



ELECTRO-MOTIVE DIVISION • GENERAL MOTORS CORPORATION

MAINTENANCE INSTRUCTION

DC AUXILIARY GENERATORS AND EXCITERS 10, 18, AND 24 kW

DESCRIPTION

Maintenance procedures presented in this instruction pertain to 10, 18, and 24 kW direct current auxiliary generators and exciters, Fig. 1. Information contained in this instruction under Service Data includes specifications and information required to maintain each model generator. The data contained in the text of this instruction applies to all models unless specifically identified.

The generator is directly driven by the engine through a flexible coupling and shaft extension. Ventilation is provided by a fan mounted on the armature shaft which draws air into the generator.

MAINTENANCE

The generator is 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

It is essential that the generator be kept clean. Both the interior and exterior of the generator should be kept clean and free of dust, dirt, oil, water, and any other substance which is likely to have a detrimental effect on insulation and performance.

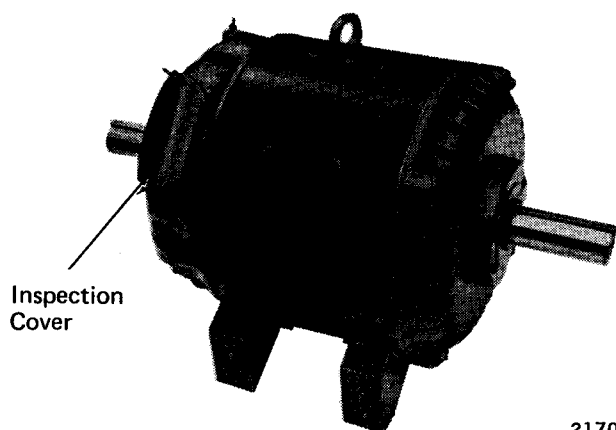
As frequently as conditions warrant, the generator should be blown clean with low pressure air (172 kPa [25 psi] max.). Avoid excessive air pressure which could cause damage to insulation.

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

COMMUTATOR INSPECTION

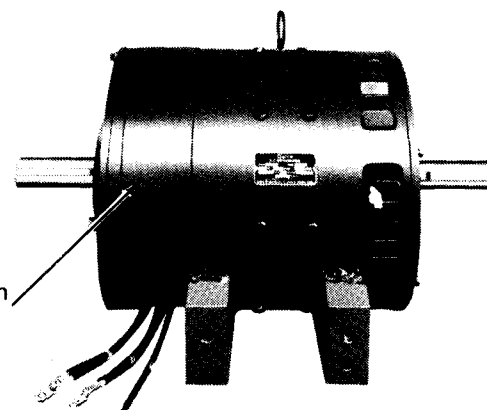
The following commutator inspections may be performed without disassembling the entire generator. Further commutator inspections, once the generator is disassembled, are included under Internal Inspections.

1. Remove inspection covers, Fig. 1, and clean slots between commutator bars. If any bars



10 kW

21702



18 And 24 kW

21703

Fig. 1 - Auxiliary Generators

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

are loose or raised, the commutator should be renewed and the armature rewound.

2. The surface of the commutator should have a clean slightly polished appearance. Minor pitting or burn marks can be removed with a piece of fine sandpaper. Use a shield to keep copper filings from entering the armature windings.

CAUTION: Do not use carborundum or emery cloth.

3. If commutator is badly worn, pitted, or burned, it should be machined to obtain a uniform surface. Refer to Service Data for repair limits.

BRUSH INSPECTION

The following brush inspections may be performed without disassembling the entire generator. The generators are equipped with either the constant pressure type brush holders, Fig. 2, or adjustable spring type brush holders, Fig. 3.

The constant pressure type brush holder assembly contains two removable spring clip assemblies, Fig. 2, which exert a preset pressure on the brushes as they wear. To remove brushes from this type holder the spring clip assemblies must first be removed by pressing the retaining spring and pulling the clip straight out.

To inspect brushes, remove inspection covers from generator, Fig. 1. Inspect for the following:

1. Freedom of movement – Brushes must be free to move up and down in the brush holder slots. Correct any binding or sticking.

On generators equipped with adjustable spring type holders, lift the pressure arm, Fig. 3, and

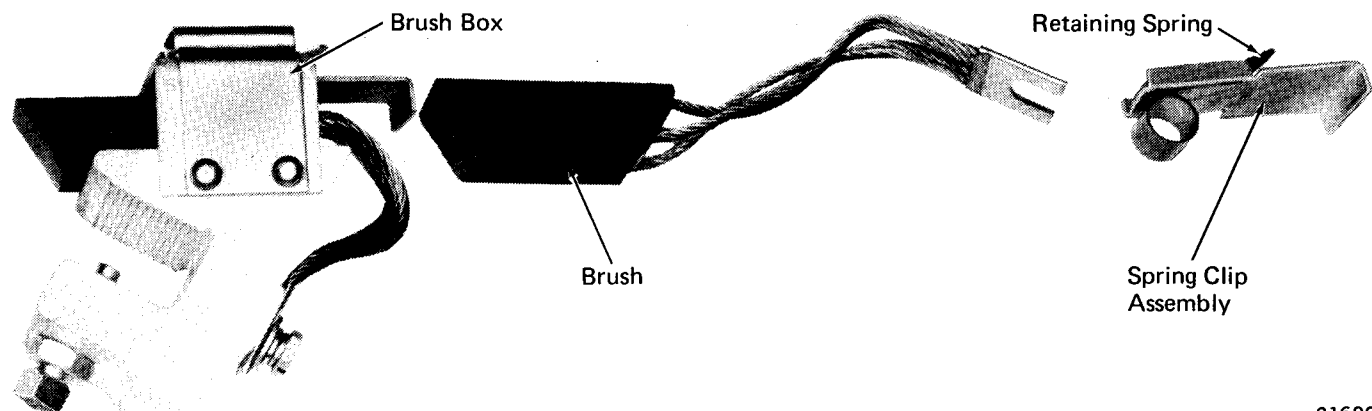
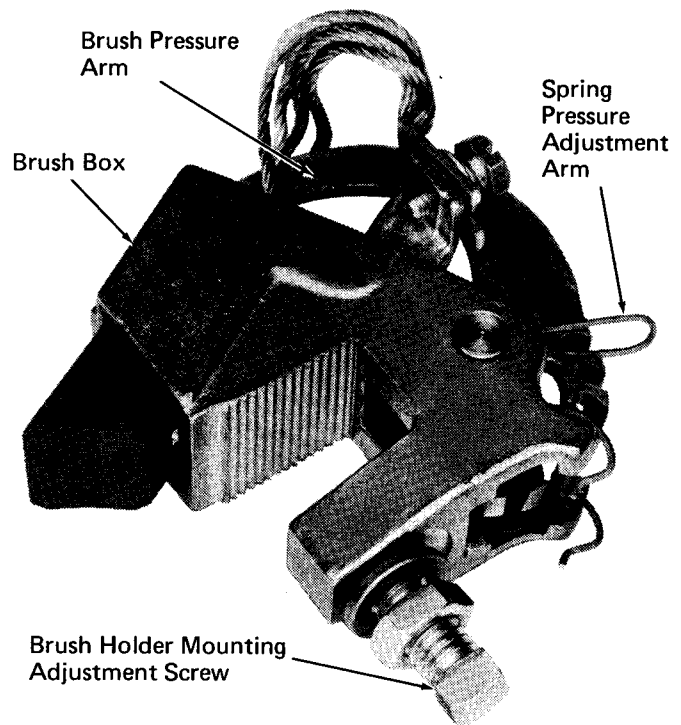


Fig. 2 - Constant Pressure Type Brush Holder



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Fig. 3 - Adjustable Spring Type Brush Holder

raise and lower brushes to remove any dirt accumulation. Do not snap pressure arm onto brush, this may cause damage to holder or chip the brushes.

On generators equipped with constant pressure type holders, remove spring clip assemblies, Fig. 2. Raise and lower brushes to remove any dirt accumulation.

2. Chips or cracks – Renew brushes if chipped or cracked. Refer to Brush Renewal for brush replacement procedure.

NOTE: If a full set of brushes is not required, new brushes should be the same grade and type as those remaining in the generator.

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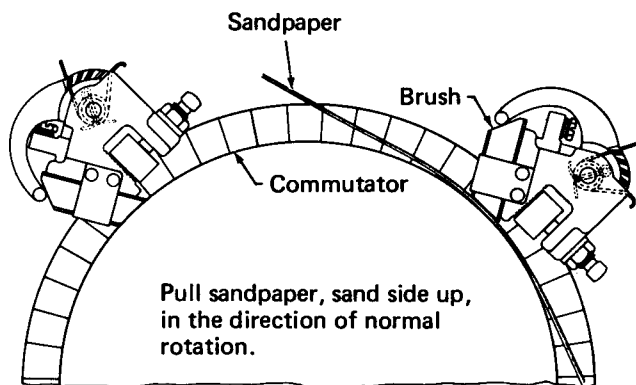
3. Wear – Renew excessively worn brushes. Refer to Service Data for minimum brush length. If length is marginal, renew brushes to ensure satisfactory operation until next scheduled inspection.

BRUSH RENEWAL

Use the following procedures to renew brushes:

1. Remove inspection covers, Fig. 1, from generator.
2. Disconnect brush leads and remove used brushes.
3. Install new brushes. Sand-in new brushes by placing a strip of No. 00 grade sandpaper, sand side up, on the commutator under the brushes, Fig. 4. Pull sandpaper across brushes in the direction of normal rotation until brush conforms to contour of commutator. Lift brush when moving paper back, and keep paper close to commutator to avoid rounding edges of brushes.

CAUTION: Do not use carborundum or emery cloth for sanding-in new brushes.



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Fig. 4 – Fitting Brushes To Commutator

4. Remove carbon dust and dirt with clean, dry, low-pressure air. Arrange brush shunts so that they will clear parts of the frame that are at ground potential.

NOTE: If brushes squeal during operation they should be sanded-in. Never lubricate the commutator.

BRUSH HOLDER INSPECTION

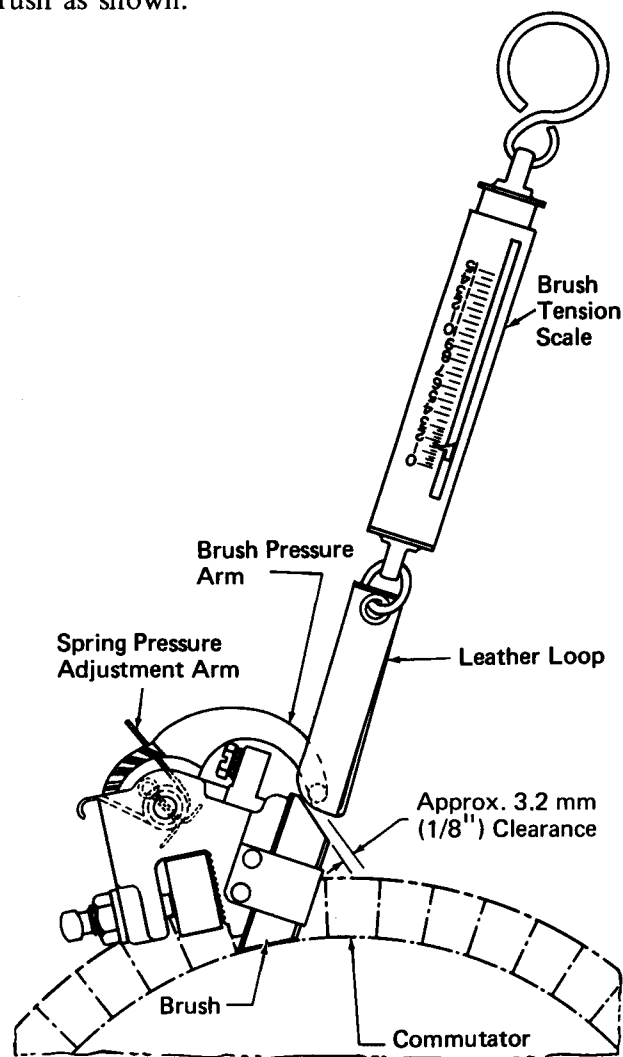
Check clearance between bottom of each brush holder (brush box) assembly and commutator. Clearance should be as specified in Service Data

with holder securely mounted. To change brush holder position, loosen holder mounting bolt and adjust holder. Arrange brush shunts so that they will clear parts of the frame that are at ground potential.

The constant pressure type brush holder springs need no adjustment, as the pressure will remain the same throughout brush life, regardless of brush length.

The adjustable spring type holder should, however, be maintained at the specified value in Service Data. It is important that all brushes be adjusted to the same pressure, as unequal brush pressure will result in unequal current distribution, causing premature brush wear or failure.

Use a brush tension scale to check spring pressure on brush pressure arm, Fig. 5. Measure pressure with pressure arm held 3.2 mm (1/8") off the brush as shown.



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Fig. 5 – Setting Brush Pressure (Adjustable Spring Type Brush Holder)

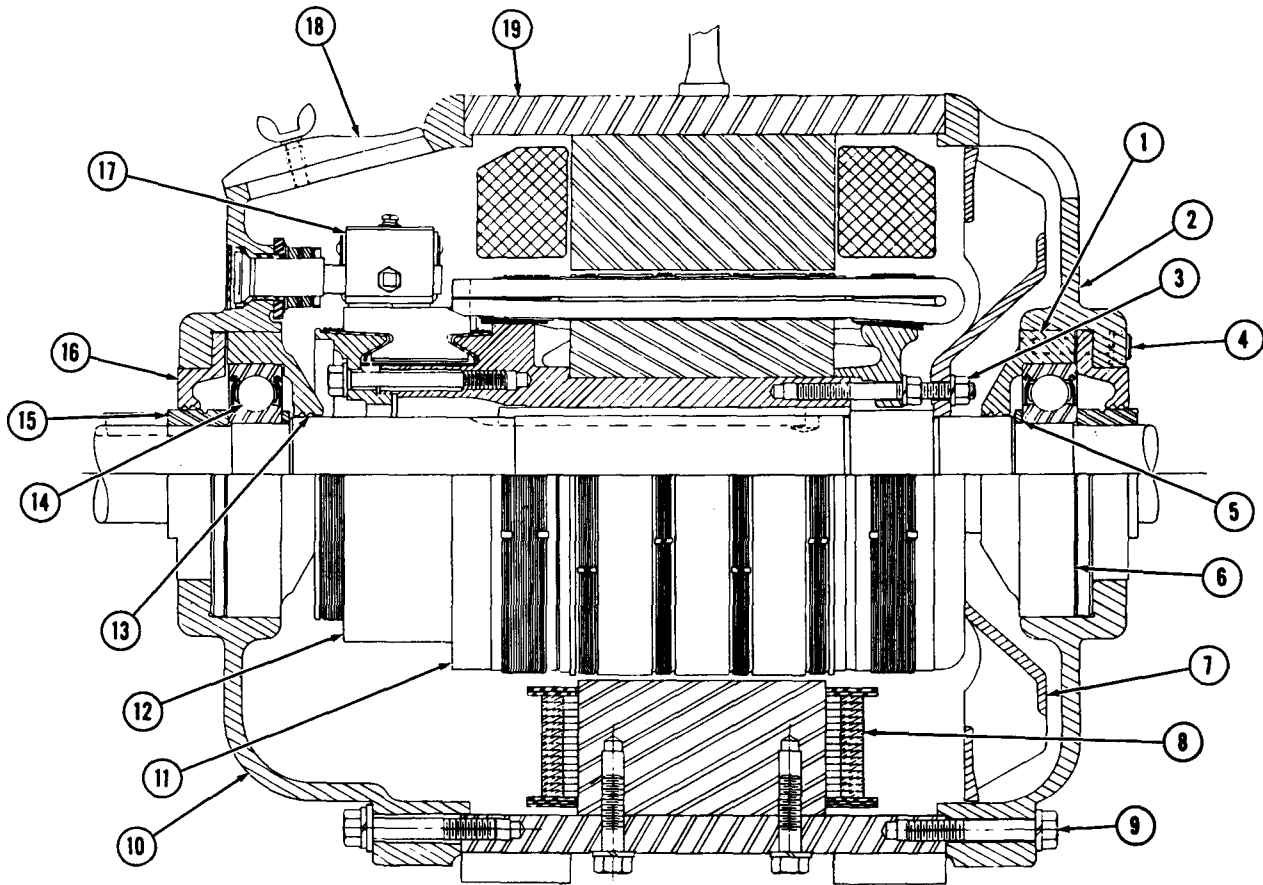
Spring pressure can be adjusted by moving the spring pressure adjustment arm. To increase pressure, move arm counterclockwise to next notch. Pressure can be decreased by moving the arm clockwise to next notch. After adjustment, re-measure pressure with brush tension scale. Readjust if necessary.

DISASSEMBLY PROCEDURE

ARMATURE REMOVAL

1. Remove sheave (when used) and keys from both ends of armature shaft.
2. Using a prick punch, mark relative position of commutator end frame to stator frame, Fig. 6

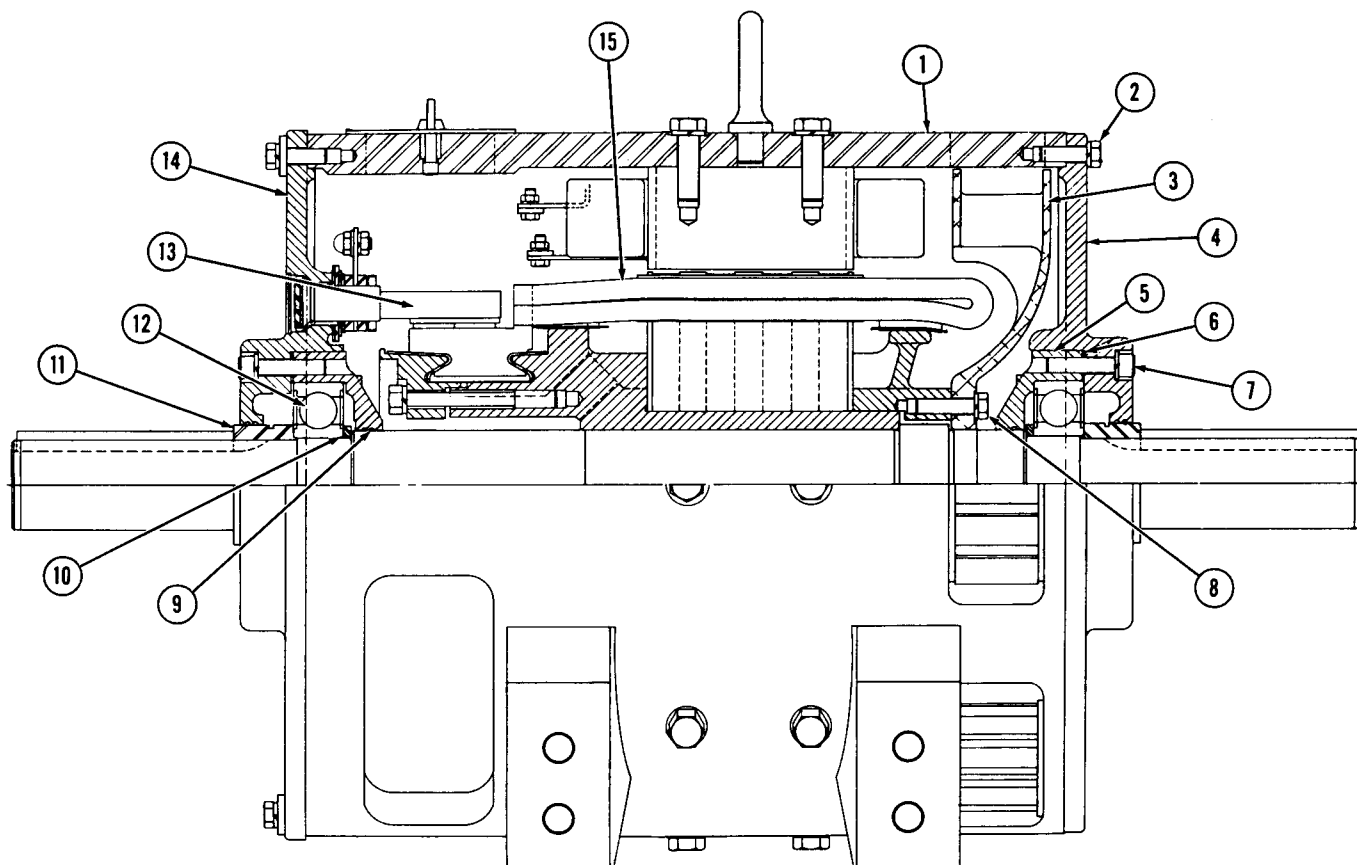
- or 7. This will prevent inadvertent shifting of the brushes away from electrical neutral when reassembling the end frame to the stator frame.
3. Remove brushes and cover commutator with a protective covering. Mark brushes so that they may be installed in their original position.
4. Disconnect field leads from brush holder assemblies. Remove clamps holding leads to stator frame.
5. Remove screws that secure bearing housing to end frame (both ends).



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- | | |
|---------------------------------------|------------------------------------|
| 1. Fan End Bearing Housing | 10. Commutator End Frame |
| 2. Fan End Frame | 11. Armature |
| 3. Fan Mounting Bolts | 12. Commutator |
| 4. Bearing Housing To End Frame Bolts | 13. Commutator End Bearing Housing |
| 5. Bearing Spacer | 14. Bearing |
| 6. Sealing Gasket | 15. Bearing Retainer Collar |
| 7. Fan | 16. Bearing Cover |
| 8. Stator Coils | 17. Brush Holder Assembly |
| 9. End Frame Mounting Bolts | 18. Inspection Cover |
| | 19. Stator Frame |

Fig. 6 - Typical 10 kW Generator (Exciter) Cross Section



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- | | |
|---------------------------------------|---|
| 1. Stator Frame | 8. Fan Mounting Bolts |
| 2. End Frame Mounting Bolts | 9. Commutator End Bearing Housing |
| 3. Fan | 10. Bearing Spacer (Not Applicable To All Models) |
| 4. Fan End Frame | 11. Bearing Retainer Collar |
| 5. Fan End Bearing Housing | 12. Bearing |
| 6. Sealing Gasket | 13. Brush Holder Assembly |
| 7. Bearing Housing To End Frame Bolts | 14. Commutator End Frame |
| | 15. Armature |

Fig. 7 - Typical 18 And 24 kW Generator Cross Section

6. Remove end frame mounting bolts and pipe plug and nipple from both ends of generator.

7. Support commutator end of armature shaft. Loosen commutator end frame from stator frame by gently tapping on end frame with a brass or copper mallet.

When commutator end frame is moved away from the stator frame, protect armature by placing strips of fish paper between bottom of stator frame and armature. Remove commutator end frame from armature shaft.

Remove fan end frame in a similar manner. Ensure that fish paper strips are placed between bottom of armature and stator coils.

8. Carefully remove armature from stator frame, fan end first. Use ropes and a pipe extension

placed on the commutator end of the armature shaft. Exercise care when handling armature to prevent damage to laminations, windings, or commutator.

CAUTION: Do not lift weight of armature with rope secured around commutator.

BEARING REMOVAL

1. Perform steps under Armature Removal.
2. On 10 kW generators, remove fillister head screws that secure bearing cover assemblies to the bearing housing at each end of generator. Gently pry cover assemblies from the housings.
3. Heat bearing retainer collars to 260° C (500° F) to soften sealant. Remove bearing retainers.

NOTE: Keep commutator end bearing parts separated from fan end bearing parts to prevent inadvertent mixing of parts.

4. Remove remaining bearing assembly.
5. Mark armature fan position on armature shaft so that the fan may be reinstalled in the same position. Remove fan mounting bolts and slide fan from armature shaft.

INTERNAL INSPECTIONS AND MAINTENANCE

NOTE: Certain repair procedures require special facilities, equipment, and knowledge. If the above are not available, the generator should be returned to Electro-Motive.

ARMATURE

1. Clean armature. If a solvent or solution is used, blow armature dry with clean, low pressure air.

WARNING: To avoid electrical shock, make no electrical tests while the armature is wet. Make certain that armature is dry before proceeding.

2. Check insulation resistance of armature. The minimum reading should be one megohm, using a 500 volt DC megger. If minimum reading cannot be obtained, dry armature in an oven set at 120° C (248° F) for 4 hours.
3. Measure armature resistance at ambient temperature. Refer to Service Data for specifications.

NOTE: If armature fails checks in Steps 2 and 3 above, locate and correct fault. If values specified cannot be obtained, the armature should be stripped and rewound.

4. Visually inspect armature shaft diameter for abnormal wear indications.
5. Armature wire bands should be tight and solder on bands should be intact. If solder has been thrown from bands, or the bands are loose, the cause should be corrected and the band renewed.
6. Inspect coil insulation for blisters, flakes, cracks, or powdering. Armature should be rewound if any of the above indications exist.

7. Inspect cast armature fan for cracks, renew if necessary.

COMMUTATOR

1. Clean slots between commutator bars. If any bars are loose or raised the commutator should be renewed and the armature rewound.
2. The surface of the commutator should have a slightly polished appearance. Minor pitting or burn marks can be removed with a piece of fine sandpaper. Use a shield to keep copper filings from entering armature windings.

CAUTION: Do not use carborundum or emery cloth.

3. If commutator is badly worn, pitted, or burned, machine it to obtain a uniform surface. Check diameter of commutator and the neck width. Refer to Service Data for repair limits.
4. Check commutator eccentricity with a dial indicator. Refer to Service Data for maximum eccentricity.
5. Remove all sharp edges from the commutator bars. Use clean, dry, low pressure air to blow debris from the armature windings.

ARMATURE VARNISH TREATMENT

All serviced armatures should receive a varnish treatment as follows:

1. Preheat armature in a convection oven set at 160° C (320° F) until core temperature reaches 120° to 140° C (248° to 284° F). Approximately 4 hours.
2. Remove armature from oven and, while hot, dip in clear baking varnish, commutator end up, for 10 minutes. Be careful not to get varnish on commutator.
3. Remove armature from varnish and allow it to drain for 5 minutes.

NOTE: Before placing armature in oven, wipe excess varnish from armature shaft.

4. Bake armature in a convection oven set at 160° C (320° F) maximum for 30 minutes.

5. Remove armature from oven and while hot, 45° to 55° C (113° to 131° F), hi-pot at 800 volts for 1 minute.

ARMATURE BALANCING

The armature must be dynamically balanced to within 0.0035 N·m (1/2 in.-oz.).

An armature, unbalanced at the commutator end, is balanced by applying weights to the commutator spider, Fig. 8.

An armature, unbalanced at the fan end, is balanced by applying weights to the fan, Fig. 8. If the point of unbalance is away from the original balance position, the fan may be turned on the armature spider to correct the unbalance.

STATOR

The following inspections and maintenance steps can be performed without removing the field coils from the stator frame.

1. Clean dirt and oil from stator coils.
2. Check mechanical and electrical condition of coil leads and connections.
3. Cable connections must be secure and all taping intact.
4. Remove and re-insulate field coils, if insulation is charred. If extensive damage is indicated, the field coils should be renewed.
5. If necessary, varnish treat coils.

FIELD COILS

To remove field coils, disconnect coil leads and remove bolts that secure pole pieces to stator frame. Remove pole and slip shunt coil from pole.

CAUTION: The interpole coils should not be removed from pole. No attempt should be made to repair an interpole coil.

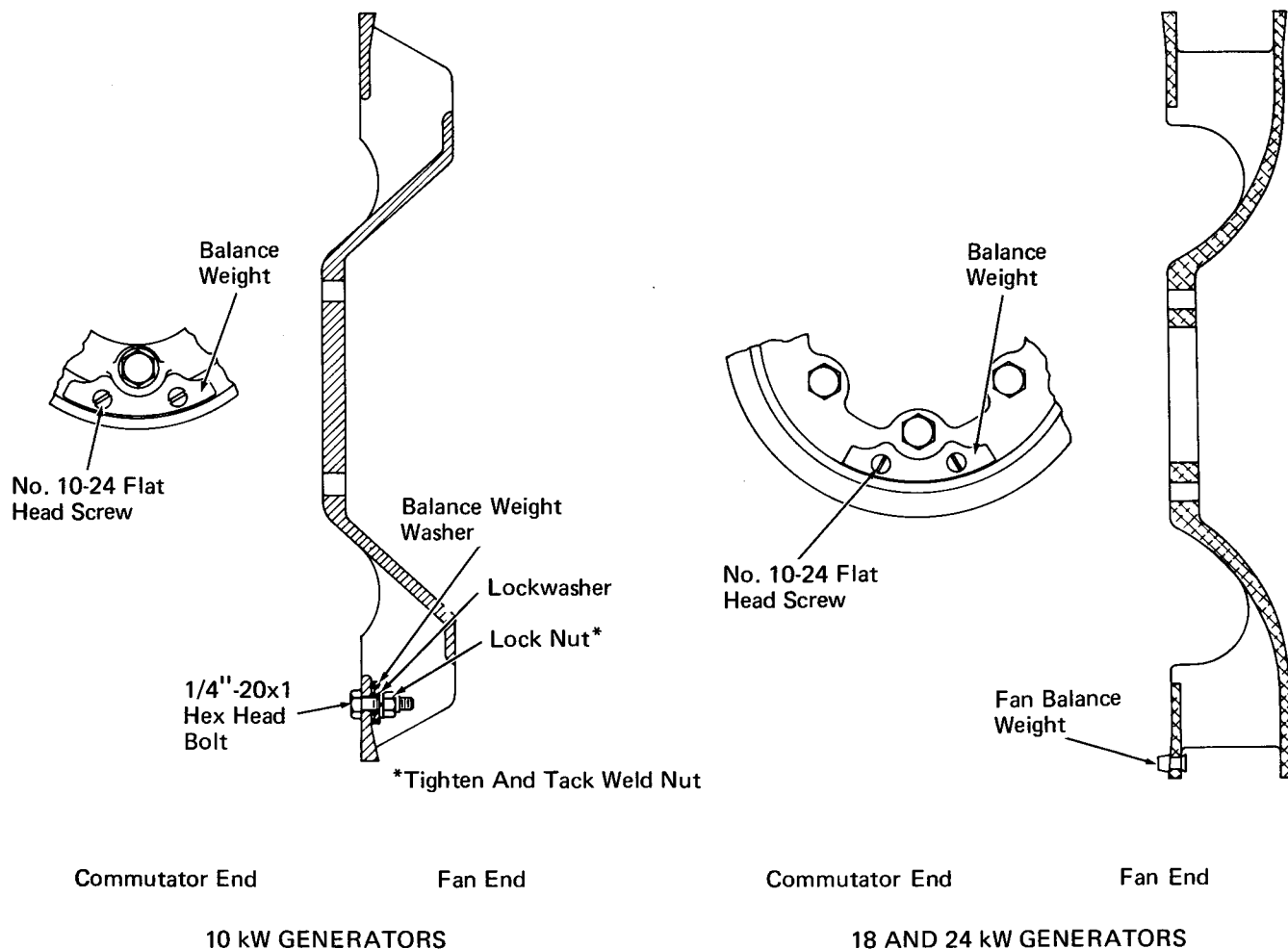


Fig. 8 - Armature Balance Weight Placement

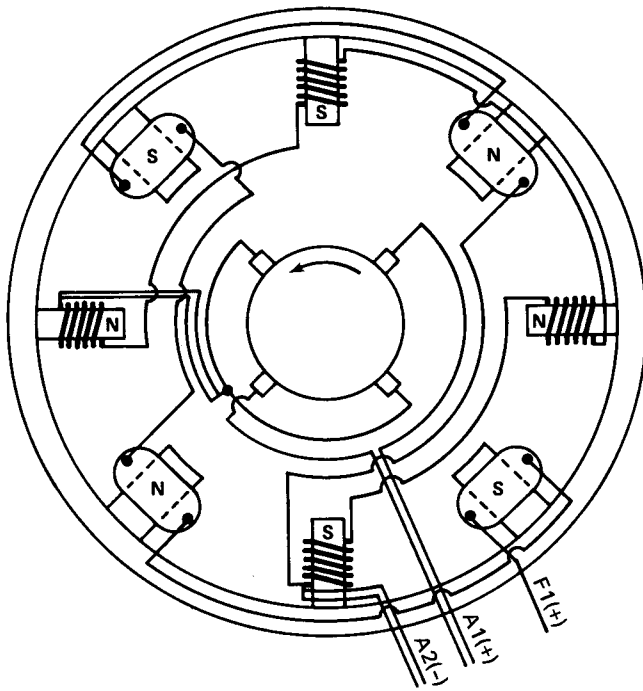
When removing interpole coils, keep each pole coil and accompanying shims together. When installing interpole coils, these shims must be replaced in their original position.

To install shunt coils, heat coils at 120° C (248° F) for one hour. While hot, assemble coils on poles and draw up tightly in the generator frame. Refer

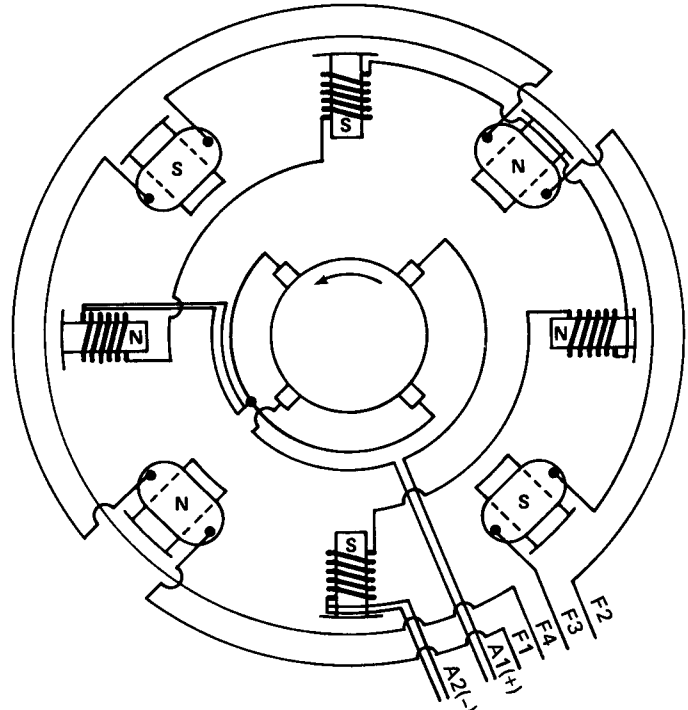
to Fig. 9 for coil connections. Hi-pot assembly at 1000 volts for 10 seconds.

STATOR VARNISH TREATMENT

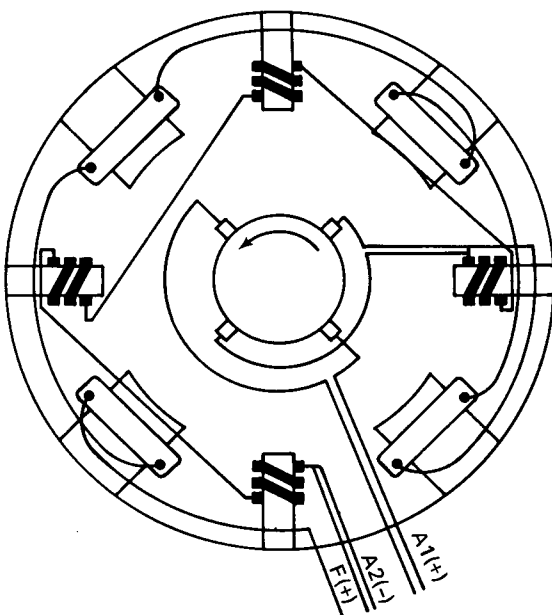
1. Cover bare surfaces of connection cables with surgical tape.



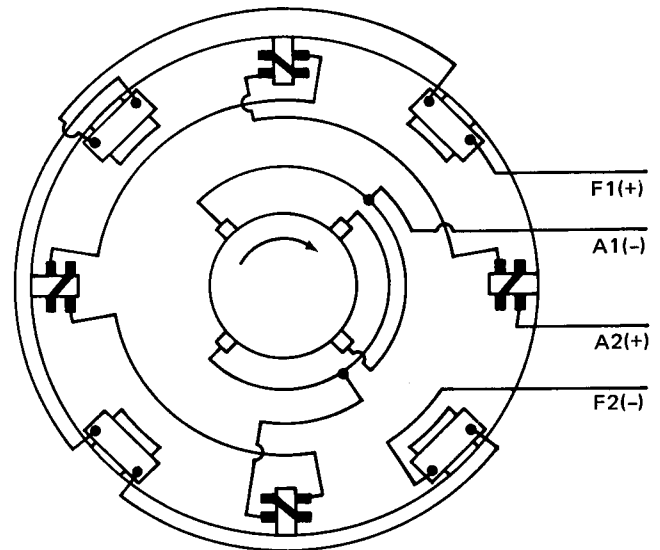
7159 Series



8106 Series



8102 And 8145 Series



8105 Series

Fig. 9 - Connection Diagrams As Viewed From The Commutator End

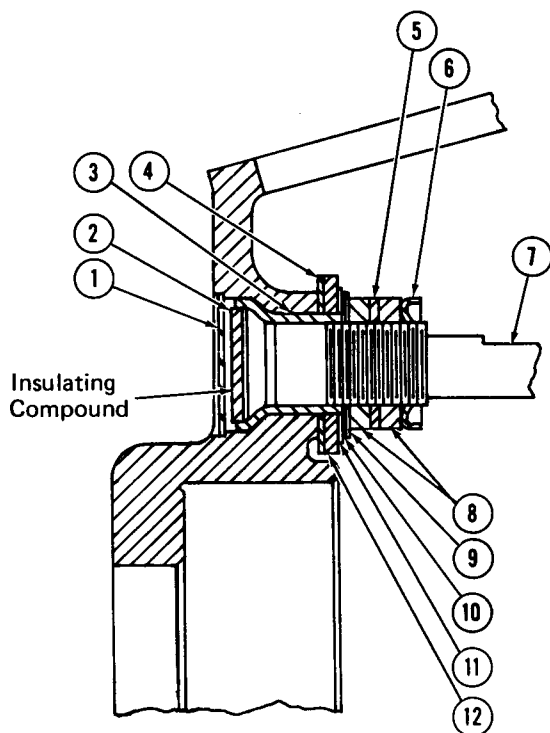
2. Preheat stator in a convection oven set at 160° C (320° F) until stator temperature reaches 120° to 140° C (248° to 284° F). Approximately 4 hours.
3. Remove stator from oven and, while hot, dip in clear baking varnish for 5 minutes.
4. Remove stator from varnish and allow it to drain for 5 minutes.
5. Bake stator in a convection oven set at 160° C (320° F) maximum for 5 hours.

BRUSH HOLDER STUD INSPECTION

Use the following procedures to inspect or renew brush holder studs or the brush holder stud insulation material:

DISASSEMBLY

1. Loosen and remove stamped lock nut (6), Fig. 10, and lock nuts (8).



- | | |
|----------------------|-----------------------|
| 1. Expansion Plug | 7. Brush Holder Stud |
| 2. Insulating Disc | 8. Lock Nut |
| 3. Insulating Sleeve | 9. Spring Washer |
| 4. Insulating Washer | 10. Flat Washer |
| 5. Terminal Clip | 11. Insulating Washer |
| 6. Stamped Lock Nut | 12. Insulating Washer |

Fig. 10 - Replacing Brush Holder Stud And Insulation

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2. Remove spring washer (9), flat washer (10), insulating washer (11), insulating washer (12), and insulating washer (4).
3. Gently tap brush holder stud (7) to push out expansion plug (1) and insulating disc (2).
4. Remove insulating sleeve (3).
5. Inspect all insulating material parts for deterioration, renew if necessary.

ASSEMBLY

1. Install insulating sleeve (3) and brush holder stud (7) into end frame.
2. Place insulating washer (4), insulating washer (12), insulating washer (11), flat washer (10), and spring washer (9) on brush holder stud in that order.
3. Thread one lock nut (8) on brush holder stud and hand tighten.
4. Align brush holder studs as shown in Fig. 11. When studs are aligned tighten lock nut (8), Fig. 10, to 89-95 N·m (65-70 ft-lbs).

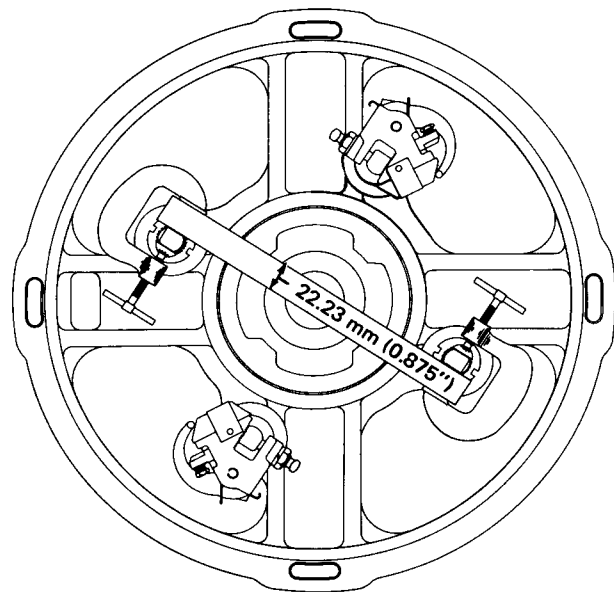


Fig. 11 - Brush Holder Stud Alignment

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5. Install terminal clip (5) and secure with lock nut (8). Tighten lock nut to 89-96 N·m (65-70 ft-lbs).
6. Thread stamped lock nut (6) on brush holder stud as shown in figure. Tighten nut until snug.

7. Install insulating disc (2), insulating compound, and expansion plug (1).

ASSEMBLY PROCEDURE

BEARINGS

1. Mount fan to armature spider.
2. Clean grease cavities in bearing housings and bearing covers or end frames.
3. On 10 kW generators, fill grease cavity in each bearing housing to shaft level. On 18 kW and 24 kW generators fill lower 270° of each bearing housing with grease. If housing is equipped with labyrinth grooves, fill grooves flush with grease.
4. Place greased bearing housings on the armature shaft. Install bearing spacers, if used, and grease packed bearing into housing. Avoid cocking bearing when applying to shaft. Bearing does not require heating during installation.

NOTE: On A-7159M2, A-7159A4, and A-7159A5 model generators, apply Loctite Grade A sealant to the inside diameter of each bearing, before placing bearing on shaft. In addition apply sealant to the outside diameter of the far end bearing. Do not apply sealant to the outside diameter of the commutator end bearing.

5. Apply sealant to armature shaft and inside diameter of bearing retainer collar. Install bearing retainer on armature shaft to secure bearing.

NOTE: Ensure that inside diameter of retainer and shaft are free of oil and grease before applying sealant. Allow a minimum of 4 hours sealant curing time.

6. On 10 kW generators equipped with bearing covers, fill cover grease cavity to shaft level and labyrinth grooves flush with grease. Assemble covers to bearing housings using new sealing gaskets between the two parts.
7. On 18 kW and 24 kW generators, fill grease cavity in each end frame as shown in Fig. 12.
8. Assemble fan end frame over fan end bearing housing using a new sealing gasket between the two parts. Secure frame to housing using the bearing housing to end frame mounting bolts, Fig. 6 or 7. Torque bolts to 27-34 N·m (20-25 ft-lbs).

ARMATURE

1. Protect commutator by wrapping it with heavy fish paper.
2. On 18 kW and 24 kW generators, screw two threaded rods, approximately 152 mm (6")

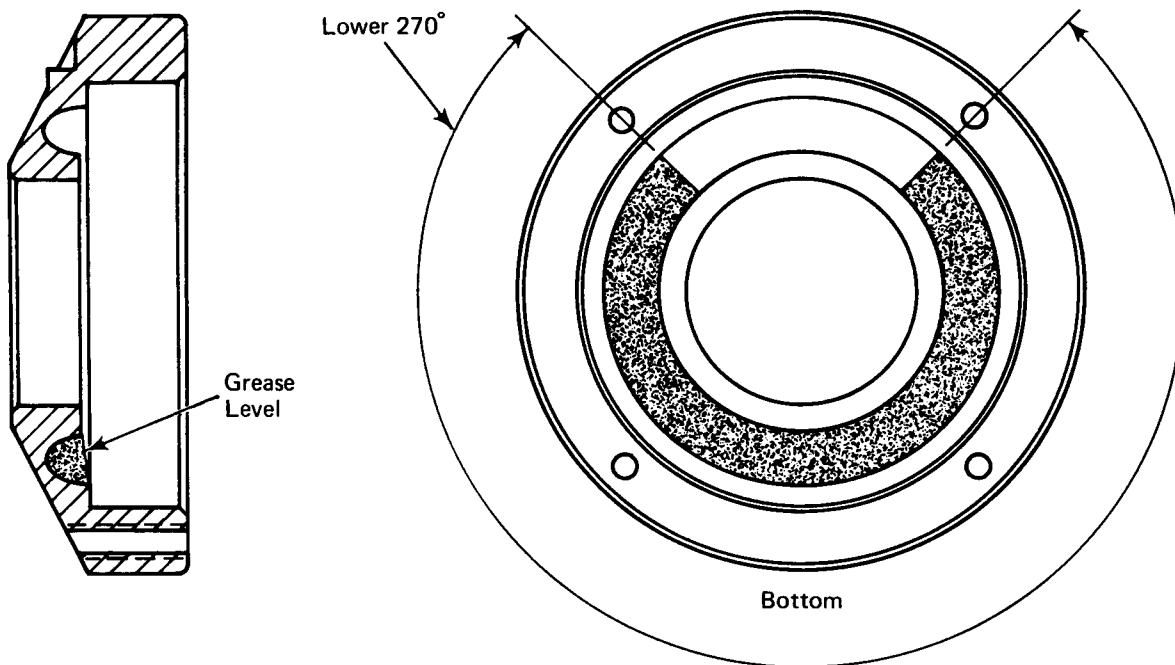


Fig. 12 - End Frame Grease Cavity, 18 And 24 kW Generators

long, into the commutator end bearing housing. These studs will serve as a guide when applying commutator end frame onto bearing housing.

3. Place stator and armature assemblies on stands close enough to each other so that a pipe extension placed over the armature shaft will protrude through the stator frame.
4. With a rope secured to each end of the armature shaft, carefully lift and guide armature assembly into the stator frame. Care must be exercised to ensure that the armature or field coil assemblies are not damaged during assembly.
5. Bolt fan end frame to stator frame. Torque mounting bolts to 68-75 N·m (50-55 ft-lbs).
6. On 10 kW generators, line up fan end bearing housing with fan end frame, and install bearing housing to end frame mounting bolts, Fig. 6 or 7. Torque mounting bolts to 27-34 N·m (20-25 ft-lbs).
7. Repeat Steps 5 and 6 for commutator end. Ensure that prick punch marks applied in Step 2 of Armature Removal line up.
8. Assemble brushes to brush holders and seat brushes to commutator. Refer to Brush Renewal section.

FINAL INSPECTIONS

1. Check runout at each end of armature shaft. Runout should be held within tolerance given on Service Data.
2. Check vertical movement of armature shaft at each end frame. Total movement should be within tolerance given in Service Data.
3. Run generator for 2 hours, or until bearing temperature stabilizes. Temperature should not exceed 50° C (122° F).
4. Measure generator resistances at 75° C (167° F), refer to Service Data.
5. Hi-pot generator at 800 volts for 10 seconds.

BRUSH SETTING (KICK NEUTRAL)

Having assembled the generator, in some cases it will be necessary to set the brushes with respect

to electrical neutral. When necessary, use the following procedure to check or set brush position:

1. Using the commutator as a scale, check brush holder angular spacing. Holders should be equally spaced around the commutator to within 0.4 mm (1/64").
2. Choose and mark one commutator bar, this is the number one bar. Facing the commutator, and counting counterclockwise, count 25 bars on 10 kW generators or 32 bars on 18 kW and 24 kW generators. This is called the span. Mark the center of last bar in span.
3. Rotate armature until center of first bar in span is near the center of the top right brush holder as viewed from the commutator end. The last bar in the span should not be near the center of the top left brush holder.
4. Connect a 6 volt storage battery and a switch in series with the generator field.
5. Isolate all brushes from the commutator.
6. Connect a zero center reading (50 millivolt movement) ammeter across the first and last commutator bars in the span.
7. Read the armature kick voltage when the switch connected in series with the field circuit is opened and closed. Wait several seconds once the switch is closed so that the field current can build up.
8. Excite the field then open the circuit. Note deflection on meter. Rotate armature about one commutator bar distance and repeat. If second reading is greater than the first, and of the same polarity, armature was rotated in wrong direction.

If second reading is opposite polarity of first, the neutral point has been passed. Repeat above pattern of slightly rotating the armature until meter reading is zero or as near zero as possible.

9. Once neutral is found, check if the upper right and left brushes are located on the first and last bars of the span as shown in Fig. 13. If not, rotate commutator end frame, while the armature remain in electrical neutral position, to bring brushes to within 0.4 mm (1/64") of location setting.

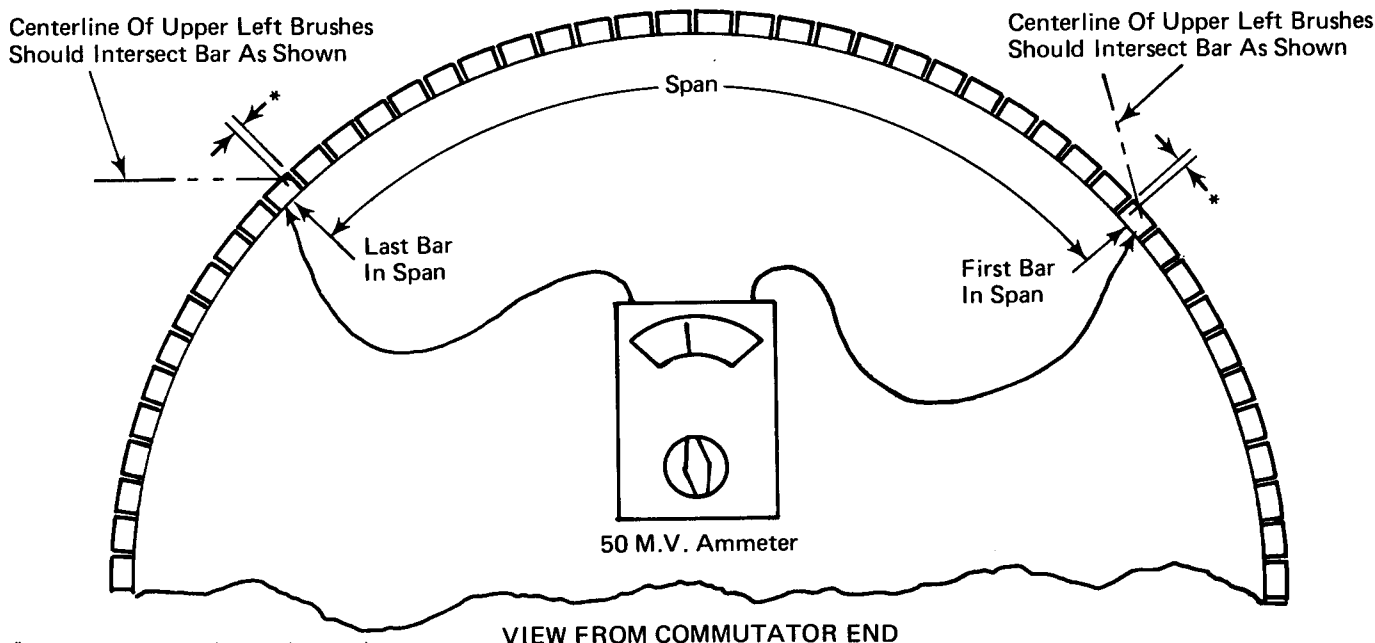


Fig. 13 - Brush Setting (Kick Neutral)

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10. Recheck setting after adjustment is complete.

GENERATOR INSTALLATION

Refer to Service Data for reference information concerning alignment of shaft driven auxiliary generators. When installing belt driven auxiliary generators the following items should be checked.

1. Belts must be clean and dry.
2. Drive and driven sheaves should be aligned and parallel with each other.
3. When pressing the auxiliary generator sheave on shaft, do not press sheave flush with end of shaft.

Allow the sheave to protrude approximately 4.76 mm (3/16") from end of shaft. Further adjustment of sheave may be made by bolt and retainer plate during the alignment operation with the driving sheave.

4. Drive belt tension is adjusted by shifting the generator in its slotted supports by means of adjusting screws, after loosening the auxiliary generator support bolts. Belts should be adjusted to avoid excessive slack. Satisfactory belt tension will be obtained when a normal pressure applied midway between the main generator and auxiliary generator sheaves will depress a single belt 13 to 25 mm (1/2" to 1").

ELECTRICAL CONNECTIONS

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

In some cases it may be necessary to re-establish the residual magnetism within the generator field windings. This magnetic flux provides initial generator excitation upon startup.

To establish the initial magnetic flux, remove the positive field lead from the voltage regulator and momentarily connect it to a convenient battery positive. Reconnect the positive field lead to the voltage regulator.

Check the auxiliary generator voltage after the installation is complete. If the voltage is low or zero, check for the following conditions:

1. Brushes not making good contact.
2. Shunt field reversed or short circuited.
3. Shunt field circuit open.

A reversed field connection can usually be detected by the generator voltage tending to approach zero when the generator is started, indicating faulty wiring.

The voltage of the generator may increase with reverse polarity because the residual field is in the wrong direction.

SERVICE DATA

REFERENCES

Alignment of Locomotive Rotating Equipment	M.I. 1753
Alignment of Rotating Equipment	M.I. 1765
Alignment of Drill Rig Rotating Equipment	M.I. 1766

MATERIALS

Insulating Compound -	
3.79 Litres (1 U.S. Gallon)	8198930
18.93 Litres (5 U.S. Gallons)	8198931
Grease, SRI-2 Bearing - 3.6 kg (8 lbs)	8490018
Sealant, Loctite Grade A - 10 cm ³ (0.34 oz.)	8305894
*Varnish, Electrical Insulating - Modified Polyester Y-432 (Sterling Varnish Co.)	
Thinner Solvent For Above Varnish	
Chevron No. 1300 Solvent	
Thompson - Hayward Chemical Company No. 2026 Solvent	
**Xylol Thinner	
An alternate thinner solvent may be blended using the following materials:	
Mineral Spirits (Rule 66 Type Thinner) 80%	
Butyl Acetate - Technical Grade 20%	

NOTE: The above blend is required because the varnish sets up in the tank when mineral spirits thinner is used alone. Butyl acetate prevents this.

*To be used where compliance with pollution control regulations is required.

**Xylol may be used as a substitute thinner, however, Xylol DOES NOT comply with pollution control regulations.

EQUIPMENT

Megger, 500 Volt DC	8071692 or 8306539
Ammeter, Zero Center Reading (50 millivolt movement)	
Battery, 6 Volt Storage	
Switch, Toggle	

SPECIFICATIONS

10 kW MODEL GENERATORS AND EXCITERS (7159, 8105, 8106, AND 8108 SERIES)

Weight (Approximate)	
Total	327 kg (720 lbs)
Armature	104 kg (230 lbs)
Air Gap	
Main Field Pole	2.49 mm (0.098")
Interpole	2.629 mm (0.1035")
Commutator	
Brush Surface Diameter, Minimum	180.98 mm (7-1/8")
Neck Width, Minimum	7.94 mm (5/16")
Mica Groove Undercut	1.19 mm (3/64")
Mica Groove Width	0.76 mm (0.030")
Eccentricity, Maximum Brush Surface (T.I.R.)	0.03 mm (0.001")
Armature	
Dynamic Balance	Within 0.0035 N·m (1/2 in.-oz.)
Shaft Runout (T.I.R.)	Within 0.076 mm (0.003")

Shaft Vertical Movement (Measured At End Frame)

Minimum	0.0203 mm (0.0008")
Maximum	0.076 mm (0.003")

Resistance Limits In Ohms @ 75° C (167° F)*

7159 And 8106 Series:

	Nominal	Minimum	Maximum
Armature	0.01913	0.01817	0.02009
Bars 1-10	0.01226	0.01165	0.01287
Interpole	0.01026	0.00975	0.01077
Shunt Field	7.48	7.11	7.85

8105 And 8108 Series:

	Nominal	Minimum	Maximum
Armature	0.05645	0.05362	0.05927
Bar 1-10	0.0264	0.0251	0.0277
Interpole	0.0210	0.01995	0.0221
Shunt Field	13.78	13.09	14.47

*Use the following formula to convert resistance measured at any temperature to resistance at 75° C (167° F):

$$\text{resistance at } 75^{\circ} \text{ C} = \frac{\text{measured resistance} \times 309.5}{234.5 + \text{temperature of item being tested in } ^{\circ} \text{ C}}$$

Brush Holders

Clearance - Brush Box To Commutator	3.18 mm (1/8")
Brush Pressure Arm Tension	0.68-1.13 kg (1.5-2.5 lbs)

Brushes

Grade	E44
Size	51 mm x 25.02 mm x 15.65 mm (2" x 0.985" x 0.616")

Brush Wear

Minimum Length	28.58 mm (1-1/8")
Maximum Allowable Wear	22.23 mm (7/8")

18 kW MODEL GENERATOR (8102 SERIES)

Weight (Approximate)

Total	327 kg (720 lbs)
Armature	118 kg (260 lbs)

Air Gap

Main Field Pole	1.85 mm (0.073")
Interpole	3.56 mm (0.140")

Commutator

Brush Surface Diameter, Minimum	180.98 mm (7-1/8")
Neck Width, Minimum	7.94 mm (5/16")
Mica Groove Undercut	0.793 to 1.19 mm (1/32" to 3/64")
Mica Groove Width	0.64 mm (0.025")
Eccentricity, Maximum Brush Surface (T.I.R.)	0.03 mm (0.001")

Armature

Dynamic Balance	Within 0.0035 N·m (1/2 in.-oz.)
Shaft Runout (T.I.R.)	Within 0.076 mm (0.003")

Shaft Vertical Movement (Measured At End Frame)

Minimum	0.0203 mm (0.0008")
Maximum	0.076 mm (0.003")

Resistance In Ohms @ 75° C (167° F)*

	Nominal	Minimum	Maximum
Armature	0.01781	0.01692	0.01870
Bars 1-8	0.00756	0.00718	0.00794
Interpole	0.01191	0.01132	0.01251
Shunt Field	6.95	6.60	7.30

*Use the following formula to convert resistance measured at any temperature to resistance at 75° C (167° F):

$$\text{resistance at } 75^{\circ} \text{ C} = \frac{\text{measured resistance} \times 309.5}{234.5 + \text{temperature of item being tested}}$$

Brush Holders

Clearance - Brush Box to Commutator	3.18 mm (1/8")
Brush Pressure Arm Tension	0.68-1.13 kg (1.5-2.5 lbs)

Brushes

Grade	E44
Size	51 mm x 25.02 mm x 15.65 mm (2" x 0.985" x 0.616")

Brush Wear

Minimum Length	28.58 mm (1-1/8")
Maximum Allowable Wear	22.23 mm (7/8")

24 kW MODEL GENERATOR (8145 SERIES)

Weight (Approximate)

Total	327 kg (720 lbs)
Armature	118 kg (260 lbs)

Air Gap

Main Field Pole	1.85 mm (0.073")
Interpole	3.56 mm (0.140")

Commutator

Brush Surface Diameter, Minimum	180.98 mm (7-1/8")
Neck Width, Minimum	7.94 mm (5/16")
Mica Groove Undercut	0.793 to 1.19 mm (1/32" to 3/64")
Mica Groove Width	0.64 mm (0.025")
Eccentricity, Maximum Brush Surface (T.I.R.)	0.03 mm (0.001")

Armature

Dynamic Balance	Within 0.0035 N·m (1/2 in.-oz.)
Shaft Runout (T.I.R.)	Within 0.076 mm (0.003")

Shaft Vertical Movement (Measured At End Frame)

Minimum	0.0203 mm (0.0008")
Maximum	0.076 mm (0.003")

Resistance In Ohms @ 75° C (167° F)*

	Nominal	Minimum	Maximum
Armature	0.01114	0.01058	0.01170
Interpole	0.00667	0.00634	0.00700
Shunt Field	8.20	7.79	8.61

*Use the following formula to convert resistance measured at any temperature to resistance at 75° C (167° F):

$$\text{resistance at } 75^{\circ} \text{ C} = \frac{\text{Measured resistance} \times 309.5}{234.5 + \text{temperature of item being tested}}$$

Brush Holders

- Clearance - Brush Box To Commutator 3.18 mm (1/8")
- Brush Pressure Arm Tension 0.68-1.13 kg (1.5-2.5 lbs)

Brushes

- Grade E44
- Size 51 mm x 25.02 mm x 22.17 mm (2" x 0.985" x 0.873")

Brush Wear

- Minimum Length 28.58 mm (1-1/8")
- Maximum Allowable Wear 22.23 mm (7/8")