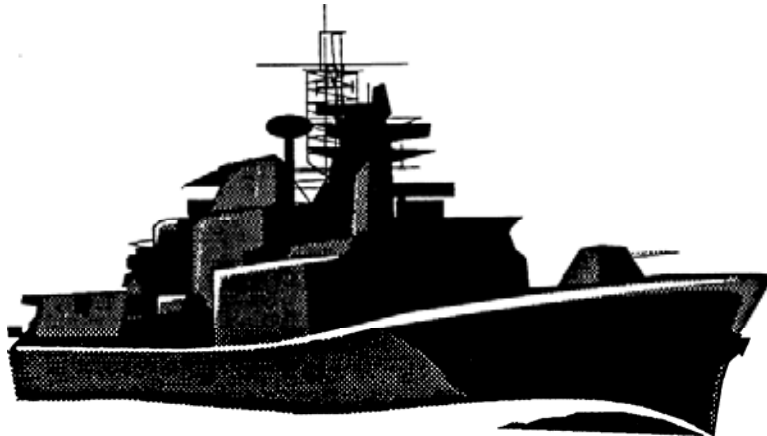


**INSTALLATION,
OPERATION AND CARE
OF INTEGRAL HORSEPOWER
INDUCTION MOTORS
(180 – 5000 FRAMES)**



NAVY

A-C MOTORS

*“Solutions
You Can
Trust”*

Instruction Manual B-3677-3
June 2008

BALDOR
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 **DANGER**

ONLY QUALIFIED ELECTRICAL PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF THIS EQUIPMENT AND THE HAZARDS INVOLVED SHOULD INSTALL, ADJUST, OPERATE, AND/OR SERVICE THIS EQUIPMENT. READ AND UNDERSTAND THIS MANUAL IN ITS ENTIRETY BEFORE PROCEEDING. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

The products described in this manual are manufactured by Baldor Electric Company.

RECEIVING AND HANDLING

ACCEPTANCE

Thoroughly inspect the motor before accepting shipment from the transportation company. If any of the goods called for in the bill of lading or express receipt are damaged or the quantity is short, do not accept them until the freight or express agent makes an appropriate notation on your freight receipt or express receipt. If any concealed loss or damage is discovered later, notify your freight or express agent at once and request him to make an inspection.

We will be very happy to assist you in collecting claims for loss or damage in shipment; however, this willingness on our part does not remove the transportation company's responsibility in reimbursing you for collection of claims or replacement of material.

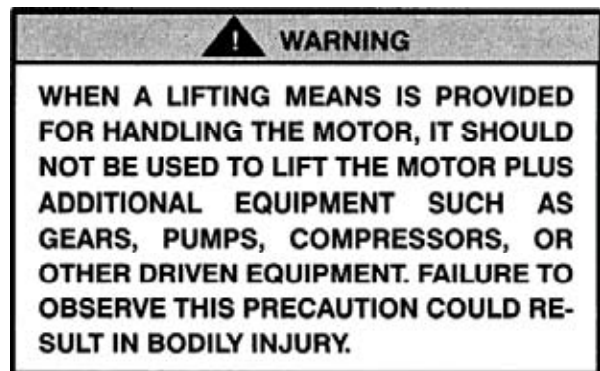
Claims for loss or damage in shipment must not be deducted from the invoice, nor should payment of the invoice be withheld awaiting adjustment of such claims, as the carrier guarantees safe delivery.

If considerable damage has been incurred and the situation is urgent, contact your nearest Reliance® Sales Office for assistance. Please keep a written record of all communications.

UNPACKING

After unpacking and inspection to see that all parts are in good condition, turn the shaft by hand to be sure there are no obstructions to free rotation. Equipment which has

been in storage for some-time should be tested and relubricated prior to being put into service. Refer to "Test for General Condition" and "Lubrication" for procedure to be performed after extended storage.



STORAGE CONDITIONS – SHORT TERM

The following storage requirements must be followed:

1. Motors are to be kept in their original containers or provided with equivalent protection and stored in a warehouse free from extremes in temperature, humidity, and corrosive atmosphere.
2. If unusual vibrations exist at the storage location, the motor should be protected with isolation pads.
3. All breathers and drains are to be operable while in storage and/or the moisture drain plugs removed. The motors must be stored so the drain is at the lowest point.

STORAGE PREPARATION

Improper storage of electric machines will result in seriously reduced reliability of that equipment. For example, an electric motor that does not experience regular usage while being exposed to normally humid atmospheric conditions is likely to cause the bearings to rust or rust particles from surrounding surfaces to contaminate the bearings. The electrical insulation may absorb an excessive amount of moisture leading to the motor winding failing to ground. The following preparations should be followed:

1. Minimize condensation in and around the motor by use of desiccants or other humidity control methods.
2. Motor space heaters when specified are to be energized where there is a possibility that the storage ambient conditions will reach the dew point. Space heaters are an option.
3. Coat all external machined surfaces with a material to prevent corrosion. An acceptable product for this purpose is Exxon Rust Ban #392.
4. Measure and record the electrical resistance of the winding insulation with a megger or an insulation resistance meter. Minimum accepted Megohm level is the insulation kV rating +1 Megohm. If levels fall below the above, contact the nearest Reliance® sales office. The recorded data will be required when removing from storage.
5. Some motors have a shipping brace attached to the shaft to prevent damage during transportation. The shipping brace, if provided, must be removed and stored for future use. The brace must be reinstalled to hold the shaft firmly in place against the bearing before the motor is moved.
6. Upon placing the motor into extended storage (greater than 3 months), the motors with regreasable bearings must be greased per Table 1 followed by the motor shaft being rotated a minimum of 15 times after greasing. Non-regreasable motors with "Do Not Lubricate" nameplate should also be rotated 15 times to redistribute grease within the bearing.
7. Remove the grease drain plug (opposite the grease fitting) on the bottom of each end bracket prior to lubricating the motor. Replace the plug after greasing.

**Table 1
Lubrication Volume (Storage)**

Frame Size	Volume in Cubic Inches
182 thru 215	0.5
254 thru 286	1.0
326 thru 365	1.5
405 thru 449	2.5
5000 (3600 RPM)	1.5
5000 (1800 RPM & Slower)	2.5

8. Regreasable bearings are to be greased per Table 1 at the time of being placed into extended storage. Motor shafts are to be rotated 15 revolutions manually every 3 months and additional grease added every nine months per Table 1 to each bearing. Bearings are to be greased at the time of removal from storage.

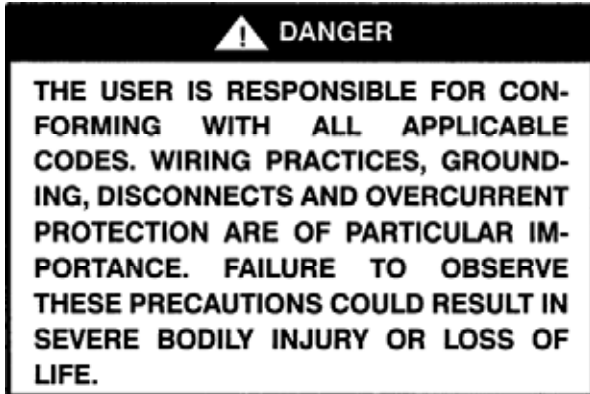
Non-regreasable motors should have their shaft rotated 15 revolutions every 3 months.
9. All breather drains should be fully operable while in storage. The motors must be stored so the drain is at the lowest point. All breathers and automatic "T" drains must be operable to allow breathing at points other than through the bearing fits.
10. The space heaters when specified are to be connected and operable while in storage.
11. Windings are to be meggered at the time equipment is put in storage. Reference Para. 4 above. At the time of removal from storage, the insulation resistance reading must not have dropped more than 50% from the initial reading. Any drop below this point necessitates electrical or mechanical drying. Refer to "Motor Drying Procedure."
12. Where motors are not stored in the original containers, but are removed and mounted on others pieces of machinery, the mounting must be such that the drains and breathers and space heaters are fully operable. In this respect, the drains must be kept at the lowest point in the motor so that all condensation can automatically drain out.

**FOR STORAGE OF
EXTENDED PERIOD OF TIME
(GREATER THAN 18 MONTHS)**

All requirements of general preparation and short term storage apply with the following additional requirements.

1. Motor is to be crated in a box similar to EXPORT BOXING but that the "shell" (sides & top of box) will be LAG-BOLTED to the wooden base (not nailed as export boxes are). This design will allow for the opening and reclosing the box many times without destroying the "shell".
2. The motor will be sealed in an airtight vapor barrier bag with desiccant inside. This airtight bag will give added protection during shipment of motor to the permanent storage area.
3. It is recommended after the first "Inspection" for megger reading, turning the shaft, etc., the vapor bag be re-sealed by taping it closed with masking or some similar tape. Also add new desiccant inside bag before closing. After which place shell over motor and replace lag bolts.
4. If a "zipper-closing" type bag is used instead of the "heat-sealed" type bag, then rezipper the bag closed instead of taping it.
5. Be sure to add new desiccant inside bag after each periodic inspection.
6. Minimize the accumulation of condensed water in and around the machine.

INSTALLATION



The user must select a motor starter and overcurrent protection suitable for this motor and its application. Consult motor starter application data as well as the National Electric Code and/or other applicable local codes.

INSPECTION

After the motor is unpacked, examine the nameplate data to see that it agrees with the circuit to which it is to be connected. The motor is minimally guaranteed to operate successfully within $\pm 5\%$ of nameplate frequency and $\pm 10\%$ of nameplate volts. The sum of the variation from rated frequency and voltage when expressed as a percentage, may not exceed 10%.

LOCATION

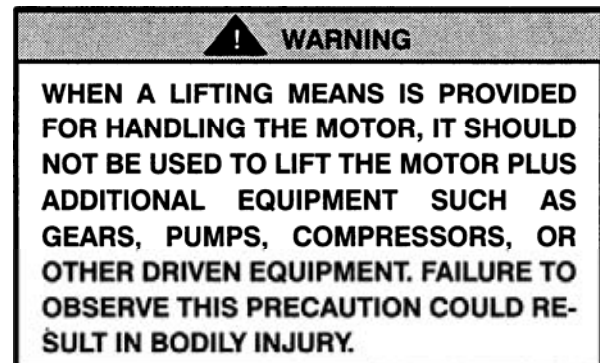
The motor should be installed in a location compatible with the motor enclosure and specific ambient.

To allow adequate air flow, the following clearances must be maintained between the motor and any obstruction:

TEFC – Enclosures

Fan Cover	180-210 Frame 1"
Air Intake	250-320 Frame 1.5" 360-449 Frame 2" 5000 Frame 2.5"
Exhaust	Envelope equal to the "P" dimension on the motor dimension sheet.
Protected Enclosures	
Bracket Intake	Same as TEFC.
Frame Exhaust	Exhaust out the sides – envelope a minimum of the "P" dimension plus 2". Exhaust out the end – same as intake.

LIFTING MEANS



When the motor is installed on a common base, the eyebolt provided on the motor should not be used to lift the assembly and base but, rather, the assembly should be lifted by a sling around the base or by other lifting means provided on the base.

In all cases, care should be taken to assure lifting in the direction intended in the design of the lifting means. Likewise, precautions should be taken to prevent hazardous overloads due to deceleration, acceleration or shock forces while handling.

MOUNTING

Mount the motor on a rigid foundation. After carefully aligning the motor with the driven unit, bolt securely in place.

DRIVEN LOAD

The coupling used to connect the motor to the driven load should be positioned on the shaft as close to the shaft shoulder as possible. If the bore on the coupling hub has an interference fit with the shaft, heat the coupling before installing on the shaft. Driving the coupling onto the shaft will damage the bearings.

Accurate alignment is essential. Secure the motor and the driven unit rigidly to the base.

COUPLING GUARDS

Providing covers for the rotating parts is essential for the safety of operating personnel. Covers should be sufficiently rigid to maintain adequate guarding in all conditions of service.

DRAIN HOLES

When motors have been equipped with a stainless steel T-drain in each end bracket, these drains are to remain in place and are not to be removed. The drains are for drainage of any condensation build up that may occur. Do not paint the T-drains, or otherwise cover their holes.

ROTATION

To prevent possible damage to the driven equipment check the motor rotation prior to installing the coupling. If it becomes necessary to reverse the direction of rotation, disconnect the motor from the power source and interchange two of the three line leads.

TEST FOR GENERAL CONDITION

If the motor has been in storage for an extended period or has been subjected to adverse moisture conditions, the insulation resistance of the stator winding must be checked with a megohmmeter.

If the insulation resistance is lower than the KV rating + one megohm, the windings must be dried out as described below.

MOTOR DRYING PROCEDURE

Motors shall be dried by the following procedure:

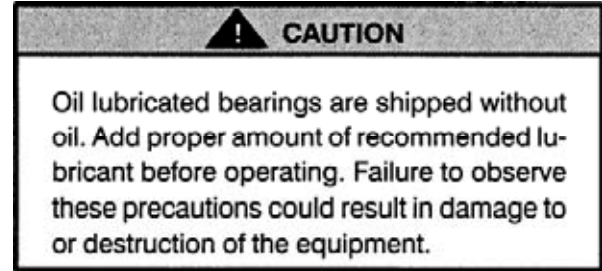
Bake motor in an oven at temperatures not exceeding 90°C until insulation resistance becomes constant.

After drying, the motor must be relubricated before placing in service.

INITIAL LUBRICATION

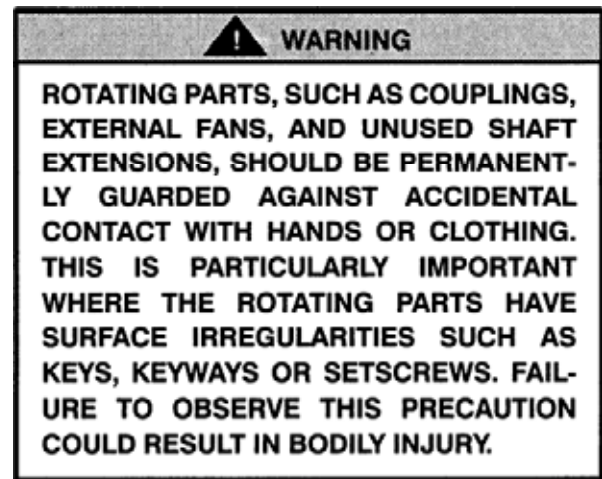
Reliance motors are shipped from the factory with the bearings properly packed with grease and ready to operate. Where the unit has been subjected to extended storage (3 months or more) the bearings when applicable should be relubricated per Table 5 prior to starting.

OIL LUBRICATED BEARINGS



The oil reservoirs (if provided) **have not** been filled with oil at the time of shipment and it is necessary to fill to the proper level indicated by the oil gages. See applicable motor drawing for details on grease or oil lubrication requirements.

STARTING



When starting the motor, check the following items:

1. The rotor should turn freely when disconnected from the load.
2. Driven machine should be unloaded when first starting the motor.

The motor should run smoothly with little noise. If the motor should fail to start and produces a decided hum, it may be that the load is too great for the motor or that it has been connected improperly. Shut down immediately and investigate for trouble.

OPERATION

Due to the inherent characteristics of insulating materials, abnormally high temperatures shorten the operating life of electrical apparatus. The total temperature, not the temperature rise, should be the measure of safe operation. Aging of insulation occurs at an accelerated rate at abnormally high temperatures.

Unbalanced voltage or single-phase operation of polyphase machines may cause excessive heating and ultimate failure. It requires only a slight unbalance of voltage applied to a polyphase motor to cause large unbalanced currents and resultant overheating.

Periodic checks of phase voltage, frequency and power consumption of a motor while in operation are recommended; such checks assure the correctness of frequency and voltage applied to the motor and yield an indication of the load offered by the apparatus which the motor drives. Comparisons of this data with previous no-load and full-load power demands will give an indication of the performance of the complete machine. Any serious deviations should be investigated and corrected.

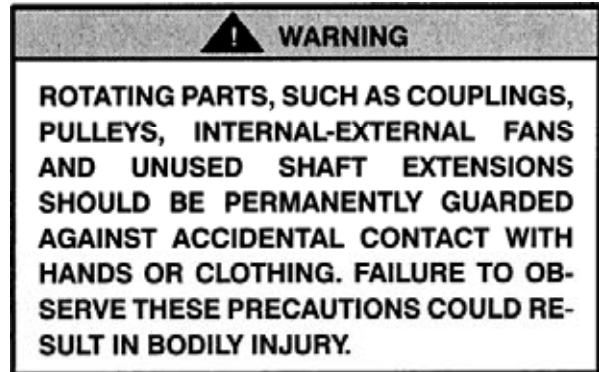
Stator troubles can usually be traced to one of the following cases.

Damaged insulation
Operating single-phase
Oil and dirt

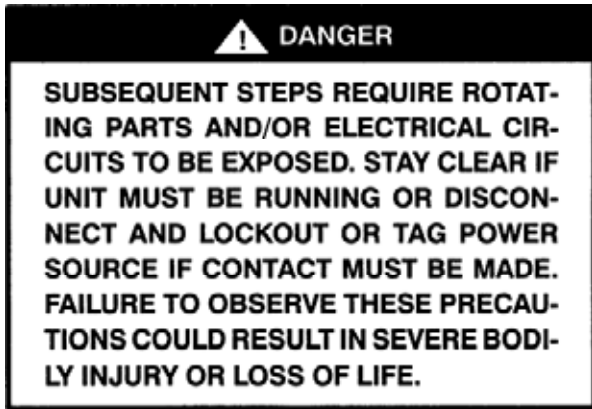
Overloading
Moisture

Dust and dirt are usually contributing factors. The effect of dust on the motor temperature through restriction of ventilation is a principal reason for keeping the motor exterior surface clean.

Squirrel-cage rotors are rugged and, in general, give little trouble. The first symptom of a defective rotor is lack of torque. This may cause a slowing down in speed accompanied by growling noise or perhaps failure to start the load. This is caused by an open or high resistance joint in the rotor bar circuit.



MAINTENANCE



The fundamental principle of electrical maintenance is **KEEP THE APPARATUS CLEAN AND DRY**. This requires periodic inspection of the motor, the frequency depending upon the type of motor and the service.

The following items should be checked at regular intervals:

1. Assembly screws, bolts and nuts should be tight. They may loosen if motor is not securely bolted and tends to vibrate.
2. Insulation resistance of motors in service should be checked periodically at approximately the same temperature and humidity conditions to determine possible deterioration of the insulation. When such measurements at regular intervals indicate a wide variation, the cause should be determined.
3. Enclosed motors require very little attention. Be sure that external air chamber of fan-cooled motors does not become clogged with foreign material which will restrict passage of air.
4. Face seal oil reservoirs when provided, must be maintained at proper level.

DISASSEMBLY

If it becomes necessary to disassemble the motor, care should be taken not to damage the stator windings. Precautions to keep bearings clean should be exercised.

Before removing either end shield:

1. Turn off and lock out or tag power to the motor.
2. Disconnect motor leads. Tag the leads to insure proper reconnection.
3. Remove motor from mounting base.

4. Mark end brackets and outer caps if provided, relative to position so they can be easily replaced.

REMOVING BRACKETS AND ROTOR

4. On TEFC motors remove the fan cover and fan.
5. When provided remove the outer caps.
6. Remove the inner cap(s) screws or nuts.
7. Remove the brackets. The rotating assembly (shaft, rotor, bearings) should be supported so it does not drop when the brackets are removed.
8. Remove the rotating assembly using extreme care to avoid damaging the motor windings.

Table 2
Bearing Locknut Torques

Bore Code	Locknut Torque (foot-pounds)
00	10-20
01	10-20
02	10-20
03	10-20
04	12-35
05	23-50
06	32-60
07	39-70
08	50-80
09	64-90
10	67-100
11	82-125
12	99-150
13	131-175
14	152-200
15	173-250
16	197-275
17	222-325
18	248-375
19	277-425
20	345-475
21	380-550
22	380-550
24	380-550
26	380-550
32	380-550

Reference MIL-B-17931E

REMOVING AND REPLACING BALL BEARINGS

Bearings should not be removed unless they are to be replaced. When removal is necessary, use a bearing puller. Refer to Motor Drawing for recommended bearing puller.

All bearings must be replaced with the identical part used by Reliance. In many cases special bearings are used which cannot be identified by markings on the bearing. Refer to Motor Drawing for bearing part number.

To install a bearing, heat the bearing in an oven at 250°F for 1 hour. This will expand the inner race, allowing it to slip over the bearing seat.

CAUTION

Do not use an induction oven to heat noise tested bearings. Arcing between the balls and races may damage the bearing. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

For MIL-STD-740 Quiet Service Motors, bearings shall be heated in a thermostatically controlled heating oven in preparation for mounting. Heat for 1 hour at $203 \pm 10^\circ\text{F}$. Install bearing locknuts while bearings are hot, torquing to the values given in table 2. Allow bearing to cool to room temperature, loosen locknut and retorquing to the values of table 2.

The majority of bearings used now have a C3 internal clearance.

REASSEMBLY

1. Apply the correct type of grease per DOD-G-24508 as shown in Figure 1 to each bracket, bearing and inner cap. Taking care to see that the bearing ball cage is packed with grease. If the motor has inlet grease pipes, fill them with grease.
2. Follow reverse procedure as outlined for Disassembly. Replace brackets and outer caps (if required) in their original position.
3. Rotate the motor shaft by hand at least 3 revolutions to make sure there is no binding or drag and the rotor shaft assembly turns freely.

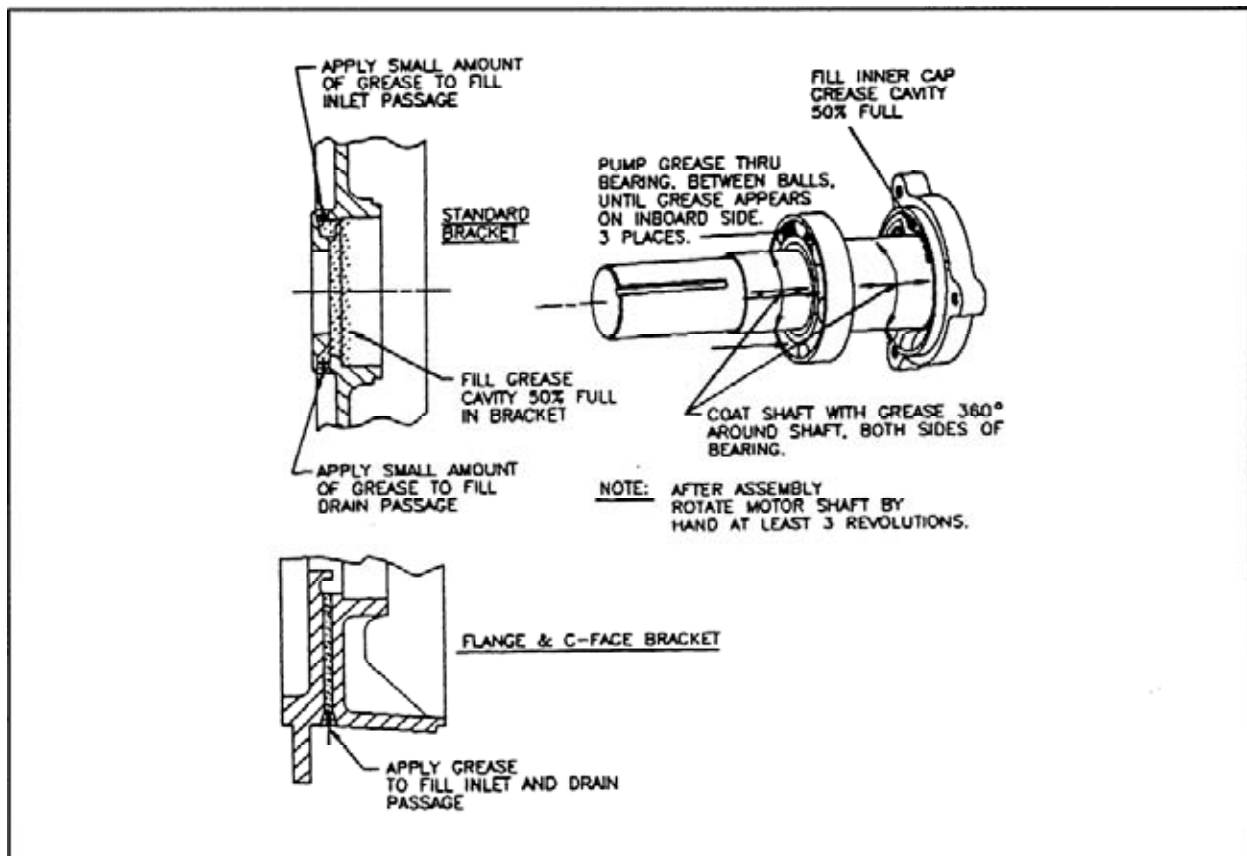


Figure 1 – All Standard and Flanged Brackets

BEARING LUBRICATION (During Operation)

This motor has been properly lubricated at the time of manufacture and it is not necessary to lubricate at time of installation. When the motor has been in storage for a period of 3 months or more, regreaseable bearings should be lubricated before starting.

Lubrication of anti-friction bearings should be done as a part of a planned maintenance schedule. The Recommended Lubrication interval should be used as a guide to establish this schedule. Infrequently used motors (operating less than 3 months) shall be maintained per Extended Storage Requirements. Over greasing is a major cause of bearing and motor failure.

Cleanliness is important in lubrication. Any grease used to lubricate antifriction bearings should be fresh and free from contamination. Similarly, care should be taken to properly clean the grease inlet area of the motor to prevent grease contamination.

RECOMMENDED LUBRICANT

Use DOD-G-24508 lubricant, Mobil 28 or compatible substitute.

Table 3 Application Severity

Standard Conditions	Eight hours per day, normal or light loading, clean, @ 50°C (120°F) maximum ambient.
Severe Conditions	Twenty-four hours per day operation or shock loading, vibration, or in dirt or dust @ 40–65°C (100–150°F) ambient.
Extreme Conditions	Heavy shock or vibration, or dust or ambient above 65°C (150°F).

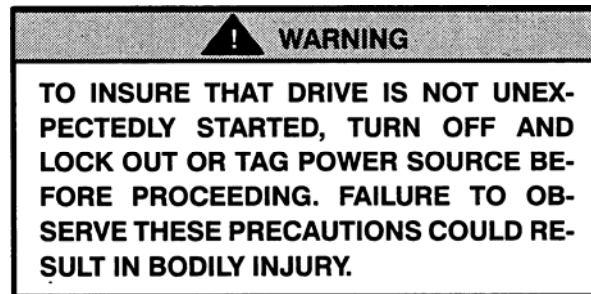
Table 4 Lubrication Frequency

Horsepower	Standard Conditions	Severe Conditions	Extreme Conditions
1 thru 7½ 1800 RPM and slower	3 Years	1 Year	6 Months
10 thru 75 1800 RPM and slower	2 Years	8 to 12 Months	3 Months
100 and greater 1800 RPM and slower 180–449 5000	1 Year 6 Months	6 Months 3 Months	1 to 3 Mos 2 Months
All over 1800 RPM	6 Months	3 Months	1 Month

CARTRIDGE BEARINGS

No lubrication required.

LUBRICATION PROCEDURE



Do not use grease fittings or grease guns.

1. Secure the motor and attach an out of service or similar type tag. Locate the grease fills and drains, referring to the motor drawing for locations.
2. Wipe all dirt from the outside of the grease fills and drains. Remove the pipe plugs and make sure the grease outlet passages are open by probing with a clean screwdriver, stiff wire, or some other similar implement.
3. In motors with grease inlet pipes, observe the condition of the grease in the pipe. If found acceptable, proceed. If not, or the pipe is empty, remove the pipe, if possible, and clean it. Pack it full of correct grease and reinstall pipe.
4. Select the proper grease cups, refer to motor drawings and Tables 3, 4 and 5. Clean the grease cups thoroughly. Using the correct grease (DOD-G-24508) and a clean spatula, fill the grease cup. Screw the cup together and squeeze out a ribbon of grease until clean grease appears.
5. Install the grease cups on the motor. Fill the grease cups and screw down on the grease cup as far as it will go. Additional grease should not be required.
6. Remove the grease cups and replace the grease fill pipe plugs. Start the motor, taking suitable precautions to guard exposed parts, and allow to run for 30 minutes before shutting down and re-installing grease drain plugs.
7. Put the motor back on line and remove the out of service tag. Run the motor.

Table 5 Recommended Volume

Frame Size	Standard Conditions	Severe Conditions	Extreme Conditions
182 thru 215	1.0 Cu. In.	0.75 Cu. In.	0.5 Cu. In.
254 thru 286	2.0 Cu. In.	1.5 Cu. In.	1.0 Cu. In.
326 thru 365	3.0 Cu. In.	2.0 Cu. In.	1.5 Cu. In.
405 thru 449	4.0 Cu. In.	3.0 Cu. In.	2.0 Cu. In.
5000 1800 RPM & Slower	2.5 Cu. In.	2.5 Cu. In.	2.5 Cu. In.
5000 3600 RPM	1.5 Cu. In.	1.5 Cu. In.	1.5 Cu. In.

OIL LUBRICATED BEARINGS

The oil reservoirs (if provided) **have not** been filled with oil at the time of shipment and it is necessary to fill to the proper level indicated by the oil gages. See applicable motor drawing for details on grease or oil lubrication requirements.

RENEWAL PARTS

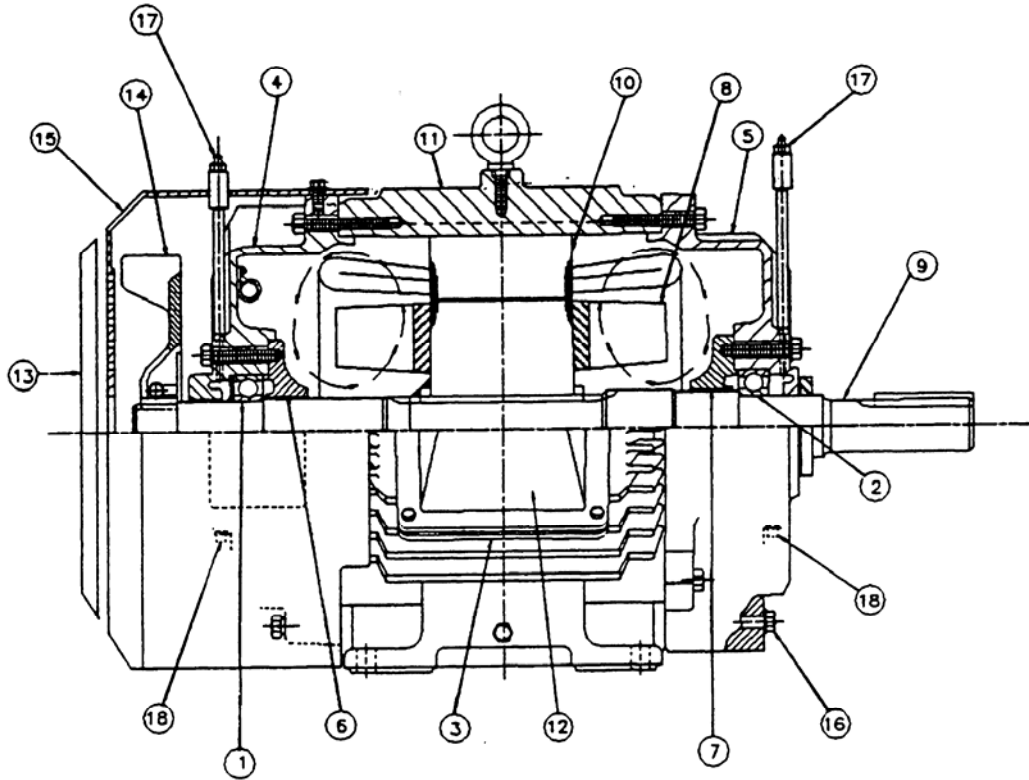
An adequate supply of factory-made renewal parts is an integral part of a sound maintenance program to protect against downtime.

Parts can be obtained directly from Reliance. When ordering parts for which a part number is not available, give complete description of part and purchase order number, serial number, or motor drawing number of the equipment on which the part is used.

A detailed parts list, which gives Reliance recommendations for spare parts that should be stocked for your equipment, can be ordered from:

1. Nearest Reliance Sales Office
2. Renewal Parts 864-297-4160

Be sure to include complete nameplate data – purchase order number, serial number, motor drawing number – for your equipment when ordering the spare parts list.



Piece No.	PART DESCRIPTION	Piece no.	PART DESCRIPTION
1	FRONT END BALL BEARING	10	STATOR CORE
2	BACK END BALL BEARING	11	STATOR FRAME
3	TERMINAL BOX	12	TERMINAL BOX COVER
4	FRONT END BRACKET	13	DRIP COVER (IF USED)
5	BACK END BRACKET	14	FRONT END OUTER FAN
6	FRONT END INNER CAP	15	FAN COVER
7	BACK END INNER CAP	16	CONDENSATE DRAIN
8	ROTOR	17	GREASE FILL PLUGGED
9	SHAFT	18	GREASE DRAIN



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