SECTION 3 - IGNITION and ELECTRICAL SYSTEMS

MERCURY
SNOWMOBILES

PART E - CHARGING and ELECTRIC START SYSTEMS

MERCURY
MARINE

INDEX

BATTERY - GENERAL

The battery comprises a number of separate elements, each located in an individual cell in a hard rubber case. Each element consists of an assembly of positive plates and negative plates which contain dissimilar active materials kept apart by separators. Elements are immersed in electrolyte composed of dilute sulfuric acid. Plate straps (located on top of each element) connect all positive plates and all negative plates into groups. Elements are connected in series electrically by connectors which pass directly thru case partitions between cells. Battery top is a one-piece cover. Cell connectors, which by-pass thru cell partitions, connect elements along shortest practical path.

With length of electrical circuit inside battery reduced to a minimum, internal voltage drop is decreased and results in improved performance, particularly during engine cranking at low temperatures.

A battery generally has 2 classifications of ratings: (1) a 20 hour rating at 80° F. and (2) a cold rating at 0° F. which indicates cranking load capacity. Ampere-hour rating (found on batteries) was based on 20-hour rating. For example, a battery capable of furnishing 3 amperes for 20 hours, while maintaining a specified average individual cell voltage, would be classified as a 60 ampere hour battery (e.g. 3 amperes x 20 hours = 60 A.H.).

PRECAUTIONS

When charging batteries, an explosive gas mixture forms in each cell. Part of this gas escapes thru holes in vent plugs and may form an explosive atmosphere around battery if ventilation is poor. This explosive gas may remain in or around battery for several hours after it has been charged. Sparks or flames can ignite this gas and cause an internal explosion which may shatter the battery.

The following precautions should be observed to prevent an explosion:

1. Do not smoke near batteries being charged or which have been charged very recently.
2. Do not break live circuits at terminals of batteries, because a spark usually occurs at the point where a live circuit is broken. Always be careful when connecting or disconnecting cable clamps on chargers. Poor connections are a common cause of electrical arcs which cause explosions.
3. DO NOT reverse polarity of battery terminal to cable connections, or Thunderbolt Ignition components can be severely damaged.

SPECIFIC GRAVITY READINGS

A hydrometer can be used to measure specific gravity of electrolyte in each cell. (Figure 1)

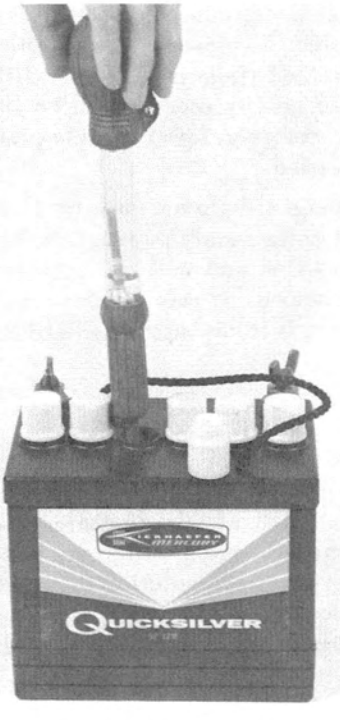

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Figure 1. Checking Specific Gravity

Hydrometer measures percentage of sulphuric acid in battery electrolyte in terms of specific gravity. As a battery drops from a charged to a discharged condition, acid leaves the solution and enters the plates, causing a decrease in specific gravity of electrolyte. An indication of concentration of electrolyte is obtained with a hydrometer.

When using a hydrometer, observe the following points:

1. Hydrometer must be clean, inside and out, to insure an accurate reading.
2. Never take hydrometer readings immediately after water has been added. Water must be thoroughly mixed with electrolyte by charging for at least 15 minutes at a rate high enough to cause vigorous gassing.
3. If hydrometer has built-in thermometer, draw liquid in several times to ensure correct temperature before taking reading.
4. Hold hydrometer vertically and draw in just enough liquid from battery cell so that float is free floating. Hold hydrometer at eye level so that float is vertical and free of outer tube, then take reading at surface of liquid. Disregard curvature where liquid rises against float stem due to capillarity.
5. Avoid dropping battery fluid on vehicle or clothing, as it is extremely corrosive. Any fluid that drops should be washed off immediately with baking soda solution.

Specific gravity of electrolyte varies not only with percentage of acid in liquid but also with temperature. As temperature increases electrolyte expands so that specific gravity is reduced. As temperature drops, electrolyte contracts so that specific gravity increases. Unless these variations in specific gravity are taken into account, specific gravity obtained by hydrometer may not give a true indication of concentration of acid in electrolyte.

A fully charged battery will have a specific gravity reading of approximately 1.270 at an electrolyte temperature of 80° F. If electrolyte temperature is above or below 80° F, additions or subractions must be made in order to obtain a hydrometer reading corrected to 80° F standard. For every 10° above 80° F, add 4 specific gravity points (.004) to hydrometer reading. Example: A hydrometer reading of 1.260 at 110° F would be 1.272 corrected to 80° F, indicating a fully charged battery.

For every 10° below 80° F, subtract 4 points (.004) from the reading. Example: A hydrometer reading of 1.272 at 0° F would be 1.240 corrected to 80° F, indicating a partially charged Battery.

SPECIFIC GRAVITY CELL COMPARISON TEST

This test may be used when an instrumental tester is not available. To perform this test, measure specific gravity of each cell, regardless of state of charge, and interpret results as follows:

- If specific gravity readings show a difference between highest and lowest cell of .050 (50 points) or more, battery is defective and should be replaced.

ELECTROLYTE LEVEL

Check electrolyte level in battery regularly. A battery, in use in hot weather, should be checked more frequently because of more rapid loss of water. If electrolyte level is found to be low, then colorless, odorless, drinking or distilled water should be added to each cell until liquid level rises approx. 3/16" over plates. DO NOT OVERFILL, because this will cause loss of electrolyte and result in poor performance, short life and excessive corrosion.

CAUTION: During service, only water should be added to the battery, not electrolyte.

Liquid level in cells should never be allowed to drop below top of plates, as portion of plates exposed to air may be permanently damaged with a resulting loss in performance.

CHARGING

The following basic rule applies to any battery charging situation:

1. Any battery may be charged at any rate in ampere for as long as spewing of electrolyte (from violent gassing) does not occur, and for as long as electrolyte temperature does not exceed 125° F. If spewing of electrolyte occurs, or if electrolyte temperature exceed 125° F., charging rate (in amperes) must be reduced or temporarily halted to avoid damage to the engerizer.

2. Battery is fully charged when, over a 2-hour period at a low charging rate in amperes, all cells are gassing freely (not spewing liquid electrolyte), and no change in specific gravity occurs. Full charge specific gravity is 1.260-1.275, corrected for electrolyte temperature with electrolyte level at split ring, unless electrolyte loss has occured (from age or over-filling) in which case specific gravity reading will be lower. For most satisfactory charging, lower charging rates in amperes are recommended.

3. If, after prolonged charging, specific gravity of at least 1.230 on all cells cannot be reached, battery is not in optimum condition and will not provide optimum performance; however, it may continue to provide additional service, if it has performed satisfactorily in the past.

CLEANING

External condition of battery should be checked periodically for damage such as cracked cover, case and vent plugs or for presence of dirt and corrosion.

Keep battery clean in area of the terminals. Accumulation of acid film and dirt may permit current to flow between terminals, which will slowly discharge the battery. For best results when cleaning batteries, wash first with a diluted ammonia or a soda solution to neutralize any acid present, then flush with clean water. Care must be taken to keep vent plugs tight, so that neutralizing solution does not enter cells.

CABLES

To insure good electrical contact, cables should be clean and tight. If cable terminals are corroded, cables should be disconnected and terminals cleaned separately with a soda solution and a wire brush. After cleaning and installing clamps, apply a thin coating of petroleum jelly on cable clamps to retard corrosion.

CARRIER and HOLD-DOWN

Battery carrier and hold-down should be clean and free from corrosion before installing battery. Carrier should be in sound mechanical condition so that it will support battery securely and keep it level.

To prevent battery from shaking in its carrier, hold-down bolts should be tight; however, bolts should not be tightened to the point where battery case or cover will be placed under a severe strain.

STORAGE

All lead acid batteries have an inherent self-discharge characteristic when not in use. Recharge every 45 days or when specific gravity drops below 1.230. Before charging, cover plates with distilled water, but not over 3/16'' above perforated baffles. Charge rate should not be more than 6 amperes. Discontinue charging when specific gravity reaches 1.260 and 80° F (27°C).

Store battery as follows:

1. Remove battery from its installation as soon as possible and remove all grease, sulfate and dirt from top surface with water hose and compressed air hose or other means.
2. Cover plates with distilled water, but not over 3/16'' above perforated baffles.
3. Lubricate terminal bolts well with cup grease or pettroleum jelly.
4. With battery in a fully-charged condition (specific gravity 1.260-1.275), store in a dry place, where temperature will not fall below freezing.
5. Remove battery from storage EVERY 45 days. Check water level and put on charge for 5 to 6 hours at 6 amperes. DO NOT FAST CHARGE.
6. When ready to place battery back into service, remove excess grease from terminals (leaving small amount on), recharge as necessary and reinstall in your snowmobile.

CHARGING and ELECTRIC START SYSTEMS

MODELS 220-250

GENERAL

CHARGING SYSTEM

Alternating current (generated in stator windings) flows to rectifier which produces direct current for charging battery. Negative side of rectifier is grounded; positive side connects to wiring harness. Direct current passes from rectifier, thru ammeter and on to positive side of battery. Negative side of battery is connected to engine ground.

WARNING: When installing battery, DO NOT reverse battery leads on battery terminals. DO NOT spark battery leads against battery terminals to check polarity. Damage to charging system components may result, if these precautions are not observed.

NOTE: On 220E and 220ER (below VEHICLE Serial No. 2547576), install an auxiliary ground strap as shown in Figure 1. Also remove the rectifier and all insulating material from the grounding surface to ensure proper grounding of the rectifier to the plate.

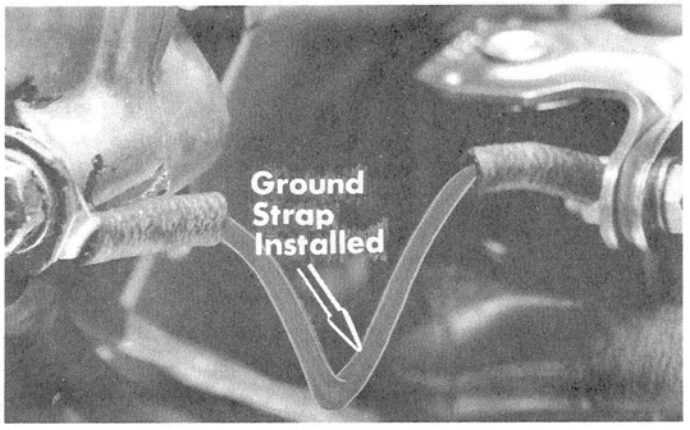


Figure 1. Auxiliary Grounding Strap Installed

ELECTRIC START SYSTEMS

A 12-volt battery supplies electrical power to operate electric start systems. These systems consist of a 12-volt starter and starter engaging mechanism and a starter solenoid on electric (E) models. They include dual starters and solenoids, a forward-reverse start switch and an electronic starter lock-out on electric reverse (ER) models.

Forward-reverse start switch located in dash is used to select direction of rotation in which engine is to be started. Starter lock-out prevents any possibility of energizing either forward or reverse start systems while engine is running.

IMPORTANT: All 250ER vehicles must be equipped with Starter Motor Protector D-59001A2.

COMPONENT CHECKS

CHARGING SYSTEM

Use VOA Electrical Tester (C-91-52751) and Magneto Analyzer (C-91-25213) for testing components.

IMPORTANT: Before making any tests with VOA Tester, turn meter selector to range specified and adjust pointer to ohms set position with small red and black leads clipped together. Ohms set position MUST BE readjusted each time meter range is changed.

STATOR ASSEMBLY - CHARGING CIRCUIT

Test charging circuit of stator assembly with VOA Tester. Disconnect both yellow/red leads from rectifier.

NOTE: Stator assembly may be checked without removing flywheel.

CHARGING CIRCUIT SPECIFICATIONS - STATOR

Check	Range	Reading
Between 2 yellow/red leads	RXI	.6-.9
Between either yellow/red and ground	RX1000	No continuity

DIODE RECTIFIER

Test diode rectifier with Magneto Analyzer. Turn selector switch to position No. 3 ("Coil Continuity") and clip small red and black leads together. Turn meter adjustment knob for Scale No. 3 until meter pointer lines up on right side (set position).

NOTE: Late model rectifiers have only two diodes and one alternator terminal.

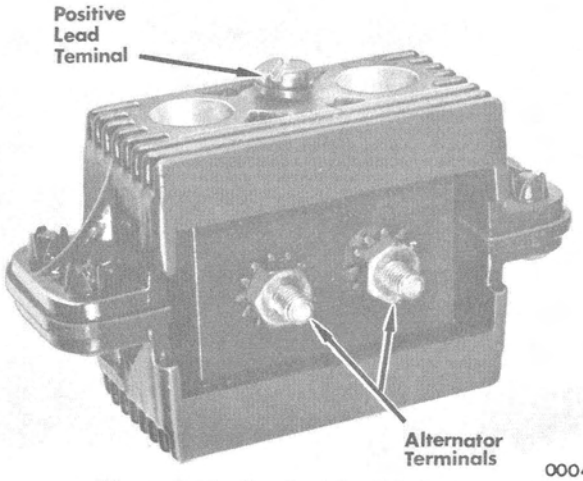


Figure 2. Testing Positive Diode

TESTING POSITIVE DIODES

1. Connect small red test lead to either alternator terminal and connect black lead to positive terminal of rectifier. (Figure 2) Meter pointer should move to right of Scale No. 3.
2. Reverse test leads on rectifier. Meter pointer should remain stationary at left side of Scale No. 3.
3. Repeat Steps "a" and "b" on the opposite alternator terminal. This will determine condition of positive diodes.

TESTING NEGATIVE DIODES

1. Connect small red test lead to either alternator terminal and connect black lead to positive terminal of rectifier. (Figure 3) Meter pointer should remain stationary at left side of Scale No. 3.
2. Reverse test leads on rectifier. Meter pointer should move to right side of Scale No. 3.
3. Repeat Steps "a" and "b" on opposite alternator terminal. This will determine condition of negative diodes.

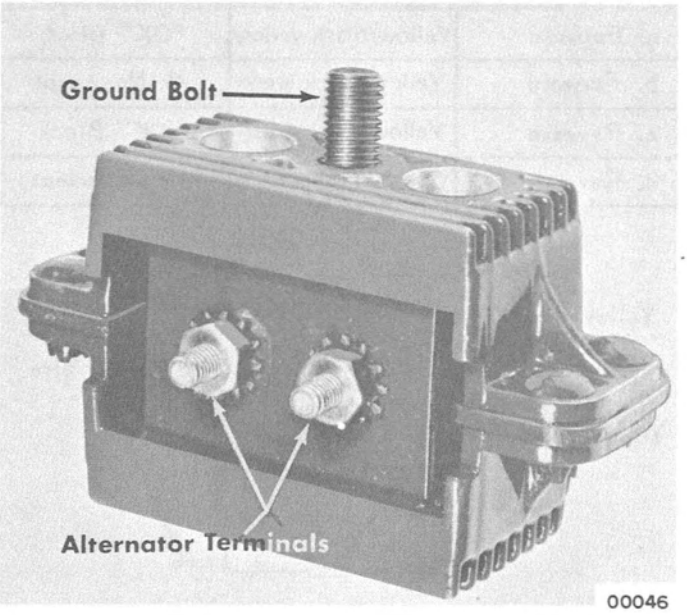


Figure 3. Testing Negative Diodes

COMPONENT CHECKS

STARTING SYSTEM

Use Magneto Analyzer (C-91-25213) for testing components.

STARTER SOLENOID(S)

1. Test starter solenoid(s) with Magneto Analyzer. Turn selector switch to position No. 2 ("Distributor Resistance") and clip small red and black leads together. Turn meter adjustment knob for Scale No. 2 until meter pointer lines up with set position on left side of "OK" block on Scale No. 2.
2. Connect small red test lead to one large terminal of solenoid and connect small black test lead to other large terminal as shown in Figure 4.
3. Using 12-volt battery and jumper leads, connect positive lead to small "S" terminal of solenoid.
4. Connect negative battery lead to "I" terminal of solenoid.
5. Meter pointer hand must move into the "OK" block, or solenoid is defective and must be replaced.

CAUTION: Do not connect battery leads to large terminals of solenoid, or meter will be damaged.

FORWARD - REVERSE START SWITCH ("ER" MODELS ONLY)

Test forward - reverse start switch with Magneto Analyzer. Turn selector switch to position No. 2 ("Distributor Resistance") and clip small red and black leads together. Turn meter adjustment knob for Scale No. 2 until meter pointer lines up with set position on left side of "OK" block on Scale No. 2.

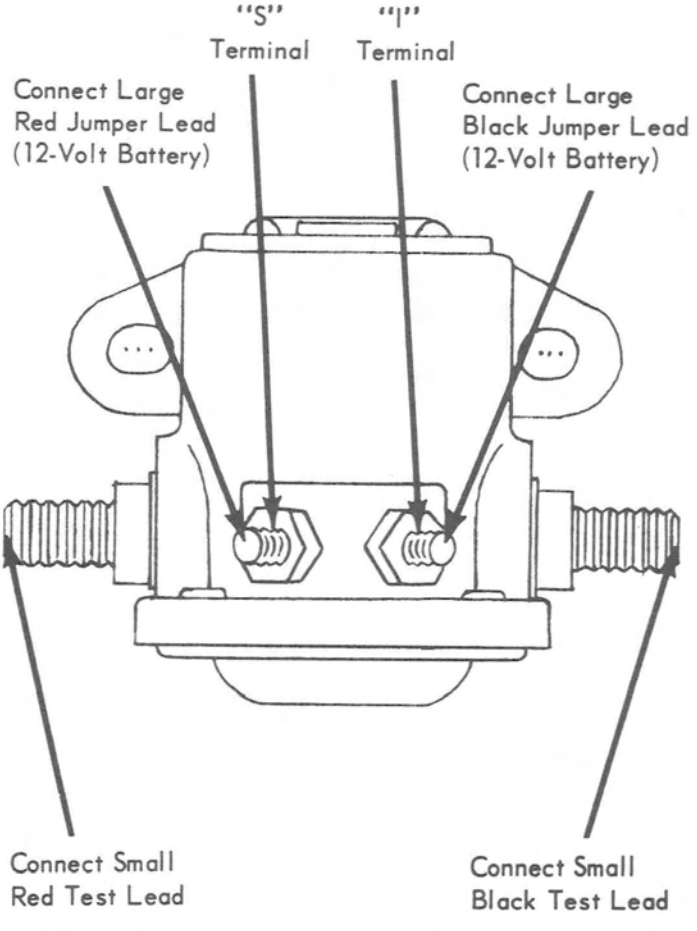


Figure 4. Testing Starter Solenoid

FORWARD-REVERSE START SWITCH TEST

Switch Position (Figure 5)	Between Terminals	Magneto Analyzer Pointer (Scale 2)
a. Forward	Yellow/black-yellow	"OK" Block
b. Forward	Yellow/black-green	No Movement
c. Reverse	Yellow/black-green	"OK" Block
d. Reverse	Yellow/black-yellow	No Movement

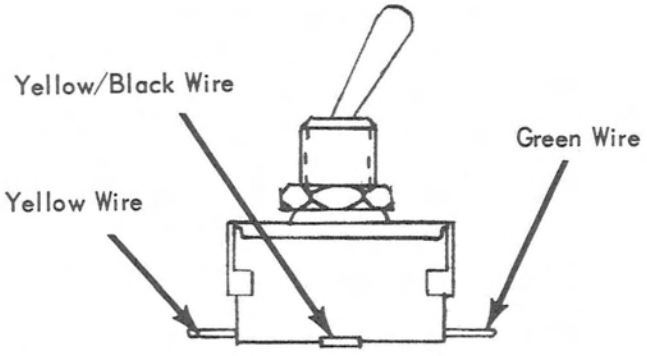


Figure 5. Side View of Forward - Reverse Start Switch

STARTER LOCK-OUT ("ER" MODELS ONLY)

The following electrical and/or trouble checks may be used to test starter lock-out and starter motor protector (D-59001A2).

NOTE: Starter lock-out shield (D-55320) MUST BE installed on all 220ER Snowmobiles below CHASSIS Serial No. 2547965. All snowmobiles above this serial number and all replacement starter lock-outs have an internal shield.

ELECTRICAL CHECKS

Use VOA Electrical Tester (C-91-52751) to test starter lock-out and starter motor protector, as outlined in the following chart.

IMPORTANT: Before making any tests with VOA Tester, turn meter selector to range specified and adjust pointer to ohms set position with small red and black leads clipped together. Ohms set position MUST BE readjusted each time meter range is changed.

STARTER LOCK-OUT CHECKS

Check	Range	Reading
Read lead to green terminal Black lead to casting	Rx100	10-15 ohms
Red lead to casting Black lead to green terminal	Rx100	12.5-17.5 ohms
Red lead to white terminal Black lead to casting	Rx1000	Slight up-scale deflection
Red lead to casting Black lead to white terminal	Rx1000	No continuity
Red lead to white terminal Black lead to green terminal	Rx1000	Slight up-scale deflection
Red lead to green terminal Black lead to white terminal	Rx1000	No continuity

STARTER PROTECTOR CHECKS

Check	Range	Reading
Red lead to any wire Black lead to casting	Rx1000	No continuity
Red lead to either brown wire Black lead to yellow wire directly opposite	Rx100	8-12 ohms
Red lead to either yellow wire Black lead to brown wire directly opposite	Rx1000	No continuity

TROUBLESHOOTING

1. NO START (either start system will not energize when ignition key is placed in the start position).

   CHECK

   a. Install a jumper wire from green starter lock-out terminal (with green/white wire connected) to a convenient ground.
   b. If forward and reverse start systems can be energized with this jumper wire installed, starter lock-out is inoperative and must be replaced.

2. NO LOCK-OUT FEATURE (forward start system can be energized while engine is running in forward rotation).

WARNING: DO NOT attempt to energize reverse electric start system while engine is running in either rotation above idle, or serious engine or starter motor damage can occur.

CHECK

a. With engine running in FORWARD rotation at idle (1250-1350 RPM), attempt to energize the FORWARD start system by briefly placing ignition key in start position.

b. If forward start system can be energized, starter lock-out is inoperative and must be replaced.

STARTER

Refer to Section 6 "Starters", for test and repair procedures.

CHARGING and ELECTRIC START SYSTEMS
ROCKET (339cc) and LIGHTNING (398cc)

GENERAL

CHARGING SYSTEM

Alternating current, generated in the flywheel magneto light winding, flows to a heat sink which produces direct current for battery charging. Direct current passes from the heat sink to the positive (+) terminal of the battery. Negative (-) terminal of battery goes to ground.

ELECTRIC START SYSTEM

A 12-volt battery supplies electrical power to operate the electric start system. This system consists of a 12-volt starter, starter solenoid and key switch.

HEAT SINK CHECKS

The heat sink functions as a rectifier to convert flywheel magneto current to direct current for battery charging. A fuse is located between the battery and heat diode to prevent damage to the magneto stator if the heat sink diode becomes shorted. The starter motor will continue to operate if the fuse is blown, but the battery will not charge. The rectifier can be checked as follows:

Use VOA Electrical Tester (C-91-52751) to test heat sink.

Check	Range	Reading
Red lead to heat sink plate Black lead to fuse terminal	R x 1	8-15 ohms
Red lead to fuse terminal Black lead to heat sink plate	R x 1	No continuity

STATOR CHECKS

Use VOA Electrical Tester (C-91-52751) to test light winding of stator as outlined in following chart.

IMPORTANT: Before making any tests with VOA Tester, turn meter selector to range specified and adjust pointer to ohms set position with small red and black leads clipped together. Ohms set position MUST BE readjusted each time meter range is changed.

Check	Range	Reading
Red lead to blue wire Black lead to ground	R x 1	.4 - .6 ohms

STARTER

Refer to Section 6 "Starters" for test and repair procedures.

BATTERY

Refer to preceding "Battery" section for battery information.

CHARGING and ELECTRIC START SYSTEMS

HURRICANE (644cc)

GENERAL

CHARGING SYSTEM

The charging system is a full wave rectifier which consists of 6 poles of the permanent magnet alternator. The rectifier portion of the charging circuit is located in the switch box.

ELECTRIC START SYSTEM

A 12-volt battery supplies electrical power to operate the electric start system. This system consists of a 12-volt starter, starter solenoid and key switch.

STATOR and SWITCH BOX - CHARGING CIRCUIT

1. Disconnect the 2 yellow/red wires from the yellow terminals on the switch box.
2. Disconnect the red/white stator wire from the in-line connector.
3. With a VOA Electrical Tester (C-91-52751), complete the following measurements, making sure that the pointer of the VOA Meter is adjusted to the ohms set position with the VOA leads shorted.

STATOR CHECKS

Check	Range	Reading
VOA leads connected to 2 yellow/red stator wires	Rx1	2-4
VOA leads connected to one yellow/red stator wire and red/white stator wire	Rx1	1-2
VOA leads connected to red/white stator wire and ground	Rx1000	No continuity

SWITCH BOX RECTIFIER CHECKS

Check	Range	Reading
1. Red VOA lead to ground and black VOA lead to each yellow terminal	Rx1	7-14*
2. Reverse VOA leads in Step 1	Rx1000	No * continuity

* *If checks indicate rectifier circuitry in switch box is malfunctioning, DO NOT replace switch box; install Rectifier Kit (D-57580A3).*

STARTER

Refer to Section 6 "Starters" for test and repair procedure.

BATTERY

Refer to preceding "Battery" section for battery information.

CHARGING and ELECTRIC START SYSTEMS
440 MAX (438cc) with CHASSIS
SERIAL NO. 3447382 and BELOW

GENERAL

CHARGING SYSTEM

Alternating current (AC), generated in the flywheel magneto light winding, flows to a rectifier which produces direct current (DC) for battery charging. Direct current flows from rectifier thru a fuse to battery.

ELECTRIC START SYSTEM

A 12-volt battery supplies electrical power to operate the electric start system. This system consists of a 12-volt starter motor, starter solenoid and key switch.

RECTIFIER CHECKS

Rectifier converts flywheel magneto current to direct current for battery charging. A fuse is located between battery and rectifier to prevent damage to magneto stator if rectifier becomes shorted. Starter motor will continue to operate if fuse is "blown", but battery will not charge. Rectifier can be checked as follows:

NOTE: Use VOA Electrical Tester (C-91-52751) to test rectifier. Remove yellow rectifier wire from terminal block and red rectifier wire from fuse.

Check	Range	Reading
Red VOA lead to red wire, black lead to yellow wire.	Rx1000	No continuity
Black VOA lead to red wire, red VOA lead to yellow wire.	Rx1000	Continuity

STATOR PLATE - LIGHT (CHARGING) WINDING CHECKS

Use VOA Electrical Tester (C-91-52751) to test light winding of stator plate as outlined in following chart.

IMPORTANT: Before making any tests with VOA Tester, turn meter selector to range specified and adjust pointer to ohms set position with small red and black leads clipped together. Ohms set position MUST BE readjusted each time meter range is changed.

Check	Range	Reading
Between 2 yellow wires	Rx1	.1 - .5
Red VOA lead to one yellow wire, black lead to ground.	Rx1000	No continuity
Red VOA lead to other yellow wire, black lead to ground.	Rx1000	No continuity

STARTER MOTOR/STARTER SOLENOID/BATTERY

Refer to Section 6, Part B ("Starter Motors") for starter motor and solenoid test and repair procedures.

Refer to preceding "Battery" section for battery information.

CHARGING and ELECTRIC START SYSTEMS

MARK I (644cc) and MARK II (644cc)

GENERAL

CHARGING SYSTEM

Alternating current (AC), generated in the flywheel stator winding, flows to a full wave rectifier which produces direct current (DC) for battery charging. Direct current flows from rectifier thru fuse to battery.

ELECTRIC START SYSTEM

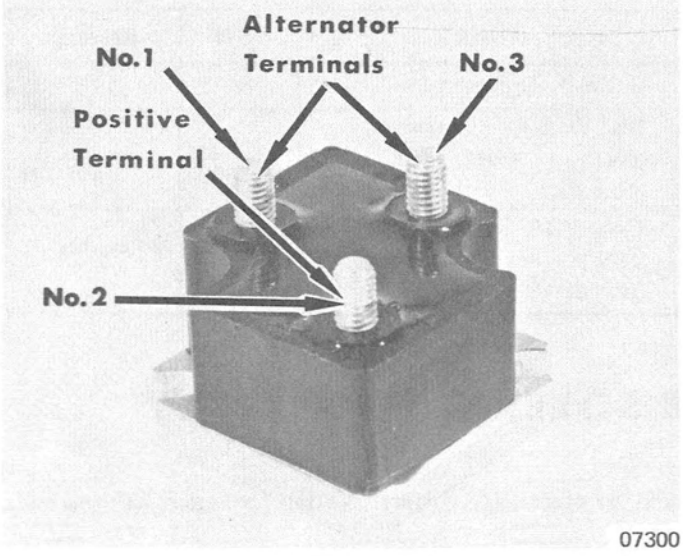
A 12-volt battery supplies electrical power to operate the electric start system. This system consists of a 12-volt starter motor, starter solenoid and key switch.

RECTIFIER CHECKS

Rectifier converts flywheel stator current to direct current for battery charging. A fuse is located between battery and rectifier to prevent damage to snowmobile circuitry and electrical components. Starter motor and lights WILL NOT operate if fuse is "blown". Rectifier can be checked as follows:

NOTE: Use VOA Electrical Tester (C-91-52751) to test rectifier. Red and yellow/red wires must be removed from rectifier before testing.

IMPORTANT: Before making any tests with VOA Tester, turn meter selector to range specified and adjust pointer to ohms set position with small red and black leads clipped together. Ohms set position MUST BE readjusted each time meter range is changed.



NOTE: Refer to Figure 1 for rectifier terminal identification.

Check	Range	Reading
Red VOA lead to ground, black lead alternately to terminals one (1) and 3.	Rx1000	Continuity
Black VOA lead to ground, red lead alternately to terminals one (1) and 3.	Rx1000	No continuity
Black VOA lead to terminal 2, red lead alternately to terminals one (1) and 3.	Rx1000	Continuity
Red VOA lead to terminal 2, black lead alternately to terminals one (1) and 3.	Rx1000	No continuity

Figure 1. Mark I and Mark II Rectifier

STATOR - CHARGING CIRCUIT CHECKS

Use VOA Electrical Tester (C-91-52751) to test charging circuit winding of stator, as outlined in following chart.

IMPORTANT: Before making any tests with VOA Tester, turn meter selector to range specified and adjust pointer to ohms set position with small red and black leads clipped together. Ohms set position MUST BE readjusted each time meter range is changed.

Remove 4 yellow/red wires from rectifier. Two of the yellow/red wires are tachometer wires and 2 are stator charging circuit wires. The 2 yellow/red wires, which extend thru the backplate below the starter motor, are stator charging circuit wires.

NOTE: Refer to "Ignition and Electrical Systems" Section 3B for stator ignition winding tests.

Check	Range	Reading
Between 2 yellow/red wires.	Rx1	.4 - 1.5
Red VOA lead to one yellow/red wire, black lead to ground.	Rx1000	No continuity
Red VOA lead to other yellow/red wire, black lead to ground.	Rx1000	No continuity

STARTER MOTOR/SOLENOID/BATTERY

Refer to Section 6, Part B ("Starter Motors") for starter motor test and repair procedures.

Refer to this section, Page 3E-5, for starter solenoid tests.

Refer to preceding "Battery" section for battery information.

CHARGING and ELECTRIC START SYSTEMS
440 MAX, 440 M/X and 440 S/R with CHASSIS SERIAL NO. 3709838 thru 4064696

GENERAL

CHARGING SYSTEM

Alternating current (AC), generated in the flywheel stator windings, flows to a voltage regulator and full wave rectifier which produces regulated direct current (DC) for battery charging. Direct current flows from rectifier thru fuse to battery.

ELECTRIC START SYSTEM

A 12-volt battery supplies electrical power to operate the electric start system which consists of a 12-volt starter motor, starter solenoid and key switch.

A fuse is located between battery and rectifier to prevent damage to snowmobile circuitry and electrical components. Starter motor, charging system and lights WILL NOT operate if fuse is "blown".

STATOR - LIGHT (CHARGING) WINDING CHECKS

Disconnect chassis electrical harness from engine electrical harness by separating connector located by secondary ignition coils. Use VOA Electrical Tester (C-91-52751) to perform the following stator checks:

IMPORTANT: Before making any tests with VOA Tester, turn meter selector to range specified and adjust pointer to ohms set position with red and black meter leads clipped together. Ohms set position MUST BE readjusted each time meter range is changed.

Check	Range	Reading
VOA leads connected between 2 yellow stator wires.	R x 1	.1 - .5
VOA leads connected between one yellow stator wire and ground.	R x 1000	No continuity
VOA leads connected between other yellow stator wire and ground.	R x 1000	No continuity

RECTIFIER CHECKS

Disconnect red, yellow/red, yellow and brown wires from rectifier terminals. Use VOA Electrical Tester (C-91-52751) to perform following rectifier checks, being sure that pointer of VOA Meter is adjusted to ohms set position with VOA leads shorted.

NOTE: Refer to Figure 1 for rectifier terminal identification.

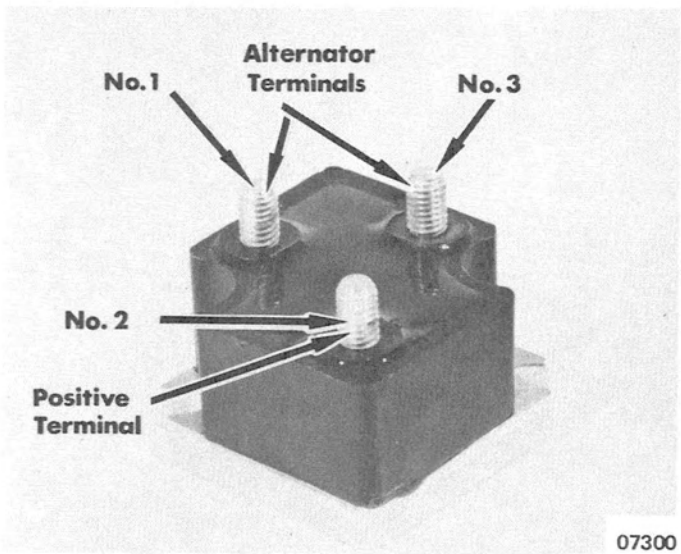


Figure 1. Rectifier Assembly

Check	Range	Reading
Red VOA lead to ground, black lead alternately to terminals one (1) and 3.	R x 1000	Continuity
Black VOA lead to ground, red lead alternately to terminals one (1) and 3.	R x 1000	No continuity
Black VOA lead to terminal 2, red lead alternately to terminals one (1) and 3.	R x 1000	Continuity
Red VOA lead to terminal 2, black lead alternately to terminals one (1) and 3.	R x 1000	No continuity

VOLTAGE REGULATOR

IMPORTANT: A defective voltage regulator usually will result in failure of charging system on an electric model and no lights on a manual model. Lights will continue to operate on an electric model until battery is discharged.

After checking stator-light (charging) windings and rectifier as outlined preceding, and voltage regulator is suspected of causing the failure, check voltage regulator in either manner as outlined following:

1. Install new voltage regulator and check operation of battery charging system.
2. On electric starting snowmobiles, disconnect red fused wire from No. 2 terminal of rectifier. (Figure 1) Using VOA Electrical Tester (C-91-52751), proceed as follows:
   a. With VOA Meter turned to 50 amps range, connect VOA leads between red fused wire and No. 2 terminal of rectifier. (Figure 1)
   b. With snowmobile lights turned off, manually start snowmobile engine. Run engine at IDLE speed and check output of charging system. Output should be 3-5 amps at 2,000 to 2,500 RPM's. Stop engine. If output is OK, refer to "Starter Motor/Solenoid/Battery", following. If no output, refer to "Step C", following.

CAUTION: DO NOT operate engine above IDLE SPEEDS or for an extended period of time with wire(s) disconnected.

   c. Disconnect brown and yellow voltage regulator wires from rectifier. With snowmobile lights turned off, manually start snowmobile engine. Run engine at IDLE speed and check output of charging system. Output should be 3-5 amps at 2,000 to 2,500 RPM's. Stop engine. If VOA meter now shows an output, voltage regulator is faulty and must be replaced. If still no output, check the following components: Rectifier, fuse, stator-light (charging) windings, all circuitry and all electrical connections.

STARTER MOTOR/STARTER SOLENOID/BATTERY

Refer to Section 6, Part B ("Starter Motors") for starter motor and solenoid test and repair procedures.

Refer to preceding "Battery" section (Page 3E-1) for battery information.

CHARGING and ELECTRIC START SYSTEMS
440 M/X and 440 S/R with CHASSIS SERIAL NO. 4064697 and ABOVE

GENERAL

CHARGING SYSTEM

Alternating current (AC), generated in the flywheel stator windings, flows to a voltage regulator/rectifier assembly which produces regulated direct current (DC) for battery charging. Direct current flows from voltage regulator/rectifier assembly thru fuse to battery.

ELECTRIC START SYSTEM

A 12-volt battery supplies electrical power to operate the electric start system which consists of a 12-volt starter motor, starter solenoid and key switch.

A fuse is located between battery and voltage regulator/rectifier assembly to prevent damage to snowmobile circuitry and electrical components. Starter motor, charging system and lights WILL NOT operate if fuse is "blown".

STATOR - LIGHT (CHARGING) WINDING CHECKS

Disconnect chassis electrical harness from engine electrical harness by separating connector located by secondary ignition coils. Use VOA Electrical Tester (C-91-52751) to perform the following stator checks:

IMPORTANT: Before making any tests with VOA Tester, turn meter selector to range specified and adjust pointer to ohms set position with red and black meter leads clipped together. Ohms set position MUST BE readjusted each time meter range is changed.

Check	Range	Reading
VOA leads connected between 2 yellow stator wires.	R x 1	.1 - .5
VOA leads connected between one yellow stator wire and ground.	R x 1000	No continuity
VOA leads connected between other yellow stator wire and ground.	R x 1000	No continuity

VOLTAGE REGULATOR/RECTIFIER ASSEMBLY

IMPORTANT: A defective regulator/rectifier assembly usually will result in either failure of battery charging system or overcharging of battery. If battery charging fails, lights and starter motor will be operable until battery is discharged. If battery is being overcharged, frequent water fillings may be required to maintain correct electrolyte level.

If, after checking fuse and stator-light (charging) windings as outlined, preceding, the regulator/rectifier assembly is suspected of causing the failure, check the regulator/rectifier in either manner as outlined following:

1. Install new voltage regulator/rectifier and check operation of battery charging system (lights and starter motor should be operable). If charging system still is not operating correctly, carefully check all circuitry, all electrical connections and refer to "Starter Motor/Starter Solenoid/Battery", following.
2. Disconnect red fused wire from terminal of terminal block. Using VOA Electrical Tester (C-91-52751), proceed as follows:
   a. With VOA Meter turned to 50 amps range, connect VOA leads between red fused wire and terminal of terminal block with 2 red wires still attached.
   b. With snowmobile lights turned off, MANUALLY START SNOWMOBILE ENGINE. Run engine at IDLE speed and check output of charging system with meter. Output should be 3 to 6 amps at 3,000 RPM (output will depend on condition of battery). Stop engine. If output is OK, refer to "Starter Motor/Starter Solenoid/Battery", following. If no output, refer to "Step 1", preceding.

STARTER MOTOR/STARTER SOLENOID/BATTERY

Refer to Section 6, Part B ("Starter Motors") for starter motor and solenoid test and repair procedures.

Refer to preceding "Battery" section (Page 3E-1) for battery information.