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50-348/364-CIVP  
2/13/92

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LOCKETED  
USNRC

Installation, Operation  
and Care of

'92 MAR 13 P5:08

**Reliance® Standard  
Integral Horsepower  
Induction Motors**  
• 180-449 FRAMES

OFFICE OF SECRETARY  
DOCKETING & SERVICE  
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BECHTEL JOB 7597

Instruction Manual B-3620-19

March, 1989

# A-C MOTORS



**RELIANCE  
ELECTRIC** 

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NUCLEAR REGULATORY COMMISSION

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# TABLE OF CONTENTS

	Page
RECEIVING AND HANDLING	
Acceptance .....	3
Storage .....	3
Unpacking .....	3
Warranty .....	3
INSTALLATION	
Inspection .....	4
Location .....	4
Lifting Means .....	4
Mounting .....	4
Drive .....	4
Rotating Parts .....	4
Wiring .....	4
Grounding .....	4
Starting .....	5
Drain Plugs .....	5
Rotation .....	5
Test For General Condition .....	5
Initial Lubrication .....	5
OPERATION .....	6
MAINTENANCE .....	7
Disassembly .....	7
Removing Brackets and Rotor .....	7
Removing and Replacing Ball Bearings .....	7
Reassembly .....	7
LUBRICATION OF ANTI-FRICTION BEARINGS .....	8
Recommended Lubricant .....	8
Lubrication Procedure .....	8
Lubrication Instructions .....	8
Service Conditions .....	8
Lubrication Frequency .....	8
Lubrication Volume .....	8
TYPICAL ANTI-FRICTION BEARING CONSTRUCTION .....	9
REPLACEMENT BEARINGS .....	9
PARTS IDENTIFICATION DRAWING .....	10
TOTAL SERVICE PROGRAMS .....	11
Renewal Parts .....	11
New Parts Guarantee .....	11
Additional Literature .....	11

# RECEIVING AND HANDLING

## 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.

## ACCEPTANCE

Thoroughly inspect the equipment 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 bill 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 Reliance Electric invoice, nor should payment of the Reliance Electric 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 the nearest Reliance Electric District Office for assistance. Please keep a written record of all communications.

## STORAGE

Storage requirements for motors are listed below. When a negotiated extended warranty is in effect, these storage requirements must be followed to allow the submission of a valid warranty claim.

1. The motors, if not mounted, are to be stored in the original containers in a clean, dry, protected warehouse.
2. The storage area is to be free from any vibration and from extremes in temperature.
3. Bearings
  - a. Ball & Roller (anti-friction regreasable type). The bearings are to be fully greased at the time of going into extended storage. Motor shafts are to be rotated manually every 6 months and additional grease added in the bearing cavity. Rotate shaft by hand before putting into service.
  - b. Ball (anti-friction non regreasable). No additional bearing precautions are necessary.
4. All drains to be fully operable while in storage, and/or the drain plugs removed. The motors must be stored so that 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.

5. All units equipped with heaters are to have the heaters connected if storage conditions in any way simulate or approach atmospheric conditions experienced in operation.
6. Windings to be megged at the time equipment is put in storage. At the time of removal from storage, the resistance reading must not have dropped more than 50% from the initial reading. Any drop below this point necessitates electrical or mechanical drying. Where a large quantity of motors is stored, an inspection or sampling should be made by removing the end brackets and visually inspecting for the presence of water in the grease or rust on the bearing. If present, replace the bearings and relubricate.
7. All external parts and motors subjected to corrosion should be protected by some corrosive resistant coating.
8. Where motors are not stored in the original containers, but are removed and mounted on other pieces of machinery, the mounting must be such that the drains and breathers are fully operable. In this respect, the drains must be kept at the lowest point in the motor and/or the drain plugs removed so that all condensation can automatically drain out. All other storage conditions apply, including rotation of motor shafts. Where such conditions cannot be met, then the equipment must be treated the same as if it were mounted in its normal position, and all protective devices such as heaters, breathers, and drains fully operable.

## 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 sometime should be tested and relubricated (regreasable type) prior to being put into service. Refer to "Test for General Condition" and "Lubrication" for procedure to be performed after extended storage.

Equipment with roller bearings is shipped with a shaft block at the opposite pulley end. In removing the shaft block, be sure to replace the bolts which are used to hold the shaft block in place during shipment.



# INSTALLATION

## INSPECTION

After the motor is unpacked, examine the nameplate data to see that it agrees with the power circuit to which it is to be connected. The motor will operate with frequency not more than 5% and voltage not more than 10% above or below the nameplate data, or combined variation of

voltage and frequency of not more than 10% above or below nameplate data. Efficiency, power factor and current may vary from nameplate data. Performance within these voltage and frequency variations will not necessarily be in accordance with the standards established for operation at rated voltage and frequency.

GENERAL EFFECT OF VOLTAGE AND FREQUENCY VARIATION ON  
STANDARD EFFICIENT INDUCTION MOTOR CHARACTERISTICS

VARIATION	STARTING & MAX. RUNNING TORQUE	SYNCHRO- NIZING SPEED	% SLIP	FULL-LOAD SPEED	EFFICIENCY			POWER FACTOR			FULL-LOAD CURRENT	STARTING CURRENT	TEMP. RISE FULL-LOAD	MAX. OVERLOAD CAPACITY	MAGNETIC NOISE—NO LOAD OR PARTICULAR
					Full Load	1/2 Load	1/2 Load	Full Load	1/2 Load	1/2 Load					
Voltage variations 100%	Increase 44%	No Change	Decrease 27%	Increase 1.3%	9-25% Decrease (1475 RPM) 9-25% Increase (1100-1200 RPM)	Decrease 1/2-2 points	Decrease 7-10 points	Decrease 5-15 points	Decrease 10-20 points	Decrease 15-40 points	Increase 12%	Increase 20%	Increase 5-10°C (1-15 RPM) Decrease 2-4°C (1100-1200 RPM)	Increase 44%	Reference Increase
110% voltage	Increase 21%	No Change	Decrease 17%	Increase 1%	Slight Decrease	Practically no change	Decrease 1-2 points	Decrease 5-10 points	Decrease 5 points	Decrease 5-8 points	Increase 2-4%	Increase 10-12%	Increase 5-8°C	Increase 27%	Increase Slightly
Frequency of mains (Variable) <sup>1</sup>	Corrected	Corrected	$\frac{1}{\text{Voltage} \times 4}$	Corrected (speed slip)								Voltage		$\frac{1}{\text{Voltage}^2}$	
90% voltage	Decrease 17%	No Change	Increase 27%	Decrease 1.1/2%	Decrease 2 points	Practically no change	Increase 1-2 points	Increase 5 points	Increase 10-20 points	Increase 15-40 points	Increase 10-11%	Decrease 10-12%	Decrease 5-7°C	Decrease 19%	Decrease Slightly
Full, variable 100% freq.	Decrease 10%	Increase 1%	Practically no change	Increase 3%	Slight Increase	Slight Increase	Slight Increase	Slight Increase	Slight Increase	Slight Increase	Decrease Slightly	Decrease 5-8%	Decrease Slightly	Decrease Slightly	Decrease Slightly
Frequency of mains (Frequency) <sup>2</sup>	Corrected	Corrected	$\frac{1}{\text{Frequency}^2}$	Corrected (speed slip)								$\frac{1}{\text{Frequency}}$			
90% frequency	Increase 11%	Decrease 1%	Practically no change	Decrease 3%	Slight Decrease	Slight Decrease	Slight Decrease	Slight Decrease	Slight Decrease	Slight Decrease	Increase Slightly	Increase 5-8%	Increase Slightly	Increase Slightly	Increase Slightly
75% voltage	Slight Decrease	Slight Decrease		Slight Decrease	2% Decrease			5-10% Decrease			1-1/2% Increase	Slight Decrease	2% Increase		
75% frequency	Slight Decrease	Slight Decrease		Slight Decrease	2% Decrease			7% Decrease			2% Increase	Slight Decrease	2% Increase		

NOTE: This table shows general effects, which will vary somewhat for specific ratings.

## 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 Air Intake — 180-210T Frame 1"  
250-320T Frame 1.5"  
360-449T Frame 2"

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

### WARNING

WHEN A LIFTING MEANS IS PROVIDED FOR HANDLING THE MOTOR OR GENERATOR, IT SHOULD NOT BE USED TO LIFT THE MOTOR OR GENERATOR PLUS ADDITIONAL EQUIPMENT SUCH AS GEARS, PUMPS, COMPRESSORS, OR OTHER DRIVEN EQUIPMENT.

In the case of assemblies on a common base, any lifting means provided on the motor or generator 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.

## MOUNTING

Mount the motor on a foundation sufficiently rigid to prevent excessive vibration. Roller bearing and ball-bearing motors may be mounted with the shaft at any angle. Roller bearing motors are not suitable for coupled duty applications. After carefully aligning the motor with the driven unit, bolt securely in place.

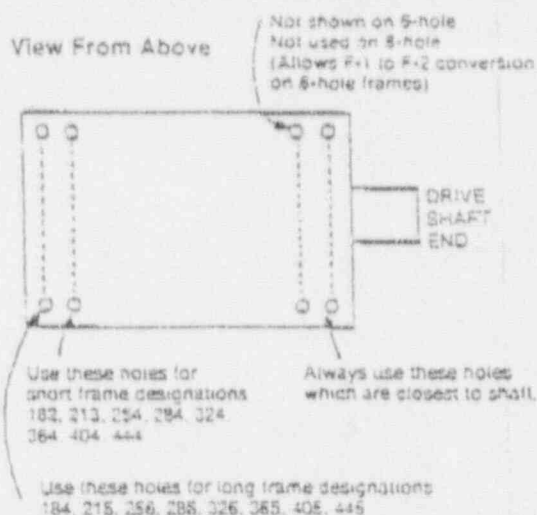
When motors, which are normally mounted with the shaft in a horizontal position, are mounted vertically, it may be necessary to provide additional guards to prevent foreign objects from falling into the motor openings and striking rotating parts. Such guards may be obtained at the time of purchase or from a local service repair center.

Explosion proof motors are shipped from the factory with the conduit box mounted. If the conduit box is removed or rotated, a minimum of five (5) full threads of engagement on the motor pipe nipple must be maintained for explosion proof integrity of the conduit box.

Some motors have standardized frames containing 6 or 8 mounting holes. 6 hole frames are not suitable for field reversal of mounting from F-1 to F-2, etc. The following diagram indicates the proper mounting holes to use.

## INSTALLATION (Cont'd)

### MOUNTING OF 6 & 8 HOLE MOTOR FRAMES



### DRIVE

The pulley, sprocket, or gear used in the drive should be located on the shaft as close to the shaft shoulder as possible. Heat to install. Driving a unit on the shaft will damage the bearings.

**Belt Drive:** Align the pulleys so that the belt will run true; tighten the belt just enough to prevent slippage, any tighter will cause premature bearing failure. If possible, the lower side of the belt should be the driving side.

**Chain Drive:** Mount the sprocket on the shaft as close to the bracket as possible. Align the sprockets so that the chain will run true. Avoid excessive chain tension.

**Gear Drive and Direct Connection:** Accurate alignment is very essential. Secure the motor and driven unit rigidly to the base.

### ROTATING PARTS

#### WARNING

ROTATING PARTS, SUCH AS COUPLINGS, PULLEYS, EXTERNAL FANS, AND UNUSED SHAFT EXTENSIONS, SHOULD BE PERMANENTLY GUARDED AGAINST ACCIDENTAL CONTACT WITH HANDS OR CLOTHING. THIS IS PARTICULARLY IMPORTANT WHERE THE PARTS HAVE SURFACE IRREGULARITIES SUCH AS KEYS, KEYWAYS OR SET SCREWS.

#### SOME SATISFACTORY METHODS OF GUARDING ARE:

1. Covering the machine and associated rotating parts with structural or decorative parts of the driven equipment.
2. Providing covers for the rotating parts. Covers should be sufficiently rigid to maintain adequate guarding in normal service.

#### DANGER

THE USER IS RESPONSIBLE FOR CONFORMING WITH THE NATIONAL ELECTRICAL CODE AND ALL OTHER APPLICABLE LOCAL CODES. WIRING PRACTICES, GROUNDING DISCONNECTS AND OVERCURRENT PROTECTION ARE OF PARTICULAR IMPORTANCE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

#### DANGER

SUBSEQUENT STEPS REQUIRE ROTATING PARTS AND/OR ELECTRICAL CIRCUITS TO BE EXPOSED. STAY CLEAR IF UNIT MUST BE RUNNING OR DISCONNECT AND LOCKOUT OR TAG POWER SOURCE IF CONTACT MUST BE MADE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

Connect the motor to the power supply according to the diagram on the motor nameplate. For most 230 and 460 volt motors, nine leads are brought out from the stator windings so that the motor may be connected for either 230 or 460 volts.

### GROUNDING

See the *National Electrical Code*, Article 430 for information on grounding of motors, Article 445 for grounding of generators, and Article 250 for general information on grounding. In making the ground connection, the installer should make certain that there is a solid and permanent metallic connection between the ground point, the motor or generator terminal housing, and the motor or generator frame.

Motors with resilient cushion rings usually must be provided with a bonding conductor across the resilient member. Some motors are supplied with the bonding conductor on the concealed side of the cushion ring to protect the bond from damage. Motors with bonded cushion rings should usually be grounded at the time of installation in accordance with the above recommendations for making ground connections. When motors with bonded cushion rings are used in multimotor installations employing group fusing or group protection, the bonding of the cushion ring should be checked to determine that it is adequate for the rating of the branch circuit overcurrent protective device being used.

There are applications where grounding the exterior parts of a motor or generator may result in greater hazard by increasing the possibility of a person in the area simultaneously contacting ground and some other nearby live electrical parts of other ungrounded electrical equipment. In portable equipment it is difficult to be sure that a positive ground connection is maintained as the equipment is moved, and providing a grounding conductor may lead to a false sense of security.

## INSTALLATION (Cont'd)

### DANGER

WHEN CAREFUL CONSIDERATION OF THE HAZARDS INVOLVED IN A PARTICULAR APPLICATION INDICATE THE MACHINE FRAMES SHOULD NOT BE GROUNDED OR WHEN UNUSUAL OPERATING CONDITIONS DICTATE THAT A GROUNDED FRAME CANNOT BE USED, THE INSTALLER SHOULD MAKE SURE THE MACHINE IS PERMANENTLY AND EFFECTIVELY INSULATED FROM GROUND. IN THOSE INSTALLATIONS WHERE THE MACHINE FRAME IS INSULATED FROM GROUND, IT IS RECOMMENDED THAT APPROPRIATE WARNING LABELS OR SIGNS BE PLACED ON OR IN THE AREA OF THE EQUIPMENT BY THE INSTALLER.

### STARTING

**CAUTION:** Check direction of motor rotation before coupling motor to load.

### WARNING

BEFORE STARTING MOTOR, REMOVE ALL UNUSED SHAFT KEYS AND LOOSE ROTATING PARTS TO PREVENT THEM FROM FLYING OFF.

Before 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.

### DRAIN PLUGS

If motor is totally enclosed fan-cooled or non-ventilated it is recommended that condensation drain plugs be removed. These are located in the lower portion of the end-shields. Totally enclosed fan-cooled "XT" motors are equipped with automatic drains which should be left in place as received.

### ROTATION

To reverse the direction of rotation, disconnect from power source and interchange any two of the three line leads for the three phase motors.

### TEST FOR GENERAL CONDITION

If the motor has been in storage for an extensive period or has been subjected to adverse moisture conditions, it is best to check the insulation resistance of the stator winding with a megohmmeter.

If the resistance is lower than one megohm the windings should be dried in one of the two following ways:

1. Bake in oven at temperatures not exceeding 90°C. until insulation resistance becomes constant.
2. With rotor locked, apply low voltage and gradually increase current through windings until temperature measured with thermometer reaches 194°F. Do not exceed this temperature.

### 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 (6 months or more) the bearings should be relubricated (regreaseable type) prior to starting." When motors are equipped for oil mist lubrication refer to Instruction Manual B-3654.

## OPERATION

**WARNING:** Surface temperatures of motor enclosure may reach temperatures which can cause discomfort or injury to personnel accidentally coming into contact with hot surfaces. When installing, protection should be provided by user to protect against accidental contact with hot surface.

### WARNING

ROTATING PARTS, SUCH AS COUPLINGS, PULLEYS, INTERNAL-EXTERNAL FANS AND UNUSED SHAFT EXTENSIONS SHOULD BE PERMANENTLY GUARDED AGAINST ACCIDENTAL CONTACT WITH HANDS OR CLOTHING.

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. The class of insulation determines the maximum safe operating temperature. Aging of insulation occurs at an accelerated rate at abnormally high temperatures. A general rule for gauging the effect of excessive heat is that for each 10°C. rise in temperature above the maximum limit for the insulation, the life of the insulation is halved.

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 unbalance currents and resultant overheating.



## OPERATION (Cont'd)

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 causes:

Worn bearings	Operating single phase
Moisture	Poor insulation
Overloading	Oil and dirt

Dust and dirt are usually contributing factors. Some forms of dust are highly conductive and contribute materially to insulation breakdown. The effect of dust on the motor temperature through restriction of ventilation is a principal reason for keeping the windings 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 a growling noise or perhaps failure to start the load.

This is caused by an open or high resistance joint in the rotor bar circuit. Such a condition can generally be detected by looking for evidence of localized heating.

## MAINTENANCE AND REPAIR

### WARNING

TO INSURE THAT THE DRIVEN EQUIPMENT IS NOT UNEXPECTEDLY STARTED, TURN OFF AND LOCK OUT OR TAG POWER SOURCE BEFORE PROCEEDING. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

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 should be checked at regular intervals:

1. Windings should be dry and free of dust, grease, oil, and dirt. Windings may be cleaned by suction cleaners or by wiping. Nozzles on suction type cleaners should be non-metallic. Gummy deposits of dirt and grease may be removed by using a commercially available low volatile solvent.

### WARNING

DO NOT USE GASOLINE OR OTHER FLAMMABLE SOLVENTS.

2. Terminal connections, assembly screws, bolts and nuts should be tight. They may loosen if motor is not securely bolted and tend to vibrate.
3. 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. Motor should be reconditioned if the motor has been subjected to excessive moisture by re-winding or re-insulating if necessary. 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.

### DISASSEMBLY

If it becomes necessary to disassemble the motor, care

should be taken not to damage the stator windings as the insulation may be injured by improper or rough handling. Precautions to keep bearings clean should be exercised.

Before removing either end shield:

1. Disconnect motor from power source, tag the leads to insure proper reconnection
2. Remove motor from mounting base.
3. Mark end brackets relative to position on frame so they can be easily replaced.

### REMOVING BRACKETS AND ROTOR

4. Remove bearing cartridge nuts or screws. (If used)
5. Remove front end bracket bolts.
6. Pull bracket.
7. Remove back end bracket in same manner.
8. Remove rotor.

### REMOVING AND REPLACING BALL BEARINGS

BEARINGS SHOULD NOT BE REMOVED UNLESS THEY ARE TO BE REPLACED. WHEN REMOVAL IS NECESSARY, USE A BEARING PULLER. 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.

TO INSTALL A BEARING, HEAT THE BEARING IN AN OVEN AT 250°F. THIS WILL EXPAND THE INNER RACE, ALLOWING IT TO SLIP OVER THE BEARING SEAT. 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 BEARING. IN ALL CASES, WHEN REPLACING BEARINGS, USE MARKINGS ON BEARINGS AND MOTOR IDENTIFICATION NUMBER TO OBTAIN CORRECT REPLACEMENT BEARING.

THE MAJORITY OF BEARINGS USED NOW HAVE A C3 INTERNAL FIT.

### REASSEMBLY

Follow reverse procedure as outlined for Disassembly. Having marked the brackets in the original position, replace as marked.



## LUBRICATION OF BEARINGS

Motors covered by this Instruction Manual are equipped with several types of bearings. This description covers regreaseable anti-friction bearings only. Non-regreaseable ball bearings require no periodic maintenance. See I/M B-3654 for oil mist lubricated anti-friction bearing procedures.

### GREASE LUBRICATED BEARINGS

This motor has been properly lubricated at the time of manufacture and it is not necessary to lubricate at time of installation unless the motor has been in storage for a period of six months or more.

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.

Cleanliness is important in lubrication. Any grease used to lubricate anti-friction 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

For motors operating in ambient temperatures shown below, use the following lubricant or its equal:

OPERATING TEMP.—25°C (–15°F) to 50°C (120°F)

CHEVRON OIL SRI NO. 2

EXXON UNIREX #2

SHELL OIL CO. DOLIUM R

TEXACO, INC. PREMIUM RS

MINIMUM STARTING TEMPERATURE –60°C (–76°F)

SHELL OIL CO. AEROSHELL #7

### LUBRICATION PROCEDURE

Reliance anti-friction bearings may be lubricated with the motor running or stationary. Stationary with the motor warm is preferred.

1. Locate the grease inlet, clean the area and replace the pipe plug with a grease fitting, if the motor is not equipped with grease fittings.
2. Add the Recommended Volume of the Recommended Lubricant using a hand operated grease gun.
3. Run the motor for two hours.
4. Replace the pipe plug in grease inlet.

### LUBRICATION INSTRUCTIONS

1. Select Service Condition from Table 1.
2. Select Lubrication Frequency from Table 2.
3. Select Lubrication Volume from Table 3.

4. Lubricate the motor at the required frequency with the required lubricant volume in accordance with LUBRICATION PROCEDURE.

**NOTE:** Mixing lubricants is not recommended due to possible incompatibility. If it is desired to change lubricant, follow instructions for lubrication and repeat lubrication a second time after 100 hours of service. Care must be taken to look for signs of lubricant incompatibility, such as extreme souppiness visible from the grease relief area.

### SERVICE CONDITIONS

TABLE 1

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

### LUBRICATION FREQUENCY

TABLE 2

BALL BEARINGS				
Speed	Frame	Standard Conditions	Severe Conditions	Extreme Conditions
1800 RPM And Slower	182 Thru 215	3 Years	1 Year	6 Months
	254 Thru 365	2 Years	6 to 12 Mos.	3 Months
	404 Thru 449	1 Year	6 Months	1 to 3 Mos.
3600 RPM	ALL	6 Months	3 Months	1 Month
ROLLER BEARINGS				
For Roller Bearings divide the time periods above by 2.				

### LUBRICATION VOLUME

TABLE 3

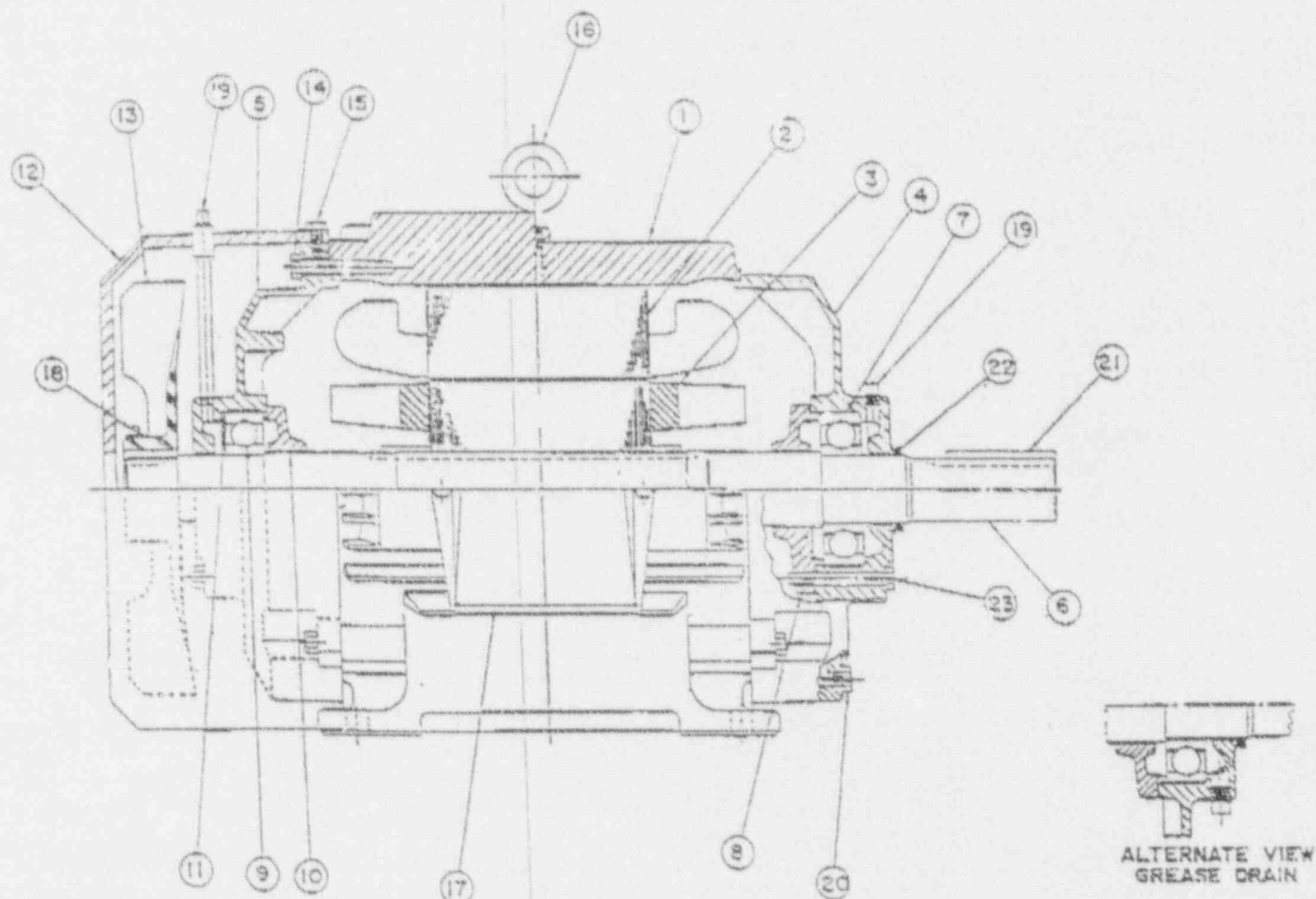
FRAME SIZE	VOLUME IN CUBIC INCHES	
	1800 RPM And Slower	3600 RPM
182 Thru 215	0.5	0.5
254 Thru 286	1.0	1.0
324 Thru 365	1.5	1.5
404 Thru 449	2.5	1.0

## REPLACEMENT BEARINGS

Your maintenance program will not be complete without including spare bearings. It must be remembered that the bearing is a wearable component and therefore must eventually be replaced. To insure that you are able to maintain original operation, we recommend the purchase of spares directly from Reliance Electric.

All bearings used in Reliance motors are subject to exact specifications and tests necessary to satisfy performance requirements. In this manner, it is possible to duplicate your present bearing. Markings on the bearing do not indicate complete specifications.

## PARTS IDENTIFICATION DRAWING



FIND NO.	PART DESCRIPTION
1	FRAME
2	STATOR
3	ROTOR
4	BACKEND BRACKET
5	FRONTEND BRACKET
6	SHAFT
7	BACKEND BALL BEARING
8	BACKEND INNER CAP
9	FRONTEND BALL BEARING
10	FRONTEND INNER CAP
11	WAVE WASHER, FRONTEND
12	FAN COVER
13	OUTER FAN

FIND NO.	PART DESCRIPTION
14	FRONT END BRACKET BOLTS
15	FAN COVER BOLTS
16	EYEBOLT
17	CONDUIT BOX
18	FAN CLAMP
19	GREASE ENTRY
20	CONDENSATION DRAIN
21	KEY
22	SLINGER
23	BACKEND CAP BOLTS

NOTE: Bearings shown are of the standard type.

## TOTAL SERVICE PROGRAMS

Reliance Electric can provide a wide range of maintenance programs to help you reduce downtime, improve productivity and increase profits. Capabilities include:

- Motor Start-Up Service
- Motor Electrical and Mechanical Preventive Maintenance
- Vibration Analysis
- Mobile Van Repair Service
- Balancing and Alignment Service
- Maintenance Schools
- 24-Hour Technical Support
- Modernization Service

For more information contact your local Reliance Electric Sales Office or write:

Reliance Electric  
Industrial Services  
24701 Euclid Avenue  
Cleveland, Ohio 44117

## RENEWAL PARTS

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

Parts can be obtained from your nearest Reliance Electric parts distributor, or directly from the Reliance Electric factory. When ordering parts for which a part number is not available, give complete description of part and purchase order number, serial number, model number, etc., of the equipment on which the part is used.

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

1. Nearest Reliance Electric Sales Office
2. Nearest Reliance Electric Keyparts Distributor
3. Reliance Electric Renewal Parts, Cleveland, Ohio

Be sure to include complete nameplate — purchase order number, serial number, rating, etc. — for your equipment when ordering the spare parts list.

For the telephone number of your local Keyparts Stocking distributor call 1-800-321-2795 or in Ohio call 216-266-7222.

## ADDITIONAL LITERATURE

Additional literature covering the maintenance of A-C motors can be obtained from the Reliance Electric Services Division. Requests should be submitted through your nearest Reliance Electric Sales Office.



# A-C DRIVES

## TRAINING AND AUDIO/VISUAL PRODUCTS

Reliance Electric offers a wide variety of Industrial Training courses for electricians, electronic technicians and engineers who are responsible for the installation, repair and maintenance of production equipment and systems.

Professional quality A/V Programs are also available. These programs have been designed to provide years of efficient in-house training. Available for playback at the user's convenience, these videotape programs allow individual or groups to learn or review subjects at any time.

Printed reference materials come with all diagnostic and troubleshooting programs.

### Training Courses

No.	Title
<b>A-C DRIVE COURSES</b>	
2-1	Maintenance and Troubleshooting of VI Style Variable Speed A-C Drives
2-4	A-C Drives Hands-On Troubleshooting Lab
2-5	Maintenance and Troubleshooting of PWM Style Variable Speed A-C Drives
2-15	Regional Class - Maintenance and Troubleshooting of A-C Drives and Systems
4-15	Regional Class - Productive Maintenance Training

### Audio/Visual Products

Order No.	Title	Format	Price
<b>A-C DRIVES PROGRAMS</b>			
TM2240	A-C Motor Theory	Videotape	\$725
TM2241	Introduction to the VI	Videotape	725
TM2242	Troubleshooting the VI Regulator	Videotape	995
TM2367	Troubleshooting the 6-Transistor Power Module	Videotape	725
<b>NEW VIDEO TRAINING PROGRAMS</b>			
VMBA001	Fundamentals of A-C Motors	Videotape	\$495
VMEV001	Concepts of Digital Controls	Videotape	495
WVVS001	GP2000 Video Training	Videotape	495
WVVS002	HR2000 Video Training	Videotape	495



For details and prices on these courses, audio/visual products and FREE Training Schedule Brochure, HD-405, contact:

Industrial Training Department  
Reliance Electric  
35000 Curtis Boulevard  
Eastlake, Ohio 44095

Call Toll Free:

800/321-2795 (Outside Ohio)  
800/262-2688 (In Ohio)

## Service Centers

### ALABAMA

Birmingham Service Center  
3100 Pinson Valley Parkway  
Birmingham, Alabama 35217  
205-341-8377

### ARIZONA

Phoenix Service Center  
3550 S. 16th Street  
Phoenix, Arizona 85040  
602-243-1791

### CALIFORNIA

Anaheim Service Center  
1025 North Sabina Street  
Anaheim, California 92801  
714-772-4773

San Jose Service Center  
341 North Montgomery Street  
San Jose, California 95110  
408-287-4060

### COLORADO

Tree Electric Service Center  
1020 South Lipan Street  
Denver, Colorado 80223  
303-935-4615

### ILLINOIS

Chicago Service Center  
17001 South Vincennes Avenue  
Thornton (Chicago), Illinois 60476  
312-877-5310

### LOUISIANA

Monroe Service Center  
2304 Ruffin Drive  
Monroe, Louisiana 71203  
318-322-1474

Shreveport Service Center  
1245 North Hearne  
Shreveport, Louisiana 71107  
318-222-9431

### MASSACHUSETTS

Boston Service Center  
31 Astor Avenue  
Norwood (Boston), Massachusetts 02062  
617-769-5900

### OHIO

Cleveland Service Center  
4950 East 49th Street  
Cleveland, Ohio 44125  
216-266-7274

Wente Service Center  
223 North Fourth Street  
Hamilton, Ohio 45011  
513-863-8816

### OREGON

Portland Service Center  
2315 N.W. 21st Place  
Portland, Oregon 97210  
503-226-4951

### PENNSYLVANIA

Philadelphia Service Center  
3240 South 78th Street  
Philadelphia, Pennsylvania 19153  
215-365-1500

Washington Service Center (Pittsburgh)  
320 Museum Road  
Washington, Pennsylvania 15301  
412-225-2900

### TEXAS

Houston Service Center  
1500 E. Main Street  
LaPorte, Texas 77571  
713-471-4611

### WYOMING

Tree Electric Service Center  
811 Edwards Road  
Gillette, Wyoming 82716  
307-682-0035

Tree Electric Service Center  
839 Elk  
Rock Springs, Wyoming 82901  
307-362-6697

For a complete listing of all Reliance Authorized Service Centers, call 1 800 321-2795 or  
in Ohio call 1-216-266-2688.

Reliance Electric / 24701 Euclid Avenue / Cleveland, Ohio 44117 / (216) 266-7000

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