MAINTENANCE INSTRUCTION

AUXILIARY GENERATOR
MODEL A-8102 PART NO. 8140947

APPLICATION: F3, F7, FP7, GP7 And SD7 (With Steam Generator) And MRS-1

GENERAL DESCRIPTION

The Model A-8102 shunt wound auxiliary generator, Fig. 1, is rated at 18 KW, 80 volts DC, 800-2400 RPM, and is ventilated by air drawn into the machine by a fan mounted on the armature. Armature rotation is counter-clockwise when viewed from the commutator end.

This auxiliary generator is driven by the engine through a flexible shaft extension from the number two idler gear of the camshaft drive gear train and provides direct current for charging batteries, control circuits, lighting, steam generator, battery field and alternator rotor field excitation. The voltage is automatically controlled by a voltage regulator.

A blower impeller mounted directly on the fan end shaft extension provides cooling air for the main generator and alternator.

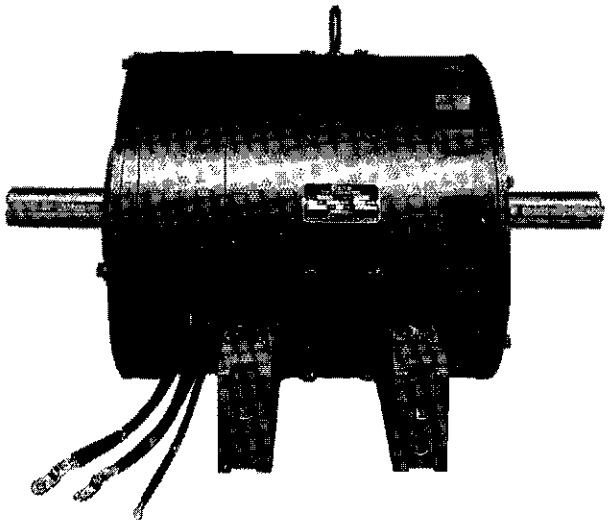

Fig. 1 - Auxiliary Generator A-8102

MAINTENANCE

Inspection

Apparatus should be inspected often enough to prevent failures in service. This should include the examinations of component parts which will appear under their respective headings in this bulletin.

Cleaning

It is essential that the auxiliary generator be kept clean at all times. It should be blown out with clean dry compressed air as outlined in Maintenance Instruction 1704. Approximately every year the insulation on the commutator cap should be cleaned and when dry painted with air-drying insulating varnish. The brush holder ring insulator should be wiped clean. Any accumulations of oil and dirt should be removed.

The electrical equipment must not be sprayed or cleaned with a liquid of any kind. Attempting to clean the coil and windings with a liquid cleaner will destroy the protective coating, causing it to peel or crack. All that is necessary is to blow out the dust and dirt with clean air periodically. This should be done often enough to prevent any accumulations. If deposits of dirt are allowed to collect, they sometimes become caked, making them more difficult to remove. A LARGE VOLUME of air at reasonably LOW PRESSURE should be used. If a high pressure from a nozzle is used, there is danger of loosening tape and cutting the protective

coating of the various parts. Some parts, such as brush holders and contacts, should be wiped with a clean dry cloth.

In cases where there are heavy deposits of grease or dirt which cannot be removed with air and dry cloths, a stiff brush, soft wood or fibre scrapers may be required. In SEVERE cases, it may be necessary to DAMPEN a cloth in cleaner to remove oxidized grease or oil. However, every precaution should be taken to KEEP THE CLEANER OFF THE COMMUTATOR as unsatisfactory brush performance may result if cleaner is used on commutator surface. Cleaners should be used only when other methods will not remove the foreign material.

Creepage Surface

Refer to instructions on creepage surface care and maintenance of traction motor and generator commutators, in Maintenance Instructions 1119, 432 or 433.

Lubrication

The ball bearings are the double-shielded type and are packed at the factory with a lubricant (ANDOK C) which does not become fluid except at temperatures higher than those reached under normal operation. Since the bearings are sealed on both sides they do not require additional lubrication. However, on overhaul the bearings should be removed and replaced with new factory packed bearings.

Care And Maintenance — Brushes And Brush Holders

A periodic inspection of brushes and brush holders should be made, and the following points should be observed.

Brushes should move freely in the holders, and not be stuck with dirt or other foreign substance. Lift the springs, and raise and lower the brushes in the carbonways so as to release any dirt that may have accumulated. Care should be taken not to snap the spring as this may chip the brush.

Replace the brushes that have been chipped or worn excessively with the same grade of brush or recommended replacement. This is especially necessary when only a partial replacement is made, as two different kinds of brushes

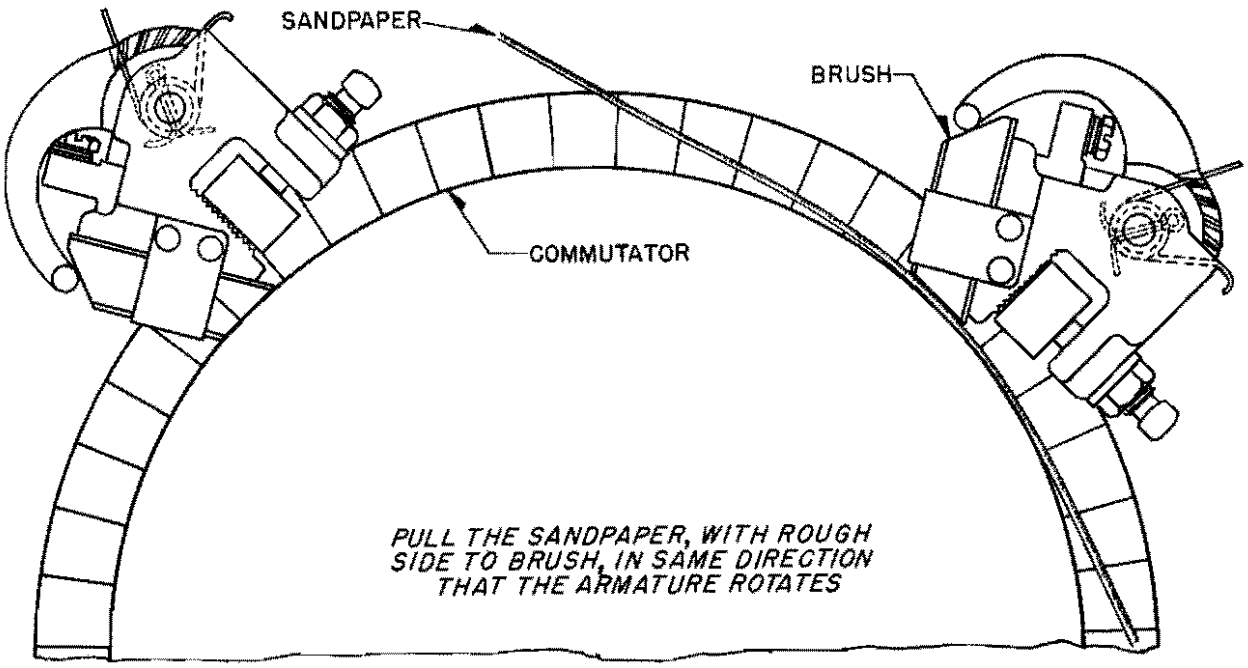

Fig. 2 - Fitting Brushes To Commutator

on the same generator are likely to be detrimental to its successful operation. When the new brushes are installed they should be "sanded-in" one at a time, Fig. 2, by placing a piece of 00 grade sandpaper under the brush with the sand side contacting the brush and moving the sandpaper the direction of rotation. Lift the brush when moving the paper back, and keep the paper close to the commutator to avoid rounding the edges of the brush.

NOTE: DO NOT USE EMERY CLOTH OR EMERY PAPER FOR "SANDING IN" BRUSHES.

Proper brush pressure should be maintained as specified under "Maintenance Data" at the end of this instruction. Unequal brush pressure may cause unequal current distribution to the brushes. Refer to Fig. 3 for method of measuring brush pressure.

Maintain 1/8" clearance between the bottom of each brush holder and the commutator. The brush holder assembly is arranged in such a way that the brush holder may be moved toward the commutator by loosening the check nut and the set screw on the brush arm. Brush holders should be rigidly bolted in place.

The carbon brush shunts should be so arranged that they will clear the parts of the frame that are at ground potential.

Commutator

The commutator should present a polished surface entirely free from pitting. In the event the commutator becomes pitted it should be cleaned with a fine commutator stone.

NOTE: Do not use carborundum, emery cloth, or emery paper on the commutator.

When cleaning the commutator with a stone, extreme caution must be taken to keep copper dust from the windings. The air openings in the end frame on the fan end should be covered to prevent the fan from drawing dust into the windings. After cleaning the commutator, blow out windings carefully with clean dry compressed air at reduced pressure.

If the commutator has high and low spots or signs of burning, the armature should be placed in a lathe and the commutator turned just enough to give it a uniform surface.

Do not apply lubricant to the commutator because it is detrimental to successful operation. If the commutator is not kept clean and free from grease and oil, carbon dust will collect in the grooves between the segments and may cause a short circuit.

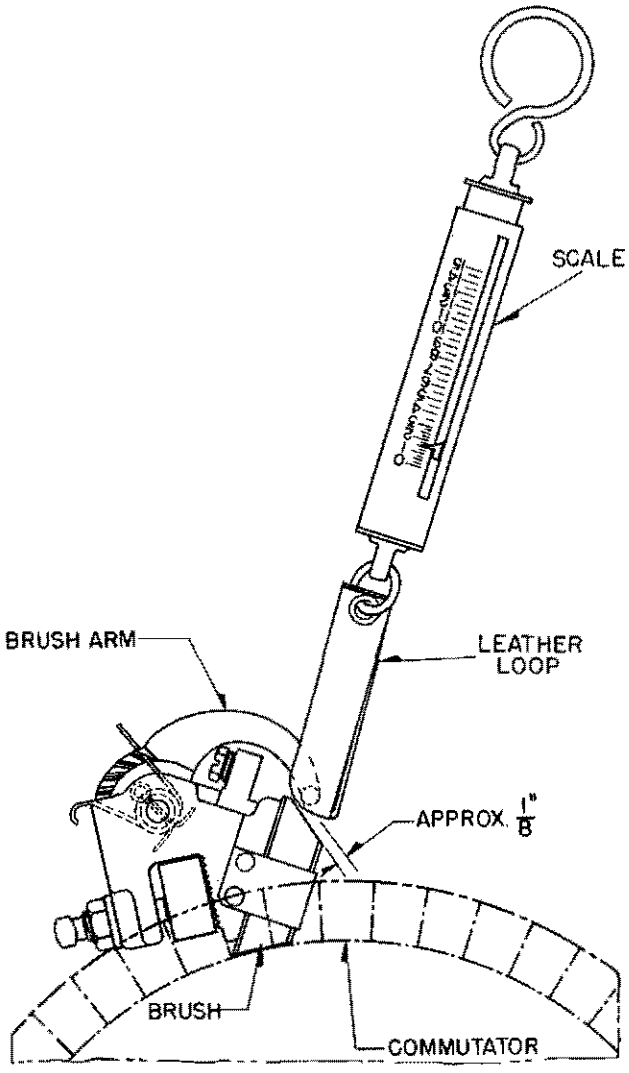

Fig. 3 - Measuring Brush Pressure

Auxiliary Generator Overhaul

Auxiliary generator overhaul consists of careful inspection of the stator field assembly, armature assembly, brush holder assembly, and bearing assembly, especially with respect to defects or necessary repairs; also application of required tests, checks, cleaning and varnish treatment so that when the component assemblies of the generator are reassembled the generator will operate successfully to the next overhaul period.

The auxiliary generator should be overhauled at periods as specified in Maintenance Instruction 1704 and should be serviced as follows:

1. Remove the armature.
2. Remove and discard (SCRAP) ball bearings.
3. Clean and repaint field coils and leads.
4. Clean, dip and bake armatures.
5. Turn and undercut the commutator (if necessary).
6. Replace string band (if necessary).
7. Assemble, using NEW double-shielded factory packed bearings. Make certain that bearing retainer nut is locked with washer provided for that purpose.

The following precautions should be observed to prevent bearing failures:

1. When removing coupling flange or blower fan wheel assembly, use a puller that does not apply a load on the bearings.
2. Coupling flange or blower fan must be pressed on the shaft in such a way that the forces are not transmitted through the bearings.
3. Care must be exercised in handling the auxiliary generator to prevent bumping of shaft which is likely to damage the bearings.
4. Bearings which have been removed from the shaft at any time should not be used again, but should be replaced with new factory packed bearings.

Disassembly Of Auxiliary Generator

Removal of armature from stator:

1. Remove coupling flange and blower fan wheel from shaft using studs and a puller plate. Remove keys from shaft.
2. Before removing the end frame on the commutator end, mark the end frame and stator assembly with a prick punch. This is done so that the brushes will not be shifted away from the electrical neutral when reassembling the commutator end frame.
3. Remove the brushes from the commutator and cover the commutator with a protective paper covering.
4. Disconnect the connection from brush holder to interpole field coils and remove the clamps holding stator leads to housing.
5. Remove bearing cap mounting bolts from the commutator and fan end frames.
6. Remove end frame mounting bolts from both end frames.
7. Place a protective covering over shaft and apply a piece of pipe over the shaft extension. Support the free end of the pipe with blocks and loosen the commutator end frame by tapping on frame using a brass or copper bar. When the commutator end frame is moved away from the stator, place stiff pieces of paper between armature and pole piece at the bottom of the armature. Remove commutator

end frame. Next remove the fan end frame by tapping on the end frame; the end frame can then be slid over the bearing assembly. The stiff paper under the armature will keep the armature from dropping.

8. To remove the generator armature entirely, a heavy rope should be placed around the ends of the armature shaft and the complete armature lifted enough to clear the pole pieces. Ease the armature out of the frame toward the fan end. Care must be exercised not to injure the laminations and windings during this process. An extension pipe may be required over shaft at the commutator end, so that the armature may be projected far enough out of the frame to be handled.

NOTE: Do not lift the weight of the armature with rope around the commutator.

Removing Armature Bearings

1. Remove bearing retainer lock nut from both ends of bearing assemblies.

2. Remove remaining bearing assembly on shaft by tapping the bearing housing lightly and evenly with a rawhide mallet or soft metal hammer. The remaining bearing parts on shaft are as follows:

   a. Ball bearing assembly.
   b. Spacer between bearing and shaft.
   c. Bearing housing.

NOTE: A new bearing is to be installed and the old bearing discarded.

Armature

Follow cleaning procedure as noted in traction motor or generator armature cleaning in Maintenance Instructions 1121, Section V, 432 or 433.

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

Armature bands should be tight and secure. Soldering on the band should be intact. If the solder has been thrown off, the cause should be determined and corrected and bands replaced.

The coil insulation should be free of blisters, flakes, or cracked insulating varnish surfaces.

Electrical Tests

Before applying a high potential test to the armature make an insulation condition test with a megohmmeter. If armature is free of insulation deterioration, moisture grounds and the creepage surface is clean, a high megohm reading may be expected, usually from 100 megohms to infinity. When low megohm readings are found, the armature should be baked for 4 hours at 100° C. in a convection type oven. Recheck megohm readings after cooling armature to the temperature of the last test for a comparison value. If below 1 megohm strip and rewind.

When armature passes the megohmmeter test apply a high potential test at 600 volts, A.C. 60 cycles. Armatures that fail on high potential test should be stripped and rewound, unless the fault can be located and a permanent repair made.

When the armature passes the high potential test, apply a bar-to-bar resistance comparison test with a low resistance ohmmeter test set. Readings above normal may indicate poor solder joints; and readings below normal will indicate a short which must be eliminated or the armature stripped and rewound.

Armature Wire Bands

Armature band wire diameter is .040" and has a tension of 150 pounds. Duplicate the banding originally on the

armature. Do not change width, diameter, position, or material of the band wire. Duplicate the insulation under the band wire to bring the wire band to proper level, Fig. 4.

CAUTION: Failure to adhere to the above instructions may cause heavy circulating currents in band wire sufficient to overheat and melt the solder.

Solder band wire and clips with pure tin solder. Flux band before soldering. Refer to banding of traction motor and generator armature bandings.

Commutator Machining

When the commutator is rough, burned, or eccentric, the armature should be placed in a lathe and the commutator turned. Before turning the commutator, a suitable head covering should be placed over the end windings to prevent the chips working into the armature. While turning, the peripheral speed of the commutator surface should be about 300 feet per minute. Use a carboloy tipped tool when cutting commutator surface. Round off the ends of the commutator segments to at least 1/32" radius with a mill file.

After commutator has been turned, the mica insulation between segment bars should be regrooved to a depth of 3/64". The width of mica insulation between commutator segments is .030", and the width of the mica under-cutting saw is to be .025". The sharp edges of the commutator bars should be removed with

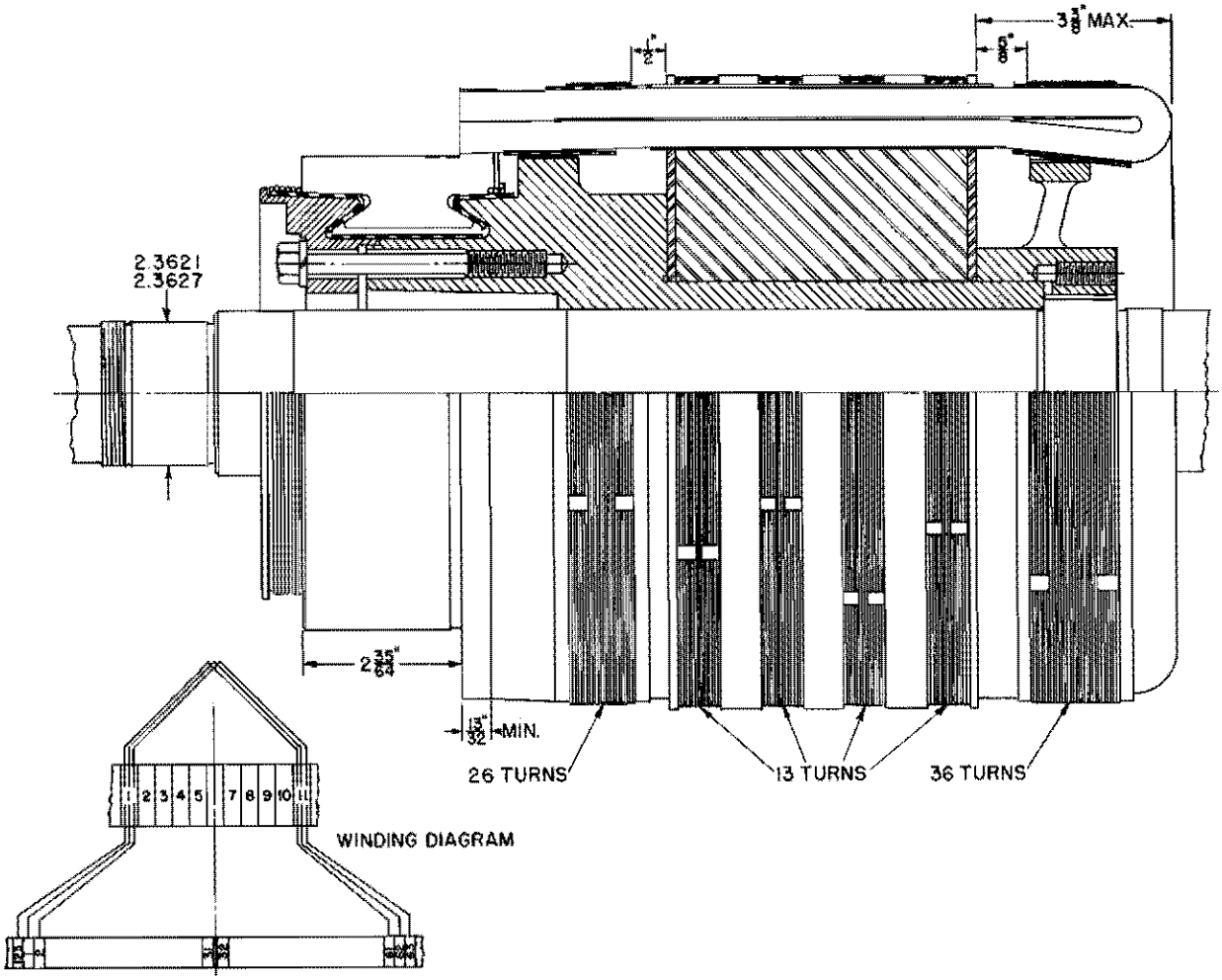

Fig. 4 - Armature Assembly

a hand scraper or a triangular file. Inspect grooves to see that no copper chips remain. Final polishing should be done with a fine grade commutator stone and crocus cloth.

Check commutator for eccentricity, maximum eccentricity .0005" and dial indicator reading .001".

Commutator Diameter Wear Limit

The diameter of a new commutator is 7.750"-7.754", and the minimum serviceable commutator diameter is 7.125".

Tightening Commutator

After varnish treatment and last baking and while armature is hot, check commutator nuts for tightness. Apply 360 inch-pounds torque to commutator nuts to test for tightness.

Varnish Treatment To Armature

Dip and bake or vacuum impregnate armature as noted under vacuum impregnation of traction motor and main generator armatures. See Maintenance Instruction 1121 Section 5 or 433.

Dynamic Balancing Of Armature

It is recommended that the armature be dynamically balanced after any of the following operations.

1. Armature rewound or coils repaired.
2. Armature rebanded.

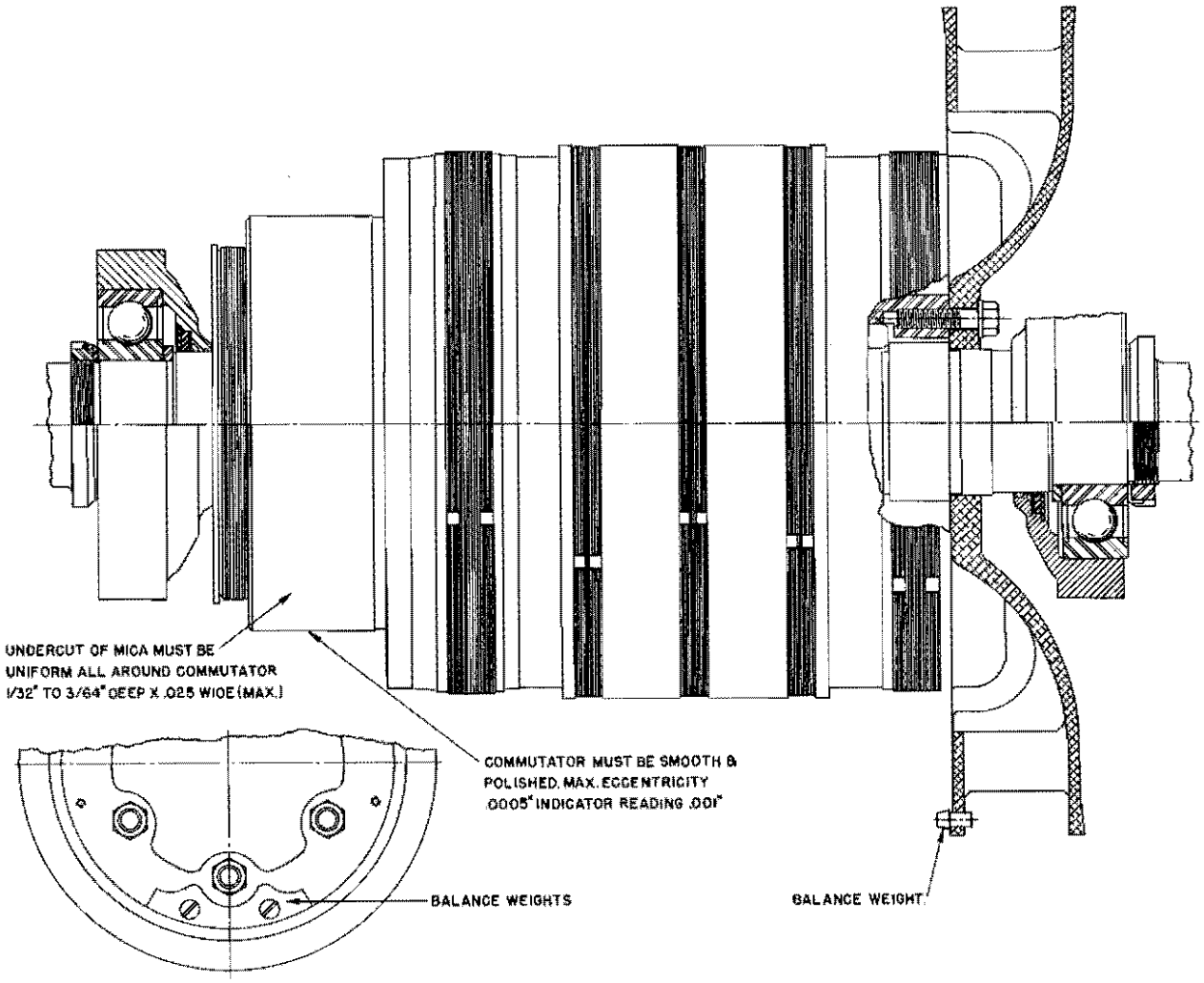

Fig. 5 - Armature And Fan Assembly

3. Armature vacuum impregnated or dipped and baked.

4. Repairs to commutator other than tightening and turning.

NOTE: It is advisable that no repairs be made to the commutators of this generator, except tightening and turning. When conditions are such that the commutator needs repair, return the generator to locomotive manufacture for remanufacture.

The auxiliary generator armature must be in dynamic balance within 1/2 inch-ounce.

Balancing Commutator End Of Armature

An armature unbalanced at the commutator end is balanced by applying weights to the commutator spider and securing the weights with special cap screws, Fig. 5. The maximum stack-up of weights at the commutator end that may be applied to the same position of the commutator spider is 3/8". Weights 5367138, 5287028 and 5387209 are to be used as required for balancing.

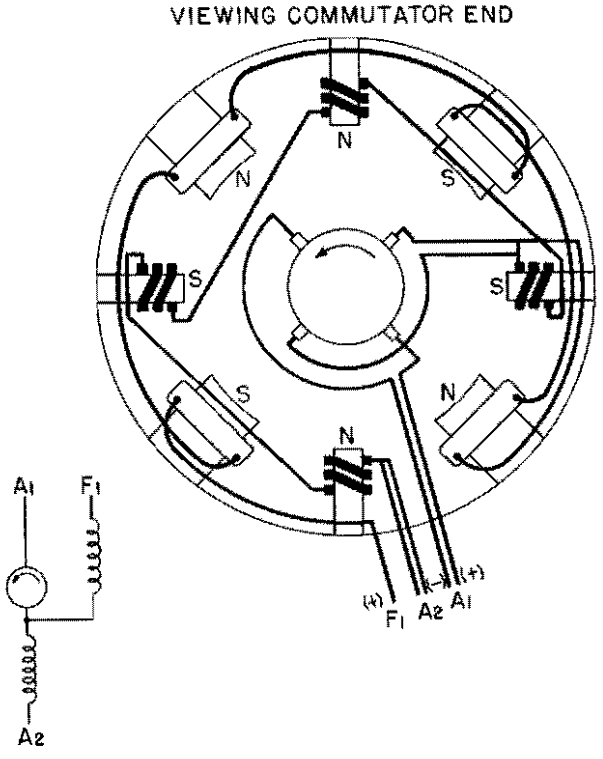

Fig. 6 - Connection Diagram

If the stack-up of weights is between 1/4" minimum and 3/8" maximum, use special cap screws 5373528.

If the stack-up of weights is between 3/32" minimum and 7/32" maximum, use special cap screws 5373527.

Balancing Fan End Of Armature

An armature unbalanced at the fan end is balanced by applying weights to the fan. If the point of unbalance is away from the original balanced position, drill a .255" - .263" diameter hole and apply fan end balance weight 5393723 as shown in Fig. 5. Drill as many holes and apply same amount of weights as required for balancing.

The fan is of one-piece construction bolted to the armature spider. By removing the bolts, the fan can be slipped off the shaft. If the balance has not been disturbed, care should be taken to reassemble the fan in the same position.

Stator Assembly

Cleaning

Follow cleaning procedure as noted for traction motor stator or main generator stator cleaning in Maintenance Instructions 1121, Section II, 432 or 433.

Electrical Tests

Apply a insulation condition test with a megohmmeter, if low readings are found, dry out stator before applying high potential test.

After megohmmeter test make a 800 volt A.C. 60 cycle high potential test on field coils to stator frame.

Make a resistance check of field coil and interpole circuits, see Maintenance Data. A polarity test, if necessary, can be made with the aid of a magnetized dip needle and by applying direct current to the field circuits, see Figs. 6 and 7.

Field Coils

Connections and leads to coils should be examined to determine if they are mechanically and electrically satisfactory. Field coils, leads, and cable connections must be secured and all taping made intact. Check shunt and interpole fields for tightness.

Examine field coil insulation for cracks in insulation. If field coils are tight and insulation in good condition, place stator assembly in a convection type oven and preheat (4) hours at 115° C. or 239° F. Remove stator assembly from oven and apply insulating varnish to field coils. After varnish treatment, bake stator assembly in a convection type oven. Remove from oven and cool to room temperature. Apply one coat of black air-drying varnish around inside of stator assembly.

When necessary to remove field coils, provision should be made to keep

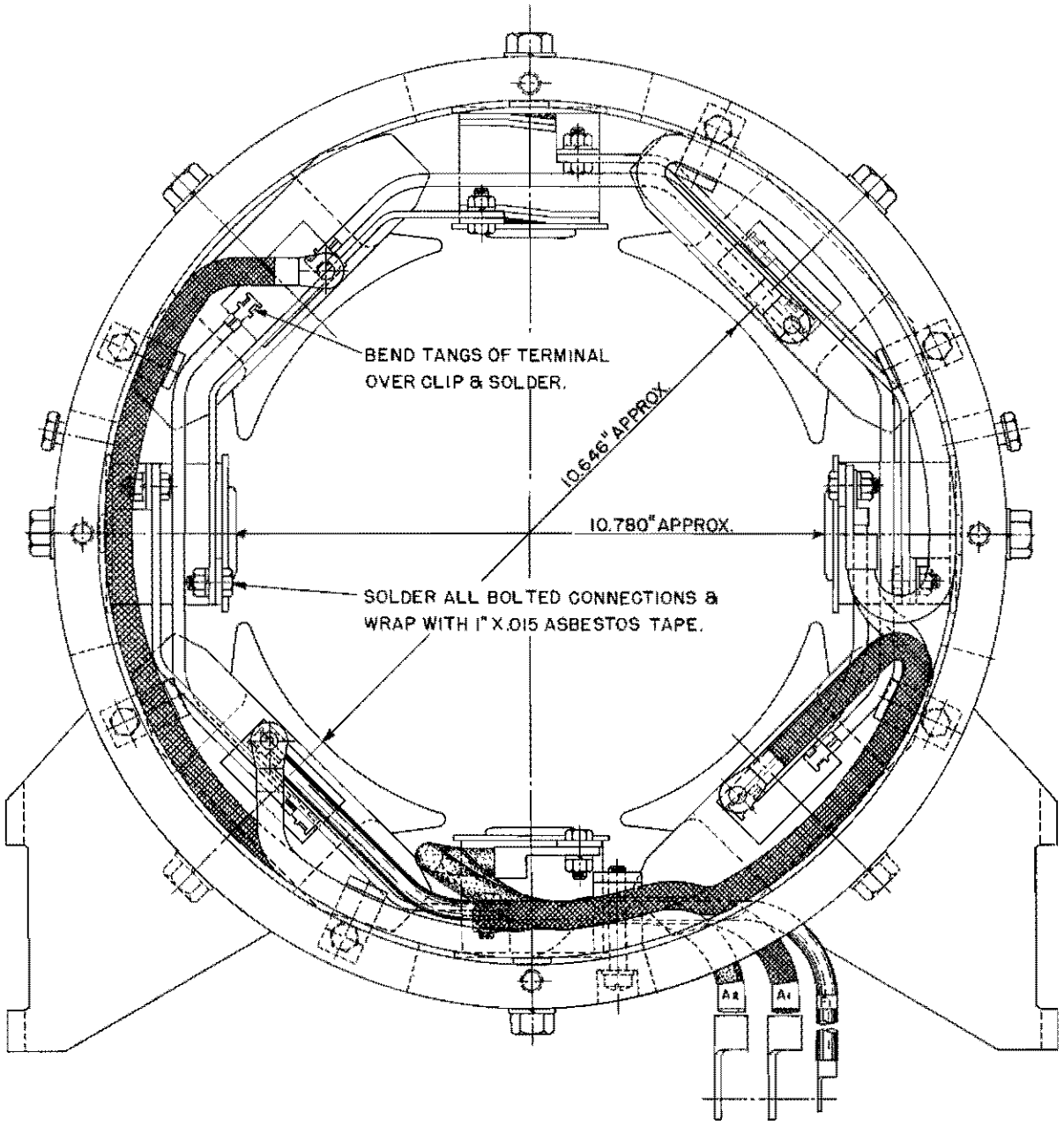

Fig. 7 - Stator Assembly

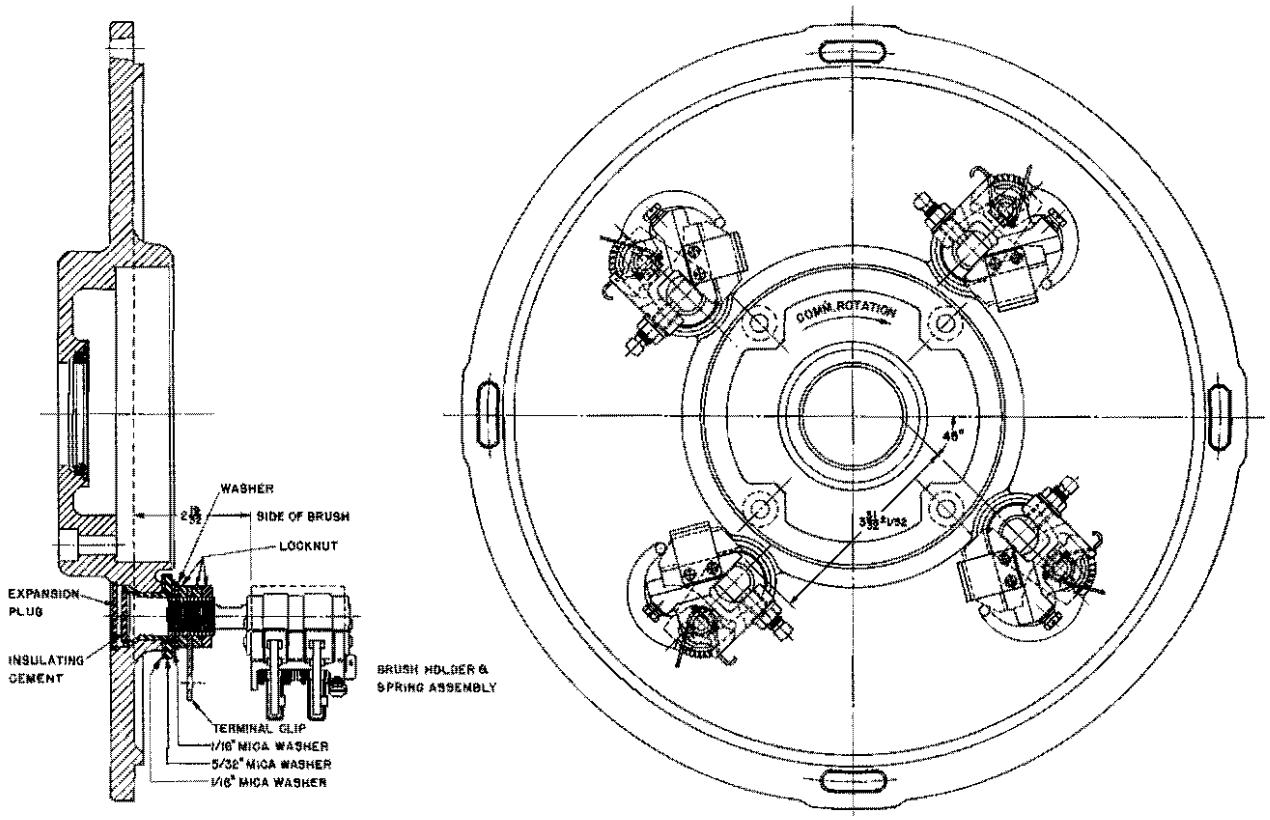

Fig. 8 - Commutator And Brush Holder Assembly

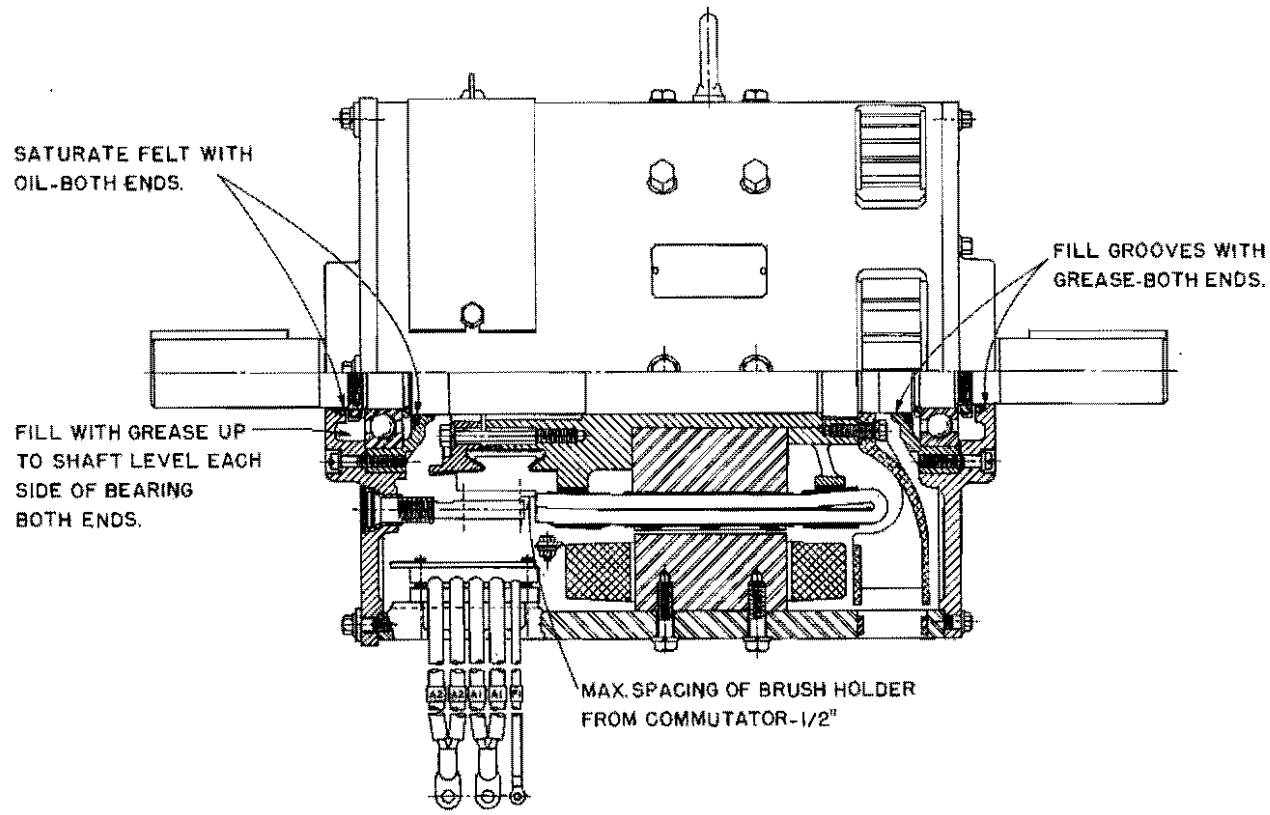

Fig. 9 - Sectional View Of Generator Outline

each pole, coil, and shims together. Upon reassembly the parts should be placed back in their original position.

New field coils which are to be installed should first be kept for 1 hour in a 80 to 100° C. oven. While hot, they should be assembled on poles and drawn up tightly in the generator frame.

Clean the contact surfaces and bolt together tightly, bolted connections, and solder connection as noted in Fig. 7.

Commutator End Frame And Brush Holder Assembly

Inspect felt seal for wear and damage. If felt seal is defective, tap out seal retainer expansion ring and seal retainer washer to get at the felt washer. Replace parts removed with new parts. Saturate felts with oil on both ends. Use no grease on felts.

Inspect brush holder assembly for damaged carbon boxes and springs. Fig. 8 shows the proper brush holder setting if brush holders are removed from the brush holder mounting stud.

Apply a high potential test to end frame and brush holder assembly using 800 volts A.C. 60 cycles.

Paint inside of end frame with air-drying insulating varnish.

Armature Bearing And Final Generator Assembly

1. Clean out grease cavities in bearing housings and in end frames surrounding bearings.
2. Check seal retainer, felt washer, and expansion washer in bearing housing. If felt washer is defective, tap out old felt seal assembly and press or tap in new felt seal assembly. Saturate felt seal in both housings with oil.
3. Fill labyrinth groove of bearing housing with Andok B grease and apply small amount of grease in bearing housing cavity to prevent parts from rusting, Fig. 9. Keep grease off felt seal.
4. Place proper bearing housing on shaft, one on the commutator end and the other on the fan end.
5. Place spacer washer on each end of shaft see Fig. 5, for position and move solidly against shoulder of shaft.
6. The old bearing assemblies previously removed and scrapped should be replaced with new factory packed bearings. Place bearings on shaft. With the aid of the locknut and a new lockwasher, move bearing solidly against the spacer washer, Fig. 5. Make sure locknut is tight against bearing and lock nut in place with lockwasher on both bearing assemblies. Fig. 10 shows dimensions of a new bearing.
7. Apply a new gasket to commutator end and fan end bearing housing.
8. Apply 3 ounces of Andok B grease to each end frame cavity as noted in Fig. 9, and assemble fan end frame over fan end bearing housing. Bolt end frame to bearing housing.
9. Apply two 3/8"-16 by 6" long studs to commutator end bearing housing for piloting bearing housing into end frame.
10. Bolt commutator end frame and brush holder rigging assembly to the stator

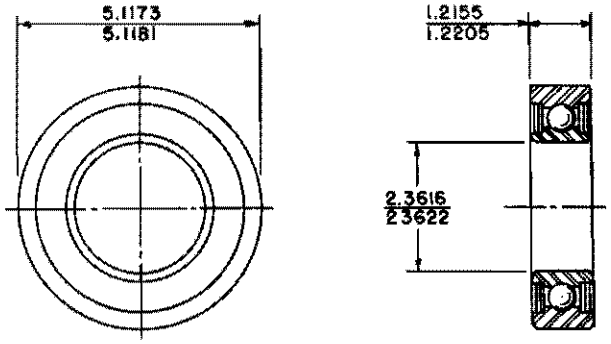

Fig. 10 - Shielded Ball Bearing

assembly. Line up prick punch marks on end frame and stator frame which were made during disassembly of generator. Insert cable leads into cleat. Bolt cable leads to brush holders removed during disassembly.

11. Raise stator assembly to vertical position and rest assembly on commutator end frame. Block under end frame to clear pilot studs and level stator assembly for installation of armature.

12. Apply eyebolt to fan end of shaft and install armature assembly into stator assembly. Guide commutator end housing pilot studs into end frame.

13. Bolt fan end frame to stator assembly and return generator to horizontal position.

14. Remove pilot studs from commutator end housing. Apply bearing housing to end frame cap screws.

15. Apply brushes to brush holders and seat brushes to commutator.

16. Fig. 11 shows the Auxiliary Generator Outline for Model A-8102.

Insulation Test After Overhaul

All high potential tests must be made by placing electrodes on circuit under test before closing switch. Dangerous over-voltage surges may result when touching the circuit under test with electrodes already energized, see Maintenance Instruction 2100.

This generator is a low voltage machine and for insulation test purpose falls in the same class as the locomotive low voltage tests. Apply 600 volts to ground for one minute after overhaul.

Aligning Auxiliary Generator

When coupling two rotating shafts together, it is important to provide proper alignment between them so as to eliminate vibration and bending of the shafts. Proper alignment requires that there be no radial displacement between the coupled ends and that the shafts be in line or have no angular displacement.

To align auxiliary generator coupling flange to engine power take off coupling flange, proceed as follows:

1. Cover the opening at top of main generator cover assembly. This will prevent objects from falling on the commutator.

2. Bolt generator support plates which were removed from previous generator.

3. Apply key to both ends of generator shaft. Be sure keys are not loose on shaft. On commutator end of generator shaft apply coupling flange (push fit). Lock flange in place with plate washer, lock washer and bolt, see Fig. 12.

4. Bolt coupling drive assembly to generator coupling flange. With the aid of a crane or block and tackle raise auxiliary generator slightly above support blocks on top of main generator and bolt coupling drive assembly to engine take off coupling flange.

5. Apply shims, which were removed from previous generator, between support plates and support blocks. Lower generator support plates on shims and bolt generator to support blocks.

6. By means of two indicators mounted on an offset rod which is bolted onto the engine power take off coupling flange, a measurement of the coupling misalignment is determined. Both indicators revolve with the engine coupling flange. Place the plunger of one indicator on the outside diameter of the generator coupling flange and the other indicator on the outside face of the same coupling flange.

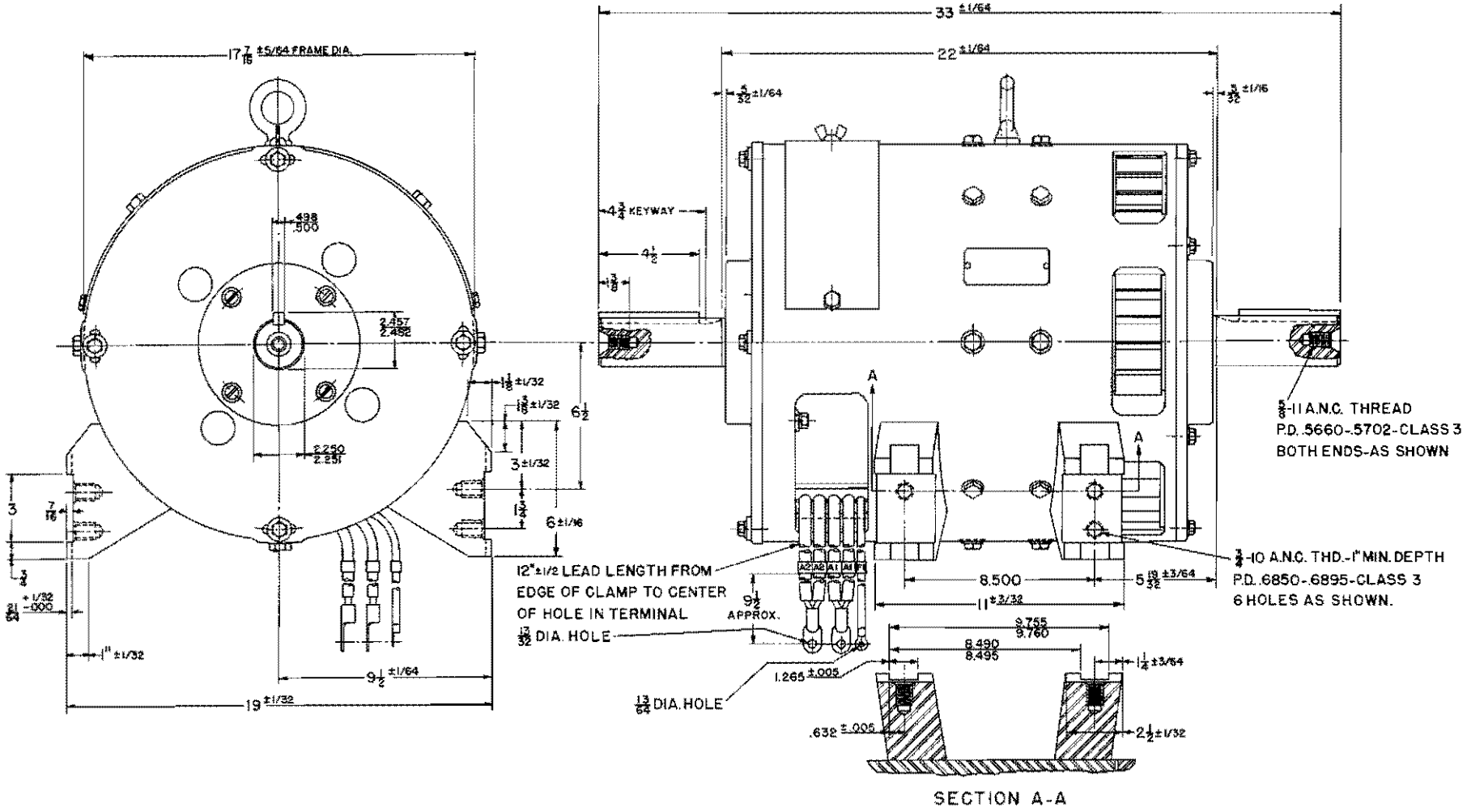

Fig. 11 - A-8102 Auxiliary Generator Outline

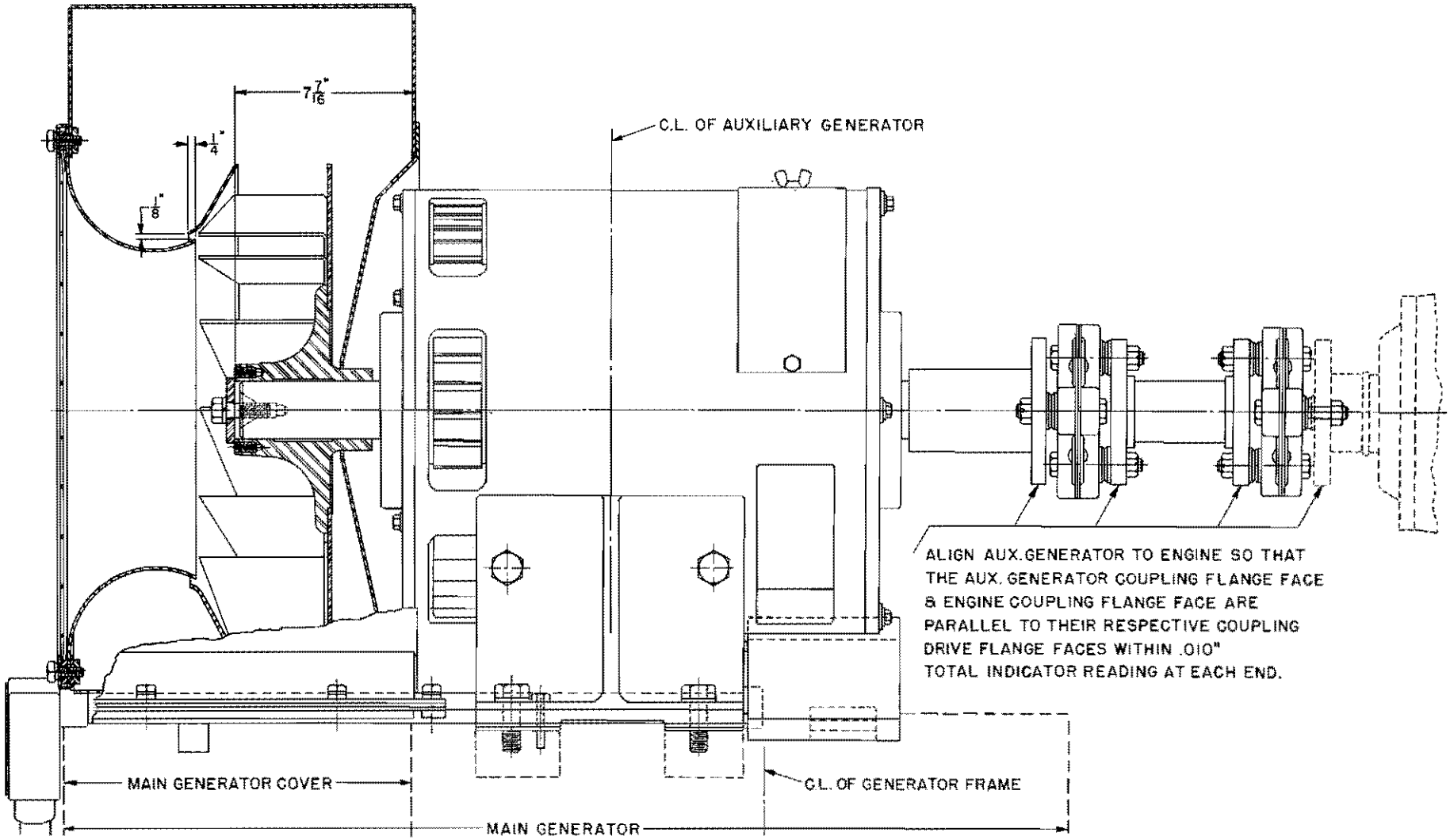

Fig. 12 - Auxiliary Generator Alignment

7. Bar or jack engine over and take readings 90° apart. If neither indicator reads over .010 total indicator reading then the alignment may be considered satisfactory. Install support to support block dowel pins.

8. Remove cover over the top of the main generator opening and inspect felt gaskets. If new gaskets are used they should be cemented with #2 Permatex to top flange of cover before mounting blower housing.

NOTE: From this point on care must be taken to prevent any objects from falling onto the commutator.

9. Mount blower housing on felt gaskets and bolt to main generator cover.

10. Apply a thin coating of grease mixed with a little graphite to hub bore of blower wheel assembly and to generator shaft. Mount blower wheel assembly on shaft and push in place.

    Care should be taken to start the blower wheel assembly straight. Bolt blower wheel in place with plate washer, lock washer and bolt.

11. Apply blower air intake and air intake screen guard to blower housing, see Fig. 12.

12. Bar or jack engine over a few times before starting engine and check assembly for rubbing of parts.

Replacing Auxiliary Generator

Make electrical connections as shown on the wiring diagram for the particular locomotive.

Use a voltmeter (0-150 volts) with polarity identification marks. Some locomotives are equipped with a battery charging voltmeter, which may be used.

Connect positive terminal of the voltmeter to the upper clip of the 150-ampere charge fuse, and negative terminal of the voltmeter to the right pole of the battery switch (when facing switch). Battery charging switch must be opened.

Start Diesel engine in usual way and check voltage of auxiliary generator.

The voltage of the generator may be low (zero or slightly greater) because:

1. The shunt field may be reversed or short circuited.

2. Brushes may not make good contact.

3. Open in the shunt field circuit.

4. A reversed field connection can usually be detected by the generator voltage tending to approach zero when the generator is started up, which indicates that the wiring is faulty.

The voltage of the generator may build up with reverse polarity because:

1. The residual field is in the wrong direction.

CAUTION: If the battery charging switch is closed, the voltage of the generator (because of the reverse polarity) would add to the battery voltage and may produce a large current with considerable damage to the charging equipment.

2. In case the generator gives the opposite polarity to that desired when building up its voltage, separately excite (flash) the fields with the correct polarity to reverse the residual magnetism.

3. Excite the fields from an external source. Connect the positive lead of the shunt field to the positive terminal of the source, and connect the negative lead of the shunt field to the negative terminal of the source. (See connection diagram for field polarity, Fig. 6).

Remove brushes from generator as a precaution to prevent current from passing through a stationary armature, as there is danger of burning out armature.

MAINTENANCE DATA

Brush pressure	1-1/2 to 2-1/2 lbs.
Brush wear	1" off new brush
Size of brush (split)	(5/16 x 5/16) x 1" x 2" (long side)
Grade (Speer)	E35

Limits Of Resistance At 75° C.

Armature	.01692 to .01870 ohms
Armature (bars 1-8)	.00718 to .00794 ohms
Interpole (circuit)	.01131 to .01251 ohms
Shunt field (circuit)	6.60 to 7.30 ohms

Air Gap

Under main field pole	.073"
Under interpole	.140"