ELECTRO-MOTIVE

M.I. 3707
*Rev. A

# MAINTENANCE INSTRUCTION

# AC AUXILIARY GENERATORS (BRUSHLESS TYPE) MODELS A-8146, A-8147, A-8147-M1, 2A-8147

## INTRODUCTION

All of these brushless AC auxiliary generators are series wound, alternating current, three phase alternators. They are used to excite a larger generator in heavy equipment such as locomotives and off-highway vehicles. Fig. 1 is a typical example.

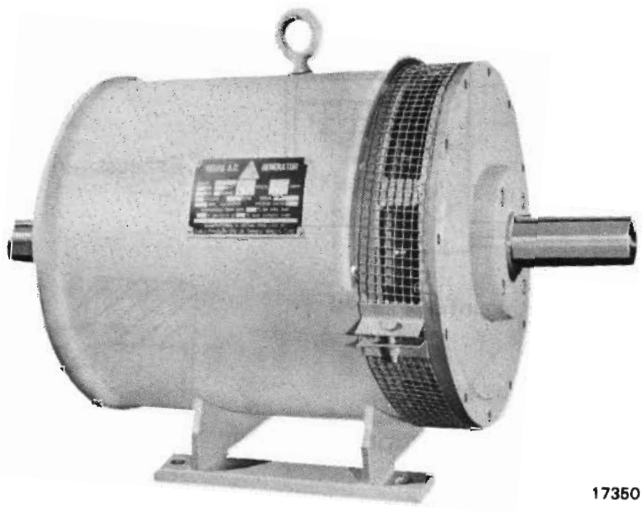



Fig.1 – Typical AC Auxiliary Generator (A-8146)

Each generator consists of a rotor (rotating field), a stator (stationary armature), an internal exciter, ball bearings, and end frames. Refer to Fig. 2.

The generators are directly driven at various speeds by an auxiliary power takeoff. These generators supply 55 V AC three phase power with an output capacity of 18 kilowatts.

## DESCRIPTION

### ROTOR

The rotor consists of field coils wound on laminated poles which are heat shrunk onto a shaft. The coils are connected in series and the leads are brought out to the rectifier mounting assembly. The coils are energized by the exciter output applied at the rectifier mounting assembly.

### STATOR

The stator consists of coil groups embedded in semi-enclosed slots of a laminated core. This core and coil assembly is pressed and pinned into a main frame of fabricated steel construction. The complete assembly is identified as the frame, stator, and coil assembly.

### EXCITER

The internal exciter consists of a field coil assembly, an armature, and a rectifier mounting assembly.

The exciter field coil assembly consists of a lamination assembly with twelve field coils connected in series. This assembly is bolted to the main frame.

The exciter armature has a three-phase, three-wire wye, and a twelve-pole winding. This assembly is made up of conventional coil groups and slotted steel laminations, which are keyed to the armature shaft.

*This bulletin is revised and supersedes previous issues of this number.

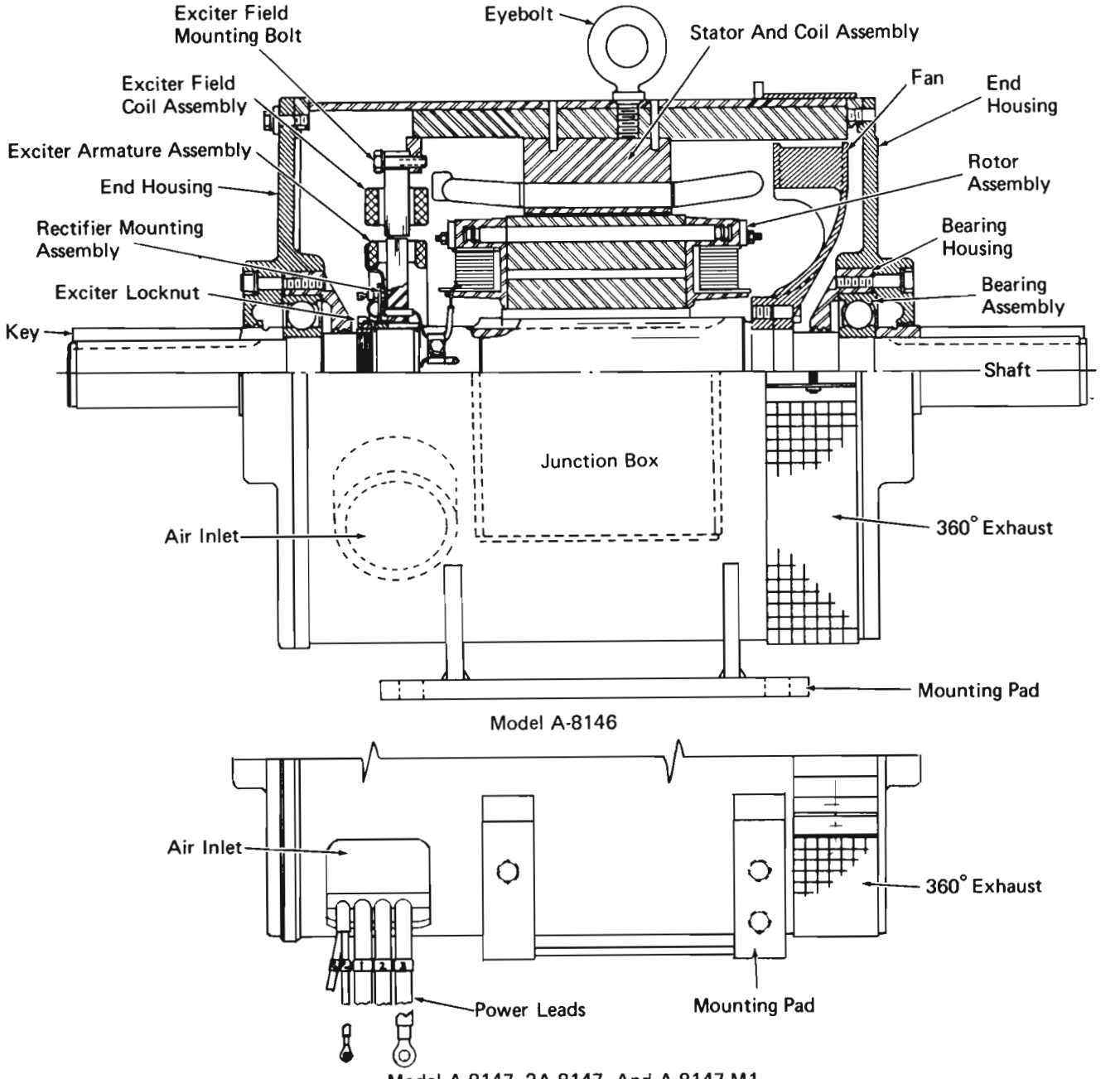



**Fig.2 - AC Auxiliary Generator Cross-Section**

The rectifier mounting assembly rectifies the AC output of the exciter armature, and supplies DC to the rotating field coils. This assembly has a printed circuit on each side of the mounting plate.

## END FRAMES

The end frames support the ball bearing housings, and contain grease reservoirs.

## COMPARISON OF MODELS

All four of the generators have similar electrical characteristics but are modified to provide different mounting arrangements and other mechanical improvements. Model A-8146 must be mounted on a horizontal base while all three 8147 models must be mounted on vertical brackets or bases. Two of the three 8147 models also have some design changes to increase reliability and improve overall operation. Model A-8147 is the oldest design and is replaced by model A-8147-M1. Model 2A-8147 is the newest design and differs from A-8147-M1 in that it has modifications in rotor bearings, bearing mounting, and ventilation. On new equipment, model 2A-8147 is used to replace A-8147-M1 in all applications.

These differences are specified as follows:

1. Model A-8146 has mounting pads located parallel to the length of the stator making it necessary to mount the generator to a horizontal base. Models A-8147, 2A-8147, and A-8147-M1 have mounting pads located perpendicular to the stator frame, which means that these generators must be mounted to vertical bases or brackets.

2. The power leads of model A-8146 are brought out into a junction box on the side of the stator. The power leads on models A-8147, 2A-8147, and A-8147-M1 are brought out through an air inlet opening in the stator.

3. Model A-8146 has an air inlet tube protruding through the stator that allows a flexible hose from an external air supply to be attached. Models A-8147, 2A-8147, and A-8147-M1 have two air inlet openings on the lead end of the stator through which surrounding air is drawn.

4. The rotor assembly of A-8147-M1 is equipped with bearing housings that have a larger grease capacity than model A-8147. The A-8147-M1 assembly uses bearing housing 4979817 at the fan end and 4979589 at the exciter end.

**NOTE**

At time of rebuild, all A-8147 generators should be remanufactured to A-8147-M1 specifications.

5. Model 2A-8147 has bearing housing 4979817 at both ends. This model also has a new exciter end frame (4987418) to ensure that the clamped bearing is always on the fan end and improved ventilation due to a re-designed fan end cover band and stator frame. Model 2A-8147 also has improved shaft seals (2800420) at both ends.

# MAINTENANCE

The generators are designed and manufactured to provide long life and satisfying performance with a minimum of maintenance. Like any machine, however, certain maintenance is required, as determined by the operation and service to which the generator is subjected. Inspections and maintenance should be performed on the systematic basis outlined in the Scheduled Maintenance Program.

## CLEANING

Both the interior and exterior of the generator should be kept clean and free of dust, dirt, oil, and water which are likely to have a detrimental effect on insulation and performance.

As frequently as conditions warrant, the generator should be blown out with low pressure air (25 psi max.). Avoid excessive air pressure which could cause damage to insulation.

Clean, bound edge, lintless, wiping cloths should be used as necessary to remove oil, grease, and accumulations of dirt.

## LUBRICATION

Grease lubricated ball bearings are assembled within bearing housings containing grease reservoirs. During an overhaul or teardown, grease should be renewed. No additional lubrication is required.

## DISASSEMBLY

The generator may be disassembled without special tools. However, repairs should not be attempted by anyone who is not an experienced electrical mechanic. The following procedures should be thoroughly studied before any repair operation is started. Refer to Fig. 2.

1. Mount generator on a sturdy stand at a suitable height from the floor.

2. Remove fan cover band assembly.

3. Remove shaft keys from both ends of shaft.

4. Remove bolts securing end frames (both ends) to stator.

5. Remove bearing housing socket-head bolts (both ends).

6. Remove end frames by prying straight out.

7. Remove the ball bearings as follows:

   a. Preheat bearing collars to soften sealant.

   b. Using a standard gear or bearing puller, remove bearing and collar from shaft.

   c. Discard bearing.

8. Remove the rotor from the stator as follows:

   a. Place an extension pipe over one end of the shaft.

**CAUTION**

Protect the portion of the shaft which will be enclosed by the extension pipe to prevent damage to shaft.

   b. With the aid of a suitable hoist, raise the pipe extension until the air gap is equal around the circumference of the rotor. With the aid of a second hoist, raise the other end of the shaft until the rotor is level.

   c. Carefully remove the rotor assembly from the stator until it clears the stator assembly and can be placed on a stand.

9. Remove exciter locknut and lockwasher.

10. Disconnect both alternator field leads, Fig. 3.

**NOTE**

The alternator field leads terminate in the pad (island) on the rectifier mounting assembly having three rectifiers.

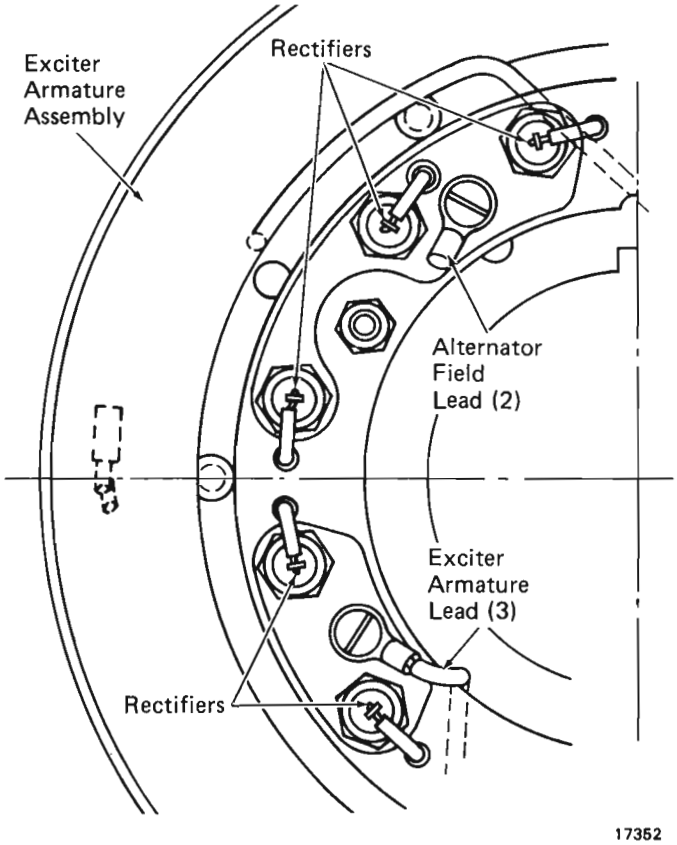



**Fig.3 – Rectifier Mounting Assembly, Front View**

11. Remove armature locking key and stop washer. Older models may not have these parts.

12. Remove exciter armature assembly and rectifier mounting assembly as a unit.

13. To separate the rectifier mounting assembly, disconnect the exciter armature leads and remove the three mounting nuts, Fig. 4.

14. Remove exciter field assembly by removing the mounting bolts.

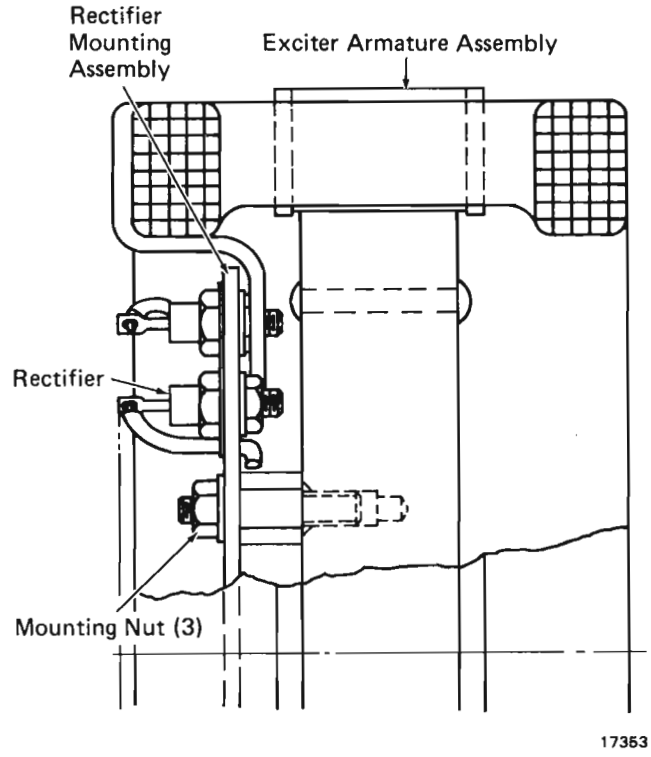



**Fig.4 – Rectifier Mounting Assembly, Cross-Section**

## INSPECTION AND REPAIR

When the generator is disassembled for repair, all parts should be carefully inspected before assembly.

### ROTOR

The rotor must be thoroughly clean and dry. Blow out all dust with clean dry compressed air. A large volume of air at reasonable low pressure (25 psi max.) should be used to prevent insulation damage. If exciter is excessively greasy or oily, wipe off excess grease or oil with clean rags.

Rotor should be carefully inspected. Coil insulation should be free of blisters, flakes, or cracked

insulation. Check coil series connections. A short or open circuit in the rotor may be detected by measuring the total resistance of the field as follows: Remove one lead from the alternator field at the rectifier mounting assembly. Measure the resistance between the detached alternator field lead and the other alternator field lead.

The exciter armature resistance can be checked by disconnecting the leads at the rectifier assembly (Fig. 3) and measuring between leads with an ohmmeter.

Resistance limits of both windings is provided in the Service Data.

Check insulation resistance by applying 1500 volts (Hi-Pot) from the field winding to ground for one second.

**NOTE**

If any part of the rotating assembly is replaced, the rotor must be dynamically balanced within 1/2 oz-in. before reassembly.

## RECTIFIERS

The rectifiers can be checked without removing them from the rectifier mounting assembly as follows:

1. Detach one of the leads to the alternator field, Fig. 3.

2. Remove the three mounting nuts, Fig. 4. Move rectifier mounting plate away from exciter armature.

3. With an ohmmeter set to "R x 1" scale, measure across one rectifier.

4. Reverse leads and measure again. If one indication is about mid-scale, and the other indication is very high, the rectifier is probably good.

**NOTE**

This ohmmeter test is not conclusive, but it will identify rectifiers that are open or shorted. Replace any rectifier giving doubtful indication.

5. Repeat test on all remaining rectifiers.

## STATOR

The stator must be thoroughly cleaned in the same manner the rotor was cleaned. Blow out accumulated dirt, inspect the insulation of coils and coil leads for breaks and worn spots. Minor repairs may be made with air dry varnish and tape. All coils and insulators should be tight in the slots. Check resistance of generator armature and exciter field windings. Resistance limits are given in the Service Data.

Check insulation resistance of each wir.ding by applying 1500 volts (Hi-Pot) to ground for one minute.

# ASSEMBLY

The reassembly of the generator is accomplished by reversing the disassembly procedure, with the exception that it requires more time, care, and skill. Refer to Fig. 5.

**NOTE**

Some generators manufactured before 1974 do not have the key and stop washer that are used when the exciter armature is put on the rotor shaft. These parts must be installed on all generators. The stop washer is applied against the shoulder of the shaft before the exciter armature is mounted. Refer to Fig. 5.

1. Place stator assembly and rotor assembly on stands close enough to each other so that, when a pipe extension is placed over the rotor shaft, the end of the pipe extension protrudes through the stator assembly.

2. Lift and guide the rotor assembly through the stator assembly slowly and carefully so that the insulation will not be damaged. Center the rotor within the stator.

3. Clean rotor shaft and remove burrs or gall marks.

4. Ensure all component parts have been cleaned, checked, inspected, and painted (if required).

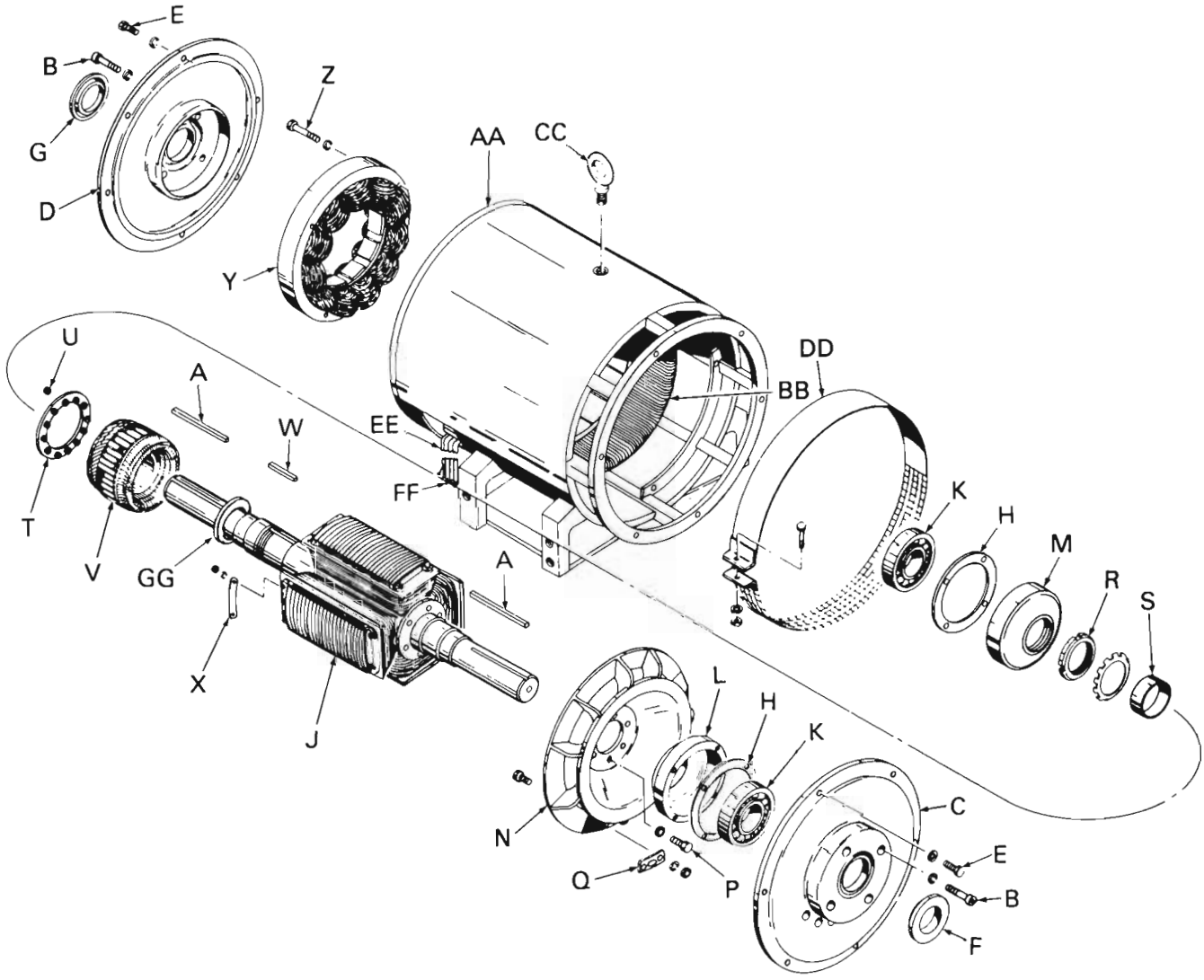
5. Reassemble bearing housings as follows. Refer to Figs. 6A and 6B.

**NOTE**

Generators manufactured after 1975 have open rotor bearings (instead of shielded) and bearing housings with larger grease reservoirs. This newer style bearing assembly is shown in Fig. 6B.

a. [Older Style Shielded Bearings]:

Apply Chevron SRI-2 grease to grease reservoir and apply Texaco Water Pump Grease, or equivalent, to labyrinth grooves




A Shaft Extension Key
B Bearing Housing Retaining Bolt
C Fan End Frame
D Exciter End Frame
E End Frame Mounting Bolt
F Fan End Seal
G Exciter End Seal
H Bearing Housing Gasket
J Rotating Field Assembly (Rotor)
K Ball Bearing
L Fan End Bearing Housing
M Exciter End Bearing Housing
N Fan
P Fan Mounting Bolt
Q Fan Balance Weight
R Exciter Retaining Locknut
S Armature Spacing Sleeve
T Rectifier Mounting Assembly
U Board Mounting Nut And Lockwasher
V Exciter Armature
W Armature Locking Key
X Rotor Balance Weight
Y Exciter Field
Z Field Mounting Bolt
AA Main Frame
BB Generator Armature Assembly (Stator)
CC Eyebolt
DD Fan Cover Band
EE Exciter Leads Assembly
FF Stator Leads Terminal Lug
GG Stop Washer

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Fig.5 – Typical AC Auxiliary Generator, Exploded View

in bearing housings. Labyrinth grooves should be filled flush, and grease reservoirs should be filled to shaft level.

[Newer Style Open Bearings]:

Apply approximately 1 oz. of SRI-2 grease to bearing housings as shown in Fig. 7.

Apply 1 oz. of SRI-2 to each bearing equally distributed between balls on each side of the bearing.

Apply 1 oz. of SRI-2 to each end frame. Refer to Fig. 7.

b. Slide bearing housings over shaft. Screw a threaded rod into one bearing housing

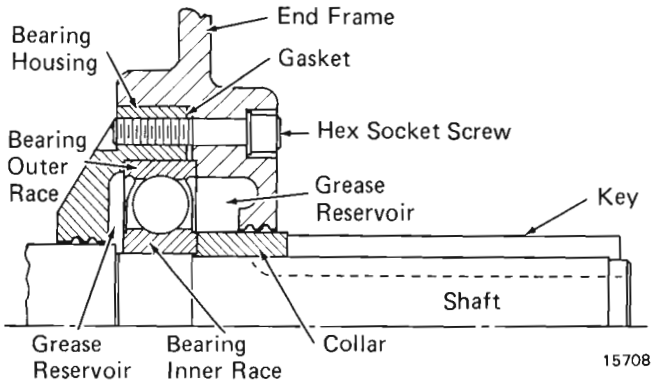


Fig.6A - Older Style (Shielded) Bearing Assembly, Cross-Section

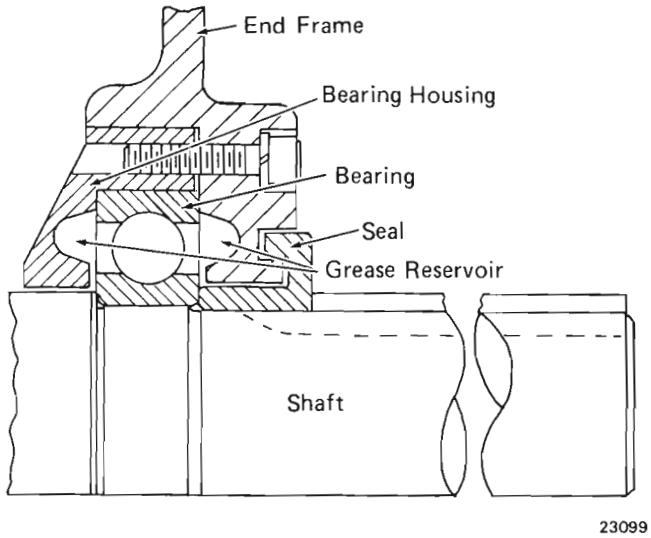


Fig.6B - Newer Style (Open) Bearing Assembly, Cross-Section

mounting bolt hole. Rod must be long enough to extend through end frame to align bearing housing in Step 6.

c. Slide new ball bearing assemblies over shaft. Apply pressure to inner race until bearing assembly is snug against shoulder on shaft. Do not apply pressure to bearing outer face.

d. Apply Loctite No. 601 on shaft under collar location, and push collar in place.

6. Carefully place end frames over shaft, and guide threaded rod (assembled in Step 5b) into one bearing housing mounting bolt hole on end frame.

**NOTE**

Step 6 aligns bearing housing.

7. Replace end frame bolts.

8. Insert three bearing housing mounting bolts, and pull bearing into place with threaded rod.

9. Remove threaded rod and insert remaining bolt. Torque these bolts to 20 to 25 ft-lbs.

10. Replace fan cover band assembly.

**NOTE**

On 2A-8147 generators, replace shaft seals on both ends after applying sealant (Loctite 601) to shaft area under each seal.

11. Replace shaft keys.

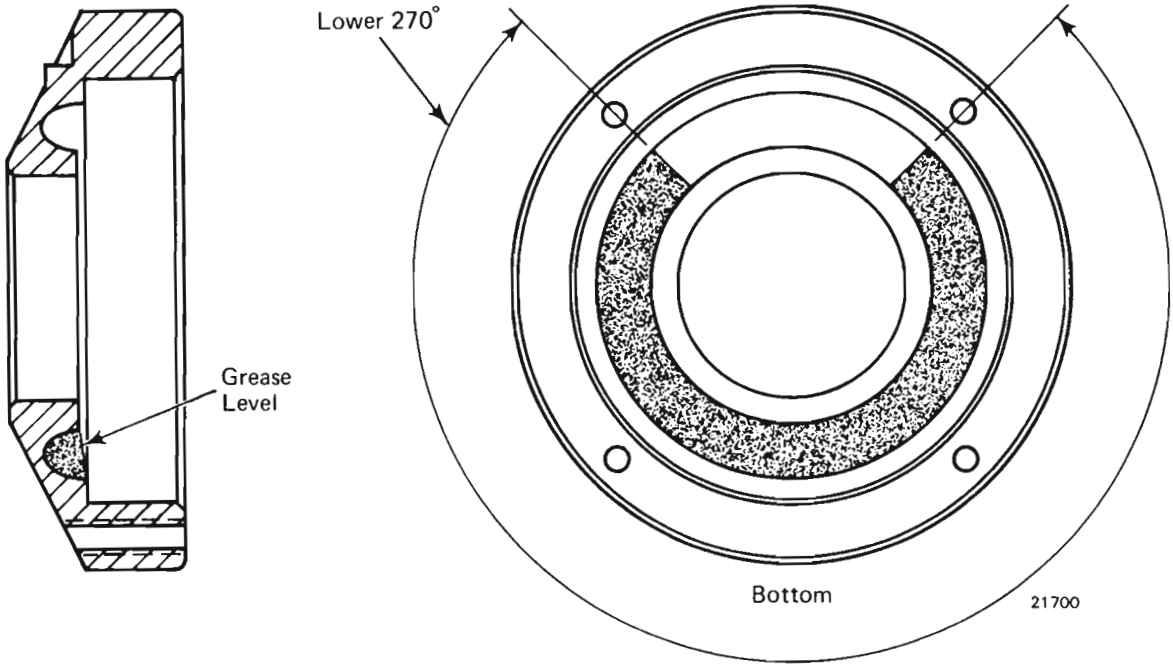


Fig.7 - End Frame And Bearing Housing Grease Cavity (New Style Only)

# SERVICE DATA

| | |
|---|---|
| Rated RPM | 956-2733 |
| Power Output | 18.0 kW |
| KVA | 19.0 |
| Output | 55 V AC |
| Cycles | 32-91 |
| Rotation | CW from fan end |
| Weight | 560 lbs |
| Bearing Lubricant | Chevron SRI-2 |
| Bearing Housing Lubricant (old style bearing only) | Texaco Water Pump Grease |
| Loctite No. 601 (250 c.c.) | 9087621 |

Stator (Generator Armature) Phase Resistance At 25° C.

| Phase | Nom. | +5% | -5% |
|---|---|---|---|
| 1-2 | .0186 | .0195 | .0176 |
| 2-3 | .0186 | .0195 | .0176 |
| 1-3 | .0186 | .0195 | .0176 |

Alternator Field Resistance At 25° C.

| Nom. | +5% | -5% |
|---|---|---|
| 2.47 | 2.59 | 2.35 |

Exciter Armature Resistance At 25° C. (Leads not connected)

| Nom. | +5% | -5% |
|---|---|---|
| .38 | .40 | .36 |

Exciter Field Resistance At 25° C.

| Nom. | +5% | -5% |
|---|---|---|
| 2.80 | 2.94 | 2.66 |

Hi-Pot Test

| | |
|---|---|
| Stator Windings To Ground | 1500 Volts RMS for 1 minute |
| Rotating Field Windings To Ground | 1500 Volts RMS for 1 second |