ELECTRO-MOTIVE DIVISION • GENERAL MOTORS CORPORATION
SERVICE DEPARTMENT
MAINTENANCE INSTRUCTION

AR10 TRACTION GENERATOR OVERHAUL – STATOR INSPECTION AND RECONDITIONING

INTRODUCTION

During traction generator overhaul, the stator should be cleaned and inspected to determine the electrical quality and to ensure satisfactory performance during subsequent operation. Visual and electrical inspections are necessary to determine what type of repair, if any, is needed.

The inspections should be carefully made and all rework performed according to the outlined procedures.

STATOR CLEANING

Clean the inside and outside of stator assembly by blowing out dirt, dust, and other contaminants using high volume, low pressure, clean, dry, compressed air. Avoid excessive air pressure which could cause insulation damage.

Remove remaining dirt by wiping frame and insulation with a clean cloth dampened with a suitable solvent such as Stoddards solvent (ASTM D474-40).

WARNING: Provide adequate ventilation when using solvents. The usual precautions should be observed when handling inflammable fluids (Stoddards solvent has a flash point of 115° F.).

In the event that the stator is extremely dirty or oily, the inside and outside may be cleaned using hot water to which a small amount of caustic has been added. The hot water and caustic solution may be applied with a pump and hose using a pressure of 45-50 lbs. After such washing, the stator should be thoroughly rinsed with clear, clean water to remove all traces of the caustic.

After washing and rinsing, dry the stator by placing it in a 90° C oven. Insulation resistance readings should be checked while the drying process is going on. The drying out run should be continued until both the insulation resistance and the temperature have become constant and remain stable for several hours.

INSPECTION AND RECONDITIONING

WEDGES

Inspect all wedges for tightness by tapping lightly with metal bar while touching wedges with fingertips. Loose wedges will vibrate or have hollow sound over 1/3 of its length when tapped. Replace loose wedges as follows:

1. Place the required thicknesses of insulation strips (several strips if necessary) in each slot, over the coils, so that all coils will be wedged tightly.

2. Press and set the coils and hold the pressure while wedges are driven into the slots.

3. Install wedges as shown in Fig. 1. After starting the wedges, coat the sides of the slot and the top of the filler strip with shellac at both ends and drive wedges into place.

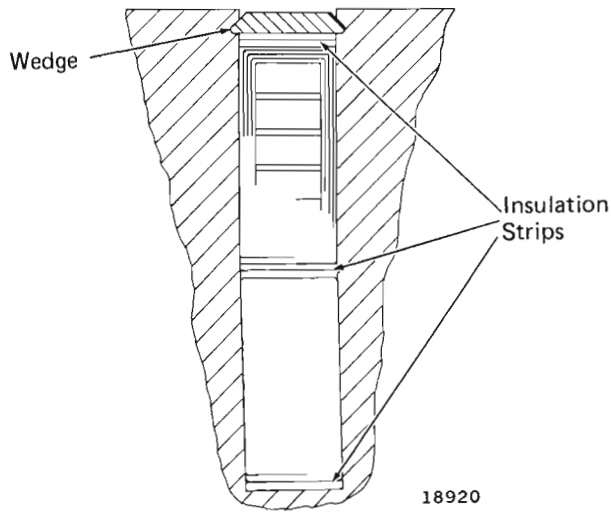

Fig. 1 – Coil Wedges And Insulation

BRACING BLOCKS

Inspect stator end windings for loose, broken, or missing bracing blocks, and replace as follows:

1. Insert bracing blocks midway in the upper and lower diamond sections between adjacent coils at each end of coil so the openings are facing radially inward on the upper diamond sections, and outward on the lower diamond sections, Fig. 2. Use the three thicknesses of bracing blocks in the proper combination to wedge coils tightly without causing distortion.

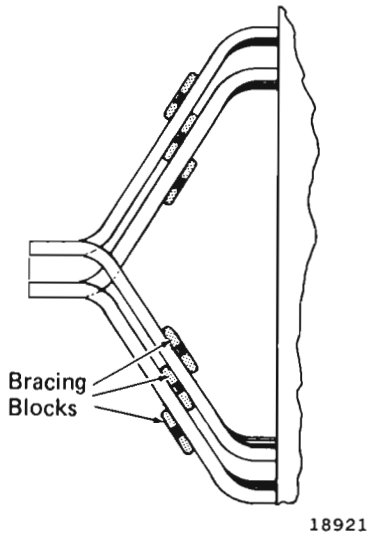

Fig. 2 – Coil Bracing Blocks

2. Apply silicone rubber sealant to the openings of the blocks so the circular portions are filled. The sealant starts to set up at room temperature within ten minutes and cures from the outside in. Initial bonding strength is attained in from three to four hours, while the ultimate bonding strength is approached after 24 hours.

WIRING

Remove cable harness and apply a 2" length of sleeving to the inner leg lead of coils. Apply the sleeving by slitting it lengthwise, placing it around the lead, and then taping it together with two wraps of adhesive glass tape.

Replace cabling if any signs of insulation wear or thermal deterioration exist. Fasten the cable harness to the stator coil with glass cord. Secure cables to every coil knuckle with one turn of doubled glass cord and pull tight. Proceed with the lacing in a counterclockwise direction, covering a group of ten coils per series of lacings.

After passing the cord through the knuckle from the frame side and upward toward the right, loop the free end of the cord to the left, over the previously applied cord on the cable, and then under, pulling the free end toward the right again. The free end is then passed through the next knuckle to the right, and the sequence repeated. At the end of the tied span, bring the single cord around the bundle of cables and tie with a square knot.

Check individual coil lead ends to see that there is equal space between adjacent coil knuckles. Leads must be properly spaced at that point to prevent shorting between leads and knuckles.

If no stator coils need rewinding, the stator should be electrically tested as described in "Electrical Tests."

STATOR WINDING

Inspect all coils for damage and replace defective coils as follows:

1. Identify defective coil and open the top and bottom connections of the coil from the cable assembly and/or other coils.

2. Identify and open the upper connections of the next eight coils in the counterclockwise direction of the defective coil.

3. Remove bracing blocks from stator end windings of the nine affected coils.

4. Remove wedges and insulation strips from the nine affected coils.

5. Carefully raise the upper coils from which the wedges were removed. The first coil in the counterclockwise position must be raised so that it is higher than the second, and each subsequent coil is raised higher than the one that follows. This must be done so that as little twisting stress as possible is created on any individual coil during removal of the defective coil. There should be just enough clearance between the raised coils and the top of the laminations to enable removal of the defective coil.

6. Remove the insulation strips between the upper and lower coils.

7. Carefully remove the defective coil from the slots and slide out from under the raised coils.

8. Replace mica insulation strip in bottom of slot where coil was removed, Fig. 1.

9. Install U-shaped insulation pieces in recesses at each end of slot, Fig. 3.

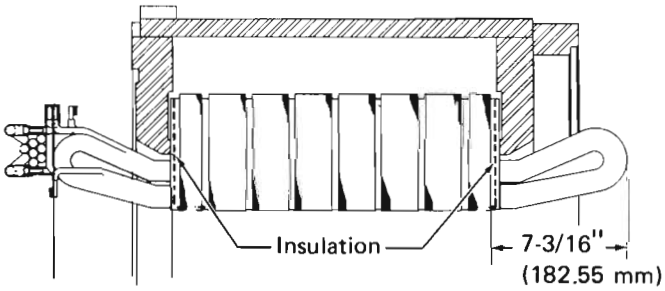

Fig. 3 – "U" Shaped Insulation

10. Install replacement coil. Ensure replacement coil is the same part number as the defective coil.

11. Place mica insulation strip in each slot on top of bottom coils, Fig. 1.

12. Position each coil so the end of the coil is 7-3/16" from the face of the first lamination, Fig. 3. A minimum air gap of 3/32" should be maintained between the upper and lower diamond sections of coils at both ends.

13. Reinstall the upper sections of coils previously raised.

14. Install wedges, insulation strips, and bracing blocks previously described in "Wedges" and "Bracing Blocks."

NOTE: If surge test will not be performed on this unit, perform insulation test and high potential test (stator not wired) as described in "Electrical Test."

15. Align series leads of coils previously opened and slide 2" insulation over coil leads. Insert spacer, fluxed with "Handy Flux," or equivalent, between the leads, Fig. 4, and braze the two leads together. Protect the insulation on the leads with a suitable heat sink.

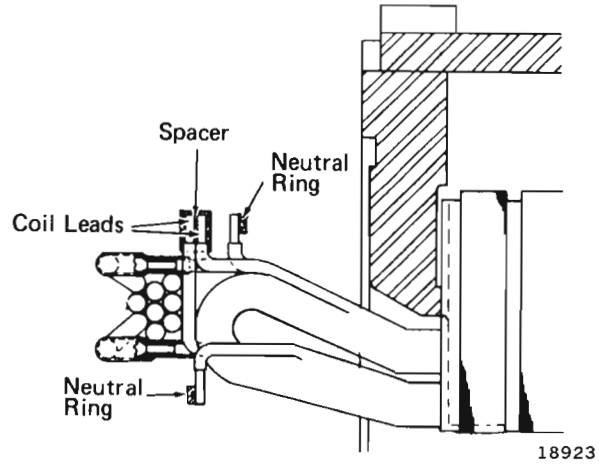

Fig. 4 – Wiring Application

NOTE: To ensure a good brazed joint, be sure the copper leads are clean and bright.

16. After each brazing operation, cool the joint with a moist shop cloth and wipe off any excess flux. File off any burrs or sharp corners.

17. Dab a small amount of rubber sealant on one side of each joint, covering the copper and sleeving.

18. Slip insulating boot over the brazed joint and over the ends of the sleeving on the coil leads. The boot must cover a minimum of 1/4" of the lead sleeving, Fig. 5.

19. Braze coil leads to neutral rings using fluxed spacer and solder piece. Cool the joint and remove excess flux using a damp shop cloth.

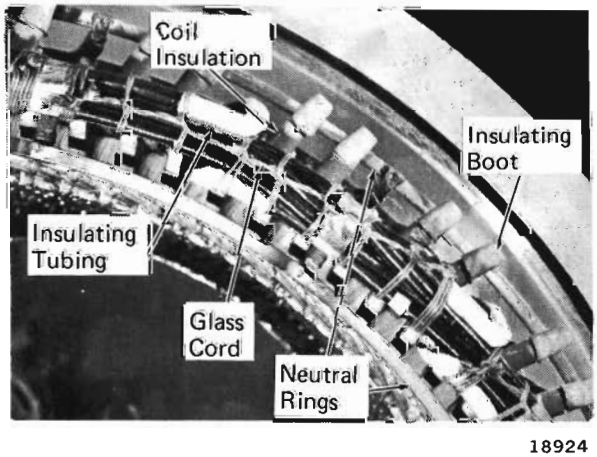

Fig. 5 – Wiring Insulation

20. Slide the cable insulating tubing back onto the cable about 2" away from the lugs.

21. Install cable terminals on coil leads and braze, using fluxed solder piece. Cool the joint and remove excess flux using a damp shop cloth.

22. Round off any sharp projections on the cable joint. After the joint has cooled, slide the tubing over the joint until it is centered on the joint.

23. Tie the cables securely with glass cord as described in "Wiring."

ELECTRICAL TESTS

INSULATION RESISTANCE TEST

Perform insulation resistance test as follows:

1. Jumper terminals 01 and 02 together, and connect to positive side of megohmmeter.

2. Connect remaining megohmmeter lead to stator frame.

3. Make insulation resistance check with 500 volt DC constant potential. Megger must indicate 200 megohms minimum after one minute.

HIGH-POTENTIAL TEST

Stator Wiring Completed

Perform high-potential test as follows:

1. Connect all odd numbered windings of "A," "B," and "C" phases together, and jumper to terminal 01.

2. Connect all even numbered windings of "A," "B," and "C" phases together, and jumper to terminal 02.

3. Jumper from terminal 02 to stator frame (ground).

4. Connect red tester electrode to terminal 01.

5. Connect black tester electrode to stator frame.

6. Test unit at 3700 volts RMS for one minute.

7. Discharge circuit under test to ground before removing electrodes.

8. Remove jumper from terminal 02 to stator frame, and connect jumper from terminal 01 to stator frame.

9. Remove red tester lead from terminal 01 and connect to terminal 02.

10. Repeat Steps 6 and 7.

11. Repeat insulation resistance test.

Stator Not Wired

Perform high-potential test as follows:

1. Jumper one end of all odd numbered windings of "A" phase together.

2. Jumper the other end of all odd numbered windings of "A" phase together.

3. Add jumper between both ends of odd numbered windings of "A" phase.

4. Connect red tester lead to "A" phase odd numbered circuit.

5. Jumper all even numbered windings of "A" phase to all even and odd numbered windings of "B" and "C" phase, and jumper to stator frame.

6. Connect remaining ends of even numbered windings of "A" phase and odd and even numbered windings of "B" and "C" phase together and jumper to stator frame.

7. Connect black tester electrode to stator frame.

8. Test coils at 5000 volts RMS for 10 seconds.

9. Discharge circuit under test to ground before removing electrodes.

10. Disconnect red electrode from odd numbered "A" phase windings, and reconnect for test of "A" phase even numbered windings as described in Steps 1 through 9.

11. Repeat the setup and testing of coil sets until all even and odd windings of "A," "B," and "C" phases have been completed.

12. Repeat insulation resistance test.

SURGE COMPARISON TEST

Perform surge comparison test as follows:

1. Jumper the five odd numbered cables of each phase group together.

2. Connect tester lead No. 1 to "A" phase group, lead No. 2 to "B" phase group, lead No. 3 to "C" phase group, and lead No. 4 to the stator frame.

3. Surge test all three phase groups with 9000 volts per phase by moving selector to positions 1-2, 2-3, and 3-1.

The image on the scope should be similar for all three positions, "A" Fig. 6. A double image at two switch positions indicates a short, "B" Fig. 6. A straight line through the image indicates a ground, "C" Fig. 6.

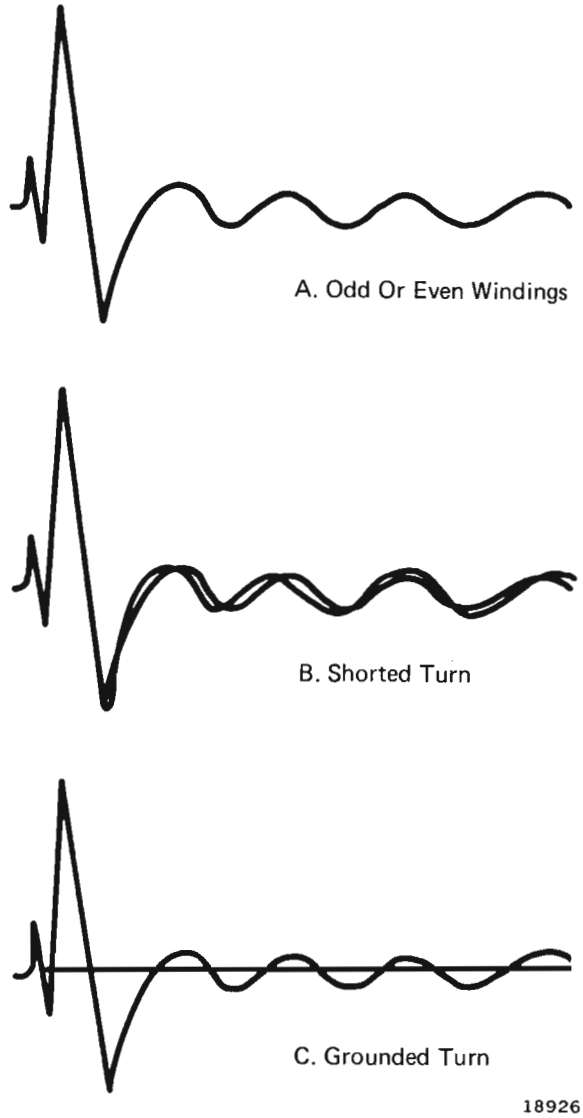

Fig. 6 – Surge Test Waveforms

To isolate a shorted coil, perform the following Steps:

a. Determine the phase in which the shorted coil is located. If the double image (short) appears at the 1-2 and 2-3 positions, the shorted coil is in the No. 2 or "B" phase. If the short appears at the 2-3 and 3-1 positions, the shorted coil is in the No. 3 or "C" phase. If the short appears at the 3-1 and 1-2 positions, the short is in the No. 1 or "A" phase.

b. Determine the coil group the short is in by surge testing each coil group separately. Attach tester leads to terminals A1, B1, C1, and the stator frame. If no short appears, disconnect tester leads from A1, B1, and C1 and connect them to A3, B3, and C3. Continue testing through all odd numbered winding groups to isolate all shorted winding groups in the suspect phase.

c. Determine which of three coils in a coil group is shorted. If short is in group B5, start at the lead end of each phase group (A5, B5, and C5) and remove the rubber boot from the first coil connection, and connect the tester leads. If the scope indicates no short, the first coil is shorted. If the scope indicates a short, connect the tester leads to the second coil connection in each phase group. If the scope indicates no short, the first and/or second coil is shorted. If the scope still indicates a short, the third coil is shorted and the number one and/or two coils could be shorted. In this case, it will be necessary to open the brazes connections between the coils in each phase, and surge test each coil separately.

4. Perform surge comparison test on all even numbered cables per Steps 1 through 3.

5. Repeat insulation resistance test.

VARNISH TREATMENT

1. Use varnish at .945 min. specific gravity and a viscosity of 100 to 130 seconds Ford Cup No. 4 at 21.1° C.
2. Preheat the stator assembly in a convection oven for approximately 2-1/2 hours at 160° C.
3. After removing the hot stator assembly from the convection oven, immerse it completely in the varnish for five minutes.
4. Drain the varnish and allow the excess to drain from the assembly for five minutes.
5. Dip stator a second time for two minutes.

6. Remove stator from varnish and allow to drain for 10 minutes.

7. Place the stator assembly back in an oven set at 160° C. and bake for four hours.

8. After removing stator from oven, immediately remove varnish from machined surfaces, tap out all bolt holes, and clean copper lugs on ends of cables.

9. Apply two coats of red air dry enamel to the winding and core assembly, being careful to ensure complete coverage with each coat. Allow to air dry to a tack-free condition between coats.

SERVICE DATA

EQUIPMENT LIST

Megohmmeter tester	8306539
High-potential tester	8324253, 8212404, 8212405, 8212406

MATERIAL LIST

Coils	8355832, 8355834, 8355835
Insulator between upper and lower coils	8479989
Spacing blocks	8352755, 8352756, 8352757
U-insulation	8354022
Coil insulation	
2" length	8442613
50 ft. roll	8436689
Adhesive glass tape (30 yd roll)	8209186
Coil insulation, bottom of slot	8332820
Glass cord (2 lb spool)	8364240
Wedge	8329702
Wedge insulation strip	8456529, 8396820, 8396819
Spacer, series coils and coil to neutral ring	8355965
Insulating boot	8356451
Solder piece, coil to neutral ring	8218228
Solder piece, cable to coil	8401145
Flux (1 lb)	8116442
Red air drying enamel	
1 qt.	8061130
5 gal.	8084876
Varnish, modified polyester (55 gal.)	8417967
Xylol	
1 gal	8098692
5 gal	8122139
55 gal	8089758
*Varnish, modified polyester (55 gal)	8489774
*Rule 66 varnish thinner	8492097

*Items marked with an asterisk are alternate materials for 8417967 varnish and Xylol and are to be used to comply with pollution control regulations.

Litho in U.S.A.