1. Introduction

REIL Alternators are AC generators with in-built rectification and electronic voltage regulator. These are designed and manufactured for use in battery charging systems of automobile, earth moving equipment, marine and stationary engines. There are various models with different electrical characteristics and mechanical features to suit the specific requirements of individual engine and vehicle manufactures.

2. Concept

The Alternators have two main parts: a Stator and an Electro Magnetic Rotor. When the Rotor rotates inside the Stator, alternating current is generated and this is rectified to direct current by means of semi-conductor diodes to suit battery charging. The important features in REIL Alternators are their inherent self current regulation and prevention of reverse current by the Diodes. Hence, only voltage regulation is required. For this purpose the Alternators are provided with an in - built Electronic Voltage Regulator.

3. Construction of alternator assy :

3.01. The alternator consists of laminated Stator with three phase star / delta winding.

3.02. 12 Pole Rotor with field winding connected to the Slip Rings.

3.03. Aluminum Alloy Drive End Bracket (DE Bracket) with Mounting Lugs.

3.04. Slip Ring End Bracket (SRE Bracket) with Mounting Lugs.

3.05. Rectifier bridge assy or Heat Sink assy .

3.06. Separate auxiliary Diode bridge / Diode - trio for excitation. (only in Alternator with in - built Regulator).

3.07. Moulded Electronic Voltage Regulator with Brush Holder Assembly. (on Alternator with in - built Regulator) .

3.08. The two End Brackets holding both the Stator pack and the rotor in position with the help of four through bolts. The Drive end bracket is provided with a heavy duty ball bearing. The bearing is lubricated for life and rubber sealed on both sides. The Lugs provided in the Bracket enable mounting of the unit on the engine and to adjust the fan belt tension. The slip ring end bracket has a ball bearing protected by a polyurethane insert against vibrations. The Rectifier assy , Regulator with Brush Holder and Auxiliary diode assy are mounted on SRE Bracket and offer easy serviceability.

3.09. A pulley mounted on the Rotor Shaft takes the drive from the engine. A fan adjacent to the Pulley which forms an integral part of Alternator design, provides adequate air flow with minimum noise during the operation of Alternator to reduce the heat / tempetature of the alternator stator and rotor assy .

4. Operation of Alternator

4.01. While gradually increasing the rotor RPM , a small alternating voltage is induced in the Stator winding. This feeds more current to the field winding through the excitation Diode bridge and the Regulator. A stronger field is set up in the rotor claws and a higher voltage is induced in the stator Winding. Thus the voltage develops rapidly. As the speed comes to the cutting-in-speed of the Alternator, the Alternator voltage exceeds the battery voltage and it starts charging the battery. When the speed is further increased, the Voltage Regulator comes into operation and controls the voltage within the specified limit.

4.02. The Regulator is electronic circuit with no moving parts and it needs no service attention.

4.03. The Alternator output voltage is maintained within the specification by varying the field current. However the switching action is obtained by means of Transistors instead of vibrating contacts. The semi-conductor devices used are sensitive to voltage and temperature. Hence due care should be taken to connect the respective Terminals with correct polarity.

5. Service Precautions

The following precautions are to be taken to ensure long and trouble-free working of the Alternator.

5.01. Always connect correct lead to the correct terminal. If the polarities are changed the Diodes and Transistors may be damaged permanently.

5.02. Do not flash the out put terminal or auxiliary terminal .

5.03. The battery should not be connected or dis-connected while the Alternator is running. This will create voltage and current surges in the charging system and immediately damage the Diodes and Transistors.

5.04. Always turn all the switches in the Alternator circuit to 'OFF' position and stop the engine before disconnecting any Lead from the Alternator assy .

5.05. Always disconnect Leads of the batteries before attending to the Alternator assy .

5.06. When Electrical Arc -Welding is carried out, the Alternator should be electrically isolated .

5.07. Ensure that the Alternator is not mounted near the exhaust manifold of the engine without necessary protection.

5.08. Always ensure that the connections are tight and clean.

5.09. Never run the Alternator in Anti-Clock Wise direction.

5.10. Ensure the fuse replaced are specified value. Do not over rate them. Avoid use of cable or thick wire.

6. General Maintenance

The design of the Alternator is robust and reliable and they need little maintenance. However following aspects may be attended during the complete overhaul.

6.01. Brushes : Ensure free movement of brushes in the Brush Holder. If they are sticky, clean the sides of the brush with a petrol or CTC moistened cloth.

6.02. Slip Ring : The surface of the slip- ring should be clean and highly polished. If not, clean with a petrol or CTC moistened cloth. Abrasives like emery paper should not be used.

6.03. Slip Ring End Bracket (SRE Bracket) :Any foreign material collected at the openings should be cleaned for proper ventilation.

6.04. Belt : Ensure the belt is in good condition and maintain proper tension.

6.05. Pulley : Ensure proper alignment of the Pulley in the drive system.

6.06. Mounting : Ensure that the mounting bolts are tightened properly with correct tools and the ventilation slots or air gaps are clear and unobstructed.

7. Fault Finding and testing of individual assemblies

7.01. Rotor : The flash test should be conducted between any slip ring and body with 110 Volts AC supply (refer fig. 1). The lamp should not glow, if it glows the winding insulation is defective and the Rotor should be replaced. The resistance between the slip rings should be as below.

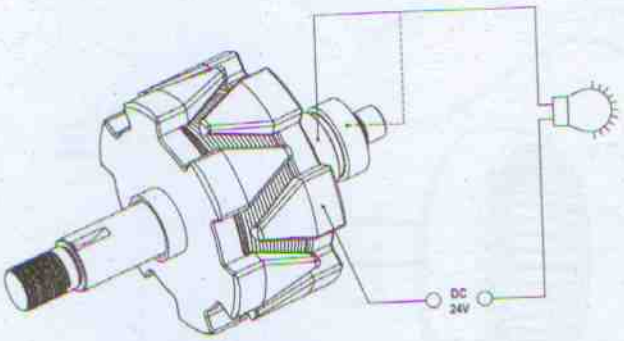

Fig. 1. Insulation Test - Rotor

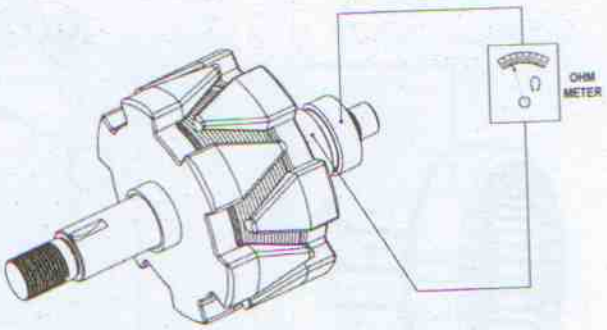

Fig. 2. Resistance Measurement - Rotor

Resistance Value

Alternator Models	Stator Resistance 30°C	Rotor Resistance 30°C
RA 13 - 02, HA-04	0.240 ± 5% OHMS	12 ± 5% OHMS
RA 13 - 03, RA13-04	0.190 ± 5% OHMS	3.2 ± 5% OHMS
RA 13 - 05,	0.140 ± 5% OHMS	3.2 ± 5% OHMS

An appreciable low resistance means, short circuit of field winding and if the resistance shows infinity then field winding is open. In both the cases the rotor should be replaced. The High Resistance value indicates un-cleaned Slip Ring surfaces. In this case clean the Slip Rings with a Petrol or CTC moistened cloth.

8.02. Stator

The same Flash Test to be conducted as done in case of rotor between anyone of the three phase wi leads and core as shown in fig. 3.The lamp should not glow, if it glows the winding insulation is def and the stator should be replaced. The winding continuity check can be done between AB, BC & CA fig. 4. In all the cases the lamp should glow, if not, replace the Stator Assembly. The resistance mea between any of the two Leads. (AB, BC & CA), should be as per the stator resistance table.

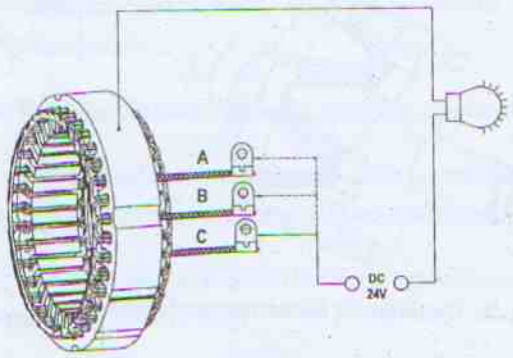

Fig. 3. Insulation Test - Stator

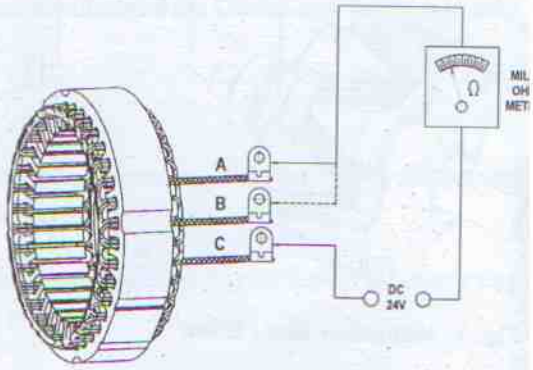

Fig. 4. Resistance Measurement - Stator

8.03. Heat Sink assy or Bridge Rectifier Assembly :

To ascertain proper functioning of the diodes a series (3Watts - 24 Volts) lamp connected to a ba may be used as follows:

Connect the Positive (+ ve) Lead to Positive (+ ve) heat sink. connect the Negative (- ve) lead to conne strips, one by one. The lamp should not glow in all three cases. .Now reconnect the Negative (- ve) le Positive (+ ve) heat sink and (by using switch) connect the Positive (+ ve) Lead to the connection strips o one. The lamp should glow in all the three cases. Repeat the same exercise to Negative heat sink also. The r obtained should be opposite to that of Positive (+ ve) heat sink .In case of any deviation from the above re the complete Heat sink Assembly should be replaced. (Ref fig No: 5)

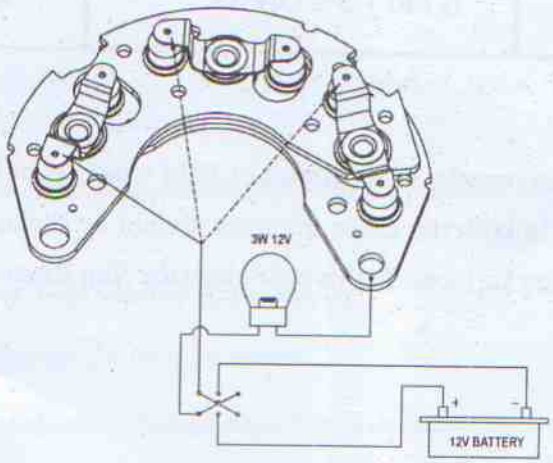

Fig. 5. Rectifier Assy

8.04. Auxiliary Diode Assembly

To check proper functioning of the Auxiliary diodes, connect the Negative (- ve) Lead of the battery to the Blade terminal and the Positive (+ ve) Lead to other end of Diodes one by one. The lamp should glow in all the three cases. Connect the Positive (+ ve) lead to the Blade terminal for changing the polarity and Negative (- ve) lead to the other ends of Diodes one by one. The lamp should not glow in all the three cases. (fig. 6)

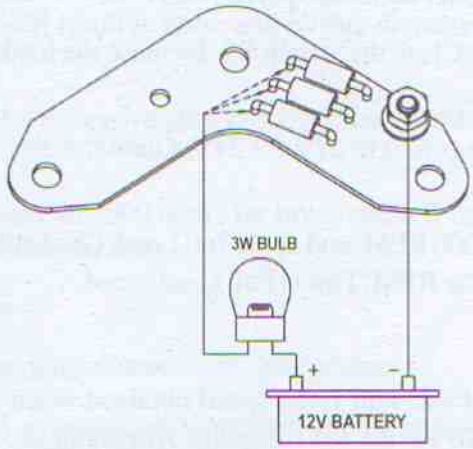

Fig. 6. Auxiliary Diode Test

If any deviation from the above is noticed the whole Auxiliary diode assembly should be replaced . Do not replace one diode / rectify the auxiliary diode assy / Diode trio assy.

8.05. Electronic Regulator Assembly

The Regulator can be checked for proper function by substituting in the Alternator since testing of individual Regulator needs special testing equipment like electronic regulator tester.

The following is the regulated voltage for 24V Alternator - 28.0 V at 20° C If the value deviates from the above the respective Regulator should be replaced.

9. Alternator Testing

Couple the Alternator with a variable Speed Motor and connect as per the circuit as shown in fig. 7.

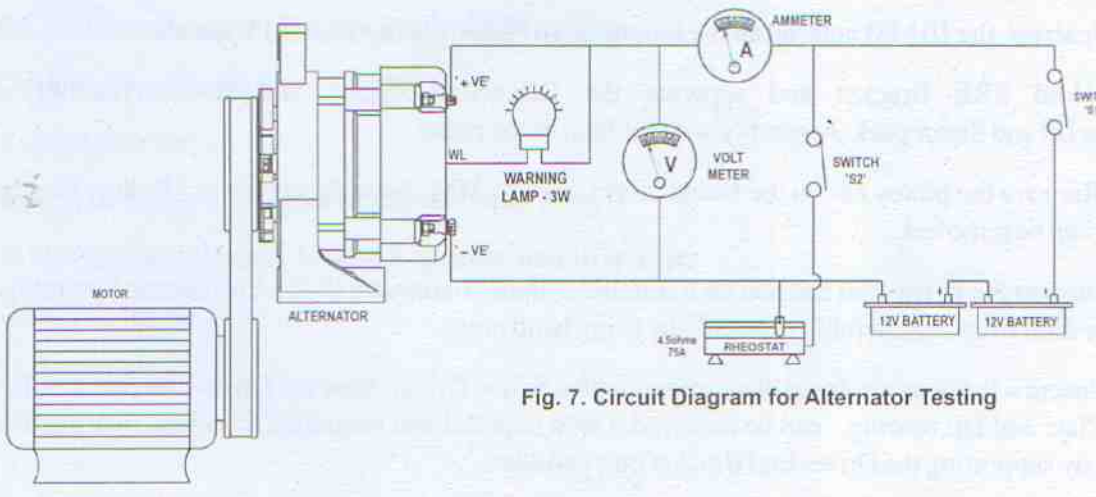

Fig. 7. Circuit Diagram for Alternator Testing

9.01. Cutting in Speed :

After connecting the Alternator close switch S1. Now the warning lamp should glow. Gradually increase the speed of the Alternator. As soon as the warning lamp stops glowing open the switch S1. Once again gradually increase the speed further and read Voltmeter . When the Voltmeter show cutting-in-voltage as indicated in the chart, note the RPM. This is the cutting-in speed.

9.02. 80% Full Load -Speed (80% FLS) and Full Load Speed (FLS) :

Increase the speed to about 4000 rpm. Close the switch S2. Increase the load to 80%. Increase load by decreasing RHEOSTAT

Gradually decrease speed till the voltage comes to 27V for 24V Alternator and note the RPM. This is the speed at 80% .

Full Load : Increase the speed to about 6000 RPM. and apply full Load. Gradually reduce the speed till the above voltage comes down to 28V. Note the RPM. This is Full Load speed.

9.03. Cold and Hot Values :

The cutting -in speed, 80% Load Speed and Full Load speed obtained when the Alternator is at room temperature are termed as cold values. To get the hot values the Alternator should be run at 5000 rpm at maximum load for one hour to stabilize the temperature and the tests as above are to be conducted immediately after the Hot Run.

10. Dismantling Procedure (for Heavy duty alternator assy .)

10.01. Remove End cover by removing four screws / 10MM nut of the SRE end cover by using 10 MM 'T' spanner.

10.02. Disconnect Regulator Auxiliary connection from the Auxiliary Diode Assembly. Remove Positive and Neg Cables from the terminal and unscrew the two Regulator fixing bolts by using 8 MM T spanner. Slightly lift the Regulator with Brush holder Assembly and withdraw the Regulator. The Brush holder assembly can be separated from the Regulator assembly by de-soldering two connections between Regulator and Brush holder assembly.

10.03 Unscrew three 10 MM nuts on the Auxiliary Diode Assembly by using 10 MM T spanner and remove the auxiliary diode.

10.04. Unscrew three 10 MM nuts on the Main Diode assembly and now you can remove the main diode assy.

10.05. Unscrew the 10 MM nuts on all the four through bolts by using 10 MM T spanner.

10.06. Hold SRE Bracket and separate the Drive-End-Bracket and Rotor Assembly from SRE Bracket and Stator pack Assembly with the help of the puller.

10.07. Remove the pulley nut on the Rotor assy (use 24 MM bit with air driver) Pulley, Fan, Spacer and Key can be removed.

10.08. Support the Drive-End Bracket on a suitable cylinder to remove Rotor. Push Rotor Assembly from the Drive-End Bracket Assembly gradually by using hand press.

10.09. Unscrew the bearing clamp plate screws with a Screw Driver. Now the Drive-End Bracket, Bearing Clamp Plate and DE bearing can be removed. Use a mandrel and push the Drive-End Bearing from the bracket, by supporting the Drive- End Bracket on a cylinder.

NOTE: To replace components in Drive-End Bracket and Rotor Assembly the operation cited in Serial No. **10.04** may be avoided.

11. Mechanical Inspection

11.01. Inspect all the components for any visible damage.

11.02. Ensure that the Drive-End Bearing is tight in the housing. Any clearance between the Bearing and housing bore will result in noise and further damage to the housing bore, Bearing, Rotor and Stator assy etc.

11.03. Inspect the Bearing for excessive play, noise, tightness and failure of seals. In case of any such defect replace the Bearing.

11.04. Check the brushes once in 5000 hours for brush wear. If the projection of brushes reduces to 4mm, replace the complete Brush holder assy. .

12. Assembling Procedure

12.01. Generally the reverse of the dismantling procedure.

12.02. In order to avoid the Leads getting trapped between Regulator Body and SRE Bracket ensure that the Leads are placed in the grooves provided in the Regulator Body.

12.03. Tighten all Screws and Nuts as per the specification by using correct special tools.

12.04. Fix the Fan Spacer, Key, Fan and Pulley on the Drive-End side of the Rotor shaft. Ensure that pulley Nut is tightened to 4.5 kg / m. torque preferably with air drive .

12.05. Check the performance of Alternator as explained under SI. No.9.

Equipment Required for Alternator Testing (A Test Bench consisting of:)

1. Variable speed motor 5 HP -(Speed 0 to 6000 rpm. at alternator pulley).
2. Battery Two Nos. 12V with 88 AH.
3. Load Resistance 75 amps capacity.
4. Single pole single throw switch 75A DC.
5. Warning Lamp bulb 24V, 2.8 / 3.00 Watts.
6. DC Voltmeter 0- 15 -30 V.
7. DC Ammeter Range 0- 75 Amps (with suitable shunt).
8. Diode Testing Equipment
9. Regulator Tester.
10. Special tools required for servicing alternator assy

A) 24 MM bit for pulley nut. 10 MM T spanner and 10 spanner.

B) 8MM T spanner.

C) 7 MM T spanner.