# M-F 1010/1020 CHARGING SYSTEM

## Part 9—Section B

## Table of Contents

# M-F 1010/1020 CHARGING SYSTEM

## GENERAL INFORMATION

Above tractors utilize a charging system consisting of an alternator and remotely located regulatory rectifier assembly to maintain correct system voltage and battery charge state whenever the engine is operating.

The alternator produces alternating currect (AC) and features permanently magnetized fields rotating around a stationary stator coil. As the fields are permanently magnetized, no excitation current is necessary to initiate system charging. The alternator is very basic in design as no brushes are required and all rectification and control of output current takes place in the regulatory rectifier.

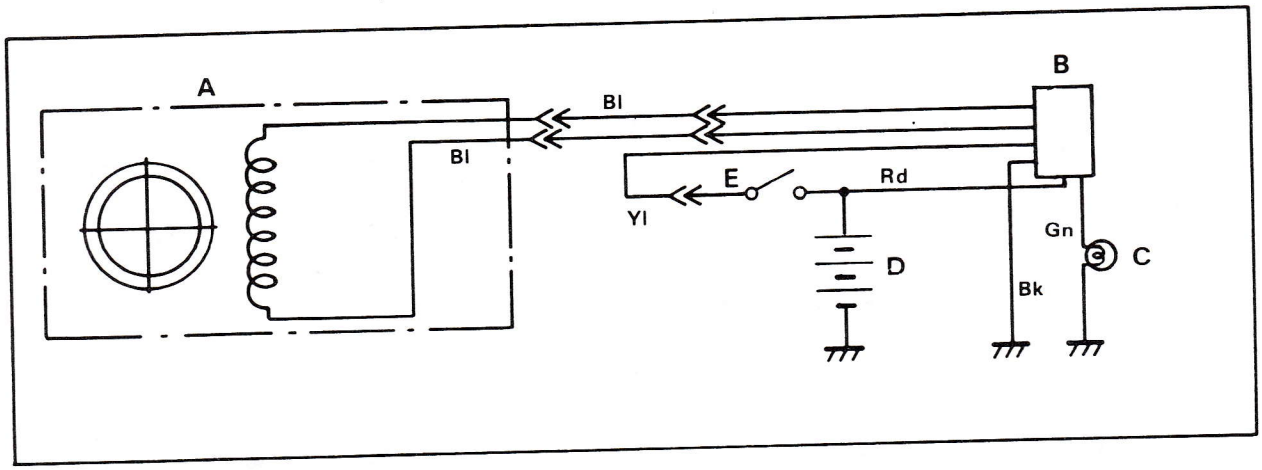
The regulatory rectifier rectifies the AC current to direct current (DC) and also controls maximum system voltage. It should be noted that the alternator produces maximum output (according to speed) at all times and that the regulatory maintains system voltage at a usable level. Once the correct voltage level is attained, the regulator directs any excess voltage to prevent high electrical system voltage and electrical component damage. The regulator features a sealed aluminum housing, all internal components being encased in epoxy resin.

## SPECIFICATIONS

| | M-F 1010 | M-F 1020 |
|---|---|---|
| **Alternator** | | |
| Model | GP 8122 | GP 9153 |
| Field Type | Permanent, 8 pole | Permanent, 12 pole |
| Rotation (viewing pulley) | Clockwise | Clockwise |
| Performance @ 14 Volts | 12.5 amp @ 4000 rpm | 19.0 amp @ 5000 rpm |
| Revolutions | 1000-5000 rpm | 1600-6500 rpm |
| Maximum Speed | 12000 rpm | 12000 rpm |
| Bearings | Sealed Ball | Sealed Ball |
| Start Charge | 1800 rpm, less than 13 volts | 1600 rpm, less than 13 volts |
| **Regulator** | | |
| Model | RS5112 | RS5104 |
| Type | Series Control, Thyrister | Series Control, Thyrister |
| Regulator Voltage | 14.5 ± .5 V @ 4000 rpm | 14.5 ± .5 V @ 5000 rpm |
| Threshold Voltage | 1800 rpm, less than 13 volts | 1600 rpm, less than 13 volts |
| Temperature Range C° | -20° to 40° | -20° to 40° |
| Temperature Range F° | -4° to 104° | -4° to 104° |
| Cooling | Aluminum Fins | Aluminum Fins |

**IMPORTANT: Alternator and regulators are matched and must not be intermixed between models. Ensure identical replacement are used.**

## General Wiring Diagram



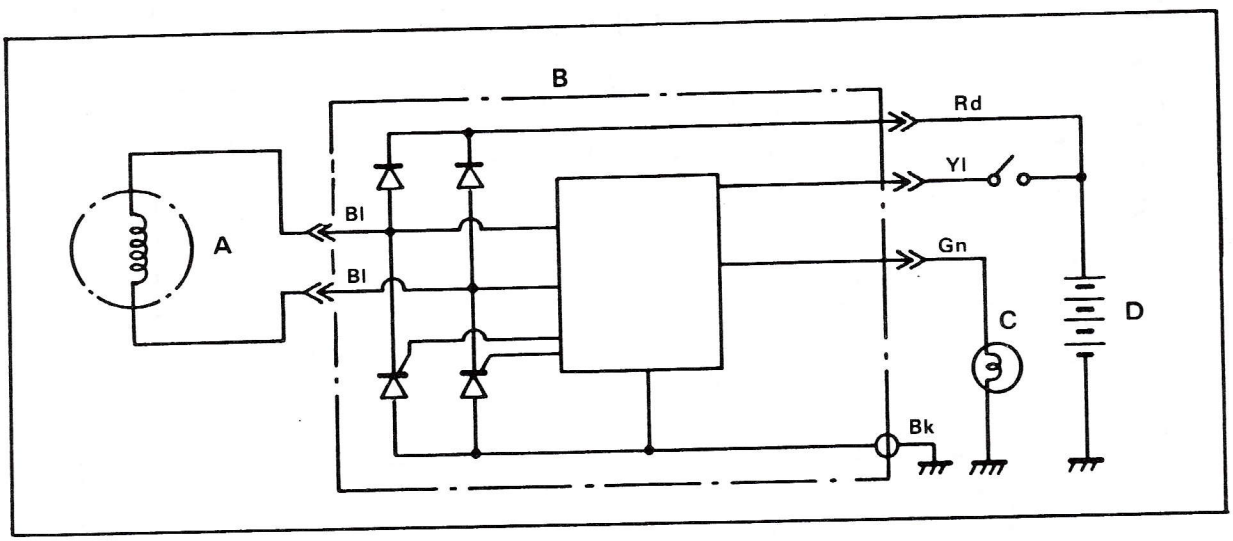

**Key**

A — Alternator
B — Regulator
C — Charge Indicator Lamp (3, 4W, 12V)
D — Battery (12V)
E — Ignition Switch Connections

**Color Key**

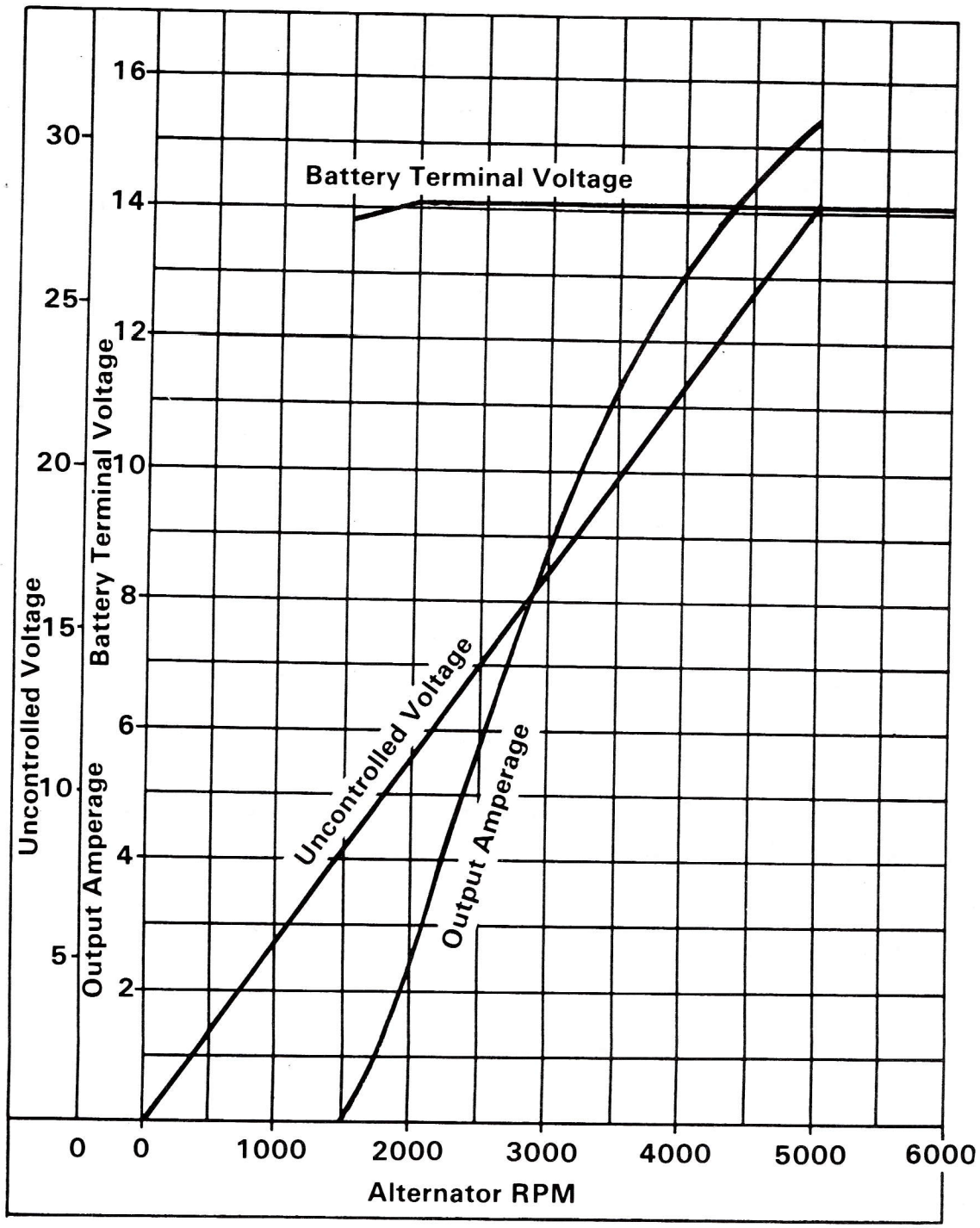
Bl — Blue
Rd — Red
Bk — Black
Gn — Green
Yl — Yellow

## Regulator Internal Diagram



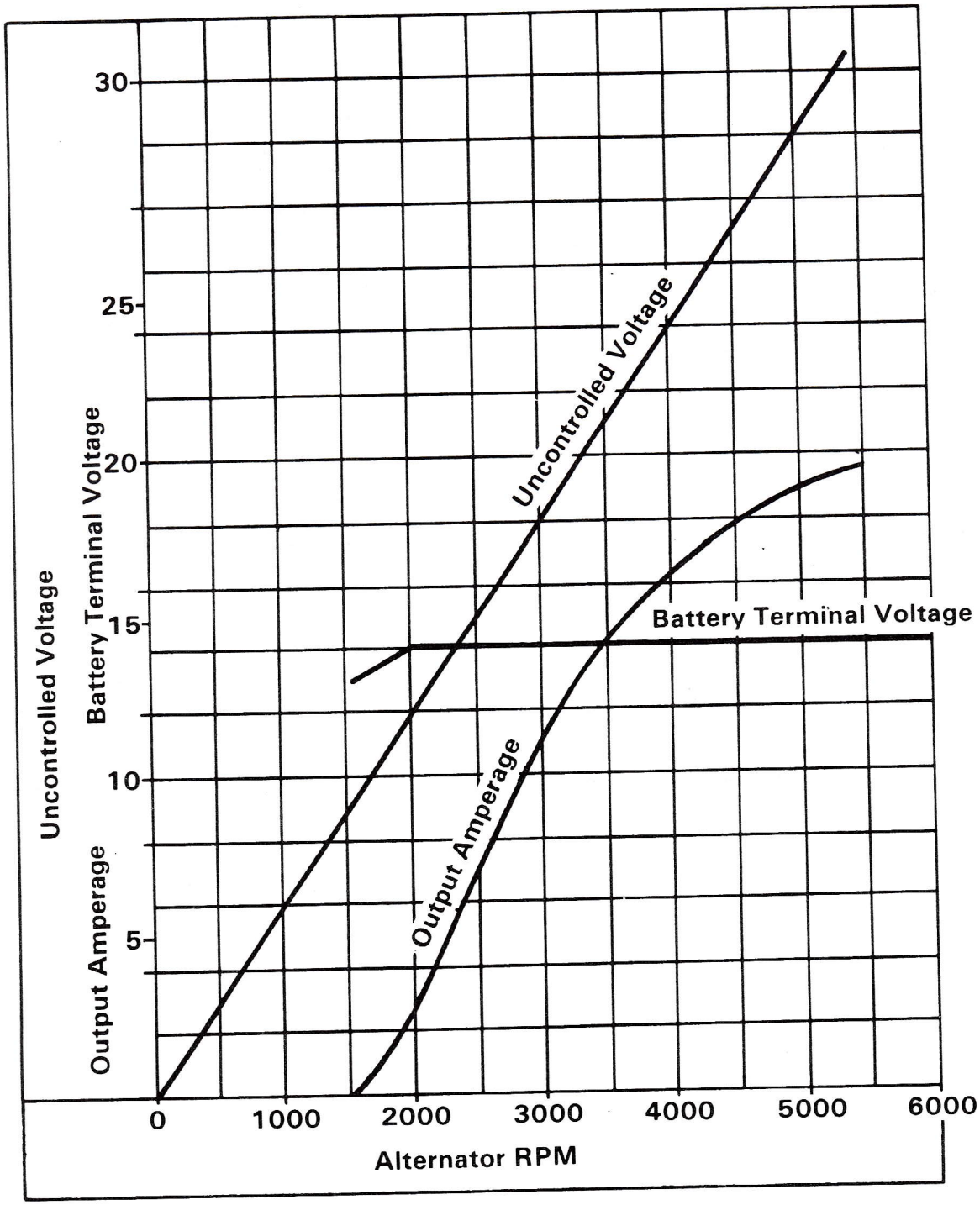
**Performance Charts**

The following charts graphically depict output amperage and voltage of alternator in its regulated state, regulated voltage at battery terminals, and uncontrolled output voltage of alternator only.




**M-F 1010 Alternator Output — Controlled and Uncontrolled.**

Charging Performance after running for 5 minutes at 14V load)




M-F 1020 Alternator Output — Controlled and Uncontrolled.

Charging Performance after running for 5 minutes at 14V load)

# M-F 1010/1020 CHARGING SYSTEM

## Charging System Precautions

| | Condition | Results |
|---|---|---|
| 1 | There should not be wrong wiring to battery. Take care of (+) (-) and lead wire colors. | Short connection of battery:<br>1. Alternator coil is burned.<br>2. Regulator is burned. |
| 2 | Running at a speed over the rated rotation. | Alternator coil is burned. Ball bearing is out of order. Regulator is out of order. |
| 3 | Belt tension should not be made higher than necessary limit. | Pulley and ball bearing are damaged. |
| 4 | Flywheel outer circumference should not be given a shock or large blow. | Flywheel is deformed. Magnets are dislodged or damaged. |
| 5 | Lead wires should not hang down. | Lead wire is broken or connection uncoupled. |
| 6 | It should always be operated under normal mounting condition in accordance with the wind speed by the engine fan. | Alternator and regulator are burned. |
| 7 | Water should not be poured on the alternator main body. | Short circuit in alternator. Ball bearing damaged. |
| 8 | Shaft tightening torque for dismantling and assembly should be 28-33 N.m (21-25 ft.-lbs.). | Flywheel is damaged by loosened screw. |
| 9 | Parts should be changed with genuine parts. | Incompatibility may result. |

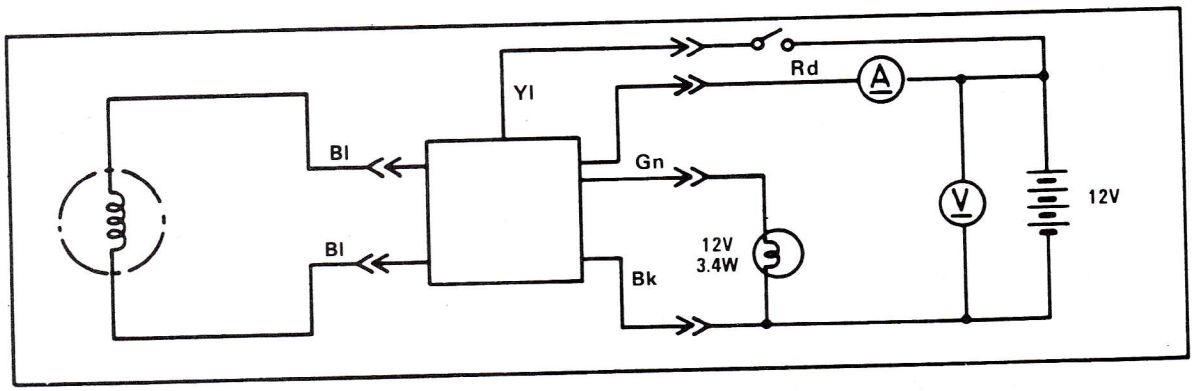
## Maintenance and Inspection

1. It should not be kept in a dusty place or in a hot and humid place.
2. When dust, mud, water and oil, etc. have collected in large amounts to the alternator or lead wires, they should be cleaned up before operation.
3. Belt must have adequate tension and should be checked periodically to prevent slipping.

## PERFORMANCE TESTING THE SYSTEM

9B—01—07

**Procedure**




Special Tools: DC Voltmeter, 0-30 volts
DC Ammeter, 0-5 amps

1. Always disconnect battery cables, negative first, prior to making gauge or meter connections.
2. Install DC voltmeter and DC ammeter in circuit, as shown above.
3. Turn ignition switch to ON. Charge indicator light will illuminate.

**NOTE: If lamp fails to illuminate, check bulb and connecton condition. Make sure battery is in good condition.**

4. Start engine and run at low speed.
5. As engine speed reaches 1400 rpm (M-F 1010) or 1000 rpm (M-F 1020), the indicator light should go out.
6. Slowly increase engine speed noting voltmeter and ammeter readings.
7. At less than 1600-1800 alternator rpm, the ammeter will begin to register output current and the voltmeter reading will begin to rise.
8. Increase rpm further, noting the voltmeter reading will reach 14.5 ± .5 volts and stabilize. Once voltage stabilizes and battery reaches full charge state, the output current as shown on ammeter will begin to decrease and stabilize at a lesser value.
9. Switch on lights. Voltmeter reading should dip briefly and restabilize at previous voltage. Ammeter reading should stabilize at slightly higher output reading.

**NOTE: Time required for voltage to stabilize and charge rate to clearance will depend upon battery charge state. Battery in poor condition may not permit stabilization. If this occurs, temporarily install new battery.**

10. Switch off lights and increase engine speed to maximum. Voltage should remain at stabilized level.
11. Reduce speed and shut off engine.

**Interpretation of Results**

12. If above conditions are satisfied, and ammeter indicates 11-12 amps (M-F 1010) or 16-18 amps (MF 1020) as battery is being charged, the system is satisfactory.
13. If results are abnormal:
    (a) Recheck all connections and retest if necessary.
    (b) If you drive the alternator at maximum rpm, but ammeter does not oscillate (battery is not charged), disconnect the alternator wiring connector and test the alternator, Operation 9B—02—08, and measure the uncontrolled voltage. If it indicates correct AC voltage at maximum rpm and no abnormality is observed in the insulation (between coil and body) of the alternator, you can decide that the regulator is defective, subject to the wiring being normal.
    (c) If voltage indication goes over 15V, it means that the regulator is defective, subject to the wiring being normal.
    (d) If ammeter and voltmeter meters make large swings to right and left or ammeter meter swings only little (voltage is below 14V) or charge indicator lamp does not go out, you have to confirm the uncontrolled voltage of the alternator, Operation 9B—02—08. and the insulation. If you find no abnormality, the regulator is defective.

## ALTERNATOR UNCONTROLLED VOLTAGE TEST

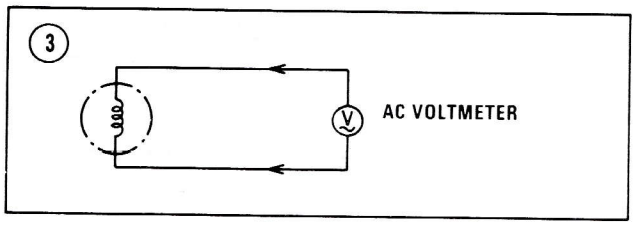
**Procedure** **9B—02—08**

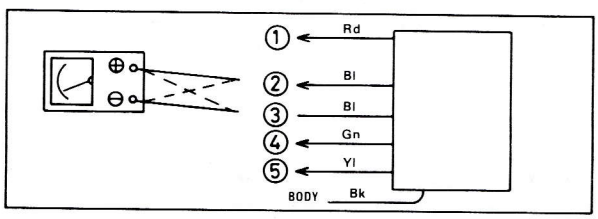
**NOTE: This test must be done with an AC VOLTMETER.**

1. Disconnect the battery cables, negative cable first in interest of safety.
2. Unplug wiring connector at the rear of the alternator.
3. Connect AC voltmeter to alternator leads.
4. Reconnect battery and start tractor.
5. Increase engine speed to maximum and observe voltmeter.
   Reference Value:
   M-F 1010..... 25 volts AC
   M-F 1020..... 30 volts AC
6. Reduce rpm and shut off engine.
7. Disconnect battery cables.
8. Reverse procedures 1 to 3.

If alternator tests satisfactorily, but system did not operate properly in performance test, the regulator can be considered suspect. If alternator does not reach uncontrolled voltage in step 5 after several minutes, the alternator should be tested for continuity through the coil leads with an ohmmeter. In addition, resistance between each alternator lead and alternator housing should be checked with an ohmmeter. Continuity should be indicated through coil leads. Very high resistance should be indicated between coil and housing.

**NOTE: All resistance and continuity checks must be done with an ohmmeter and the engine off to prevent meter damage.**




## REGULATOR CONTINUITY TEST

**Procedure** **9B—03—08**

**NOTE: With this method, and you cannot find abnormality 100%. However, as it is an easy method, its usage can often confirm a defective regulator. All checks done with regulator plug disconnected.**

1. Refer to illustration at right. If you measure a solid line by the ohmmeter you will get a value different from the one obtained by reversing test leads as shown as dashed line.
2. Therefore, please measure the same set of regulator leads two times, alternating (+) and (-) leads.

**NOTE: Never use a voltage tester, since it gives a high voltage that will destroy the regulator.**

3. The following chart shows only a normal case, checked by a ohmmeter. Reverse leads of the ohmmeter and check if the needle oscillates to opposite end of meter scale.

**Ohmmeter Checking Chart (Prior to Reversing Leads)**

| Tester (-) Terminal (Black) | Ohmmeter (+) Terminal (Red) | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | Body |
| 1 | — | OFF | OFF | OFF | OFF | OFF |
| 2 | ON | — | OFF | OFF | OFF | OFF |
| 3 | ON | OFF | — | OFF | OFF | OFF |
| 4 | OFF | OFF | OFF | — | OFF | OFF |
| 5 | ON | ON | ON | OFF | — | ON |
| Body | OFF | OFF | OFF | OFF | OFF | — |

**NOTE: 1. If oscillates — ON.**
**2. If no oscillation — OFF.**
**3. The higher the range used, the larger the oscillation of the needle in ON condition making it easier to indentify.**

## ALTERNATOR

**Disassembly and Reassembly** **9B—04—09**

**Disassembly**

1. Remove the hexagonal nut, lock washer and flat washer, while holding the end of shaft.

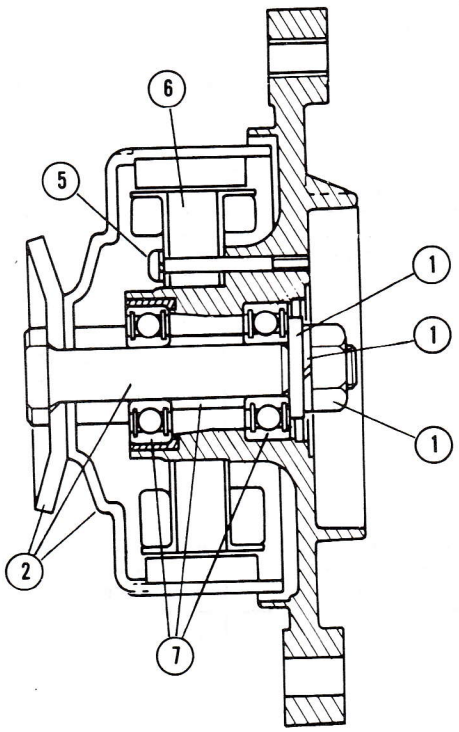
**NOTE: Take care not to give force to the outer circumference of flywheel.**

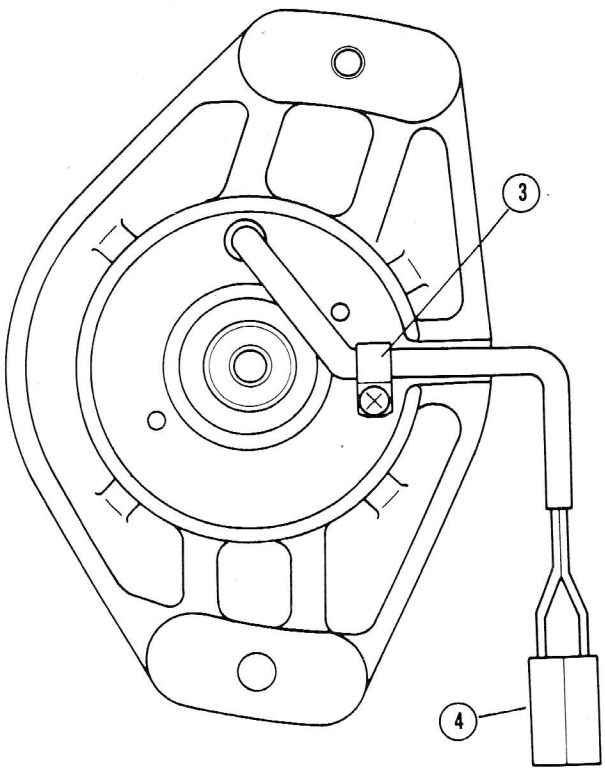
2. Pull out flywheel, pulley and shaft assembly. Strike the threaded end of shaft gently with a wooden hammer, etc., to dislodge.
3. Detach the lead wires and clamp.
4. Remove the wire leads from connector block by depressing inside edges of connector terminals.
5. Remove the two screws retaining the coil.
6. Withdraw the coil assembly, pulling the wire leads through the housing.
7. Press off the bearings and spacer collar as required.

**Reassembly**

8. Reverse procedures 1 to 7, except:

Assemble the alternator in reverse steps of dismantling.



# M-F 1010/1020 CHARGING SYSTEM

## TROUBLE-SHOOTING

**Performance Testing — Inspection in assembled condition.**

**Maximum Rpm**

| Test | Normal | Condition | Cause |
|---|---|---|---|
| Relation between charging current and battery terminal voltage. | M-F 1010 — Output 12.5 amps at less than 14 volts. Output 0-12.5 amps at 14-15 volts.<br>M-F 1020 — Output 19 amps at less than 14 volts. 0-19 amps at 14-15 volts. | Excessive output amperage at more than 15 volts. | Regulator defective. |
| | | Charging amperage 0 at less than 14 volts. | Connection defective. Regulator defective. Alternator defective. |
| | | Charging current adequate, but battery terminal voltage is low. | Battery defective. |

**Alternator Test — Inspection of alternator only.**

| Test | Normal | Condition | Cause |
|---|---|---|---|
| No load AC voltage during operation. | Over approximately:<br>M-F 1010—25 volts AC.<br>M-F 1020—30 volts AC. | Less than specified output. | Flywheel demagnetized, alternator disconnected. |
| Resistance of armature with ohmmeter. | Continuity. | Open. | Coil disconnected or open. |
| Resistance test between armature leads and alternator housing. | Over 3M ohms. | Under 3M ohms. | Insulation of armature defective. Grounded. |
| Flywheel is rotated slowly by hand. | Should rotate rather smoothly with 8 (M-F 1010) or 12 (M-F 1020) repelling positions per revolution. | It make abnormal sound when rotates. | Foreign substance has got into ball bearing. |
| | | No repelling power, and it rotates lightly. | Decreased magnetic force of flywheel and no magnetic force. |