cause of trouble, check the condition of the battery and electrical connections throughout the circuit, before proceeding with electrical testing. A visual inspection may be all that is required to locate the trouble.

NOTE

Disconnect battery leads before tightening or changing any connections, to avoid the possibility of shorting out the electrical system.

a. Battery. Check condition as described under Battery Testing, Battery Inspection, and Battery Care.

b. Wiring. The importance of connections which are good electrically and mechanically throughout the circuit cannot be overemphasized. The largest percentage of electrical system failures are caused by one or more loose or dirty connections. Check for corroded or loose connections, and for worn or frayed insulation. Check the battery cables for possible reverse polarity.

c. Connections. Although connections are easily made, care must be used when fastening terminals together. If connectors are not assembled properly, one or more of the terminals may back out of the housing, preventing one or more of the electrical circuits from operating. To eliminate problems due to improper connections, examine the terminals on both halves of the connectors after assembly to be sure that all terminal ends are in place.

If a visual inspection of the electrical system shows all components to be in good condition, an electrical inspection will be necessary to determine which component of the charging system is the cause of trouble.

ALTERNATOR COILS

The alternator coils are replaceable along with the charge coils as an assembly. See Figure 7-41. The alternator coils can be checked for their correct resistance without removal of the flywheel as shown in Test #12.

Figure 7-41

ALTERNATOR AND CHARGE COIL REPLACEMENT

a. Follow steps 1 and 2 of "IGNITION SYSTEM REPAIR - DISASSEMBLY."

b. Disconnect alternator and charge coil leads.

c. Remove alternator and charge coil assembly.

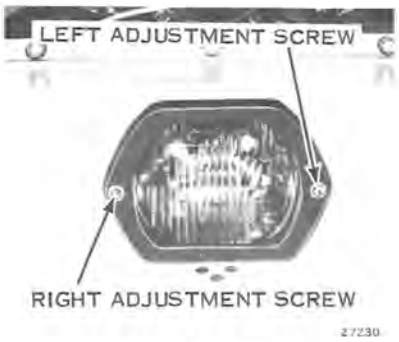

Figure 7-42

d. Install and connect new alternator and charge coil assembly. Make certain that coil laminations are flush with bosses on fan housing.

e. Reassemble as described in "IGNITION SYSTEM REPAIR - REASSEMBLY."

HEADLAMP ADJUSTMENT (See Figures 7-42 and 7-43)

Headlamp is adjustable for elevation of beam and right or left throw of beam.

For elevation, turn both adjustment screws in or out equally. With high beam on, adjust elevation of beam so that center of high intensity zone is 2 inches below center of lamp at a distance of 25 ft. from headlamp.

For right or left throw of beam, adjust either screw until proper aim is obtained.

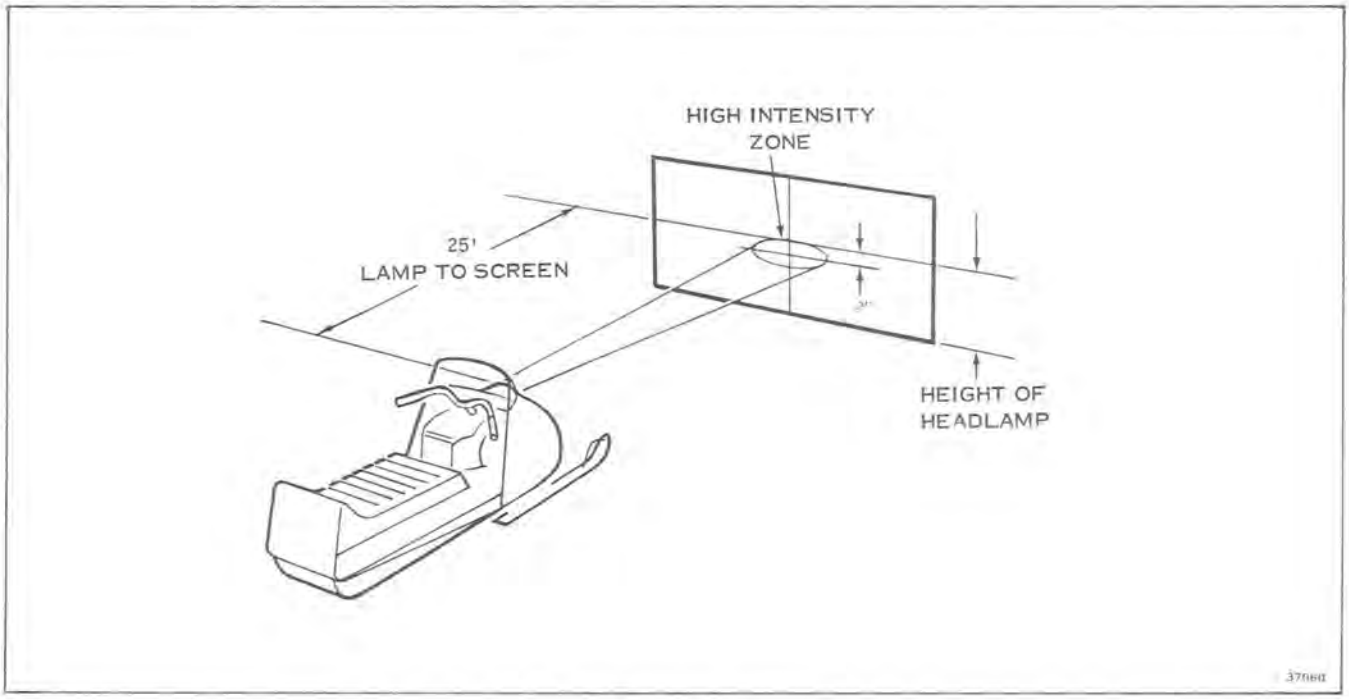

Figure 7-43

PEAK VOLTAGE TEST (USING MERC-O-TRONIC KILOVOLT METER MODEL 172)

1. Remove spark plug.
2. Connect high voltage probe to spark plug high tension lead and meter ground lead to a good engine ground. Set switch to -60 scale.
3. Pull starter vigorously with ignition and safety stop switches in "RUN" position. Observe meter reading.
4. Reading should be 18 kilovolts (minimum) (using manual starter).
5. If the reading on the kilovolt meter is 18 Kv or above the ignition system is functioning properly.
6. If the reading is lower than 18 Kv troubleshoot the ignition system components.