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FESCR 8109

STUDENT OUTLINE

REPAIR JACK AND HEINTZ 300 AMP GENERATOR ASSEMBLY - FESCR 8109

LEARNING OBJECTIVE

1. TERMINAL LEARNING OBJECTIVE: Given a Jack and Heintz 300 amp generator assembly, the required common and special tools, test equipment, repair parts, shop supplies, and TM 9-2920-224-34&P, per information contained in the reference, repair the generator assembly. (8.1.6)

2. ENABLING LEARNING OBJECTIVES: Given a Jack and Heintz 300 amp generator assembly, the required common and special tools, test equipment, repair parts, shop supplies, and TM 9-2920-224-34&P, per information contained in the reference:

a. disassemble the generator, (8.1.6a)

b. inspect the components of the disassembled generator to determine their suitability for reuse, (8.1.6b)

c. test the components of the disassembled generator for serviceability, (8.1.6c)

d. repair or replace the unserviceable components as required, (8.1.6d)

e. assemble the generator from serviceable components, and (8.1.6e)

f. test the generator on an appropriate test bench. (8.1.6f)

OUTLINE

1. DESCRIPTION OF THE JACK AND HEINTZ 300 AMP GENERATOR ASSEMBLY

a. General Description; Similarities and Differences

(1) Similarity among models. All Jack and Heintz 300 amp generators are six-pole, six-brush units. The generator armature is coupled to the engine drive mechanism through a drive shaft with spring-loaded friction plates which dampen and absorb sharp increases in torque from the engine drive mechanism. All models are cooled by constant air circulation and are equipped with radio-noise suppression capacitors for protection of nearby communications equipment. All models are alike with respect to output, rotation, drive mechanism, and brush arrangement.

(2) The difference between the generator models is in the method used to deliver cooling air to the generator. One model is equipped with a fan at the commutator end, mounted on the tubular armature shaft. Another model consists of a basic generator housing with neither an internal nor direct mounted external cooling fan. The end cover has an opening for attaching a cooling air duct, thus permitting the generator to be cooled by a remote source of air. The model G-22-6F, which is the one we'll be covering, is equipped with a separate cooling fan assembly attached to the commutator end of the generator in place of an internal fan. This fan unit is mounted in line with the generator and is attached to the generator housing through a fan adapter. This model also has a guard for the ground terminal.

b. Detailed Description

(1) The major components of the generator are the stator assembly, the armature, the brush holder, the brushes, the damper mechanism, the end bell, the filter assembly, the fan cover, and the drive shaft assembly.

(2) The stator assembly consists of the field coils, the pole shoes, and the interpole coils mounted in and supported by the heavy steel cylinder frame. The shunt field coils are held in position on the inside wall of the frame by the pole shoes. Each pole shoe is secured in place by four screws and each interpole by three screws. Each pole shoe and interpole carries four turns of a heavy gage conductor which makes up a series field winding.

(3) The drive shaft assembly consists of a flexible splined shaft and a friction damper mechanism. Flexibility is obtained with the damper mechanism which will absorb sharp peaks which may occur in the drive torque. The friction damper pressure is adjustable.

(4) The armature rotates in a pair of ball bearings. Both bearings are sealed and permanently lubricated.

2. PRINCIPLES OF OPERATION OF THE JACK AND HEINTZ 300 AMP GENERATOR ASSEMBLY

a. The generator is mounted to a mounting pad on the engine by six studs which correspond to six, keyhole-type mounting holes in the flanged end of the generator housing.

b. The generator drive shaft is spline coupled to the engine drive shaft and transmits engine drive torque to both ends of the hollow armature shaft. The connection between the drive shaft and the armature shaft at the drive end is not rigid, but through a friction damper mechanism on the drive shaft. The connection between the drive shaft and the armature shaft at the commutator end is made quite rigid by tapered splines drawn together.

(1) The friction damper mechanism is adjusted to allow limited slippage at about 20 foot-pounds. Input torques which exceed the setting of the damper mechanism use the length of the drive shaft as a torsion bar. The torsion spring action absorbs shocks or sharp peaks in the drive torque, which could damage the generator.

(2) The damper mechanism also permits at least 0.10 inch displacement between the axis of the generator input spline and the axis of the male spline on the armature.

c. Power Generation. When the armature turns, an electrical charge is produced as the armature coils cut the magnetic lines of force around the generator field coils. The electricity produced is conducted from the armature windings to the commutator where it is collected by the brushes and delivered to the output terminals and the noise suppression capacitors. These capacitors minimize stray currents which could interfere with communications equipment operating within the vicinity of the generator.

(1) DC voltage applied across "A" and "E" terminals on the filter assembly causes a current flow in the shunt winding which produces a magnetic field with six poles. Three north poles and three south poles are generated by the current flow and these poles are positioned so that each armature coil must cut six fields of alternate polarities as it makes one revolution.

(2) Voltage generated in each armature coil will thus change polarity six times per revolution. The commutator bars and brushes provide a reversing switch so that polarity of the generated voltage is always the same at any brush terminal. While alternating current is being generated in the armature windings, the switching action of the commutator and brushes rectifies the generated current to a DC output.

(3) Residual magnetism in the pole shoes can produce an output as soon as the armature begins its rotation. If the generator output at filter terminal "B" was connected directly to the field excitation terminal "A," output could increase to damaging magnitude. The generator is always operated with an external voltage regulator which controls excitation to the shunt windings.

(4) Since output from the armature tends to increase with speed of rotation, it is a function of the voltage regulator to reduce excitation current in the field, as necessary, to hold generator output at the rated voltage for any output load within the operating range.
Normally used in a circuit with a storage battery, the generator is controlled to offset any load which would produce a voltage drop or increase at the battery terminals.

d. Parallel Generators. The series windings (interpole) provide another control on generator output so that one or more generators can be operated in the same circuit as this generator. Connection to this winding is made at filter terminal "D."

3. PRACTICAL APPLICATION ON THE REPAIR OF THE JACK AND HEINTZ 300 AMP GENERATOR ASSEMBLY

a. Cleaning the Generator Before Disassembly

(1) Find the procedures for cleaning the generator before disassembly in TM 9-2920-224-34&P. Read the procedures completely to become familiar with the total task.

(2) Explain to the instructor the procedures for cleaning the generator.

b. Disassembly of the Generator Assembly

(1) Find the procedures for disassembly in TM 9-2920-224-34&P. Read the procedures completely to become familiar with the total task.

(2) Disassemble the generator.

(a) Remove the brush cover band.

(b) Remove the fan, adapter, and guard.

(c) Disassemble the basic generator assembly.

1 Remove the drive shaft.

2 Test the brush springs.

3 Remove the electrical contact brushes.

4 Remove the armature assembly.

5 Remove the electrical end bell.

6 Check the armature shaft and the commutator.

7 Inspect the armature.

8 Inspect the commutator contact surface.

9 Remove the radio interference filter and housing as an assembly.

10 Inspect the generator housing.

11 Inspect the brushes and springs.

12 Inspect the generator support assembly.

13 Check the generator drive shaft.

14 Inspect the fan housing.

c. Repair of Component Parts

(1) Find the procedures for repairing the component parts in TM 9-2920-224-34&P. Read the procedures completely to become familiar with the total task.

(2) Explain or demonstrate to the instructor the procedures for repairing the component parts. Have instructor initial.

d. Assembly of the Generator Assembly

(1) Find the procedures for the assembly of the generator assembly in TM 9-2920-224-34&P. Read the procedures completely to become familiar with the total task.

(2) Assemble the generator assembly.

(a) Assemble the electrical end bell.

(b) Assemble the radio interference filter.

(c) Assemble the tube axial fan and adapter.

(d) Assemble the armature and brush holders.

(e) Assemble the drive shaft subassembly and perform adjustment.

Have instructor initial.

(f) Install the stator assembly.

(g) Install the drive shaft.

(h) Connect the lead terminals.

Have instructor initial.

(i) Install the fan and adapter.

(j) Install the band assembly and gasket.

Have instructor initial.

e. Test the Generator on the Alternator/Generator/Regulator/ Starter (AGRS) Test Stand

NOTE: An instructor will be at your test stand to provide you with individual instructions and assistance while you test your generator.

(1) Install the generator on the test stand.

(a) Position the generator on the cradle and install the spline adapter on the generator drive shaft. Aline the spline adapter with the

test stand drive by moving the cradle up or down, using the large adjusting bolt at the bottom of the bracket. Slide the generator toward the test stand to engage the spline adapter into the test stand drive. Secure the generator to the test stand with the 6 mounting bolts.

(b) Connect cable 1511 into the positive 24 volts socket of the test stand and to the B terminal on the generator. Connect cable 1512 into the negative socket of the test stand and to the E terminal on the generator. Connect cable 1535 to the cannon connector on the generator fan and to the B and E terminals on the generator. Connect cable 1538 to the 0-36 VDC 20 A power supply cannon connector of the test stand and to A and E terminals on the generator.

(2) Perform the generator output test.

NOTE: The UUT cover must be in the down position before the drive will operate.

(a) Make sure the louvers are in the open position and that all five air inlets on the test stand are open.

(b) Turn the test stand main power switch to the ON position. Turn the control power switch, located on the lower right side of the control panel, to the ON position.

(c) Turn the UUT voltage switch to the 24V position. The 24 volt load bus voltage green indicator light should be on at this time.

(d) Turn the UUT ground polarity switch to the NEG position. The bus grounding negative green indicator light should be on at this time.

(e) Turn the drive motor rotation switch to the CW position. The drive motor CW green indicator light will start blinking.

(f) Turn the drive motor switch to the START position. The load bank fan, glycol coolant pump, and the DRV MTR lube pump green indicator lights should be on at this time.

(g) When the drive motor green indicator light stops blinking, turn the drive motor speed adjust until the direct drive rpm meter reads 3000 rpm.

(h) Turn the DC power supply switch to the ON position. SLOWLY rotate the DC power supply volts adjust until the 24 volt Gen/Alt volts meter reads 30 volts.

NOTE: If the DC field amps, as indicated on the DC power supply amps meter, exceeds 7 amps, turn the DC power supply volts adjust down to zero, shut down the test stand and check the field within the generator.

(i) With the 8 load steps rotary switches in the OFF position, turn the load bank control switch to the ON position.

(j) Slowly apply a 300 amp load, utilizing the 24 volt load steps rotary switches as applicable. The amps will be read on the 24 volt Gen/Alt amps meter. As the load is applied you will have to readjust the volts, using the DC power supply volts adjust.

1 A 300 amp load at 30 volts and a reading of less than 7 amps on the DC power supply amps meter indicates a serviceable generator.

2 If the 300 amps cannot be obtained or the field amps exceeds 7 amps, the generator must be repaired.

(k) Slowly turn the DC power supply volts adjust down to zero and the DC power supply switch to the OFF position.

(l) Return all load bank switches to the OFF position.

(m) Turn the rpm down to zero and turn the drive motor switch to the STOP position.

(n) After the blower stops, turn the control power and test stand main power switches to the OFF position.

(o) Remove the generator from the test stand and return the cable assemblies to their original location.

f. Test the 300 amp solid-state regulator on the Alternator/ Generator/Regulator/Starter (AGRS) test stand.

(1) With a known good 300 amp generator mounted on the test stand, position the 300 amp solid-state regulator on the regulator bracket and secure it with the holding clamp.

(2) Make the following cable connections.

(a) Connect cable assembly 1506 to the cannon connector on the regulator and cannon connector exciter regulator meters on the test stand. Connect the two large leads from cable 1506 to the B terminal on the generator. Connect the small lead marked ground to terminal E on the generator. Connect the small lead marked A to terminal A on the generator.

(b) Connect cable 1512 to terminal E on the generator and into the negative socket on the test stand.

(c) Connect cable 1505 to the cannon connector on the regulator and into the positive 24 volts sockets.

(d) Connect cable 1535 to the cannon connector on the generator fan and to terminals B and E on the generator.

(e) Connect cable 48306 to one of the regulator housing bolts and to terminal E on the generator.

(3) Perform the regulator test.

(a) Turn the test stand main power switch to the ON position. Turn the control power switch, located on the lower right side of the control panel, to the ON position.

(b) Turn the UUT voltage switch to the 24V position. The 24 volt load bus voltage green indicator light should be on at this time.

(c) Turn the UUT ground polarity switch to the NEG position. The bus grounding negative green indicator light should be on at this time.

(d) Turn the drive motor rotation switch to the CW position. The drive motor CW green indicator light will start blinking.

(e) Turn the drive motor switch to the start position. The load bank fan, glycol coolant pump, and the DRV MTR lube pump green indicator lights should be on at this time.

(f) When the drive motor green indicator light stops blinking, turn the drive motor speed adjust until the direct drive rpm meter reads 3000 rpm.

(g) With the 8 load steps rotary switches in the OFF position, turn the load bank control switch to the ON position.

(h) Slowly apply a 300 amp load, utilizing the 24 volt load steps rotary switches as applicable. The amps will be read on the 24 volt Gen/Alt amps meter. As you apply the load, note the voltage as indicated on the 24 volt Gen/Alt volts meter and the field amps as indicated on the exciter field amps meter. The regulator should maintain a minimum of 28 volts and the field amps should not exceed 7.5 amps.

(i) Shock-test the regulator by turning the load bank control switch OFF and ON. The voltage should remain the same with the load bank control switch OFF or ON.

(j) If the test results are not within specifications, the regulator must be replaced.

(k) Return all load bank switches to the OFF position.

(l) Turn the drive motor speed adjust down to zero and the drive motor switch to STOP.

(m) After the blower stops, turn the control power and test stand main power switches to the OFF position.

(n) Remove the regulator and generator from the test stand and return the cable assemblies to their original location.

STUDENT REFERENCE:

TM 9-2920-224-34&P