



SERVICE DEPARTMENT

ELECTRO-MOTIVE DIVISION • GENERAL MOTORS CORPORATION

MAINTENANCE INSTRUCTION

FRACTIONAL HORSEPOWER MOTORS

INTRODUCTION

The fractional horsepower motors, Fig. 1, covered in this maintenance instruction are used in several different applications including: heater blowers, lubricating systems, and fuel pumping systems. A chart included under Service Data gives all appropriate information required to identify and overhaul each model motor.

All models feature sealed grease packed ball bearings that require no additional lubrication once assembled in the motor.

The following maintenance instructions pertain to all models. Any dissimilarities between instructions for different models will be identified.

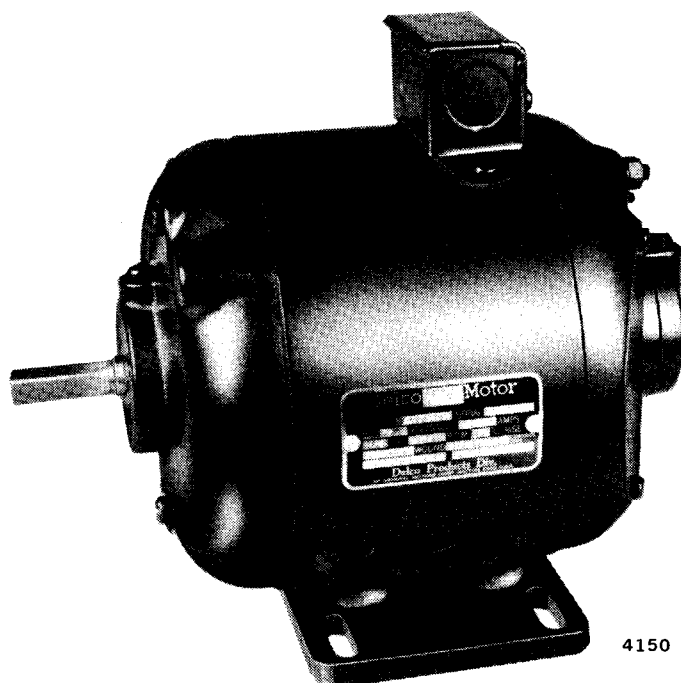
MAINTENANCE

Due to the critical duty required of these motors, inspections should be frequent. To ensure continuous trouble free operation perform inspections at intervals specified in the Scheduled Maintenance Program.

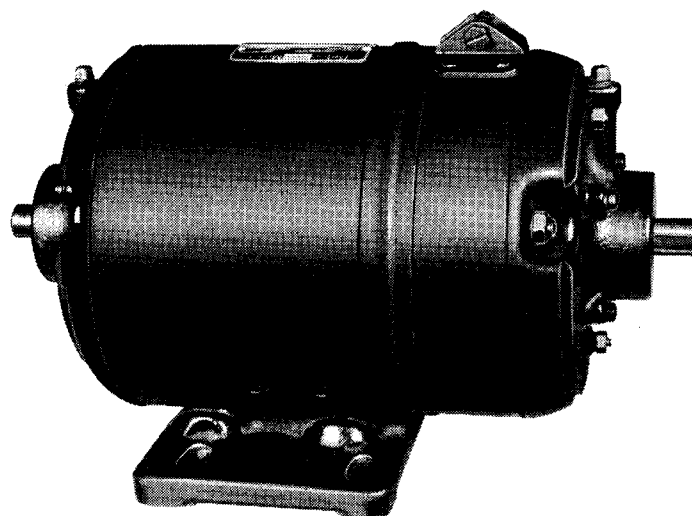
INSPECTION

The following inspections do not require that the motor be disassembled. A separate set of internal inspections is included following the Disassembly Of Motor section. These inspections require that the motor be disassembled completely.

1. Check tightness of coupling or connection between motor and the device it drives.



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Fig. 1 - Typical Fractional Horsepower Motors

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

2. Check for freedom of rotation.
3. Make certain that electrical connections to the motor are clean, tight, and free of defects.
4. Using a megohmmeter, check for grounded armature and frame. If the reading is less than one megohm, disassemble motor and perform Internal Inspections that follow the Disassembly Of Motor section. Overhaul motor as required.
5. Inspect brushes as outlined under Brush Inspection And Renewal.

CLEANING

In addition to the above inspections, a thorough cleaning of the motor should be included in the routine maintenance operation. Perform the following cleaning steps:

1. Wipe entire exterior of motor to remove oil and dirt accumulation.
2. Remove inspection covers and blow out motor interior. Use clean, dry, low pressure air to remove carbon dust and dirt.

NOTE: A cloth dampened with solvent may be used to clean motors that are extremely dirty. Make certain that solvent does not come in contact with the commutator. Always allow motor to dry thoroughly before returning it to service.

BRUSH INSPECTION AND RENEWAL

Brushes may be inspected without disassembling the entire motor. To inspect brushes, remove the inspection band or cover from motor. 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.
2. Chips or cracks -- Renew brushes if chipped or cracked.
3. Wear -- Renew brushes if less than 19 mm (3/4").

To renew brushes use the following procedure:

1. Remove inspection covers or band from motor.

2. Disconnect brush leads and remove brushes.
3. Install new brushes.
4. Sand-in new brushes by placing a strip of No. 00 grade sandpaper sand side up on the commutator under the brushes. Rotate the armature in the direction of normal rotation until brushes conform to the contour of the commutator.
5. Remove carbon dust and dirt with clean, dry, low pressure air.
6. Check brush spring force. Replace springs that do not meet minimum brush force listed under Service Data.

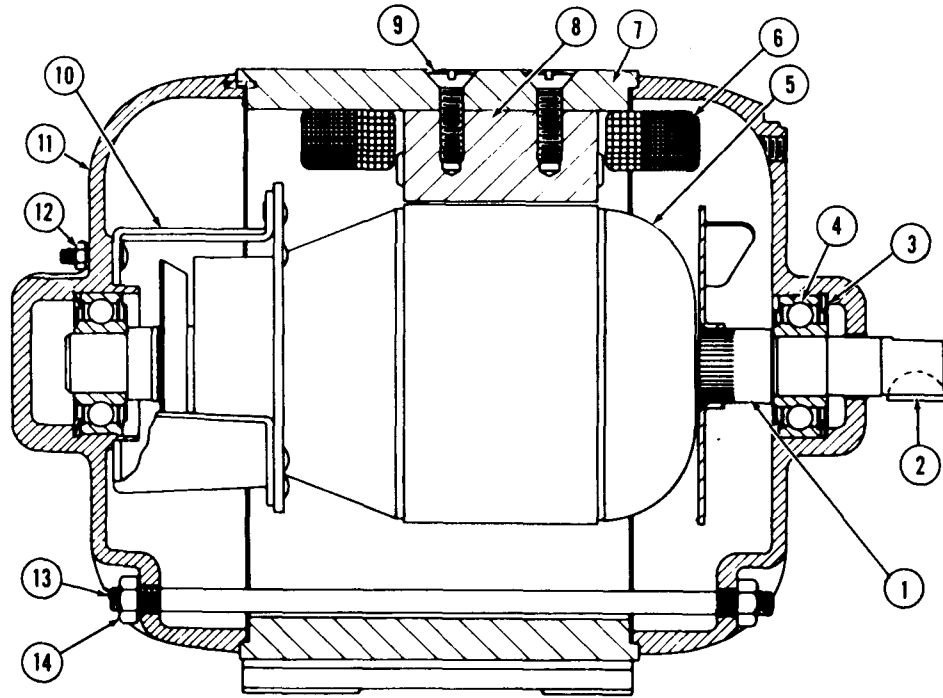
NOTE: If brushes squeal during operation they should be sanded-in. Never lubricate the commutator.

DISASSEMBLY OF MOTOR

Suggested periodic overhauls as outlined in the Scheduled Maintenance Program, internal inspections, or motor failures all require that the motor be disassembled. When rebuilding a motor, perform all Internal Inspections included after this section. Disassemble motor by following appropriate procedure below. Use Procedure A for motor models A-732, C-974, C-974A1, A2, A3, M2, M3, C-992 and C-994. Use Procedure B for motor models A-731, A-9385, and A-9385A1.

PROCEDURE A, Fig. 2

1. Loosen and remove coupling and Woodruff key, (2) Fig. 2, from armature shaft assembly (1).
2. Remove inspection covers (17) from motor.
3. Disconnect brush (19) and field (20) leads. Remove brushes (18).
4. Remove conduit box cover (15) and conduit box (16).
5. Unthread through bolt nuts (14) and remove through bolts (13).
6. Working at the commutator end, remove the end frame (11) with the armature assembly (5). Use care to avoid damaging the armature.



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|--------------------------|----------------------------|-----------------------|
| 1. Armature Shaft | 8. Pole Piece | 15. Conduit Box Cover |
| 2. Woodruff Key | 9. Pole Piece Screw | 16. Conduit Box |
| 3. Spring Bearing Washer | 10. Brush Bracket Assembly | 17. Inspection Cover |
| 4. Sealed Bearings | 11. End Frame | 18. Brushes |
| 5. Armature Assembly | 12. Brush Bracket Bolt | 19. Brush Leads |
| 6. Field Coils | 13. Through Bolt | 20. Leads |
| 7. Motor Frame | 14. Through Bolt Nut | |

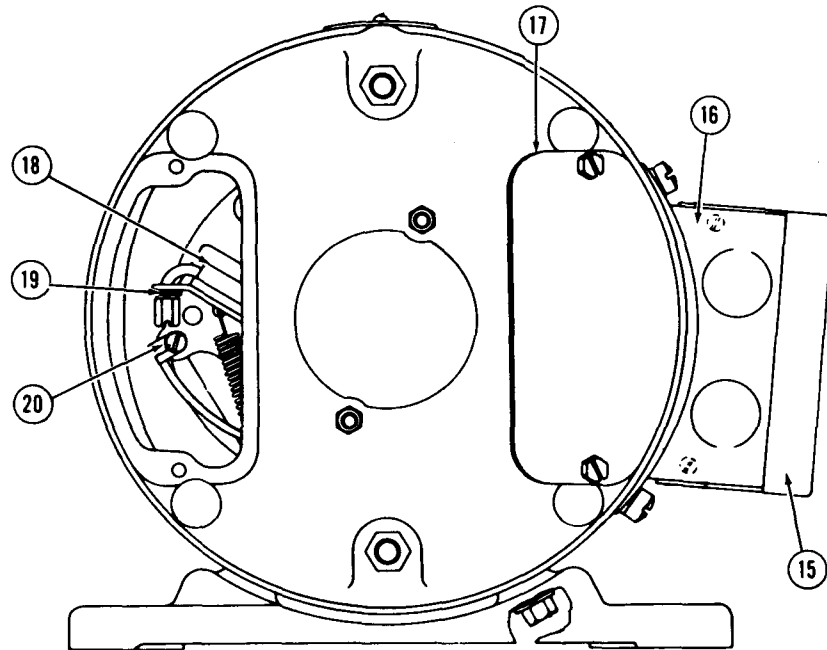


Fig. 2 - A-732, C-974, C-974A1, A2, A3,
M2, M3, C-992, and C-994 Models

7. Using a rawhide mallet or a similar tool, tap the end frame (11) from the armature shaft assembly (1).
8. Remove spring bearing washers (3), and bearing seals (if used).
9. Using a suitable bearing puller remove bearings (4).
10. Unthread bolts (12) that secure the brush bracket assembly (10) to end frame (11).
11. Disconnect lead that joins the field coils (6).
12. Loosen and remove pole piece screw (9). Remove field coils (6) and pole pieces (8) through one end of the motor frame (7).

NOTE: Visually inspect all parts for wear or defects. Discard worn parts, bearings, gaskets, and seals. To ensure trouble free operation replace with new parts.

13. Perform all Internal Inspections included after this section.

PROCEDURE B, Fig. 3

1. Loosen and remove coupling and Woodruff key from motor shaft.
2. Remove inspection band, (11) Fig. 3, from motor.
3. Disconnect brush and field leads.
4. Remove conduit box cover (22) and conduit box (23).
5. Unthread bearing cover cap screws (2) that secure the bearing cover (1) and gasket (7) to end frame (6) at both ends of motor.
6. Loosen and remove through bolt nuts (12). Remove through bolts (9).
7. Using a rawhide mallet or similar tool, tap end frame (6) from armature (8) shaft.
8. Unthread bolts (18) that secure the brush bracket assembly (13) to end frame (6).
9. Remove all bearing seals (4) where used.
10. Unthread bearing locknut (17) and remove bearing lockwasher (16) from both ends of motor.

11. Using a suitable bearing puller remove bearings (5).
12. Disconnect lead that joins the field coils (19).
13. Loosen and remove pole piece screws (21). Remove field coils (19) and pole piece (20) through one end of motor frame (10).

NOTE: Visually inspect all parts for wear or defects. Discard worn parts, bearings, gaskets and seals. To ensure trouble free operation replace with new parts.

14. Perform all Internal Inspections included after this section.

INTERNAL INSPECTIONS AND REPAIR

ARMATURE

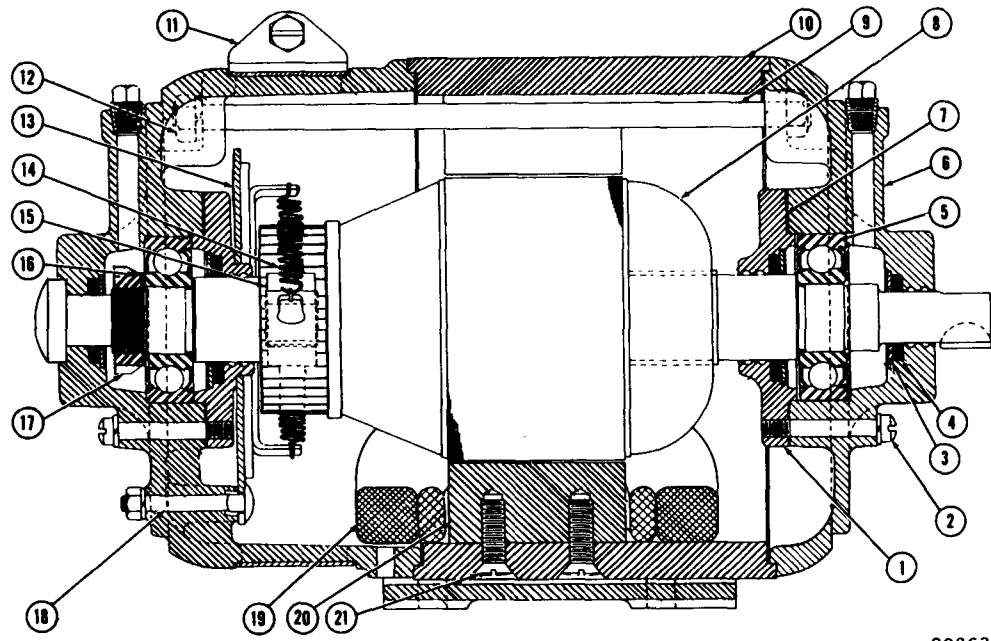
1. Clean armature. If a solvent or solution is used, blow dry the armature with clean, low pressure air.

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

2. When armature is dry:
 - a. Test for shorts and open circuits.
 - b. HI-POT at 500 volts for 10 seconds.

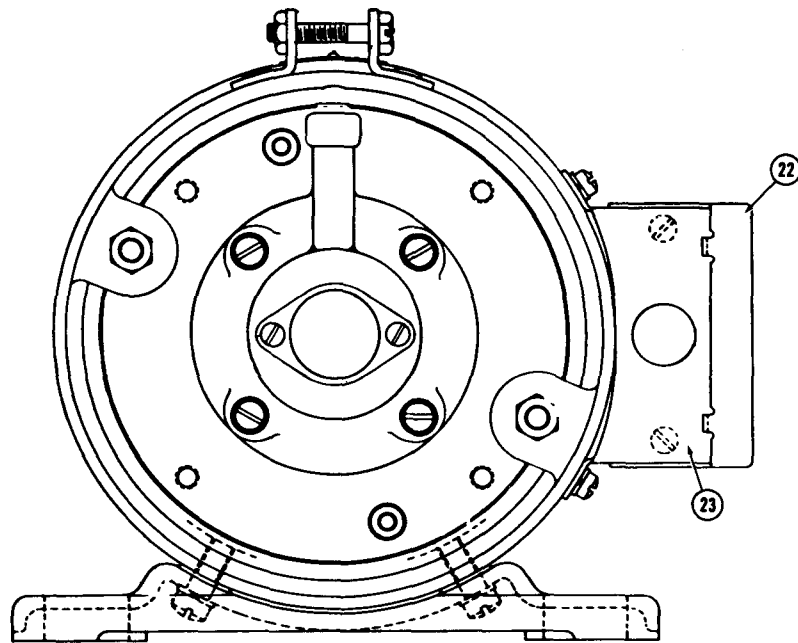
NOTE: Replace armature if it fails the above tests.

3. Visually inspect armature shaft diameter for abnormal wear indications.
4. Inspect solder condition at the connection between the armature windings and the commutator. Resolder the connections if necessary.
5. Make certain that the insulation is free from blisters, flakes, or cracks.
6. All serviced armatures should receive a varnish treatment as follows:
 - a. Preheat armature to 120°-130° C (248°-266° F).
 - b. Dip armature in clear baking varnish, see Service Data. Be careful not to get varnish on the commutator.



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| 1. Bearing Cover | 9. Through Bolt | 17. Bearing Lock Nut |
| 2. Cap Screw | 10. Motor Frame | 18. Brush Bracket Bolt |
| 3. Expansion Plug | 11. Inspection Band | 19. Field Coil |
| 4. Felt Seal | 12. Through Bolt Nut | 20. Pole Piece |
| 5. Ball Bearings | 13. Brush Bracket Assembly | 21. Pole Piece Screw |
| 6. End Frame | 14. Brush Spring | 22. Conduit Box Cover |
| 7. Gasket | 15. Brush With Hook | 23. Conduit Box |
| 8. Armature | 16. Bearing Lock Washer | |



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Fig. 3 - A-731, A-9285 and A-9285A1 Models

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

- c. Bake armature in an oven set at 160° C (320° F) for four hours.

COMMUTATOR

1. Clean slots between commutator bars. If any bars are loose or raised the commutator should be scrapped.
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. Never use emery or carborundum. Use a shield to keep copper filings from entering the armature windings.
3. If the commutator is badly worn, pitted, or burned, machine it to obtain a uniform surface. See Service Data for repair limits.
4. Check commutator concentricity with a dial indicator. Surface should be concentric within 0.025 mm (.001") total indicator reading.
5. Undercut the mica area between the commutator bars 0.793 mm (.0312") x 0.76 mm (.030") wide.
6. Remove all mica fins and polish the commutator surface with No. 00 grade sandpaper. Clean slots between commutator bars.
7. Remove all sharp edges from the commutator bars.
8. Use compressed air to blow all debris from the armature windings.

FIELD COILS

1. Clean all dirt and oil from the field coils.
2. Make certain that coil leads and connections are tight.
3. Renew coils when insulation is charred or brittle. See Step 2a under Assembly Of Motor for proper wiring.
4. Check resistance of field coils. See Service Data.

ASSEMBLY OF MOTOR

Use the following procedure to assemble all model motors:

1. Apply grease to motor:
 - a. For models A-731, A-9385, A-9385-A1, and all other models with double shielded bearings, and for model A-732, and all other models with single shielded bearings. Apply 14.18 g (.5 ounce) of Chevron BRB-2 grease, see Service Data, in the cavity that will surround the shielded side of each bearing.
 - b. Models C-974, C-974-A1, A2, A3, M2, M3 and all other models with double sealed bearings, do not require additional grease application when reassembling the motor.
2. Assemble motor by reversing the disassembly procedure. Observe the following while assembling the motor.
 - a. For proper coil polarity, reconnect coils as shown in Fig. 4.
 - b. Install new bearing seals, bearing washers, expansion rings, and bearings.

NOTE: When installing the bearing tap gently on the inner race only, to avoid damaging the bearing.

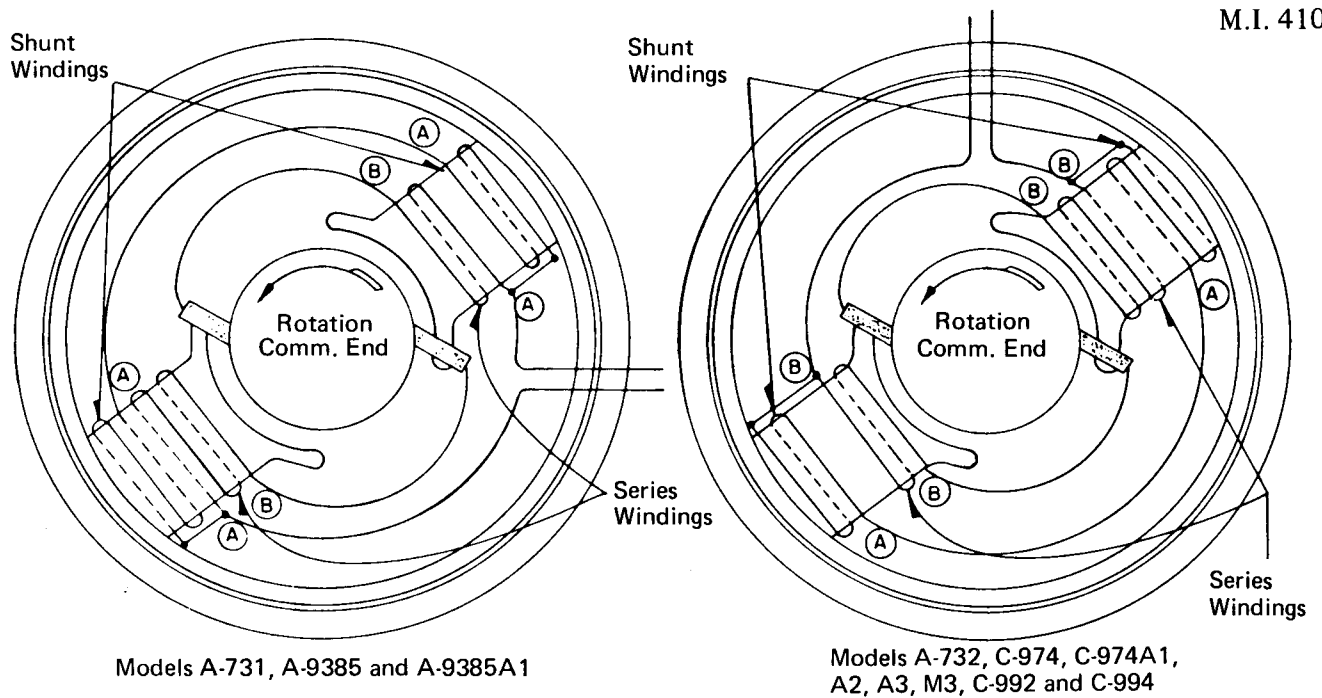
- c. When mounting the brush bracket, a notch in the bracket must be lined up with the notch in the end plate. If the notches cannot be located, brushes must be set for kick neutral. See Brush Setting section for procedure.

NOTE: If either the armature or the end plate has been renewed, the brushes must be set for kick neutral. See Brush Setting section for procedure.

3. Sand-in new brushes by placing a strip of No. 00 grade sandpaper, sand side up, on the commutator under the brushes. Rotate the armature in the direction of normal rotation until brushes conform to the contour of the commutator.

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

4. HI-POT assembled motor using 440 volts AC for one second.
5. Some older motor end frames may have tapped holes for grease fittings. Permanently seal these holes with pipe plugs.



Models A-731, A-9385 and A-9385A1

Models A-732, C-974, C-974A1,
A2, A3, M3, C-992 and C-994

NOTE: Leads marked A leave coils on coupling end of motor.
Leads marked B leave coils on commutator end of motor.

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Fig. 4 - Connection Diagrams

6. Inspect for tightness of all mounting bolts.
7. Check that motor shaft rotates freely.
8. Connect correct voltage to motor and check rotation of armature. Rotation should be counterclockwise viewed from the commutator end.

BRUSH SETTING (KICK NEUTRAL)

Having reassembled the motor, 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. Lift all brushes off the commutator.
2. Count the number of commutator bars and main field poles. Divide the number of commutator bars by the number of main field poles.
3. Locate the center of one bar and count off bars to equal the number found in Step 2. This will be the span. Mark the center of the last bar in the span.
4. Position the center of a brush and its holder on the center of the first bar. The center of the last bar in the span should now be near the other brush.
5. Apply current from a 6 volt storage battery to the main field. Include a switch in the field circuit.
6. Use a 50 millivolt center reading voltmeter. With the leads and prods from the meter, place the prods on the first and last bar of the span. Kick the field by opening and closing the field circuit switch. Note the deflection on the meter. If the second reading is greater than the first and of the same polarity, the armature was rotated in the wrong direction. If the meter shows a deflection of the opposite polarity, the neutral point has been passed. Follow the above pattern of rotating the armature until the deflection of the meter is zero or as near zero as possible.
7. Hold the armature in this position and rotate the brush bracket so that the center line of the first brush lines up with the first bar center and the second bar center lines up with the other brush center. Work to $\pm .4$ mm ($1/64''$) of location setting.
8. A recheck should be made of kick neutral after moving the brush bracket to make certain the armature did not move.

Apply proper voltage to the motor and check for proper rotation. Rotation should be counterclockwise when viewed from the commutator end.

SERVICE DATA

SPECIFICATIONS

MODEL	POWER	DC VOLTS	RPM	BRUSH FORCE		BRUSH LENGTH	RESISTANCE-OHMS @ 25° C (77° F)			AIR GAP
				NEW	WORN		SHUNT FIELD	SERIES FIELD	ARMATURE*	
A-731	0.187 kW (.25 hp)	64	1100	411.1 g (14.5 oz)	212.6 g (7.5 oz)	19 mm min. (3/4" min.)	69-76	.1346-.1487	1.19-1.31	0.79-0.94 mm (.031-.037")
A-732	0.119 kW (.16 hp)	72	1350	269.3 g (9.5 oz)	113.4 g (4 oz)	19 mm min. (3/4" min.)	392-436	.31-.344	2.5-2.75	0.69-0.79 mm (.027-.031")
A-9385 A-9385A1 C-974 C-947A1 C-974A2 C-974A3 C-974M3	0.187 kW (.25 hp)	64	1100	411.1 g (14.5 oz)	212.6 g (7.5 oz)	19 mm min. (3/4" min.)	125-145	.132-.146	.79-.88	0.79-0.94 mm (.031-.037")
C-974M2	0.187 kW (.25 hp)	28	1200	311.9 g (11 oz)	141.8 g (5 oz)	19 mm min. (3/4" min.)	20.3-22.5	.0177-.0196	.118-.130	0.79-0.94 mm (.031-.037")
C-992	0.187 kW (.25 hp)	120	1200	311.9 g (11 oz)	141.8 g (5 oz)	19 mm min. (3/4" min.)	520-580	1.37-1.52	2.05-2.38	0.79-0.94 mm (.031-.037")
C-994	0.56 kW (.75 hp)	74	1200	311.9 g (11 oz)	141.8 g (5 oz)	19 mm min. (3/4" min.)	167-186	.106-.118	.450-.495	0.79-0.94 mm (.031-.037")

*Measured Between Opposite Bars.

COMMUTATOR CONDEMNING LIMITS (All Models)

Outside Diameter 66.7 mm (2-21/32")
 Neck Width 2.8 mm (7/64")
 Runout (Total Indicator Reading) 0.03 mm (.001")

MATERIALS

Grease, Chevron BRB-2, 3.6 kg (8 lb) 8490018
 Varnish, Modified Polyester, 208 Litres (55 Gal.) 8489774
 Thinner, Xylol
 3.8 Litres (1 Gal.) 8098692
 18.9 Litres (5 Gal.) 8122139
 208 Litres (55 Gal.) 8089758
 *Thinner (Rule 66)
 Chevron 1300 8499659

*Alternate material for Xylol where compliance with pollution control regulations is required.