

NAVSEA
STANDARD ITEM

FY-11

ITEM NO: 009-17
DATE: 24 JUL 2009
CATEGORY: II

1. SCOPE:

1.1 Title: Rotating Electrical Equipment; repair

2. REFERENCES:

2.1 Standard Items

2.2 Equipment Technical Manual

2.3 S9086-KC-STM-010/CH-300, Electric Plant - General

2.4 S9086-KE-STM-000/CH-302, Electrical Motors and Controllers

2.5 S9086-KN-STM-010/CH-310, Electrical Power Generators and Conversion Equipment

2.6 S9086-HN-STM-010/CH-244, Propulsion Bearings and Seals

2.7 S6260-BJ-GTP-010, Electrical Machinery Repair, Electric Motor Repair, Shop Procedures Manual

2.8 S9310-AC-HBK-010, Commutator/Slip Ring Maintenance Handbook

2.9 MIL-STD-1310, Shipboard Bonding, Grounding, and Other Techniques for Electromagnetic Compatibility and Safety

3. REQUIREMENTS:

3.1 Accomplish preliminary repair preparations as follows:

3.1.1 Prior to disconnecting equipment:

3.1.1.1 Record and retain electrical hook-up data. Record and retain air gap readings. Record and retain bearing clearances for sleeve bearing equipment only.

3.1.1.2 Inspect couplings for cracks, broken segments, wear, and misalignment in excess of tolerances specified in 2.2.

3.1.2 Disconnect the equipment electrically and mechanically, using 2.2 for guidance.

3.1.2.1 Matchmark, identify, and retain chocks, shims, shock mounts, sound damping pads, and other accessories associated with equipment.

3.1.2.2 Record shaft thrust and run out readings.

3.2 Remove equipment including rotating components connected directly to the shaft.

3.2.1 Remove entire vaneaxial and tubeaxial fan assemblies from the duct system and transport to the shop for repair.

3.3 Inspect foundations for cracks, areas of distortion, and deterioration in excess of 25 percent of the thickness of each member of the structure.

3.4 Submit one legible copy, in electronic media, of a report listing inspection results, missing parts, defective parts, and measurements taken in 3.1 and 3.3 to the SUPERVISOR.

3.5 Matchmark, disassemble, and inspect the equipment removed in 3.2, using 2.2 through 2.7 for guidance.

3.6 Accomplish 500-volt megger insulation resistance test, using Paragraphs 300-3.2.2 through 300-3.2.3, 300-3.4.8, 300-3.4.11, and 300-5.3.7.1 of 2.3 for guidance. Record data.

3.6.1 Disconnect solid-state devices and ground temperature-sensing leads prior to measuring insulation resistance of windings.

3.6.2 Accomplish a core loss test prior to dipping (varnishing) in accordance with Paragraphs 300-4.5.6 and 300-4.5.6.1 of 2.3. Record data.

3.6.2.1 Inspect for hot spots in accordance with the Core Loss Tester Instruction Manual.

3.7 Accomplish a DC resistance test of windings, using a Wheatstone or Kelvin bridge, or with an ohmmeter capable of resolving one milliohm (0.001 ohm). Record phase balance for multi-phase equipment, using Paragraph 5.22 of 2.7 for guidance. Record data.

3.8 Accomplish a voltage surge test in accordance with Paragraphs 300-3.5.4 through 300-3.5.5 of 2.3. Record data.

3.9 Accomplish a DC HI POT test in accordance with Paragraph 300-3.5.2 through 300-3.5.2.3.4 of 2.3. Record data.

3.10 Accomplish a Polarization Index Test in accordance with Paragraph 300-3.4.12 of 2.3. Record data.

3.11 Measure resistance value of each winding temperature detector, heater, and heater strip using low voltage ohmmeter. Record data.

3.12 Submit one legible copy, in electronic media, of a report listing results of the requirements of 3.5 through 3.11 to the SUPERVISOR.

3.13 Clean the equipment and windings in accordance with Paragraphs 300-4.5.1 through 300-4.5.5 of 2.3.

3.13.1 Dry the equipment by placing it in an oven in accordance with Paragraph 300-5.3.2.3 of 2.3.

3.14 Allow to cool to ambient temperature and accomplish a 500-volt megger insulation resistance test, using Paragraphs 300-3.2.2 through 300-3.2.3, 300-3.4.8, 300-3.4.11, and 300-5.3.7.1 of 2.3 for guidance. Record data.

3.15 Accomplish a DC HI POT test in accordance with Paragraphs 300-3.5.2.3 through 300-3.5.2.3.4 of 2.3. Record data.

3.16 Repeat cleaning, drying, and testing in 3.13 through 3.15 if DC HI POT test readings are questionable, or if insulation resistance readings are not in accordance with the following:

3.16.1 DC generators and motors (except propulsion and auxiliary generators for submarines) including exciters, Table 300-3-4 of 2.3.

3.16.2 DC propulsion generators and motors and DC auxiliary generators for submarines, Table 300-3-5 of 2.3.

3.16.3 AC generators and motors other than propulsion, Table 300-3-6 of 2.3.

3.16.4 AC propulsion generators and motors, Table 300-3-7 of 2.3.

3.17 If satisfactory readings are not obtained after the second cleaning, repeat 3.13 through 3.15.

3.18 Notify the SUPERVISOR if satisfactory readings are not obtained after a third cleaning.

3.19 Accomplish a DC resistance test of windings, using a Wheatstone or Kelvin bridge, or with an ohmmeter capable of resolving one milliohm (0.001 ohm). Record phase balance for multi-phase equipment, using Paragraph 5.22 of 2.7 for guidance. Record data.

3.20 Accomplish a voltage surge test in accordance with Paragraphs 300-3.5.4 through 300-3.5.5 of 2.3. Record data.

3.21 Submit one legible copy, in electronic media, of a report listing winding defects such as opens, grounds, shorts, reversed or unbalanced coil

groups or phases, incorrect connections, cracked or brittle insulation, and loose bands, fillers, wedges, and connections to the SUPERVISOR.

3.21.1 Include test results from 3.14 through 3.17, 3.19 and 3.20.

3.22 Protect the windings and machined surfaces and clean the equipment housing exterior, including fan(s), and interior and exterior of end bells to bare metal.

3.22.1 Prime equipment housing, fan(s), and end bells with one coat F-84 alkyd zinc molybdate TT-P-645 (1.5 mils dry film thickness).

3.23 Inspect and test non-wound rotors for loose or cracked bars, localized overheating, and rubbing in accordance with 2.7. Inspect wound rotors, slip ring leads, and armatures for insulation damage and burns/hot spots. Inspect for loose coils and slot wedges. Inspect slip rings and commutators for damage and for wear limits, using 2.2 for criteria. Record data.

3.24 Inspect and dimensionally measure end bells, frame, rabbet fits, shaft, sleeve and pedestal bearings, keyways, fan and running surfaces for wear, eccentricity, and other defects, using 2.2 for accept or reject criteria, and 2.6 for location and type of measurements to be taken. Record data.

3.25 Inspect brush rigging for cracks, chips, worn areas, distortion, spring condition, and insulating material for cracks and arc paths. Record data.

3.26 Inspect leads and terminal lugs for damage and defects. Identify and tag leads with aluminum wrap-around bands with metal stamped or embossed markings. Record data.

3.27 Submit one legible copy, in electronic media, of a report listing results of the requirements of 3.23 through 3.26 to the SUPERVISOR.

(V) "VARNISH TEMPERATURE, VISCOSITY, AND GEL TIME TESTS"

3.28 Select the proper insulating process based on winding insulation classifications and to meet state or local air pollution standards.

3.28.1 Select varnish methods and material, using Paragraphs 300-4.5.8 through 300-4.5.8.2 of 2.3 for guidance.

3.28.1.1 Maintain the varnish in accordance with Paragraphs 300-4.5.8.3 through 300-4.5.8.3.3 of 2.3 and the varnish manufacturer's instructions.

3.28.1.2 Maintain a current revision of the varnish manufacturer's instructions on storage, maintenance, and use of the type of varnish to be applied.

3.28.1.3 Maintain a record of varnish temperature, viscosity and, for solventless varnish, gel time tests. Tests must show varnish is within varnish manufacturer's recommendations and have been accomplished in the intervals specified by the varnish manufacturer. The record must also show that the varnish is being stored as recommended by the varnish manufacturer.

3.29 Varnish windings in accordance with Paragraphs 300-4.5.8.2 of 2.3 and the varnish manufacturer's instructions.

3.29.1 Do not immerse the leads.

3.29.2 Wipe surfaces that affect assembly, such as rabbet fits and mounting flanges, with a cloth moistened with a solvent after draining and before baking.

3.30 Remove excess varnish run-off from the component locations described in 3.29.2, after baking. Apply a thin coat of air-dry varnish to metal surfaces exposed by the removal process in accordance with Paragraph 300-4.5.8.5 and 300-4.5.8.6 of 2.3.

3.31 Repeat tests described in 3.14, 3.15, 3.19, and 3.20.

3.32 Accomplish an AC HI POT test in accordance with Paragraphs 300-3.5.3 through 300-3.5.3.2.9 of 2.3. Record data.

3.33 Accomplish a 500-volt megger insulation resistance test, using Paragraphs 300-3.2.2 through 300-3.2.3, 300-3.4.8, 300-3.4.11, and 300-5.3.7.1 of 2.3 for guidance. Record data.

3.34 Measure resistance value of each winding temperature detector, using a low voltage ohmmeter. Record data.

3.35 Submit one legible copy, in electronic media, of a report listing results of the requirements of 3.31 through 3.34 to the SUPERVISOR.

3.36 True the commutator or collector rings. Eccentricity shall not exceed the requirements of 2.8. Resurface or machine each individual collector ring to the same exact diameter to allow symmetrical brush holder to ring clearance spacing. Ensure metal shavings are not permitted to contaminate the rotor or stator assembly.

3.36.1 Each cut shall not exceed 0.010 inch. Finish thickness shall not be less than design wear tolerance as shown in 2.2.

3.36.2 Undercut the mica between the commutator bars with the edge of the mica not exceeding a depth of 5/64-inch below the bars.

3.36.3 Chamfer the bar edges and remove rough surfaces in accordance with Paragraph 5-2-4 of 2.8.

3.36.4 Burnish the commutator with a very fine commercial burnishing stone conforming to A-A-58052. Polish collector rings to a mirror finish.

3.37 Accomplish the requirements of 009-15 of 2.1 for each rotating assembly.

3.38 Accomplish the following for the brush rigging:

3.38.1 Disassemble the brush rigging.

3.38.2 Remove foreign matter.

3.38.3 Replace existing cadmium-plated parts with zinc in accordance with ASTM A 153.

3.38.4 Recondition threads of plated parts.

3.38.5 Assemble brush rigging.

3.39 Repair lightly scored areas of frame, end bells, and shaft by manual methods. Recondition threads and fit key to keyway. Step keys shall not be used.

3.39.1 Apply a thin coat of petrolatum to unpainted mating surfaces except for explosion-proof motors, which shall have clean, dry mating surfaces.

3.40 Prepare and refinish equipment. Protect machine surfaces, windings, and nameplates from being painted or otherwise damaged.

3.40.1 Accomplish the requirements of 009-32 of 2.1 for each housing, fan, and interior and exterior of each end bell.

3.41 Accomplish the requirements of 009-32 of 2.1 for the foundations of the equipment removed in 3.2.

3.42 Accomplish the following on equipment having other than sleeve-type bearings unless otherwise specified in the invoking Work Item, using 2.7 for guidance.

3.42.1 Except as indicated in 3.42.1.1, install new bearings, seals, fittings, lock washers, and locknuts conforming to 2.2, using 2.6 and Chapter 6 of 2.7 for guidance.

3.42.1.1 Install Type 111, Class 8 (double seal), bearings in motors meeting the criteria identified in Chapter 6 of 2.7. Only double seal bearings identified in Chapter 6 of 2.7 are acceptable for use.

3.42.1.2 For vaneaxial and tubeaxial fan motors not meeting the criteria of Chapter 6 of 2.7, if not originally furnished or already

accomplished during previous repair, install Type 111, Class 8 (double seal), bearings with a C3 (greater than normal) radial internal clearance in place of the Type 111 bearing originally furnished. Install Type 120 bearings in vaneaxial and tubeaxial fan motors originally furnished with Type 120 bearings.

3.42.1.3 Install new label plates with the inscription "DO NOT LUBRICATE" on equipment using double seal bearings (Type 111, Class 8, or Type 120).

3.42.1.4 For equipment converted from re-lubricable bearings to double seal bearings, install pipe plugs on all grease fills and drains.

3.42.2 For equipment not using double seal bearings, lubricate bearings with grease conforming to DOD-G-24508 as required in Paragraphs 244-1.7.7.1 and 244-1.7.7.3 of 2.6.

3.43 Assemble the equipment disassembled in 3.5, using 2.2 through 2.7 for guidance.

3.43.1 Do not use materials containing silicone in the repair and assembly of equipment with commutator or collector rings.

3.43.2 Install new fasteners conforming to MIL-DTL-1222, Type I or II, Grade 5, zinc coated.

3.43.3 Fasteners requiring a permeability factor of 2.0 or less shall conform to Grade 304 CRES.

3.43.4 Install new gaskets on covers, inspection plates, and between the external connection box and the frame. Gaskets shall conform to MIL-PRF-1149 unless otherwise specified in 2.2.

3.43.5 Set brush holders not less than 1/16-inch or more than 1/8-inch from commutator or collector rings unless otherwise specified in 2.2.

3.43.6 Set brush holders in electrical neutral plane and stagger brushes for maximum coverage of the commutator, in accordance with Paragraph 300-4.7.7.1.10 of 2.3.

3.43.7 Center the brush holder over the collector rings.

3.43.7.1 Ensure the brushes do not extend beyond the edge of the collector rings.

3.43.8 Install new brushes in accordance with 2.2. Sand new brushes to fit curvature of the commutator or collector rings, **in accordance with** Paragraph **6-3.5** through **6-3.5.4** of 2.8.

3.43.8.1 Brushes shall have a surface contact of 100 percent and shall not be chipped, cracked, or broken.

3.43.8.2 Remove sand, carbon, and other foreign matter resulting from fitting new brushes.

3.43.9 Adjust spring tension of brushes in accordance with 2.2.

3.43.10 Adjust air gap as specified in 2.2, plus or minus 10 percent.

3.43.11 Rotate shaft by hand a minimum of 3 revolutions. Rubbing or binding of the rotating assembly not allowed.

3.43.12 Install label plates conforming to MIL-DTL-15024 for those found to be missing or damaged.

(V) "NO-LOAD SHOP TEST"

3.44 Accomplish a no-load shop test of the motor for a minimum of one-half hour.

3.44.1 Verify proper direction of rotation.

3.44.2 After one-half hour, record current and voltage in each phase, speed and bearing temperature rise measured on the equipment's exterior near each bearing.

3.44.3 Submit one legible copy, in electronic media, of the recorded data to the SUPERVISOR.

(V) **"OPERATIONAL SHOP TEST (FOR VANEAXIAL/TUBEAXIAL FANS - ASSEMBLY COMPLETELY REASSEMBLED)"**

3.45 With vaneaxial fan assembly reassembled, accomplish an operational test of the equipment at full nameplate load or maximum system capacity for a minimum of one hour after temperatures stabilize, unless otherwise specified in the invoking Work Item.

3.45.1 Verify proper direction of rotation.

3.45.2 Record current, voltage, frame and bearing temperature rise and speed at 15-minute intervals.

3.45.2.1 Bearing temperatures shall not exceed 180 degrees Fahrenheit, unless otherwise specified in the invoking Work Item or equipment technical manual.

3.45.3 Measure and record hot insulation resistances of winding to ground immediately upon completion of the operational shop test, using a 500-volt megger.

3.46 Install equipment removed in 3.2.

3.46.1 Remove existing and install new foundation fasteners conforming to MIL-DTL-1222, Type I or II, Grade 5, zinc coated, and self-locking hexagon nuts conforming to NASM-25027, excluding body-fitted bolts and studs.

3.46.2 Remove existing galled or distorted body-fitted bolts and studs and install new fitted bolts and studs conforming to MIL-DTL-1222, Type I, Grade 5.

3.46.3 Fasteners, body-fitted bolts, and studs requiring a permeability factor of 2.0 or less shall conform to Grade 304 CRES.

3.46.4 Align equipment in accordance with 2.2. Measure and record facial and peripheral coupling data.

3.46.4.1 Install chocks, shims, shock mounts, and sound damping pads.

3.46.4.2 Accomplish the requirements of 009-58 of 2.1 for driver and pump shafts.

3.46.5 Connect electrical cables to equipment, using data retained in 3.1.1.1.

3.46.6 Bond and ground equipment in accordance with 2.9, using new ground straps.

3.46.7 Rotate shaft by hand a minimum of 3 revolutions. Rubbing or binding of rotating assembly not allowed.

3.46.8 Measure and record the air gap and bearing clearance (sleeve bearing equipment only), insulation resistance (at 500 volts DC), and thrust.

(V)(G) "OPERATIONAL TEST"

3.47 Accomplish an operational test of the equipment at full nameplate load or maximum system capacity for a minimum of one hour after temperatures stabilize, unless otherwise specified in the invoking Work Item.

3.47.1 Verify proper direction of rotation.

3.47.2 Verify/establish oxide film coating of the commutator/collector rings, using 2.8 for guidance

3.47.3 Record current, voltage, frame and bearing temperature rise, and speed at 15-minute intervals. ***Frame and bearing temperature rise and speed is not required for vaneaxial and tubeaxial fan assemblies.***

3.47.3.1 Bearing temperatures shall not exceed 180 degrees Fahrenheit, unless otherwise specified in the invoking Work Item or equipment technical manual.

3.47.4 Measure and record hot insulation resistances of windings to ground immediately upon completion of test, using a 500-volt megger.

3.48 Submit one legible copy, in hard copy or electronic media, of a report listing data recorded in **3.45.2, 3.45.3**, 3.46.4, 3.46.8, 3.47.3, and 3.47.4 to the SUPERVISOR.

4. NOTES:

4.1 Equipment technical manual and drawings will be listed in the invoking Work Item.

4.2 Shop test of generator will be addressed in the invoking Work Item.

4.3 The use of silicone is not allowed on any rotating electrical machinery containing brushes.