

Refrigeration Duty Motors

Low and Medium Voltage Polyphase Motors

Installation and Maintenance

**Read Carefully Before
Installing and Starting Motor**

TABLE OF CONTENTS

Receiving, Handling, and Storage	1
Mounting and Alignment	2
Operation	3
Maintenance	4
Relubricating Schedule	5
Connection Diagram	6



INDUSTRIES

LLC

The following instructions and procedures represent necessary practices that will optimize the utility efficiency and reliability of your RAM motor. These instructions do not and cannot cover all situations that may arise in your industrial environment. Exceptional situations should be referred to the manufacturer for guidance.

Improperly installed high voltage rotating equipment may present serious hazards to personnel. It is imperative that installation, operation, and maintenance of this and associated equipment be performed by qualified personnel who are familiar with this document and all safety standards applicable to equipment of this nature.

Handling and Lifting

Cartage of palletized or crated units should be accomplished through the use of equipment properly sized and designed for the movement of the load presented by the motor. Stacking of these units is not recommended.

A LIFTING EYE(S), THAT IS DESIGNED TO SUPPORT ONLY THE WEIGHT OF THE MOTOR, is provided along the axial center line of the unit. When lifting involves assembled equipment in conjunction with the motor, additional provisions must be employed to support such assemblies.

When lifting motors provided with hoods, a spreader is required to prevent damage to the housing. Motors equipped with hoods may provide additional lifting eyes located in each corner. **THESE EYES ARE PROVIDED TO FACILITATE REMOVAL OF THE HOOD ONLY AND WILL NOT SUPPORT OR PROVIDE AUXILIARY SUPPORT WHEN ATTEMPTING TO LIFT THE MOTOR.**

Receipt and Acceptance

On arrival, inspect the equipment for damage or shortages. Report any damages or shortages to the carrier and the shipper at once. Request an inspection of damages by the carrier's agent to initiate a claim for losses.

Confirm that the nameplate data provided on the motor conforms to the ordered unit. Report any discrepancies to the shipper at once.

When communicating problems to the proper agents, provide all pertinent information regarding the identification of the shipment and unit and specific data relating to the nature of the problem.

Storage

The motor should be stored in a clean and dry environment that is free from vibration and extremes in temperature. Protective coverings and coatings on the motor should be maintained.

When units are held beyond 60 days in storage, the motor shaft should be rotated manually several revolutions at 30-day intervals in order to distribute the grease within the bearings.

If humidity is present during the storage period, the bearing grease should be inspected for the presence of moisture and the grease flushed and renewed if contamination is evident. During the period in storage, space heaters (if provided) should be energized or an alternate heat source, such as lamps, should be placed near or within the motor's enclosure or low voltage power may be applied to one phase of the motor's winding. Winding resistance should be measured and recorded on a monthly basis and if significant change occurs, corrective actions must be taken.

Installation

Location

The area in which the motor is to operate should be clean and free of loose dust, dirt or grit, liquids or caustics or any hazardous process or combustible material that is specified by the National Board of Fire Underwriters to require explosion proof fixtures and enclosures.

Adequate ventilation must be provided to the motor and care taken that the intakes and exhaust ports of the unit are free of obstructions.

Foundations

The foundation should provide a generously sized flat surface, suitable for leveling the motor, that is lagged, bedded and grouted into concrete that extends down to a solid sub-base. This surface must be of sufficient rigidity and be uniformly supported to inhibit resonant vibrations. Variables in local conditions require that the determination of what is adequate be specified by local experts.

Where the motor is to be supported on girders or other structural steel, the supports must be adequately bedded and braced to prevent vibration and provide equal support at each attach point of the motor to the structure to eliminate stresses to or distortions of the frame.

Mounting

The motor is not self supporting. All units (including those provided with machined face or flanged end brackets) must be securely and uniformly fastened to the bed plate or platform at each attach point provided, using adequately sized mounting bolts and hardware. The horizontal suspension of face or flange-mounted units without additional vertical support can result in the catastrophic mechanical failure of the motor and damage to the driven equipment.

Leveling of the motor is accomplished by applying shims, as necessary, beneath the motor's attach points. **STAINLESS STEEL SHIMS SHOULD BE EMPLOYED TO ASSURE STABILITY AND SUPPORT.** The shim size, in area, should be as near as possible to the area of the motor's mounting pads. The number of shims employed should be minimized through the use of fewer thicker shims as opposed to many thinner shims, to a maximum of six shims per leveling point.

Couplings

A clamping device is provided at the primary shaft extension to inhibit axial motion during shipment and handling. This device should be removed at this time and the shaft and key cleaned with a solvent to remove rust inhibiting agents applied at the factory.

Coupling hubs should be heated for proper installation. The use of force or driving blows may damage the bearings and should not be applied.

Alignment

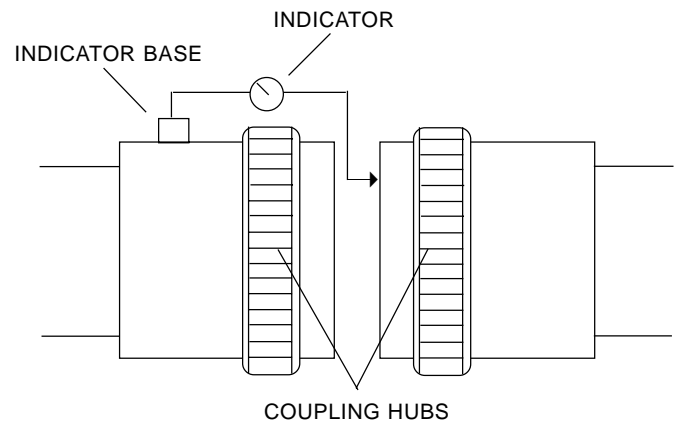
Several procedures exist to perform the alignment of the motor to the driven equipment. Wherever possible, the use of optical equipment by qualified personnel is recommended.

A preliminary alignment may be accomplished by use of feeler gauges and a straight edge applied to the top, bottom and sides of the gap between the faces and the rims of the opposing coupling hubs. The distance between the hubs must conform to the recommendations of the coupling manufacturer. The parallel and angular alignment should be within .002 inches. Mounting bolts must be uniformly tightened.

A final alignment may be performed as follows:

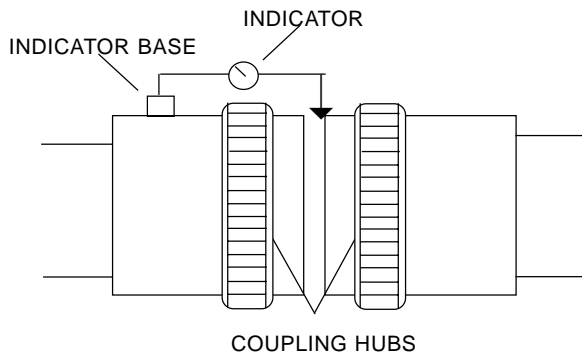
1. The integrity of the motor to base mounting surface should be checked by releasing one mounting bolt at a time with a dial indicator placed near each attach point as it is released. Spring-back should not exceed .002 inches at any point.

Fig 1



2. Angular alignment should be checked by securely mounting a dial indicator to the motor shaft or coupling hub with the probe against the face of the opposing hub. Mark the point of contact on the opposing hub, zero the indicator and rotate both shafts simultaneously in one direction. Note the indicator reading at 0°, 90°, 180°, and 270°. The total indicator readings should not exceed .002 inches.
3. The hub face runout may be checked by rotating one shaft while the other remains stationary with the indicator positioned as in step number 2 above. The total indicator reading should not exceed .003 inches. The runout measurements should be subtracted from the previous readings in step number 2 to achieve desired alignment setting or this method may be used where only one shaft can be rotated to measure angular alignment.
4. The parallel alignment should be checked by placing the indicator probe on the machined surface about the rim of the opposing hub, marking the point of contact and rotating both shafts simultaneously in one direction. Note the indicator readings at 0°, 90°, 180°, and 270°. Total indicator reading should not exceed .002 inches. **NOTE:** Be sure the indicator support is firm and rigid to eliminate gravitational deflection.
5. To check the coupling diameter runout, rotate one shaft while the other remains stationary with the indicator positioned as in step number 4 above. The total indicator reading should be factored into the previous reading to achieve desired alignment setting or this method may be used to achieve parallel alignment where only one shaft can be rotated.

Fig 2



6. Thermal expansion of equipment may result once operating temperatures are achieved and necessitate realignment in the "HOT" condition. The above procedures should be repeated as soon as possible after the equipment has been de-energized to correct any deviations from the "COLD" settings.
7. Once the motor has returned to ambient or "COLD" condition, readings should be made without correction and recorded in a maintenance log for future reference.

Electrical

ELECTRICAL CONNECTIONS SHOULD BE PERFORMED, WITH POWER REMOVED, BY QUALIFIED PERSONNEL ONLY. ALL WIRING TO THE MOTOR, CONTROLS, AND ACCESSORY EQUIPMENT SHOULD BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE AND COMPLY WITH ALL APPLICABLE LOCAL CODES AND GOVERNANCES.

The motor should be grounded with a suitably sized conductor with a brazed or solderless terminal attached to the grounding stud provided on the motor and fastened at the opposite end to the nearest acceptable grounding point.

The motor's mounting bolts should not be employed for grounding purposes.

A conduit box is normally provided on the motor to house the power connections to the motor. Unit specific connection sequences are provided on the data plate of each motor. The motor leads are provided with crimp-on ring type terminals that accept 3/8 inch fastening hardware. The power and interconnections must be mechanically secure and adequately insulated and isolated, one from the other. A periodic visual and thermal inspection of the power terminations is recommended to assure the integrity of the connections.

THE USE OF SET-SCREW TYPE TERMINATION DEVICES, IF USED, WILL VOID THE MOTOR WARRANTY. SUCH DEVICES ARE GENERALLY INCOMPATIBLE WITH THE HIGH-STRAND CONSTRUCTION OF THE MOTOR LEADS CAUSING FAILURE OF THE DEVICE AND PRODUCING EXTREME TEMPERATURES, FIRE AND ELECTRICAL SHOCK HAZARDS.

Operation

Pre-Start Up

Confirm that the shipping clamp on the primary shaft has been completely removed and that the shaft turns freely.

Confirm that all hardware is properly secured on the motor and driven equipment, power transmission components, and all guards or protective covers.

Remove any and all non-essential objects and waste from the immediate area surrounding the motor and driven equipment.

Confirm that all ventilation intake and exhaust ports are unobstructed.

Confirm that all electrical connections are secure, properly insulated, and that they conform to the available power supply and controlling devices.

Confirm ground connections are secure.

Confirm that the available power source is within $\pm 10\%$ of the nameplated voltage rating and that the frequency of the available power source is within $\pm 5\%$ of the motor's nameplated rating and that the combined variation of voltage and frequency does not exceed $\pm 10\%$ of the nameplated ratings.

Confirm that power is available at each of the three phases.

No Load Start

With alignment correctly completed, but with the coupling elements disengaged and the motor shaft coupling sleeve secured to the shaft away from the hub face, apply power to the motor following the normal starting sequence of the controlling devices.

Confirm that the direction of rotation conforms to that which is required by the load or driven equipment. To correct the rotational direction, consult the control manufacturer's manual for recommended phase sequencing procedures.

Confirm that the motor operates smoothly and is free of excessive vibrations or noise. If vibration or noise is present, remove power and evaluate and correct the causes of the vibration or noise before re-starting the motor.

Audible bearing noise may be present upon initial start up after a period of storage or disuse. The application of a small quantity of grease (1/2 ounce or less) should alleviate this.

Confirm that the amperage drawn by the motor is within limits and balanced phase to phase.

Monitor bearing temperatures for excessive or rapid heating.

When satisfied that the motor has stabilized and that no remarkable conditions exist, remove power.

Loaded Start

Having completed a satisfactory un-coupled or no-load run, complete the final assembly of the coupling elements to the load.

Position and install all necessary covers and guards to prevent injury to personnel.

Apply power to the motor following the normal starting sequence of the controlling devices.

Confirm that the direction of rotation conforms to the driven load. Immediately remove power if the direction is incorrect to prevent damaging the driven equipment. Correct the rotation as described above and re-start the motor.

Monitor the motor and driven equipment for excessive vibration or noise. Remove power and evaluate and correct the causes of the vibrations or noise before re-starting the motor.

Confirm that the amperage draw of the motor is within limits and balanced phase to phase.

Monitor bearing temperatures for excessive or rapid heating.

When satisfied that the motor and associated equipment have stabilized and that no remarkable conditions exist, you may remove power. Note all readings and observations in a maintenance log for future reference.

Maintenance

Inspection

Perform inspections of the motor at regular intervals. Keep the motor clean and free of obstructions. Monitor the motor for changes in operating temperature, vibration, noise, and amp draw. Evaluate and correct the causes of any conditions beyond the norm as they arise.

Lubrication

The motor is normally provided with open type ball or cylindrical roller bearings that are fully serviced with lubricating grease during factory assembly. A grease fitting and relief vent and plug are provided in each end bracket to provide for field servicing of the bearings.

Grease should only be applied to the motor bearings with the venting port plugs removed.

The venting port must remain open during a suitable run-in period to compensate for the thermal expansion of the lubricating grease. *Failure to properly vent the system will lead to the premature failure of the bearings.*

The frequency of re-lubrication will be influenced by local operating conditions such as service cycle times and the environmental and ambient conditions prevailing on site. The following chart represents typical minimum service cycles where the motor is applied under conditions that are consistent and within the nameplated performance limits of the motor.

The specific manufacturer and designation of the lubrication applied at the factory is listed on the motor's nameplate.

Wherever possible, it is recommended that this product be applied in the field. If an alternate must be employed, the mixing of lubricants is not recommended and the purging of the original grease must be accomplished.

Questions of compatibility by product to product must be addressed to the specific manufacturers of those products for guidance.

Relubrication Schedule

Ball Bearings*

SYNCHRONOUS RPM	FRAME SERIES	SERVICE CYCLE**	
		8 HR DAY OPERATION	24 HR DAY OPERATION
3600	360-5800	150 DAYS (1200 HOURS)	50 DAYS (1200 HOURS)
1800	360	390 DAYS (3120 HOURS)	130 DAYS (3120 HOURS)
	400-440	270 DAYS (2160) HOURS	90 DAYS (2160) HOURS
	5000-5800	210 DAYS (1680 HOURS)	70 DAYS (1680 HOURS)
1200	360-440	390 DAYS (3120 HOURS)	130 DAYS (3120 HOURS)
	5000-5800	270 DAYS (2160 HOURS)	90 DAYS (2160 HOURS)

* RELUBRICATION SCHEDULE FOR ROLLER BEARINGS = 1/3 OF ABOVE INTERVALS

** RELUBRICATION SCHEDULE FOR SEVERE SERVICE INVOLVING VIBRATION, SHOCK AND/OR ENVIRONMENTAL EXTREMES = 1/3 OF ABOVE INTERVALS

All RAM motors are supplied with Exxon/Mobil Polyrex EM grease. *This is a #2 polyurea-based grease, and the motor should only be lubricated with this type of grease. The use of an alternate grease type may lead to premature mechanical failure and may void the manufacturer's warranty terms.*

Relubrication Instructions

With the power removed, clear and clean the grease fittings and immediate area surrounding the grease fittings to prevent contamination of the lubricant.

Remove the pipe plugs from the venting ports located at or near the bottom of each end bracket. *Probe the venting port to assure it is clear of impacted hardened material.*

Using a low pressure grease gun containing the correct type of lubricating grease, apply not more than 1 ounce (1.8 cubic inches) of grease to the fittings.

Cease application immediately if lubricant flows out of the vent port or appears about the shaft aperture.

DO NOT OVERGREASE.

Do not replace the venting port plugs at this time.

Operate the motor under power for a minimum period of at least 30 minutes or longer until the bearing temperatures stabilize. It is normal for bearing temperatures to increase until the grease is evenly distributed throughout the bearing housing. Grease may not relieve from drain. See notes below.

Remove power and replace the venting port pipe plugs and all covers and guards that may have been removed to access the equipment. Return unit to normal operation.

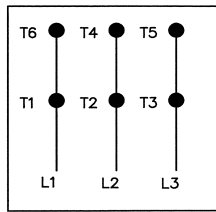
NOTE 1: Prior to commissioning new motors, it is strongly recommended to add 1 ounces (30 grams) of grease, per the above instructions. It is necessary to run the motor unloaded immediately after adding the grease, in order to evenly distribute the grease throughout the bearing housing.

NOTE 2: The relubrication period for bearings on 3600 rpm screw compressor motors is every 1200 hours. The grease amount should never exceed 1 ounce (30 grams) into each bearing cavity during relubrication.

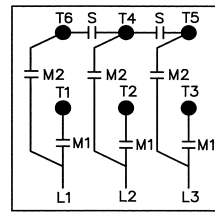
Connection Diagrams

A. Single Voltage Leads Numbered 1 thru 6 Delta Connected Motors

1. ACROSS-THE-LINE START

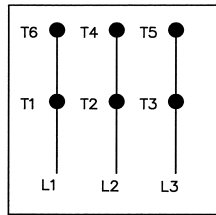


2. WYE START DELTA RUN*

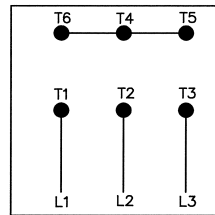


B. Dual Voltage Six Lead Delta/Wye Connected Motors

1. ACROSS-THE-LINE START LOWER VOLTAGE

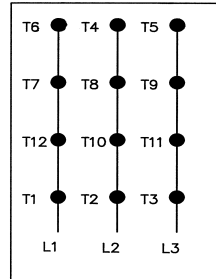


2. ACROSS-THE-LINE START HIGHER VOLTAGE

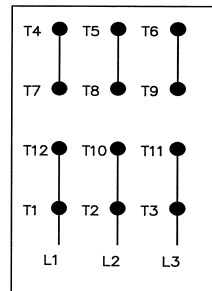


C. Dual Voltage Twelve Lead Delta Connected Motors

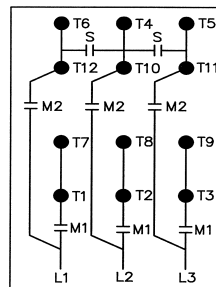
1. ACROSS-THE-LINE START LOWER VOLTAGE



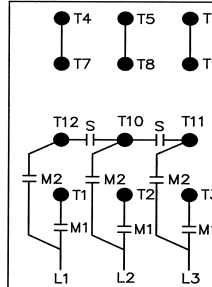
2. ACROSS-THE-LINE START HIGHER VOLTAGE



3. WYE START DELTA RUN* LOWER VOLTAGE



4. WYE START DELTA RUN* HIGHER VOLTAGE



* CONTACT SEQUENCE
WYE START/DELTA RUN

	M1	M2	S
START	CLOSE	OPEN	CLOSE
RUN	CLOSE	CLOSE	OPEN



Rt. 61 • Leesport, PA 19533
800-999-8183 • (610) 916-3939

www.ramusa.com

MA-0004MO / JULY 07 / REV 6
SUPERSEDES APRIL 06 / REV 5