ELECTRO-MOTIVE DIVISION • GENERAL MOTORS CORPORATION
SERVICE DEPARTMENT

MAINTENANCE INSTRUCTION

DYNAMIC BRAKE GRID FAN AND MOTOR

DESCRIPTION

The dynamic brake grid cooling fan assemblies consist of a fan powered by a direct current series motor. Differences in the assemblies arise from various combinations of fan and motor sizes.

The fan and motor assemblies, Figs. 1 and 2, consist of five major components:

Armature assembly
Frame and field coil assembly
End frame and brush rigging assembly
End frame and stator assembly
Fan rotor assembly

The grid fan motor is insulated with Class A and B insulation. It is arranged for ceiling mounting in the grid hatch assembly and has the fan rotor assembly bolted to the fan mounting hub.

1. Fan Rotor Assembly
2. End Frame-Stator Assembly

Fig. 1 — Grid Fan And Motor Assembly - 48" Fan

1. Fan Rotor Assembly
2. End Frame-Stator Assembly

Fig. 2 — Grid Fan And Motor Assembly - 36" Fan

OPERATION

When the locomotive is operating in dynamic braking, the traction motors operate as generators. The electrical power generated by the traction motors is converted into heat in the braking grids. This heat is dissipated into the atmosphere by the dynamic brake grid fan and motor assembly.

The dynamic brake grid motor is powered by a portion of the electricity generated by the traction motors during dynamic braking operation.

*NOTE: Information contained herein is applicable to equipment being produced as of the date of publication.

MAINTENANCE

CLEANING

It is essential that the motor be kept clean at all times. It should be inspected and the inside of the motor blown out with clean dry compressed air, whenever conditions warrant. A large volume of air at reasonably low pressure should be used. If high pressure from a nozzle is used, there is danger of loosening insulation and protective coating on the various parts. Brush holders and their insulated washers should be wiped with a clean dry cloth.

If deposits of dirt are allowed to collect, they sometimes become caked and difficult to remove. If this condition should exist it may be necessary to clean the motor using a cloth dampened with a solvent. Most solvents require some time to evaporate, so no electrical test should be attempted immediately after cleaning. Keep solvents off the commutator surface.

CAUTION: Use the usual safety precautions that apply to inflammable fluids. Provide adequate ventilation when any type of solvent is being used.

INSPECTION

The motor should be inspected often enough to prevent failures in service. This should include the examination of items, details of which appear under their respective headings.

LUBRICATION

Ball bearings used on grid fan and motor assemblies are identical. They are of the double shielded prelubricated grease type. The bearings, protected by inner and outer seals, are packed and sealed at the factory with Chevron BRB-2 grease and are designed to operate without further lubrication. On overhaul, the bearings should be removed and replaced with new factory packed bearings. For the overhaul period, refer to the applicable Scheduled Maintenance Program.

BRUSH HOLDERS AND BRUSHES

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 brush holder so as to release any dirt that may have accumulated. Care should be taken not to snap the spring as this might chip the brush. The Maintenance Data gives the type of brush used for each type of fan.

Replace brushes that have been chipped or worn excessively with the same grade or a recommended replacement. This is especially necessary when only a partial replacement is made as two widely different kinds of brushes on the same motor are likely to be detrimental to successful operation. When new brushes are installed, they should be "sanded-in," see Fig. 3.

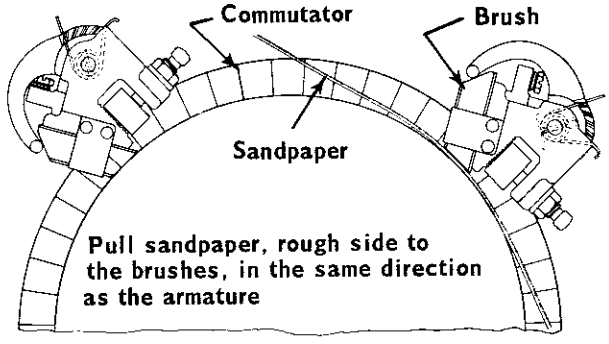


Fig. 3 — Fitting Brushes To Commutator

Proper brush pressure should be maintained, as specified under "Maintenance Data" at the end of this bulletin. Unequal

brush pressure will cause unequal current distribution to the brushes. The current distribution will be inversely proportional to the contact resistance. Refer to Fig. 4 for method of measuring brush pressure.

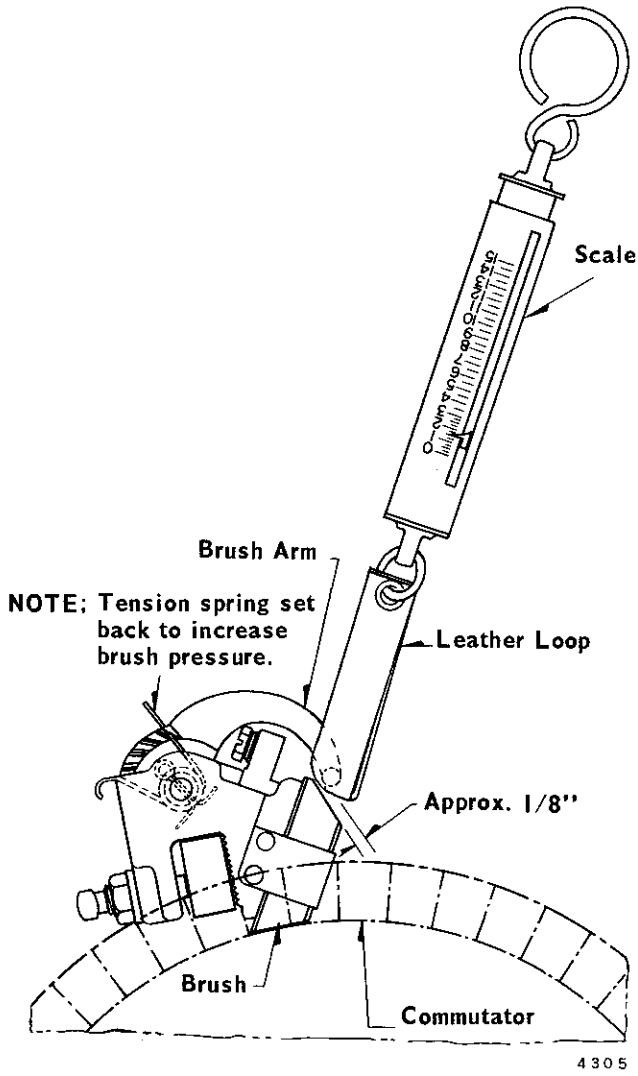


Fig. 4 — Measuring Brush Pressure

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 bolted rigidly in place.

NOTE: When replacing brush holder studs and brush holders, align as shown in Fig. 5. The carbon brush shunts should be so arranged that they will clear the parts of the frame at ground potential.

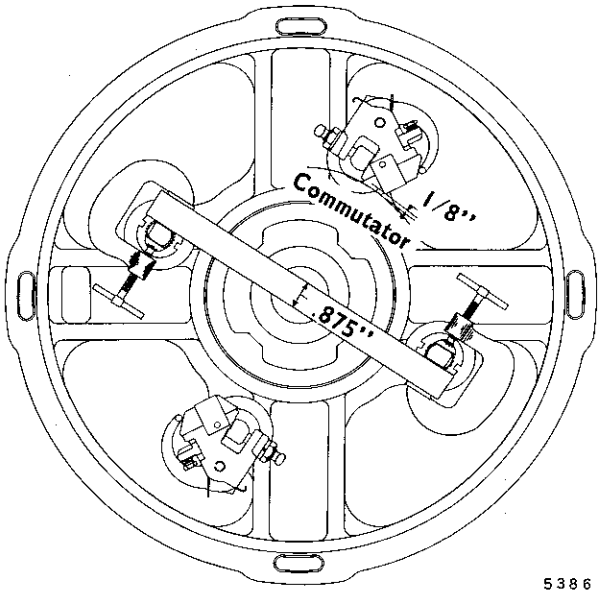


Fig. 5 — Brush Holder Stud Alignment

ARMATURE

Test the insulation resistance of the armature by using a 500 volt DC megger. The minimum reading allowed is 1 megohm. If a megger reading of 1 megohm cannot be obtained, armature may have to be dried by placing it in an oven for 4 hours with the oven set at 120° C.

If after drying, the megger reading is still less than 1 megohm, the armature will have to be electrically tested to determine cause of low reading.

Armature bands should be tight and secure. Soldering on the bands should be intact, and soldering to the commutator risers should be uninjured.

Armature band wire diameter is 0.040" and has a tension of 150 pounds. Arma-

ture bands should be tight and secure. If solder was thrown off, cause should be determined, corrected, and band replaced. When applying new bands, duplicate the banding originally on the armature; that is, do not change the diameter of the banding wire, the band position, or the width of the band. Deviating from the original band may cause heavy currents in the bands, enough to overheat and melt the solder.

The coil insulation should be checked for blisters, flakes, or cracked insulating varnish surfaces. When any of these conditions exist, the armature should be given a varnish treatment.

After cleaning and checking the armature it may be varnish treated as outlined below.

VARNISH TREATMENT

When the armature is ready for varnishing, it should be treated as follows:

1. Preheat four hours in an oven set at 125° C. Remove from oven and while hot dip in clear baking varnish thinned with Xylol and mixed according to instructions given in the Maintenance Data. Allow to soak in the varnish for five minutes.

2. Remove from the varnish and allow to drain for five minutes. Clean varnish from all machined surfaces using a cloth saturated with Xylol.

3. Place in oven set for 125° C. and bake for two hours.

4. After baking, remove from oven, while still hot (50° $\pm$ 5° C.) make a hypot test to ground. See the Maintenance Data for voltage and time.

BALANCING 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.

3. Armature impregnated and baked.

4. Repairs to commutator, other than tightening and turning.

The brake blower motor armature must be in dynamic balance within 1/2 inch-ounce.

BALANCING COMMUTATOR END OF ARMATURE

An unbalanced armature at the commutator end is balanced by applying weights to the commutator spider and securing the weights with special cap screws. See the Parts Catalog for numbers of weights and special cap screws for securing weights.

BALANCING FAN END OF ARMATURE

An unbalanced armature at the fan end is balanced by applying weights to the coil support. See the Parts Catalog for numbers of weights, screws, and washers.

BALANCING OF FAN ROTORS

If any of the blades of the fan rotor is removed or replaced, it will be necessary to dynamically balance the reassembled rotor. Weight is added in the form of washers stacked on the blade mounting bolts.

A small washer must be used against the hub and adjacent to the nut with the larger washers sandwiched between them. No more than four large washers may be used on any one bolt. At least two full threads of the bolt must protrude beyond the end of the nut. A third small washer must be used between the bolt head and the blade casting. Torque the bolts to 95-110 ft-lbs. If additional weight is required, drill a 7/16" hole in the hub at a radius of 9" from the center. Place a bolt and small washer through the hole, threaded portion down. Then add weight washers, a small washer, and the nut. See Parts Catalog for numbers of special bolts and washers to be used for balancing the fan assembly, see Fig. 6.

COMMUTATOR

The commutator should present a polished surface and be entirely free from pitting. In the event that the commutator becomes pitted, it should be cleaned with a fine commutator stone. 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. After the commutator has been cleaned, the windings should be blown out carefully with clean dry compressed air, at reduced pressure.

CAUTION: Do not apply lubricant to the commutator as it is detrimental to operation. If commutator is not kept clean and free from grease and oil carbon dust will collect in the slots between the segments, and will tend to cause a short circuit.

If the commutator is badly worn or burned, it should be turned just enough to give a uniform surface. Before turning the commutator, a suitable head covering should be placed over the end windings to prevent chips from working into the armature. While turning or grinding, the peripheral speed of the commutator surface should be 300 feet per minute. Round off the ends of the commutator segments to at least 1/16" radius with a file. When grinding commutator, use fine grade stone.

Check outside diameter and neck of commutator surface. Condemning limit is when the commutator diameter has reached 7-1/8" or the neck width is less than 3/16".

Check commutator for eccentricity. Maximum eccentricity is .001" total dial indicator reading.

After the commutator has been turned and ground, the mica should be undercut. Undercut of mica must be uniform all the

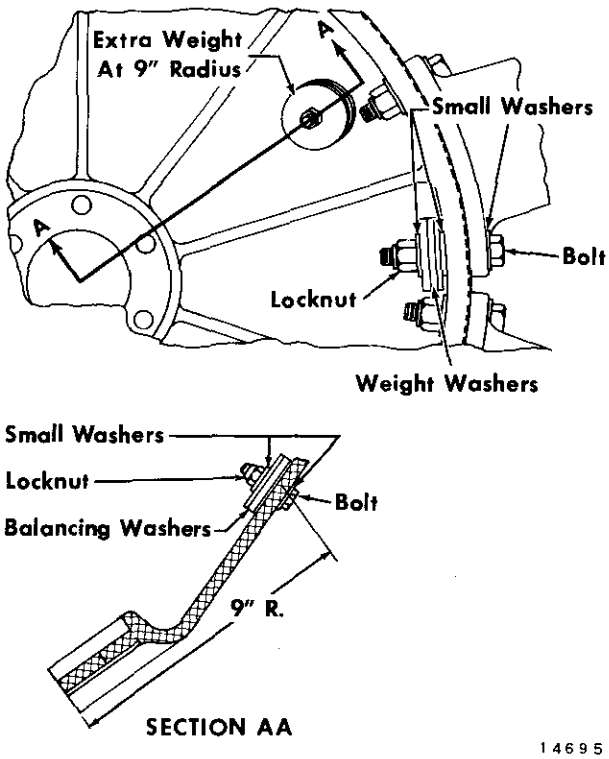


Fig. 6 — Fan Balancing Details

way around the commutator, 1/32" to 3/64" deep. The sharp edges of the bars should be removed with a hand scraper. Remove all mica cuttings and inspect to see that no copper chips remain. Final polishing with crocus cloth is recommended. The width of mica insulation between commutator segments is 0.030", and the width of the mica undercutting saw is to be 0.025".

TIGHTENING COMMUTATOR

After last baking and while armature is hot, check commutator nuts for tightness. Apply 360 in.-lbs torque to commuator nuts to test for tightness.

COMMUTATOR CREEPAGE SURFACE

When the creepage surfaces between the end of the bars and the steel V-ring or the riser area become coated with dirt, grease, and carbon dust; shorts, grounds and flashovers are likely to occur. This condition is as critical for the blower motor as it is for larger machines such as traction motors and main generators. Therefore, it is imperative that these surfaces be kept clean. Refer to Maintenance Data for the numbers of relevant Maintenance Instructions.

FIELD POLES AND COILS

Inspect insulation on field coils and investigate any unusual condition. Keep oil and dirt off coil insulation. Whenever examination indicates the coil insulation to be charred, the cause should be determined and the fan motor removed for repairs.

Clean the frame assembly with clean dry compressed air. (Refer to "Cleaning" and "Inspection" in this Maintenance Instruction.)

Examine field coil insulation and cables. If tight and in good condition, but varnish treatment is necessary; proceed as outlined under "Armature."

When field coils and pole pieces are to be removed, provision should be made to keep each pole piece and coil assembly and accompanying shims, if any, together. When reassembling, the assemblies should be installed in their original position.

To remove a field coil, remove the coil connector bolts, remove the bolts which hold the pole to the frame and remove the the pole assembly through the end of the frame. The series coil can readily be slipped off the pole. The interpole coils, however, should not be removed from the pole piece.

Where field coil pole piece bolts have been removed, new lock washers should be used when reassembling.

After coils are reassembled, care should be taken that the cables are properly reconnected. Refer to connection diagram, Fig. 7. Carefully check the coil polarity.

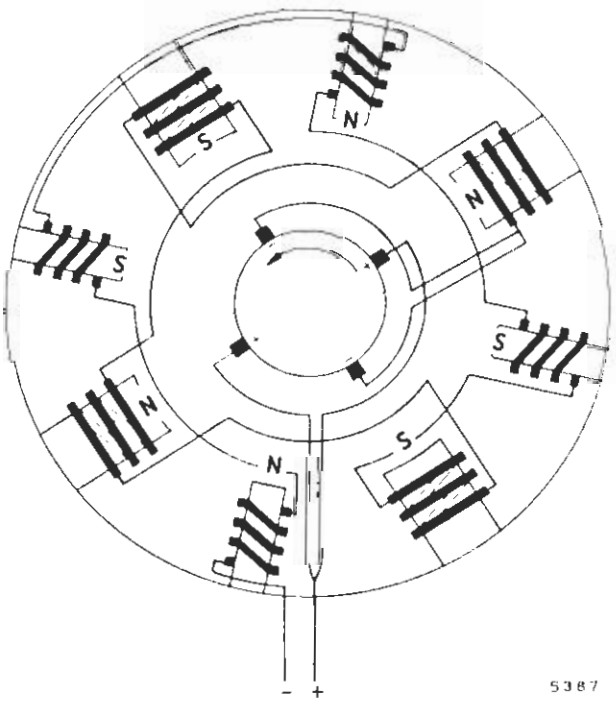


Fig. 7 — Connection Diagram
Viewing Commutator End

Contact surfaces should be clean and the bolts drawn up tightly.

CONNECTIONS

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.

Any connections found loose or loosened for any reason should have their contact surfaces cleaned and properly bolted together to insure a good electrical connection.

When soldering connectors to cables, flux leads with "Nokorode" solder flux and solder with pure tin solder.

Tape all field connections with asbestos tape and coat with black air drying varnish.

INSULATION TEST AFTER OVERHAUL

All high potential tests MUST be made by placing electrodes on circuit under test before closing switch. Dangerous overvoltage surges may result when electrodes touch the circuit under test if they are already energized.

This is a low voltage motor connected in a high voltage circuit and for insulation test purpose falls in the same class as the locomotive high voltage tests.

See the Maintenance Data for the voltages and times to be used in the hy-pot test.

DISASSEMBLY OF FAN AND MOTOR ASSEMBLY

The fan and motor assembly should be disassembled in the order outlined below, except that operations 13 through 16 may be performed without disturbing the remainder of the assembly. Fig. 8 shows a cross-section view of fan and motor assembly.

NOTE: As mentioned previously in this instruction, fan and motor assemblies are identical with the exception of changes in the fan rotor and end frame-stator assemblies. For all practical purposes, the procedure for disassembly is the same for all fan and motor assemblies.

Before preparing to set the fan and motor assembly in the vertical position (fan end up), remove the four bearing housings to end frame cap screws from the commutator end.

Raise the fan and motor assembly to the vertical position (fan end up) and properly support the motor to prevent damage to the leads. With the fan and motor assembly resting in the vertical position, refer to Fig. 7 and proceed with disassembly as follows:

1. Remove the brushes from the holders, and if brushes are to be reused, identify them so that they will be returned to their original holders.

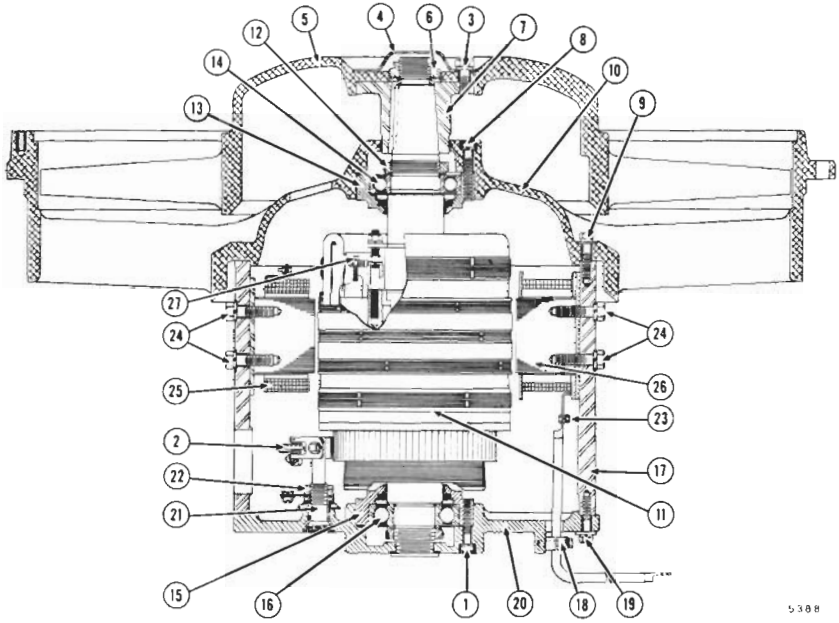
2. Cover the commutator with a heavy fish paper taped in place to prevent damage to the commutator during disassembly.

3. Remove the fan rotor mounting bolts and shaft end cover. Lift out fan rotor.

4. Remove the hub mounting locknut and washer. The rotor hub is to be removed by tapping the hub flange with a nonmetallic mallet.

5. Mark the relative position of the end frames to the main frame with a prick punch.

6. Remove the bearing housing cap screws and remove the end frame



1. Bearing housing cap-screw
2. Brush holder assembly
3. Fan rotor mounting bolts
4. Shaft cover
5. Fan rotor
6. Hub locknut
7. Rotor hub
8. Bearing housing cap-screws
9. End frame mounting bolts
10. End frame and stator assembly
11. Armature assembly
12. Bearing locknut
13. Fan end bearing housing
14. Fan end ball bearing
15. C. E. bearing housing
16. Commutator end ball bearing
17. Frame and coil assembly
18. Line lead clamp
19. End frame mounting bolts
20. End frame and brush rigging
21. Brush holder studs
22. Brush holder stud locknut
23. Field coil connector bolts
24. Pole assembly mounting bolts
25. Series coil
26. Interpole coil and pole piece assembly
27. Balance weights fan end

Fig. 8 — Cross-Section Of Fan And Motor Assembly

mounting bolts from the fan end of the motor.

7. With the aid of a hoist, lift end frame from stator assembly.

8. Apply an eyebolt to the fan end of shaft and lift out the armature assembly. Lay the armature in a saddle in preparation for the removal of the bearing assembly.

9. Remove the bearing locknut and lockwasher from the fan end of the shaft.

10. Engage the jaws of a bearing puller behind the shoulder of the bearing housing and withdraw the bearing and housing from the shaft.

11. Remove the bearing and housing from the commutator end of shaft in the same manner as described in operations 9 and 10.

12. Invert the frame, remove the line lead clamp assembly and disconnect the leads from the field coil to the

brush rigging. Identify the leads with markers.

+ 13. Remove the end frame mounting bolts and remove the end frame and brush rigging assembly.

+ 14. Remove the brush holders by loosening the locknuts and the clamp screws.

+ 15. Remove the brush holder studs by removing the locknuts and tapping the studs out of end frame.

NOTE: When replacing the brush holder studs and brush holders, align the studs and brush holders as shown in Fig. 5.

+ 16. Unsolder and remove the field coil connector bolts.

+ 17. Remove the pole piece mounting bolts and lift the pole pieces out of frame.

NOTE: Series coils may be replaced individually. Interpole coils are serviceable only in assembly with the pole piece.

Check polarity of coils after connecting.

+ These operations should not be performed unless part replacement is necessary.

ARMATURE BEARING AND FINAL FAN AND MOTOR REASSEMBLY

1. Clean out the grease cavities in the bearing housings and in the end frames surrounding the bearings.

2. Check the seal retainer felt washer and the expansion washer in the bearing housing. If the felt washer is not in good condition, tap out the old felt seal assembly and press or tap in a new felt seal assembly.

3. On top of each bearing in the cavity surrounding the bearing, apply additional grease. Refer to the Maintenance Data for quantities involved.

4. Place the bearing housings on the shaft; one on the commutator end and the other on the fan end.

5. Discard (scrap) the old bearings previously removed and replace with new factory packed bearings on both ends of the shaft. With the aid of the locknuts and new lockwashers, move the bearing assemblies solidly against the shoulders of shaft. Make sure that the locknuts are tight against the bearings and that the locknuts are in place with lockwashers on both bearing assemblies.

6. Cover the commutator with heavy fish paper taped in place to prevent damage during reassembly.

7. Apply two 3/8" - 15 × 6" studs to the commutator housing to pilot the bearing housing into the end frame.

8. Apply a new gasket to the commutator end bearing housing.

9. Apply a new gasket to the fan end bearing housing. Assemble the end frame and stator assembly over the bearing housing. Bolt the end frame to the bearing housing.

10. Apply the commutator end frame and brush rigging assembly to the main frame assembly. Line up the prick punch marks on the end frame and main frame which were made during disassembly of the fan motor. Insert the motor line leads through the opening provided in the end frame and bolt the assemblies together.

11. Raise the main frame assembly to the vertical position and rest the assembly on the commutator end frame. Block under the end frame to prevent damage to the motor leads.

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

13. Line up the end frame and fan stator assembly with the punch marks on the main frame and bolt the assemblies together.

14. Insert the hub locking key to the shaft.

15. Mount the rotor hub on the shaft. Apply the washer and hub mounting locknut to the fan end of the shaft and draw it up tight.

16. Mount the fan rotor assembly to the hub. Clean the shaft end cover and apply red insulating enamel to the cover. While the paint is still wet, bolt the cover and the fan rotor to the mounting hub.

NOTE: The paint on cover is used for sealing purpose.

17. Remove the pilot studs from the commutator end housing and apply the bearing housing retaining cap screws.

18. Apply the brushes to the brush holder. Secure the fan motor line leads to the end frame and brush rigging assembly with the line lead clamp.

SERVICE DEPARTMENT

MAINTENANCE DATA

FAN ASSEMBLY	8324324 48" 36 H.P.	8324128 48" 18 H.P.	554790 36" 16 H.P.
COMMUTATORS			
Min. Commutator Dia.	7-1/8"	7-1/8"	7-1/8"
Min. Neck Thickness	1/4"	3/16"	3/16"
Undercutting Depth	3/64"	3/64"	3/64"
Undercutting Width	.025"	.025"	.025"
Eccentricity TIR - Cold	.001"	.001"	.001"
Hot	.002"	.002"	.002"
BRUSHES			
Type	Split	Split	Solid
Dimensions	2"×1"× (5/16+5/16)"	2"×1"× (5/16+5/16)"	2"×1"× 5/8"
Minimum length	1"	1"	1"
Pressure	1-1/2 — 2-1/2 lb.	1-1/2 — 2-1/2 lb.	1-1/2 — 2-1/2 lb.
RESISTANCES @	75° C.	167° F.	Values in ohms
Series field	.0619-.0695	.0326-.0360	.0326-.0360
Interpole field	.0302-.0333	.0262-.0289	.0262-.0289
Armature	.0521-.0575	.0397-.0437	.0397-.0437
Armature (1-10)	.0238-.0264	.0173-.0191	.0173-.0191
GREASE			
To be added to bearing cavity	3 oz.	2 oz.	2 oz.
HY-POT TO GROUND			
cold and dry			
Armature	2400 V, 10 sec.	1800 V, 1 min.	1800 V, 1 min.
Stator	2400 V, 10 sec.	1800 V, 1 min.	1800 V, 1 min.
FAN ASSEMBLY			
Maximum unbalance	3 in. oz.	3 in. oz.	1/4 in. oz.

MISCELLANEOUS

5 lb. Chevron BRB-2 grease	8398924
Fan end bearing (Chevron BRB-2 packed)	907831
Commutator end bearing (Chevron BRB-2 packed)	907931
Felt seals for bearing housings	1079145
Gaskets for bearing housings	5357547

March, 1968

Clear baking varnish	8136692
Xylol	8089758

Varnish - Xylol mixture to have viscosity
of 120-150 seconds Ford Cup #4 at 21.1° C.

Commutator grinding stone	8204167
Black air drying varnish	8122357
Red insulating enamel	8061130
Solder	8107868

REFERENCE

M.I. 1704 Scheduled Maintenance Program
M.I. 3302 Main Generator - Types D32, D22, And D12
M.I. 3900 General Maintenance - Traction Motors
M.I. 3904 General Maintenance - Export Traction Motors

} For Commutator Creepage Surface Maintenance

Litho in U.S.A.