OPERATION AND MAINTENANCE OF

RELIANCE TYPE 'T' STANDARD D-C. MOTORS

1. UNPACKING - If facilities for shelter of equipment are not available, do not unpack until ready for use. After unpacking, check to see that all parts have been received in good condition. Turn motor shaft by hand to be sure that there are no obstructions to free rotation.

2. POWER SUPPLY - Check nameplate data to be sure that voltage is same as that at power source.

3. WIRING - Refer to diagram with motor starter for proper connections to power supply.

4. NO PRE-LUBRICATION REQUIRED - Lubrication of anti-friction bearings at installation is not required, inasmuch as motor has been properly lubricated before shipment. See lubrication in service.

5. STARTING - Before starting the motor check the following items:

    1. The armature should rotate freely and be clear of any obstructions.

    2. The brushes should move easily in their holders and should make proper contact on the commutator.

    3. The driven machinery should be unloaded, if possible.

    4. There should be no obstruction of ventilation to the motor.

When starting, small sparks may appear on the commutator due to particles of dirt. Other than this, there should be little, if any, sparking at the brushes. The motor should run smoothly with little noise. The bearings should not over-heat. While operating the motor, notice the performance. Any noise, overheating or erratic performance should be investigated and repaired immediately in order to prevent further damage.

6. INSPECTION AND MAINTENANCE - The motor should be inspected weekly in order to keep it in good operating condition. Remove the drip and protective covers and check the following:

1. Windings should be dry and free of dust, grease and dirt.

2. Commutator should be clean, smooth, polished and have a very light chocolate color.

3. Brushes should move freely in their holders and have correct, equal pressure on the commutator.

4. Armature and field leads should be undamaged. Terminal connections should be tight.

In maintaining motors, cleanliness if of prime importance. Dirty windings may overheat and cause failure of the insulation. Windings may be cleaned by suction cleaners, compressed air or by wiping. The compressed air must be free of moisture and the pressure must not be excessive. Nozzles on suction type cleaners should be non-metallic. Gummy deposits of dirt and grease may be removed by using carbon tetrachloride. Be sure that adequate ventilation is provided as the fumes have a toxic effect. Do not use gasoline or other inflammable solvents.

More detailed instructions as to maintenance and repair are given on following pages.

THE COMMUTATOR

APPEARANCE - A commutator in good operating condition should be clean, smooth, and have a medium polish. The surface should have a stable, copper oxide-carbon film (not a bright copper surface). The color of the film may vary from copper to chocolate. The mica should be undercut.

CARE - The commutator should be kept clean and well polished. Clean it occasionally with a pad of canvas or other similar hard-woven, non-linting material. Use no grease or lubricant on the commutator.

UNDERCUTTING - Keep the mica between the commutator segments undercut between 1/64 and 1/32 inch, and keep the undercut slots clean. When the motor is shipped, the slots are undercut 1/32 inch and should not be allowed to be less than 1/64 inch.

If an undercutting tool is not available, a piece of hacksaw blade mounted in a suitable holder may be used. Use no lubricant while undercutting.

Thin edges of uncut mica should be removed from the sides of the slots. These mica fins may prove a source of trouble and should be removed with a knife blade or other suitable tool such as a hacksaw blade ground in the form of a hook shaped cutter.

Rough edges that are raised on the edge of the commutator bars by the undercutting tool should be removed by a triangular file or suitable shaped scraper.

After undercutting, the commutator should be polished as outlined below.

POLISHING - A roughened commutator may be polished by grinding with a commutator dressing stone fitted to the curvature of the commutator. If this is not available, sandpaper can be used by pressing it against the commutator with a block of wood having the same curvature. The armature should be removed and the commutator turned at least as fast as its normal speed while polishing. Move the dressing stone or sandpaper slowly back and forth parallel to the shaft. Finish with a fine grade of sandpaper to give a smooth surface. Wipe off all grit and copper particles before reassembling. Never use emery, carborundum cloth or paper on a commutator.

An extremely rough commutator, or one that is out of round should be turned in a lathe. Light cuts should be taken.

OVERHEATING - Overheating of the commutator may be caused by overloads, shorted or open armature winding, or excessive brush pressure.

BRUSHES

MOUNTING ARRANGEMENT - The brushes fit in brushholders provided with spring operated fingers to maintain pressure on the brushes. The brushholders are clamped to a stud. The stud is bolted to a rocker which holds the studs equally spaced around the commutator. The rocker is clamped around the bearing housing inside the front bracket. Correct position is indicated by a white stripe painted on bracket and yoke. On small motors the rocker is made of micarta while on the larger machines it is made of cast steel with fibre sleeves and washers to insulate the stud.

ALIGNMENT - The spacing and setting of the brushes is correct when the motor leaves the factory and should require no adjustment. However, if for some reason, the brush rigging is disassembled for replacement or repair, the following suggestions should be followed when re-assembling:

The correct position of the rocker (or yoke) is indicated by a white mark. If this mark has been obliterated then the correct position must be determined. There are several methods of checking the setting of the rocker. The most simple is checking to see that the speed in both directions of rotation under full load is the

same. Another method is to use a voltmeter of about 5 volts range. Hold the leads about as far apart as the width of one commutator bar and touch them to the surface near the brush while the motor is running under full load. Move the leads until the voltmeter reads zero and adjust the brushes so that they are over this spot. The brushes then are on the electrical neutral, which is their correct position.

The brushholders should have 1/8 inch clearance from the surface of the commutator. A piece of fiberboard or micarta of the correct thickness may be used as a guage.

All the brushes on each stud should be in line. This may be checked by noting if they toe the same slot in the commutator.

The brushes must be equally spaced around the commutator. As mentioned before the rocker serves to hold them in this position and therefore, they are not apt to become mis- aligned except through rough handling when disassembling. The spacing may be checked easily by wrapping a piece of paper around the commutator underneath the brushes and marking it with a sharp pencil at the toe of each brush, identifying the marks in some manner with the several brush studs. If measurement in these marks indicates uneven spacing, the studs must be adjusted to give even spacing.

SPARKING - Under normal conditions of operation there should be no sparking at the brushes. Sparking is injurious to both the commutator and the brushes and should never be permitted to continue. Some of the causes of sparking are:

1. Brushes not set at the proper place.
2. Brushes not properly fitted to the commutator.
3. Brushes do not have proper pressure.
4. Brush pressure not equal on all brushes, this causing a heavier current to flow through some brushes.
5. Brushes not fitted to the surface of the commutator due to burned or chipped contact surfaces.
6. A rough commutator.
7. A loose, high, or low commutator bar.
8. High mica or projecting mica fins.
9. Dirty or oily commutator.

10. A loose connection between the armature conductors and the commutator bars, or an open circuit in the armature winding.

11. Brushes wedged in the holders.

Make sure that brush leads (pigtails) are secure. A loose connection may cause the current to flow from the brush through the sides of the holder or tension spring, causing burning of the holder and possible sticking of the brush or overheating of the tension spring.

CHATTERING - Chattering of the brushes may be due to:

1. Rough commutator

2. Dirty commutator

3. High mica

4. High or low bars

5. Incorrect brush pressure

6. Incorrect brushholder position and thus giving the wrong angle to the brush.

Chattering, if allowed to continue will chip and shatter the brush and will burn the commutator bars. Incorrect spring tension is perhaps the most common cause of chattering. Too much tension increases the friction while insufficient tension allows the brush to bounce on small irregularities of a commutator surface.

PRESSURE -The correct brush pressure is approximately 1-1/2 pounds per square inch and should be the same for all brushes. The pressure may be checked by means of a small spring scale. The scale should be connected directly to the brush or brushholder finger (not the pigtail) and held in line with the brush. Read the scale just as the brush leaves the commutator surface. A good method is to slip a strip of paper beneath the brush face and pull on it gently while lifting the spring scale. Read the scale when the tension is such that the paper may just be pulled from beneath the brush.

The tension may be adjusted by means of the notches and spring lever that are provided on the brushholder.

REPLACEMENT - Brushes should be replaced before they wear down so far that the spring can no longer exert the correct pressure.

To remove the brushes, disconnect the pigtail from the holder, loosen the tension, lift the brushholder finger and remove the old brush.

Check the inside of the brushholders for burned spots. If any burned spots are found, smooth them with sandpaper.

Insert the new brush making sure it slides easily in the holder, connect the pigtail and adjust the tension on the spring.

After placing the new brushes in the holders, carefully fit the face (contact or rubbing surface) of the brush to the curvature of the commutator. This is called seating the brush and may be done by strips of flintpaper or sandpaper, first using No. 1 grit and then a finer grade such as No. 00. Never use emery carborundum cloth or paper as they are conductors and the particles of their grit will cause serious trouble if imbedded in brush or commutator. Cut the sandpaper into strips slightly wider than one brush. Insert a strip under a brush with the smooth side of the sandpaper next to the commutator and draw the sandpaper in the direction of rotation of the commutator while pressing down on the brush. Lift the brush and repeat until the brush is a good fit. Make sure the sandpaper is held to the curvature of the commutator.

Blow out all carbon dust, wipe off the commutator, the connections and the carbon brushes. Adjust the brushholder springs so that all brushes have the same pressure.

Examine the contact that the brushes make after a period of operation and continue inspection and fitting until the brush face shows a good contact over the full surface of the brush face.

WINDINGS

MAINTENANCE - Keep windings clean and dry. Even though protected by enclosures, the armature and field coils will become dirty and must be cleaned to prevent overheating and breaking down of insulation. Dry dirt and dust may be removed by wiping with a clean dry cloth, blowing it out with compressed air, or using a suction cleaner. If the accumulation contains oil or grease, a solvent such as carbon tetrachloride may be used.

DO NOT USE GASOLINE for cleaning due to the fire hazard. When using compressed air be sure the air stream is free from water.

REPLACEMENT - If it becomes necessary to replace a field coil or interpole coil, study the connections and installation in order that the new coil can be installed in the same manner as the old. Refer also to the cross section drawing.

The faulty coils may be replaced by following instructions given in Disassembly. When the pole is removed from the frame, the coil may be slipped off and a new one installed.

The shunt field coil is mounted on a metal bobbin and held in place by clips welded to this bobbin. The series field coil is slipped over the shunt field coil and held in place by metal bands.

Interpole coils are held in position by means of clips welded to the core. To remove the coil from the core, carefully straighten these clips and slide the coil off. Some spare interpole coils are wound directly on the interpole core. When installing a new pole of this type, the air gap should be checked carefully to make sure the gap under the newly installed interpole is the same as that under the others.

Connections should be made just as they were on the coil that was removed. Leads should be lashed with cord, if necessary, to keep them from interfering with the armature or brush rigging. The main field poles should be of alternate North and South polarity. This may be tested by placing two ordinary nails, or an iron bar between adjacent field poles. The point of one nail should touch one pole tip, the point of the other nail should touch the other pole tip, and the heads should touch each other. If an iron rod is used it should be long enough to reach from one pole to another. When current is sent through the field coils the nails should stick together or the iron bar should be held strongly between the poles. If the nails do not stick together or there is little attraction for the bar, the new field coil is reversed. Either the coil itself or the connections of the coil should be reversed.

The interpoles should have the same polarity as the main field pole just back of the interpole. Thus, in a motor having clockwise rotation, the interpole should have the same polarity as the adjacent main pole in the counter clockwise direction. (Directions of rotation given are as seen when facing commutator end).

DISASSEMBLY

GENERAL - The motor should not be disassembled unless it is necessary to replace a field pole or bearings or make repairs on the armature. When dismantling the motor, care must be taken not to damage the field coils or armature windings as the insulation may be injured by improper or rough handling. The bearings should not be allowed to become dirty through handling.

PRELIMARY - Before removing either end shield:

1. Make certain the motor is disconnected from the line.
2. Disconnect leads in the terminal box. Tag incoming leads to insure correct reconnection.

3. Remove the motor from its base.

4. Mark the brackets and frame so they can be replaced easily.

5. Remove drip covers and protective covers.

6. Remove brushes, disconnect leads to brushholder studs.

REMOVING END SHIELDS AND ARMATURE

7. Remove two grease cups and pipe nipples.

8. Remove four cap screws and washers holding inner bearing cap.

9. Remove four cap screws and washers from front end only. Some force may be required to remove the front end bracket due to the machined fit on the frame and the snug fit on the frame and the snug fit on the bearing. Force should be evenly applied around the edge using either a wood block or a lead mallet to transmit the blows. Use care to avoid injury to the commutator when removing the bracket.

10. Remove four bolts and washers attaching the rear end bracket; remove armature and end bracket together. Do not injure the armature coils or commutator. Rest the armature on wood supports.

11. Remove four cap screws and washers.

12. Remove rear end bracket from armature shaft.

REMOVING FIELD POLES

13. Field poles (either main or interpole) may be removed by removing the bolts which attach them to the frame. The leads must be disconnected before removal. The shims must be kept and replaced with the pole to which they belong.

REMOVING BALL BEARING - Bearings should not be removed unless they are to be replaced. To remove bearings:

14. Bend up the ear of the lock washer and unscrew lock nut using spanner wrench.

15. Pull off bearing. Apply pressure to the inner race only, using a steady pressure rather than hammer blows. If a hammer must be used, the blows should be transmitted through a hard wood or fibre block.

A bearing puller may be rigged by using a metal plate, with holes drilled to match the tapped holes in the inner cap. Use care to keep the pressure equal to prevent breaking the cap.

RE-ASSEMBLY - (Refers also to sections on Winding, Brushes and Bearings).

1. Install the rear bearing by placing on the inner cap and the retaining ring. Press on the bearing. Use a steady pressure on the inner race. One method is to use a piece of pipe of the correct size to slip over the shaft. Then use pressure to bear against the inner race, using a hammer to transmit the blows if it is the only tool available. A block of wood or fibre should be used to transmit the blows. Put on lockwasher and locknut. Bend down the ears in the slots of the locknut.

2. Put on the inner cap, retainer ring and front bearing.

3. Slip on the rear end bracket.

4. Install field poles and connect correctly. Make sure the original shims are replaced and that the field pole attaching bolts are tight.

5. Place the armature in the frame and bolt the rear bracket to the frame. Make sure the end bracket is on the correct end and in the same position as before removal.

6. Bolt the front end Bracket to the frame. Make sure the end shield is in the correct position.

7. Reconnect the leads to the brushholder studs and replace brushes. Make sure the rocker is in the correct position as indicated by the white marks.

LUBRICATION
OF BEARINGS - Ball and roller bearing motors are properly lubricated when shipped from the factory. Therefore, it is unnecessary to

grease the motor when installing. For future lubrication refer to Instruction Sheet A-3042.

RENEWAL PARTS - When ordering spare or replacement parts, give data from the motor nameplate. Be sure to include the motor serial number. Refer to spare parts list included with spares for applicable spare parts numbers.