GENERAL MAINTENANCE

GENERAL

All apparatus should be blown out using clean, dry compressed air, and accessible parts should be wiped off with dry waste or clean wiping rags. Washed wiping rags are preferable to cotton waste as they are less liable to leave lint. When using air for cleaning in the vicinity of exposed mica insulation, care should be taken not to use too high pressure or get the nozzle too close or small flakes of mica will be blown off, finally resulting in complete destruction of the insulation. DO NOT BLOW OUT ENCLOSED RELAY PANELS, as they are dust tight and blowing will probably put in more dirt than is blown out.

Oil is very destructive to insulating materials as it collects dust and dirt, causing them to break down electrically. When lubricating apparatus, extreme care should be taken to prevent the lubricant from getting on insulated parts and commutators. If this should occur, wipe off lubricant with clean wiping rags.

All screws, bolts and nuts which secure electric connections should be kept tight to insure good contact. When making a ground connection, the surface to which connection is to be made should be thoroughly cleaned of all dirt, paint or rust to assure good electric contact.

Cement may be used to advantage in repairing burned insulation such as sides of arc chutes, contactors and switches. One of these that has been used with considerable success is GE No. 12-G Compound. Another good cement is Sauereisen INSALUTE high temperature cement No. 7 manufactured by Sauereisen Cement Company, Pittsburgh, Pa., or equivalent.

Glyptal No. 1201 varnish is recommended for all cables exposed to dirt or moisture, especially where creepage is important. It has high insula-

ting qualities and gives a smooth surface which is easily cleaned.

When painting control apparatus, use a good quality of insulating varnish such as GE No. 458 or Glyptal No. 1201 varnish.

Be sure that tools, bolts, nuts, etc. are not left on or around the frames of the electrical equipment. Serious damage may result from an oversight of this nature.

During inspection, the following should be watched for and corrected:

Loose screws and nuts.

Cotter pins missing or not split.

Broken or weak springs.

Grease, oil or dirt on insulating material, contacts or any current carrying parts.

Worn or burned contacts.

Loose terminals and connections.

Broken insulators

Loose tie rods on resistors.

TESTING

After rotating apparatus has been removed from locomotive a megohmeter test can be used to check insulation resistance of armature and field coils. To check insulation resistance of armature or field coils, lift all brushes, then apply megger. Insulation resistance should not read less than one megohm.

OVERHAUL PROCEDURE FOR ROTATING APPARATUS

The following operations are recommended for rotating apparatus at overhaul periods. Steps 2,3,11,12,16 and 17 pertain especially to the Traction Motors.

GENERAL MAINTENANCE

1. Clean dirt away around all openings, such as commutator covers; waste chamber covers and oil filler pipes on axle caps; and around armature bearing caps.
2. Measure radial wear and end play of the axle bearings. Replace if wear exceeds the limits recommended for these parts.
3. Remove old waste and oil from the axle caps and wash them out with kerosene or other petroleum cleaner. Repack with new waste.
4. Dismount the motor and remove the pinion with a hydraulic pinion puller.
5. Remove the armature. Blow out dust and dirt with clean dry compressed air. Recondition per detailed instructions under ARMATURE and COMMUTATOR.
6. Examine bearing housings to make sure grease leaks have not developed. Remove armature bearings and clean and inspect them in accordance with detailed instructions under CARE OF ARMATURE BEARINGS.
7. Blow out the frame assembly with dry compressed air and clean the interior of the motor wiping with carbon tetrachloride to remove any oil or grease.
8. Make sure field coils are tight and are not moving in the magnet frame. If the field coils and connections are tight and in good condition give them two coats of Glyptal No. 1201 red enamel. If necessary to remove the coils proceed per detailed instructions which follow.
9. See that the brushholder mechanisms operate freely, that shunts and terminals are tight, and that insulators are clean and free from cracks; also see that carbonways are not rough or worn. Check spring tension.

10. See that pole piece bolts are tight and properly locked.
11. Fill countersinks around pole piece bolt heads with G-E No. 837 compound to exclude water.
12. Replace wearing plate on motor suspension nose if badly worn.
13. Reassemble armature bearings and housings on armature shaft.
14. Reassemble the armature in the motor and remount the pinion or pulley (See instructions on succeeding pages).
15. Put in new brushes if necessary.
16. Clean and repaint gear cases with Glyptal No. 1201 red enamel.
17. Remount the motor. See that all nuts and bolts are tight and properly locked, covers fast, axle caps packed with new waste and filled with oil, cable secured and gear case supplied with sufficient lubricant of proper quality. Be sure that axle flange dust guard is properly assembled with the drain on the down side.

ARMATURES

The armature should be closely inspected for the condition of bands, wedges, coils, insulation, general assembly and commutator.

Armature bands and core wedges should be tight and secure. Solder in the bands should be intact. If solder has thrown off, the cause should be determined and corrected and the bands replaced by tight banding.

The coil insulation should be clean and free from blisters, flakes or cracked insulating varnish surface.

When the condition of the insulating varnish on the armature is such that treatment is necessary, or if the banding is loose, the following should be observed:

1. Clean air holes through core. Clean creepage surface back of risers and creepage surface on armature head by reaching in from fan end through spokes of spider.
2. Remove bands and banding base if necessary.
3. Clean all surfaces with cloth dipped in carbon tetrachloride or equivalent, and blow out with dry compressed air. Protect windings from air blast.
4. Heat armature to a temperature of 120 C (248 F) - 140 C (284 F); to hold end windings in place, apply narrow temporary bands to each end winding, using fibre base to protect windings.
5. Dip hot 110 C (230 F) - 120 C (248 F) in Glyptal 2480 varnish; for viscosity refer to section on "PREPARATION OF VARNISHES". Hold armature in varnish for 5 to 10 minutes. Armature should be held on a swivel hook with the commutator end up and be submerged in varnish up to the commutator risers.
6. Thoroughly drain excess accumulation of varnish by spinning and wipe varnish from shaft, using a cloth soaked in Toluol.
7. Bake for 16 hours at an oven temperature of 140 C (284 F) to 150 C (302 F).
8. Measure the insulation resistance while armature is hot. The armature should be baked until the insulation resistance is at least one megohm.
9. Replace temporary bands with permanent binding.
10. Repeat 4, 5, 6 and 7.
11. Cool armature to approximately 50 C (122 F) and dip in Glyptal No. 1201 red enamel to provide the outside finish; for viscosity refer to "PREPARATION OF VARNISHES".

12. Thoroughly drain excess enamel and remove all enamel from the shaft.

13. Bake for 16 hours at an oven temperature of 140 C (284 F).

If armature is in good condition and banding is not replaced, the above varnish treatment should not be necessary. In such case, clean armature as in steps 1 and 3 above; then bake armature for 6 hours at 140 C (284 F) to 150 C (302 F) to remove moisture, cool to approximately 50 C (122 F) and proceed with treatment specified in steps 11, 12 and 13.

NOTE: If it is found necessary to rewind an armature it should be sent to the nearest G.E. Service Shop.

COMMUTATORS

The commutator should present a smooth surface free from pitting. If it has become pitted or damaged from any cause, it should be stoned or turned.

a. Stoning

A stone of proper curvature to fit the commutator surface with a span of approximately 30 degrees around commutator should be used. Extreme care must be taken while the stoning process is taking place to prevent the copper dust from settling in the windings. Blow out armature with dry compressed air frequently. Use paper to close open risers if possible, before stoning commutator. CAUTION: -paper must be secured to prevent flying off when armature is rotated.

After stoning, check the commutator surface for concentricity by using a dial indicator which will mount on the apparatus frame. Indicator should be 50 mils or less for one revolution of the pointer.

Check concentricity with apparatus mounted in its own bearings.

Wipe dirt or grease off string band. Be certain string band is tight and has a smooth surface. If finish has started to flake or chip, sand it lightly and blow out with dry compressed air. A coat of Glyptal No. 1201 red enamel should then be applied and permitted to dry.

b. Turning

If the commutator is badly worn or burned, remove the armature from the machine and turn the commutator in a lathe. Remove only enough copper to give a uniform surface, after which the side mica between segments should be recut, and the commutator surface stoned and cleaned.

Whenever possible, turn the commutator by supporting the armature in its own bearings. If the armature is held on lathe centers, be sure that these centers are true with respect to the bearing seats.

Before turning a commutator, make a suitable covering to keep the chips and dust from working into the armature. This covering can best be made as follows:

Use a strip of cloth wide enough to cover commutator risers, and long enough to encircle the commutator. Wrap this cloth around the commutator, binding the inside edge with a cord as close to the end connections of coils as possible. Then turn the cloth up over the cord and bind with another cord to the outside of the armature covering the band.

Make sure that the turning post is so set that the ways are parallel to the commutator and that they are fastened and braced securely. Use a side-cutting tool with the point ground to about 1/16 inch radius. The cutting side of the point should be given more rake than is customary for working iron and steel. The tool should be sharp enough to make a clean, smooth cut, without dragging copper over the mica.

While turning the commutator, it should be run at a surface speed of approximately 300 ft. per minute, which is about as fast as the tool will cut without burning. With a file, round off the ends of the commutator bars to at least 1/16 inch radius, while the commutator is still in the lathe.

c. Undercutting the Mica

After a commutator has been turned, undercut the side mica to the correct depth. See Data Sheet for apparatus concerned. Special saws are available for this purpose and care must be taken not to cut the slots too wide. Remove the sharp edges of the commutator bars with a hand scraper or a knife. Do not bevel the edges of the segments. Clean out the slots to remove all mica chips and fins, and be sure that no copper chips remain in the slot. A satisfactory tool for this operation can be made from a piece of worn-out hack-saw blade.

After the mica has been undercut and the slots cleaned out, the commutator is ready for sanding and final polishing.

BRUSHHOLDERS

Maintain clearance between the bottom of the brushholders and the commutator as outlined on the Data Sheet for apparatus concerned. When adjusting brushholders, place cardboard between commutator and brushholder. Adjust spacing by loosening the capscrew (main generator) which secures the mycalex stud to the framehead and move support up or down to obtain the correct clearance. Remove the bolt in the slotted ear of the bus ring (main generator) before attempting to move the brushholder support and tighten it after setting the brushholder. Brush-holders in most machines are fixed with the exception of the traction motor which has an adjustment at the brush-holder itself.

Examine the brushholders for damage caused by flashover or binding of the brushes. Brushes must slide freely in the holders. Work the brush up and down several times to release any carbon dust or other foreign material which tends to cause binding. Do not snap the spring as this may chip the brush.

To replace a brushholder, remove the complete support assembly with brush holders. First lift or remove the brushes. Remove the bolt which secures the bus ring terminal to the terminal on the brush-holder support (main generator). Remove the capscrew through the framehead which holds the mycalex insulating stud on the end of the support. Lift out the complete assembly and remove the cardboard.

Installation of a brush-holder assembly is the reverse operation. Position the support so the face of the brush holder maintains the limits specified on Data Sheets, from commutator. Assemble the capscrew and lockwasher and draw up securely. Assemble slotted bus ring terminal (main generator) and bolt tightly to the support terminal. Install brushes.

BRUSHES

Replace brushes that have been chipped or worn excessively, with the same grade of brush or a G-E recommended substitute, as widely different kinds of brushes on the same machine may effect the operation.

To install a new brush, release tension on spring, lift the brush lever with the fingers and drop the brush in place in the brush-holder carbonway. Secure the brush pigtail under the terminal screw on the brush-holder body. Care must be taken to arrange the pigtail shunts so that they clear the commutator riser on the armature and the window in the brush-holder body.

a. Sanding

When new brushes are installed they must be sanded to fit the

curvature of the armature. Plate A-118563 readily shows how this is to be done by inserting sandpaper between brush and commutator with rough side against the brush.

b. Seating

When more than one third of a set of new brushes are installed in a generator the brushes must be seated to a smooth fit. This is done by running the generator at Idling speed and holding a seater (Cat. 106X98) lightly against the commutator and move it back and forward axally across the commutator to cover the entire brush surface. The fine particles of dust must be blown off after the seater has been applied and allowed to wear the brushes smooth.

FIELD COILS

Coils removed from the machine should be given the following treatment:

1. To remove, the coil, disconnect the cables and remove the pole-piece bolts. Remove the coil and pole through the end of the frame.
2. Thoroughly clean the coil to remove any dirt, oil or grease.
3. Heat the field coils to 100-C (212 F) to remove any moisture; then paint, spray, or preferably dip the coil in Glyptal No. 1201 red enamel of barrel viscosity and drain thoroughly.
4. Bake in an oven for 8 hours at a temperature of 100 C (212 F) to 120 C (248 F).
5. Clean all terminals and contact surfaces of the coil and pole pieces.
6. Reassemble poles and coils in the frame, using the original shims. Always use new lockwashers under the pole-piece bolts when re-assembling.

7. Connect all cables and reinsulate the connections with G-E putty No. 2. Put this putty around the terminals in the same manner as it was originally applied. Refer to the CONNECTION DIAGRAM for the particular machine, and check the coil polarity.

8. Apply high-potential test between the coils and the frame.

After the coils are reassembled in the frame (traction motors), brush or spray the frames with an additional coat of Glyptal No. 1201 red enamel and allow it to dry.

Assembly

All new coils, or coils which have been dipped and baked, should be assembled in the frame while they are hot, 80 to 100 C (176 F - 212 F) (except those which are permanently assembled to the pole piece). The hot coil has more give to it, thus allowing the pole to be pulled down tight against the frame.

After connecting the coils according to the CONNECTION DIAGRAM, the relative polarity can be checked by exciting the field circuit. Adjacent poles of the same field circuit should be opposite polarity; this can be observed by means of a compass.

BEARINGS

a. Cleaning

As conditions dictate, bearing assemblies should be disassembled and thoroughly cleaned with kerosene or similar solvent to remove the accumulation of old and hardened grease from bearings, housing and grease passages.

After bearings have been cleaned in the solvent, they should be further washed in a light mineral lubricating oil of SAE-10 grade, heated to 90 C (194 F). This is to prevent corrosion of the highly polished sur-

faces.

b. Inspection

After the bearing has been cleaned, rotate it slowly and feel for roughness in rollers or races. Visually inspect rollers and races for signs of pitting or galling, worn spots, loose rivets or loose or worn cages. Inspect for discoloration of rollers, and bearing races for evidence of overheating. Examine bearing fit in framehead for excessive wear. If the bearing condition is questionable, a new bearing should be installed and steps taken to have the questionable bearing reconditioned or scrapped and worn frameheads corrected.

c. Repacking

When bearing compartment is clean and dry, repack with fresh grease. See Data Sheet for apparatus concerned for proper grease capacity. When reassembling, some grease should be packed in the bearing itself.

PREPARATION OF VARNISHES

Glyptal No. 2480 varnish and Glyptal No. 1201 red enamel are recommended for dipping and baking armatures and field coils of rotating apparatus. Glyptal No. 2480, a clear synthetic varnish, has high heat endurance, ability to penetrate windings, and high dielectric strength. It bonds well and is used to fill the fibrous structure of the insulation.

Glyptal No. 1201, a synthetic red enamel, has excellent film building properties, is resistant to oil and acid, and is used to provide surface finish. It has good heat endurance, and dielectric properties.

To obtain satisfactory penetration, bonding and curing with these finishes, it is essential that their viscosity be correct. The G-E Zahn viscosimeter is recommended for measuring the viscosity because of its

convenience, accuracy and low cost.

The equipment necessary to measure viscosity is as follows:

1. Thermometer to measure temperature.
2. Stop watch.
3. Zahn viscosimeter, Use No. 3 Zahn cup for both Glyptal No. 2480 varnish and Glyptal No. 1201 red enamel.
4. Curve sheets for correcting viscosity to 77 F or 25 C.

   Curve H-4781124 for Glyptal No. 2480 varnish.

   Curve H-2782562 for Glyptal No. 1201 red enamel.

Method of measuring viscosity is as follows:

1. Mix material thoroughly and allow to settle for a few minutes to eliminate trapped air.
2. Immerse viscosimeter cup and let it remain for about a minute to allow it to assume the temperature of material.
3. Raise cup quickly by ring in end of handle and start stop watch at instant cup leaves surface of liquid.
4. Stop the watch at instant draining column first breaks from cup.
5. The number of seconds measured is viscosity at temperature of material.
6. Correct viscosity as measured, to viscosity at 25 C by using curve H-4781124 for Glyptal No. 2480 varnish and curve H-2782562 for Glyptal No. 1201 red enamel. The viscosities desired on these materials for treatment of armature are as follows:

   Glyptal No. 2480 - 35 seconds at 25 C (77 F) with No. 3 Zahn cup.

   Glyptal No. 1201 - 25 seconds at 25 C (77 F) with No. 3 Zahn cup.

7. If measured viscosity is not correct for 25 C (77 F) as shown on curve, correct it by addition of solvents to decrease viscosity or new stock to increase viscosity.

CAUTION: Clean cup and its orifice after every reading and take care that stray lumps or skins in liquid do not prolong cup draining time.

Use Toluol as a solvent for controlling the viscosity of these finished.

Agitate these materials in dipping tank, preferably by use of a circulating pump, to thoroughly mix solvent throughout solution. This is particularly necessary for Glyptal No. 1201, since solids tend to separate from thinner if allowed to stand.

CONTROL REPAIRS

Maintenance men should be cautioned against bending contacts while cleaning.

Copper or Alloy Contact Tips, Segments and Fingers

Smooth up roughened or beaded surfaces by filling very lightly with a very fine file. Do not remove too much material as it is not necessary to remove small pits. Be sure that full contact is obtained across and between the contact surfaces after filing.

Install new parts when contacts are badly pitted or worn half way through at the contact surface or when wear is sufficient to cause poor contact.

Silver-Faced Contacts and Fingers

Clean surfaces preferably with a clean, lintless cloth moistened with carbon tetrachloride or use a very fine file. Do not use sandpaper or emery cloth as these leave grains embedded in the silver that will insulate the contacts. When serated contacts are used, resharpen them with a small triangular file.

Install new parts when silver facing has worn through.

Operating Coils

Measure resistance. If it varies more than 10 percent from value given under each device, install new coil.

AIR CYLINDERS

During the overhaul of the device, it should be disassembled, cleaned, and checked for any defective parts and replacements made.

If the piston leathers are brittle or cracked they should be replaced. Dry or hard piston leathers should be soaked in GE PC No. 1 oil.

Before reassembly of the device the cylinder walls should be thinly coated with GE PC No. 2 grease.

CAUTION: When reassembling a piston a thin shim should be inserted between the piston and the oil inlet in the cylinder wall to protect the piston leathers from abrasion.

Adjustments

See instructions under each device.

Contact Gaps, Wipes and Pressures

These are checked during annual inspection and after the device has been torn down and reassembled. Their values are given under each device.

The contact gap is the distance between contact surfaces with device fully open. The gap with old contacts will be greater than that given under each device by the amount of wear on the contact surfaces. Low gap may be caused by worn contact arm or bent armature stop.

The wipe (wear allowance) is a measure of the armature movement after the contacts touch. It is the distance the movable contact would travel from the point it first touches the stationary contact to the position it would assume if the stationary contact were removed. Low wipe is caused by

badly worn or bent contacts, insufficient armature travel or bent stationary contact supports. High wipe is due to bent contacts or worn stop on contact arm.

Measure contact pressures by attaching a spring balance (with wire or string stirrup when necessary) to the movable contact arm at or near the point of contact. Plate 819281A shows the method of measuring final contact pressure on contactors.

Initial pressure is the force required to just move the contact when the armature is open. Low pressure is caused by defective spring, worn spring seat or worn stop on movable contact arm.

Final pressure is the force required to just release a thin piece of paper between the contacts. The armature must be fully closed, either mechanically or by energizing the operating coil. Low final pressure is caused by defective spring, low wipe or badly worn contacts.

INSPECTION AFTER REPAIRS

After apparatus has been reconditioned or repaired, a careful check should be made to see that no foreign matter remains in the apparatus and no loose brushes or other obstructions remain on commutators. Check connections with the connection diagram to make certain that the apparatus is connected properly. See that all bolts are drawn up tightly and locked if necessary.

TESTING AFTER REPAIRS

After rotating apparatus has been reconditioned or repaired, measure insulation resistance with a megohmeter. If insulation resistance measures not less than one megohm, apply the following high-potential tests to the assembled machines.

	Type Machine	Hipot
GT-564	Main Generator	1500 volts
AM-806	Exciter 115 V	600 volts
GY-20A	75 Volt Auxiliary	600 volts
GE-726	Traction Motor	1500 volts
GY-19	Braking Resistor Blower	600 volts
GY-26	Traction Motor Blower	600 volts