Product Information Packet

ECP84413T-4

150HP, 3570RPM, 3PH, 60HZ, 445TS, A4478M, TEFC
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### Performance Data

#### A-C Motor

**Frame:** A44W3535-R001

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**NEMA Nominal Efficiency = 95.2%**

**Temperature Rise at 1.1 S.F. = 89°C**

**Remarks:**
- Amperes shown for 460 Volt connection. If other voltage connections are available, the amperes will vary inversely with the rated voltage.
- Calculated data.

**Printed on 2/3/11 @ usmghengdev1**

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**Product Information Packet: ECP84413T-4 - 150HP, 3570RPM, 3PH, 60HZ, 445TS, A4478M, TEFC**

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**A-C Motor**

**Frame:** A44W3535-R001

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**A-C Motor**

**Frame:** A44W3535-R001

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**Temperature Rise at 1.1 S.F. = 89°C**

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- Calculated data.

**Printed on 2/3/11 @ usmghengdev1**
DUTY MASTER ALTERNATING CURRENT MOTORS
SQUIRREL-CAGE INDUCTION

ENCLOSURE: TOTALLY ENCLOSED
FRAME G445TS ABOVE NEMA RATINGS
MOUNTING: FOOT
INCLUDES 445TS FRAME MOUNTING HOLES

841-XL

WEIGHT (LBS): 2149

DIMENSIONS ARE IN INCHES; SEE SHEET 2 FOR DIMENSIONS IN MILLIMETERS

CUSTOMER IS RESPONSIBLE FOR DETERMINING THAT MOTOR PERFORMANCE IS SUITABLE IN THE APPLICATION.
DUTY MASTER ALTERNATING CURRENT MOTORS
SQUIRREL-CAGE INDUCTION

ENCLOSURE: TOTALLY ENCLOSED
FRAME G445TS ABOVE NEMA RATINGS
MOUNTING: FOOT
COOLING: FAN COOLED
INCLUDES 444TS FRAME MOUNTING HOLES

WEIGHT (KGS): 975

DIMENSIONS ARE IN MILLIMETERS; SEE SHEET 1 FOR DIMENSIONS IN INCHES
CUSTOMER IS RESPONSIBLE FOR DETERMINING THAT MOTOR PERFORMANCE IS SUITABLE IN THE APPLICATION.

1. GROUND HOLES QTY 1 1/2-13 TAP; QTY 1 3/8-16 TAP
2. VARIES +.000, -.001
3. VARIES +.001, -.001
4. ON STANDARD MOTORS THIS IS CONDUIT SIZE. ON XT AND
   CORROSION PROOF MOTOR THIS IS PIPE TAP.
5. MOTOR WEIGHTS MAY VARY BY 1% DEPENDING ON RATING.
6. OBSTRUCTION MUST NO ENCROACH ON AIR INLET

CONDUIT BOX LOCATED ON OPPOSITE SIDE WHEN F-2.
IF MOUNTING CLEARANCE DETAILS ARE REQUIRED, CONSULT FACTORY.
MAXIMUM PERMISSIBLE SHAFT RUNOUT WHEN MEASURED AT END OF
STANDARD SHAFT EXTENSION IS .038 MM T.I.R. FOR BALL BEARING
MOTORS AND .051 T.I.R. FOR ROLLER BEARING MOTORS TO 127 MM DIA.

MOTOR WEIGHTS MAY VARY BY 1% DEPENDING ON RATING.6.
OBSTRUCTION MUST NO ENCROACH ON AIR INLET

13/16 HOLES
3.0" LEAD OPENING
DUTY MASTER ALTERNATING CURRENT MOTORS
SQUIRREL-CAGE INDUCTION

ENCLOSURE: TOTALLY ENCLOSED
FRAME G445TS ABOVE NEMA RATINGS
MOUNTING: FOOT
COOLING: FAN COOLED
INCLUDES 444TS FRAME MOUNTING HOLES

WEIGHT (KGS): 975

DIMENSIONS ARE IN MILLIMETERS; SEE SHEET 1 FOR DIMENSIONS IN INCHES
CUSTOMER IS RESPONSIBLE FOR DETERMINING THAT MOTOR PERFORMANCE IS SUITABLE IN THE APPLICATION.

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MOTOR WEIGHTS MAY VARY BY 1% DEPENDING ON RATING.6.
OBSTRUCTION MUST NO ENCROACH ON AIR INLET

13/16 HOLES
3.0" LEAD OPENING
A-C MOTOR
CONNECTION DIAGRAM
STANDARD 3 LEAD CONNECTED

T1 L1
T2 L2
T3 L3

(N.P. 1575-BA)
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Section 1
General Information

Overview
This manual contains general procedures that apply to Baldor Motor products. Be sure to read and understand the Safety Notice statements in this manual. For your protection, do not install, operate or attempt to perform maintenance procedures until you understand the Warning and Caution statements.

A Warning statement indicates a possible unsafe condition that can cause harm to personnel.

A Caution statement indicates a condition that can cause damage to equipment.

Important: The information manual is not intended to include a comprehensive listing of all details for all procedures required for installation, operation and maintenance. The manuals contain general guidelines that apply to most Baldor Motor products. Be sure to read and understand the safety information statements in the manuals for your particular product specification.
WARNING: Use proper care and procedures that are safe during handling, lifting, installing, operating and maintaining operations. Improper methods may cause muscle strain or other harm.

WARNING: Pacemaker danger
- Magnetic and electromagnetic fields in the vicinity of current carrying conductors and permanent magnet motors can result in a serious health hazard to persons with cardiac pacemakers, metal implants, and hearing aids. To avoid risk, stay away from the area surrounding a permanent magnet motor.

WARNING: Before performing any motor maintenance procedure, be sure that the equipment connected to the motor shaft cannot cause shaft rotation. If the load can cause shaft rotation, disconnect the load from the motor shaft before maintenance is performed. Unexpected mechanical rotation of the motor parts can cause injury or motor damage.

WARNING: Do not use non-UL/CSA listed explosion proof motors in the presence of flammable or combustible vapors or dust. These motors are not designed for atmospheric conditions that require explosion proof operation.

WARNING: Motors that are to be used in flammable and/or explosive atmospheres must display the UL label on the nameplate along with CSA listed logo. Specific service conditions for these motors are defined in NFPA 70 (NEC) Article 500.

WARNING: Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions, should be permanently guarded to prevent accidental contact by personnel. Accidental contact with body parts or clothing can cause serious or fatal injury.

Caution: To prevent premature equipment failure or damage, only qualified maintenance personnel should perform maintenance.

Caution: Do not over-lubricate motor as this may cause premature bearing failure.

Caution: Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.

Caution: If eye bolts are used for lifting a motor, be sure they are securely tightened. The lifting direction should not exceed a 20° angle from the shank of the eye bolt or lifting lug. Excessive lifting angles can cause damage.

Caution: To prevent equipment damage due to over the ratings set by the manufacturer or motor manufacturer's specifications, follow the precautions and procedure in NEMA MG1 and MG2 standards to avoid equipment damage.

If you have any questions or are uncertain about any statement or procedure, or if you require additional information, please contact your Baldor distributor or an Authorized Baldor Service Center.

Receiving
Each Baldor Electric Motor is thoroughly tested at the factory and carefully packaged for shipment. When you receive your motor, there are several things you should do immediately.

1. Observe the condition of the shipping container and report any damage immediately to the commercial carrier that delivered your motor.

2. Verify that the part number of the motor you received is the same as the part number listed on your purchase order.

Handling
The motor should be lifted using the lifting lugs or eye bolts provided.

Caution: Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.

1. Use the lugs or eye bolts provided to lift the motor. Never attempt to lift the motor and additional equipment connected to the motor by this method. The lugs or eye bolts provided are designed to lift the motor and its lifting hardware.

2. To avoid condensation inside the motor, do not unpack until the motor has reached room temperature. (Room temperature is the temperature of the room in which it will be installed). The packing provides insulation from temperature changes during transportation.

3. A spreader bar should be used to lift the motor by the cast lifting lugs located on the motor frame. A spreader bar should be used to lift the motor by the cast lifting lugs located on the motor frame.
4. If the motor must be mounted to a plate with the driven equipment such as pump, compressor etc., it may not be possible to lift the motor alone. For this case, the assembly should be lifted by a sling around the mounting base. The entire assembly can be lifted as an assembly for installation. Do not lift the assembly using the motor lugs or eye bolts provided. Lugs or eye bolts are designed to lift motor only. If the load is unbalanced (as with couplings or additional attachments) additional slings or other means must be used to prevent tipping. In any event, the load must be secure before lifting.

Storage

Improper motor storage will result in seriously reduced reliability and failure. An electric motor that does not experience regular usage while being exposed to normally humid atmospheric conditions is likely to develop rust in the bearings or rust particles from surrounding surfaces may contaminate the bearings. The electrical insulation may absorb an excessive amount of moisture leading to the motor winding failure.

A wooden crate "shell" should be constructed to secure the motor during storage. This is similar to an export box but the sides & top must be secured to the wooden base with lag bolts (not nailed as export boxes are) to allow opening and reclosing many times without damage to the “shell”.

Minimum resistance of motor winding insulation is 5 Meg ohms or the calculated minimum, whichever is greater. Minimum resistance is calculated as follows:

\[ R_m = kV + 1 \]

where: \( R_m \) is minimum resistance in Meg ohms and \( kV \) is rated nameplate voltage defined as Kilo Volts.

Example: For a 480VAC rated motor \( R_m = 1.48 \) meg ohms (use 5 MΩ).

For a 4160VAC rated motor \( R_m = 5.16 \) meg ohms.

Preparation for Storage

1. 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.

2. Store in a clean, dry, protected warehouse where control is maintained as follows:
   a. Shock or vibration must not exceed 2 mils maximum at 60 hertz, to prevent the bearings from brinelling. If shock or vibration exceeds this limit vibration isolation pads must be used.
   b. Storage temperatures of 10°C (50°F) to 49°C (120°F) must be maintained.
   c. Relative humidity must not exceed 60%.
   d. Motor space heaters (when present) are to be connected and energized whenever there is a possibility that the storage ambient conditions will reach the dew point. These heaters are optional. The space heating/cooling system that is used to maintain the storage environment is to be considered to secure the motor during transportation. A wooden crate "shell" should be installed to secure the motor. The crate must be held in place by the wooden base and secured with lag bolts.

3. Measure and record the resistance of the winding insulation (dielectric withstand) every 30 days of storage.
   a. If motor insulation resistance decreases below the minimum resistance, contact your Baldor District office.
   b. Place new desiccant inside the vapor bag and re-seal by taping it closed.
   c. If a zipper-closing type bag is used instead of the heat-sealed type bag, zip the bag closed instead of taping it. Be sure to place new desiccant inside bag after each monthly inspection.
   d. Place the shell over the motor and secure with lag bolts.

4. Where motors are mounted to machinery, the mounting must be such that the drains and breathers are fully operable and are at the lowest point of the motor. Vertical motors must be stored in the vertical position. The storage environment must be maintained as stated in step 2.
5. Motors with anti-friction bearings are to be greased at the time of going into extended storage with periodic service as follows:
   a. Motors marked “Do Not Lubricate” on the nameplate do not need to be greased before or during storage.
   b. Ball and roller bearing (anti-friction) motor shafts are to be rotated manually every 3 months and greased every 6 months in accordance with the Maintenance section of this manual.
   c. Sleeve bearing (oil lube) motors are drained of oil prior to shipment. The oil reservoirs must be refilled to the indicated level with the specified lubricant (see Maintenance). The shaft should be rotated monthly by hand at least 10 to 15 revolutions to distribute the oil to bearing surfaces.
   d. “Provisions for oil mist lubrication” – These motors are packed with grease. Storage procedures are the same as paragraph 5b.
   e. “Oil Mist Lubricated” – These bearings are protected for temporary storage by a corrosion inhibitor. If stored for greater than 3 months or outdoor storage is anticipated, connected to the oil mist system while in storage. If this is not possible, add the amount of grease indicated under “Standard Condition” in Section 3, then rotate the shaft 15 times by hand.

6. All breather drains are to be opened at the time of removal from storage.

7. Coat all external machined surfaces with a rust preventing material. An acceptable product for this purpose is Exxon Rust Ban # 392.

8. Carbon brushes should be lifted and held in place in the holders above the commutator, the commutator should be wrapped with a suitable material such as cardboard paper as a mechanical protection against damage.

Non-Regreasable Motors

Non-regreasable motors with “Do Not Lubricate” on the nameplate should have the motor shaft rotated 15 times to redistribute the grease within the bearing every 3 months or more often.

All Other Motor Types

Before storage, the following procedure must be performed.

1. Remove the grease drain plug, if supplied, (opposite the grease fitting) on the bottom of each bracket.
2. The motor with regreasable bearing must be greased as instructed in Section 4 of this manual.
3. Replace the grease drain plug after greasing.
4. The motor shaft must be rotated a minimum of 15 times before greasing.
5. Motor Shafts are to be rotated at least 15 revolutions every 9 months. Additional grease is added every 9 months (see Section 3). The bearings around the shaft should be rotated a minimum of 15 times by hand. 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 and draining at points other than through the bearings around the shaft.

Removal From Storage

1. Remove all packing material.
2. Measure and record the electrical resistance of the winding insulation resistance meter at the time of removal from storage. The insulation resistance must not be less than 50% of the initial reading. A decrease in resistance indicates moisture in the windings and necessitates electrical or mechanical drying before the motor can be placed into service. If resistance is low, contact your Baldor District office.
3. Regrease the bearings as instructed in Section 4 of this manual.
4. Reinstall the original shipping brace if motor is to be moved. This will hold the shaft firmly against the motor shaft.

5. General Information MN408
General Information 1−5
Equipment Marking for IEC Certified Product
IEC certified products have special markings that identify the protection concept and environment.

IEC ExnA MOTOR
MFG. BY BALDOR ELECTRIC  FORT SMITH, AR 72901    USA
ExnA IIC       Gc Tamb
° C to ° C
II 3 G     IP______
Sira__________________
IECEx__________________

Ex Protection Concept (ExnA)
Gas Group (IIC)
Temperature Class
ATEX Specific
Marking of
Explosion Protection

ATEX Equipment Group and Category (II3)
Type of Atmosphere: G-Gas, D-Dust (G)
Ambient Range
European Conformity Mark
Place of Manufacture
Specific Conditions of Use:
If the motor certificate number is followed by the symbol 'X', this indicates that the motor has specific conditions of use which are indicated on the certificate. It is necessary to review the product certification manual in conjunction with this instruction manual.
Operation On Frequency Converters:
If the motor is evaluated for operation with an adjustable speed drive, the type of converter (for example PWM for Pulse Width Modulated) and safe speed range (for example 0−120Hz) will be specified in the certification documents or on motor nameplates. It is necessary to consult the adjustable speed drive manual for proper set up.

Figure 3-1  IEC Certified Product Markings

Equipment Marking for IEC Certified Product
IEC certified products have special markings that identify the protection concept and environment.

Figure 3-1  IEC Certified Product Markings

Requirements: A key to the symbols is shown in Figure 3.1. IEC certified products have special markings that identify the protection concept and environment.
**Installation & Operation**

**Overview**

Installation should conform to the National Electrical Code as well as local codes and practices. When other devices are coupled to the motor shaft, be sure to install protective devices to prevent future accidents. Some protective devices include coupling, belt guard, chain guard, shaft covers etc. These protect against accidental contact with moving parts. Machinery that is accessible to personnel should provide further protection in the form of guard rails, screening, warning signs etc.

**Location**

It is important that motors be installed in locations that are compatible with motor enclosure and ambient conditions. Improper selection of the motor enclosure and ambient conditions can lead to reduced operating life of the motor.

Proper ventilation for the motor must be provided. Obstructed airflow can lead to reduction of motor life.

1. **Open Drip-Proof/WP** motors are designed for installations with high corrosion or excessive moisture conditions. These motors should not be placed into an environment where there is the presence of flammable or combustible vapors, dust or any combustible material, unless specifically designed for this type of service.

**Hazardous Locations**

Are those where there is a risk of ignition or explosion due to the presence of combustible gases, vapors, dust, fibers, or flyings. Facilities requiring special equipment for hazardous locations are typically classified in accordance with local requirements. In the US market, guidance is provided by the National Electric Code.

**Mounting**

The motor must be securely installed to a rigid foundation or mounting surface to minimize vibration and maintain alignment between the motor and shaft load. Failure to provide a proper mounting surface may cause vibration, misalignment and bearing damage.

Foundation caps and sole plates are designed to act as spacers for the equipment they support. If these devices are used, be sure that they are evenly supported by the foundation or mounting surface.

When installation is complete and the motor and shaft load is aligned, the motor should be grouted to the foundation to maintain this alignment.

The standard motor base is designed for horizontal or vertical mounting. Adjustable or sliding rails are designed for horizontal mounting only. Consult your Baldor distributor or authorized Baldor Service Center for further information.

<table>
<thead>
<tr>
<th>Enclosure</th>
<th>Air Intake</th>
<th>Exhaust</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEFC / TENV (IC0141)</td>
<td>170 - 250 (4.3 - 6.3cm)</td>
<td>180 - 210 (4.5 - 5.3cm)</td>
</tr>
<tr>
<td>Fan Cover Air Intake</td>
<td>180 - 210 (4.5 - 5.3cm)</td>
<td>250 - 449 (6.3 - 11.3cm)</td>
</tr>
<tr>
<td>IEC 100 - 125 (2.5 - 3.2cm)</td>
<td>180 - 210 (4.5 - 5.3cm)</td>
<td>250 - 449 (6.3 - 11.3cm)</td>
</tr>
<tr>
<td>IEC 112 - 132 (2.5 - 3.2cm)</td>
<td>180 - 210 (4.5 - 5.3cm)</td>
<td>250 - 449 (6.3 - 11.3cm)</td>
</tr>
<tr>
<td>IEC 160 - 280 (4 - 7cm)</td>
<td>180 - 210 (4.5 - 5.3cm)</td>
<td>250 - 449 (6.3 - 11.3cm)</td>
</tr>
<tr>
<td>Exhaust Envelope equal to the P Dimension on the Motor dimension sheet</td>
<td>180 - 210 (4.5 - 5.3cm)</td>
<td>250 - 449 (6.3 - 11.3cm)</td>
</tr>
<tr>
<td>OPEN/Protected Enclosures</td>
<td>1.5 X P Dimension plus 2&quot; (50mm)</td>
<td>1.5 X P Dimension plus 2&quot; (50mm)</td>
</tr>
<tr>
<td>Exhaust out the sides envelope</td>
<td>Exhaust out the end same as intake.</td>
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</tr>
<tr>
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</tbody>
</table>

**Note:**

Always check the motor's nameplate for additional information.
Some motors have standardized frames containing 6 or 8 mounting holes. Figures 2-7-6 & 8 Hole Motor Frame Mounting

For field reversed mounting from F-1 to F-2, etc., Figure 2-7-6 illustrates the proper mounting holes to use.

For short frame designations 182, 213, 254, 284, 324, 364, 404, 444 (NEMA)

For long frame designations 184, 215, 256, 286, 326, 365, 405, 445 (NEMA)

Caution: Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.

In the case of assemblies on a common base, any lifting means 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. 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.

Accurate alignment of the motor with the driven equipment is extremely important. The pulley, sprocket, or gear used in the drive should be located on the shaft as close to the shaft shoulder as possible. If it is not possible to center the pulley, sprocket, or gear used in the drive, consult the drive or equipment manufacturer for recommendations on drive coupling and shaft alignment.

1. Direct Coupling

For direct drive, use flexible couplings if possible. Consult the drive or equipment manufacturer for more information. Mechanical vibration and roughness during operation may indicate poor alignment. Use dial indicators to check alignment. The space between coupling hubs should be maintained as recommended by the coupling manufacturer.

2. End-Play Adjustment

The axial position of the motor frame with respect to its load is also extremely important. The standard motor bearings are not designed for excessive external axial thrust loads. Improper adjustment will result in wear and premature bearing failure.

Before installing the motor frame, the gap between coupling hubs should be maintained as recommended by the coupling manufacturer. The space between coupling hubs should be maintained as recommended by the coupling manufacturer.

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Doweling & Bolting

After proper alignment is verified, dowel pins should be inserted through the motor feet into the foundation. This will maintain the correct motor position should motor removal be required. Borador/C0083 Reliance motors are designed for doweling.

1. Drill dowel holes in diagonally opposite motor feet in the locations provided.
2. Drill corresponding holes in the foundation.
3. Ream all holes.
4. Install proper fitting dowels.
5. Mounting bolts must be carefully tightened to prevent changes in alignment.

Use a flat washer and lock washer under each nut or bolt head to hold the motor feet secure. Flanged nuts or bolts may be used as an alternative to washers.

WARNING: Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions, should be permanently guarded to prevent accidental contact by personnel. Accidental contact with body parts or clothing can cause serious or fatal injury.

Guarding

Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions. This is particularly important where the parts have surface irregularities such as key ways 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 during normal service.

Grounding

In the USA consult the National Electrical Code, Article 430 for information on grounding of motors and 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. In non-USA locations consult the appropriate national or local code applicable.

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 there is an insulation in the stator windings, this is a solid and permanent metallic connection between the ground point and the frame. A ground conductor is attached to the neutral side of the transformer or generator. The neutral side does not carry current, so there is no potential difference between the ground point and the frame. The ground conductor is attached to the ground point by means of a copper strap or wire, and to the neutral side of the transformer or generator.

Power Connection

Motor and control wiring, overload protection, disconnects, accessories and grounding should conform to the National Electrical Code and local codes and practices.

For ExnA hazardous location motors, it is a specific condition of use that all terminations in a conduit box be fully insulated. Flying leads must be insulated with two full wraps of electrical grade insulating tape or heat shrink tubing.

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Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions. This is particularly important where the parts have surface irregularities such as key ways 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 during normal service.
For ease of making connections, an oversize conduit box is provided. Most conduit boxes are provided on some motors for accessories such as space heaters, RTD's etc.

**AC Power**

1. AC power is within ±10% of rated voltage with rated frequency.
2. AC power is within ±15% of rated frequency with rated voltage.
3. A combined variation in voltage and frequency of ±10% (sum of absolute values) of rated values, provided the frequency variation does not exceed ±5% of rated frequency.

**TD1 TD2**

Leads are equal to 2. Red/1-White leads, or 2. White/1-Red lead.

**Figure 2-3 Accessory Connections**

Performance with these voltages and frequency variations are shown in Figure 2-4. Any variation in voltage and frequency above 1% (sum of absolute values of rated values), on the control box, are safe for operation and will not damage the motor.

Winding RTD's are installed in windings (2) per phase.

Three thermistors are installed in windings and lead in series.

Leads are equal to 2. Red/1-White leads, or 2. White/1-Red lead.

The numbers should be tied together.

Figure 2-4 Rotation

All three phase motors are reversible. To reverse the direction of rotation, disconnect and lock out power and interchange any two of the three line leads for three phase motors. For single phase motors, check the connection diagram to determine if the motor is reversible and follow the connection instructions for lead numbers to be interchanged. Not all single phase motors are reversible.
Note: Main power leads for CE Marked Motors may be marked U, V, W – for standard configurations, please consult connection diagrams.
Initial Lubrication

Reliance Reliance motors are shipped from the factory with the bearings properly packed with grease. Additional lubrication is not required. All bearings are properly packed at the factory with the correct grade of grease. If the motor is to be stored for an extended period of time, the grease should be removed and replaced with the recommended grade of grease.

First Time Start Up

1. Be sure that all power to motor and accessories is off. Be sure the motor shaft is dismounted from the load and not cause mechanical rotation of the motor shaft.

2. Make sure that the mechanical insulation is secure. All bolts and nuts are tightened.

3. Inspect all electrical connections for proper termination, clearance, mechanical strength, and electrical continuity. Inspect all electrical connections for proper termination, clearance, mechanical strength, and electrical continuity.

4. Be sure all shipping materials and boxes (used) are removed from motor shaft.

5. Manually rotate the motor shaft to ensure that it rotates freely.

6. Verify that the motor is mounted in the correct position before applying power to the motor.

7. Make sure that the motor is mounted in the correct position before applying power to the motor.

8. If motor rotation is incorrect, be sure power is off and change the motor lead connections.

9. Momentarily apply power and check the direction of rotation of the motor shaft.

10. After 1 hour of operation, disconnect power and connect the lead to the motor shaft.

11. Verify all electrical connections and protective devices are retained. Ensure motor is properly ventilated.

12. After 1 hour of operation, disconnect power and connect the lead to the motor shaft.

13. Verify all electrical connections and protective devices are retained. Ensure motor is properly ventilated.

14. Start the motor and ensure operation is smooth without excessive vibration or noise.

15. Check the motor and ensure operation is smooth without excessive vibration or noise.

16. Verify that the motor is mounted in the correct position before applying power to the motor.

17. Make sure that the mechanical insulation is secure. All bolts and nuts are tightened.

18. Inspect all electrical connections for proper termination, clearance, mechanical strength, and electrical continuity. Inspect all electrical connections for proper termination, clearance, mechanical strength, and electrical continuity.

19. Be sure all shipping materials and boxes (used) are removed from motor shaft.

20. Manually rotate the motor shaft to ensure that it rotates freely.

21. Momentarily apply power and check the direction of rotation of the motor shaft.

22. If motor rotation is incorrect, be sure power is off and change the motor lead connections.

23. Start the motor and ensure operation is smooth without excessive vibration or noise.

24. After 1 hour of operation, disconnect power and connect the load to the motor shaft.

25. Verify all electrical connections and protective devices are retained. Ensure motor is properly ventilated.

26. Totally enclosed fan-cooled "XT" motors are normally equipped with automatic drains which may be left in place as received.
Coupled Start Up

This procedure assumes a coupled start up. Also, that the first time start procedure was successful.

1. Check the coupling and ensure that all guards and protective devices are installed.
2. Check that the coupling is properly aligned and not binding.
3. The first coupled start up should be with no load. Apply power and verify that the load is not transmitting excessive vibration back to the motor through the coupling or the foundation. Vibration should be at an acceptable level.
4. Run for approximately 1 hour with the driven equipment in an unloaded condition.

The equipment can now be loaded and operated within specified limits. Do not exceed the name plate ratings for amperes for steady continuous loads.

Jogging and Repeated Starts

Repeated starts and/or jogs of induction motors generally reduce the life of the motor winding insulation. A much greater amount of heat is produced by each acceleration or jog than by the same motor under full load. If it is necessary to repeatedly start or jog the motor, it is advisable to check the application with your local Baldor distributor or Baldor Service Center.

Heating

-Duty rating and maximum ambient temperature are stated on the motor name plate.

Class I Division 1 / Zone 1 (Explosion-proof or flameproof motors)

Baldor offers a range of motors suitable for installation in a Division 1 or Zone 1 environment. These motors are known as explosion proof or flameproof. Baldor/Reliance motors are typically designed to meet Class I (Division 1) Group C and D (explosion proof) or Ex d IIB (flameproof).

An application note regarding equipment applied in accordance with the US National Electric Code (NFPA) 70-2002 (according to Article 500.8(C) Marking, sub clause (2)) in the fine print note, it is noted that equipment not marked to indicate a division is suitable for both Division 1 and Division 2 locations. These motors are not gas tight. To the contrary, this protection concept assumes that due to the normal heating and cooling cycle of motor operation that any gas present will be drawn into the motor. Since explosion proof or explosion resistant motors are designed to contain the combustion and extinguish any flame transmission, the fit of these flameproof joints are designed to contain the combustion prior to it exiting the motor.

Protection Concepts

-Distribute the load of service centers.

Heating - Do not exceed the name plate. This is an assumption of the National Fire Protection Association. The application with your local distributor or service center is necessary to determine if there is an acceptable level.

An application note regarding equipment applied in accordance with the US National Electric Code (NFPA) 70-2002 (according to Article 500.8(C) Marking, sub clause (2)) in the fine print note, it is noted that equipment not marked to indicate a division is suitable for both Division 1 and Division 2 locations. These motors are not gas tight. To the contrary, this protection concept assumes that due to the normal heating and cooling cycle of motor operation that any gas present will be drawn into the motor. Since explosion proof or explosion resistant motors are designed to contain the combustion and extinguish any flame transmission, the fit of these flameproof joints are designed to contain the combustion prior to it exiting the motor.

Hazardous Locations

-Hazardous locations are those where there is a risk of ignition or explosion due to the presence of flammable or explosive gases. These locations are typically classified as follows:

Class I Division 1 / Zone 1 (Explosion-proof or flameproof motors)

Baldor offers a range of motors suitable for installation in a Division 1 or Zone 1 environment. These motors are known as explosion proof or flameproof. (Insert flameproof motor cut away drawing)

Motors that are explosion proof or flameproof use specially machined flameproof joints between the end bell or bracket and the frame, as well as along the rotating shaft and at connection box covers and entries. The fit of these flameproof joints are designed to contain the combustion prior to it exiting the motor. These flameproof joints have lengths and widths selected and tested based on the gas group present in the atmosphere. Baldor/Reliance motors are typically designed to meet Class I (Division 1) Group C and D (explosion proof) or Ex d IIB (flameproof).

An application note regarding equipment applied in accordance with the US National Electric Code (NFPA) 70-2002 (according to Article 500.8(C) Marking, sub clause (2)) in the fine print note, it is noted that equipment not marked to indicate a division is suitable for both Division 1 and Division 2 locations. These motors are not gas tight. To the contrary, this protection concept assumes that due to the normal heating and cooling cycle of motor operation that any gas present will be drawn into the motor. Since explosion proof or explosion resistant motors are designed to contain the combustion and extinguish any flame transmission, for this protection concept, only external surface temperatures are of concern. Thermal limiting devices such as thermostats, thermistors or RTDs may be provided on these motors to limit the external surface temperature during overload conditions.

For the protection concept, any external surface temperature exceeding the maximum expected operating temperature may provide an excessive risk of fire. Thermal limiting devices such as thermostats, thermistors or RTDs may be provided on these motors to limit the external surface temperature.
If thermostats are provided as a condition of certification, it is the installer's responsibility to make sure that these devices are properly connected to a suitable switching device. The ATEX directive requires that motor shutdown on thermal trip be accomplished without an intermediate software command.

Flameproof motors, internationally referred to as Ex d, use a protection concept similar to that used in Class I Division 1 motors, with minor differences in the flameproof joints and cable entry designs.

Flameproof and explosion proof motors are both type tested. Representative motors are connected to a reference gas and ignited in laboratory conditions to verify that the flame is not transmitted outside the motor enclosure and to determine the maximum internal pressure encountered.

Explosion proof and Flame proof motors shipped without a conduit box require use of a certified box of suitable dimensions and that is appropriate for the classification.

Class I Division 2 / Zone 2 Ex nA, [Equipment Protection Level (EPL) Gc]
This protection concept relies on having no sources of ignition present such as arcing parts or hot surfaces. For this protection concept, internal temperatures as well as external temperatures are considered. In many cases, the internal temperatures are higher than the external temperatures and therefore become the limiting factor in determination of temperature code designation. In these applications, it is very important to use a motor that has been evaluated thermally for use with an inverter or converter, if variable speed operation is desired. Thermostats used for Class I Division 2 and Ex nA motors are used to protect the motor only. For motors using flying lead construction, it is important to use connection lugs and insulate with heat shrink tubing or a double wrap of insulation grade electrical tape to avoid the risk of spark or ignition.

Class II Division 1 / Zone 21 [Equipment Group III, Equipment Protection Level (EPL) Db]
This area classification is one where the risk of ignitable concentrations of dust is present at all or some of the time. The protection concepts used for Class II Division 1 is similar to flamepath, except with additional dust exclusion paths designed for the rotating shaft. In the international designations, this concept is referred to as dust ignition proof or Ex tD. External surface temperature remains the limiting factor. Thermal limiting devices such as thermostats, thermistors or RTDs may be provided on these motors to limit the external surface temperature during overload conditions. If thermostats are provided as a condition of certification, it is the installer's responsibility to make sure that these devices are properly connected to a suitable switching device.

Note: In the North American area classification system, Class III exists for fibers and flyings. In the IEC designation, both dusts and flyings are absorbed into Group III.

Class II Division 2 / Zone 22 [Equipment Group III, Equipment Protection Level (EPL) Dc]
This area classification is one where the risk of exposure to ignitable concentrations of dust are not likely to occur under normal operating conditions and relies heavily on the housekeeping practices within the installation.

Sine Wave Power Operation for Division 1 or 2 and Zone 1 or 2 and Zone 21 or 22 Hazardous Location.

These motors are designed to operate at or below the maximum surface temperature (or T_{max}) stated on the nameplate. Failure to properly operate the motor can cause this maximum surface temperature to be exceeded. Operation of the motor must be at or below the nameplate value. Failure to operate the motor properly can cause the marked surface temperature to be exceeded. Operating the motor at any of the following conditions can cause the marked surface temperature to be exceeded.

1. Motor load exceeding service factor nameplate value
2. Ambient temperatures above nameplate value
3. Voltages above or below nameplate value
4. Unbalanced voltages
5. Loss of proper ventilation
6. Voltage above or below nameplate value
7. Severe duty cycles of repeated starts
8. Motor reversing
9. Motor reversing
10. Single phase operation of polyphase equipment
11. Excessive currents

Variable Frequency Power Operation for Division 1 or 2 and Zone 1 or 2 and Zone 21 or 22 Hazardous Location (motors with maximum surface temperature listed on the nameplate).

Only motors with nameplates marked for use on inverter (variable frequency) power, and labeled for specific hazardous areas may be used in those hazardous areas on inverter power. The motor is designed to operate at or below the maximum surface temperature (or T_{max}) stated on the nameplate. Failure to properly operate the motor can cause this maximum surface temperature to be exceeded.
If applied in a Division 1 or 2 / Zone 1 or 2 and Zone 21 or 22 environment, this excessive temperature may cause ignition of hazardous materials. Operating the motor at any of the following conditions can cause the marked surface temperature to be exceeded.

1. Motor load exceeding service factor nameplate value
2. Ambient temperature above nameplate value
3. Voltage (at each operating frequency) above or below rated nameplate value
4. Unbalanced voltages
5. Loss of proper ventilation
6. Operation outside of the nameplate speed / frequency range
7. Altitudes above 3300 feet / 1000 meters
8. Single phase operation of polyphase equipment
9. Multiple motors on same circuit
10. Lower than name plate minimum carrier frequency

Thermal Limiting

1. Loss of proper ventilation
2. Motor load exceeding service factor nameplate value
3. Voltage (at each operating frequency) above or below rated nameplate value
4. Unbalanced voltages
5. Loss of proper ventilation
6. Operation outside of the nameplate speed / frequency range
7. Altitudes above 3300 feet / 1000 meters
8. Single phase operation of polyphase equipment
9. Multiple motors on same circuit
10. Lower than name plate minimum carrier frequency

If applied in a Division 1 or 2 / Zone 1 or 2 and Zone 21 or 22 environment, this excessive temperature can...
WARNING: UL and EX Listed motors must only be serviced by UL or EX Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.

General Inspection

Inspect the motor at regular intervals, approximately every 500 hours of operation or every 3 months, whichever occurs first. Keep the motor clean and the ventilation openings clear. The following steps should be performed at each inspection:

1. Check that the motor is clean. Check that the interior and exterior of the motor is free of dirt, oil, grease, water, etc. Oily vapor, paper pulp, textile lint, etc. can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure.

2. Perform a dielectric with stand test periodically to ensure that the integrity of the winding insulation has been maintained. Record the readings. Immediately investigate any significant decrease in insulation resistance.

3. Check all electrical connectors to be sure that they are tight.

Relubrication & Bearings

Bearing grease will lose its lubricating ability over time, not suddenly. The lubricating ability of a grease over time depends primarily on the type of grease, the size of the bearing, the speed at which the bearing operates and the severity of the operating conditions. Good results can be obtained if the following recommendations are used in your maintenance program.

Type of Grease

A high grade ball or roller bearing grease should be used. Recommended grease for standard service conditions is Exxon Mobil Polyrex EM. Do not mix greases unless compatibility has been checked and verified.

Ball Bearing Motors

<table>
<thead>
<tr>
<th>Type of Grease</th>
<th>Bearing Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exxon Mobil Polyrex EM</td>
<td>-25°C (-15°F) to 50°C (120°F)</td>
</tr>
</tbody>
</table>

Roller Bearing Motors

<table>
<thead>
<tr>
<th>Type of Grease</th>
<th>Bearing Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exxon Mobil Polyrex EM</td>
<td>-25°C (-15°F) to 50°C (120°F)</td>
</tr>
</tbody>
</table>

WARNING: Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.
Relubrication Intervals

Recommended relubrication intervals are shown in Table 3-2. It is important to realize that the recommended intervals of Table 3-2 are based on average use. For best relubrication results, only use the appropriate amount of grease for each bearing size (not the same for both).

<table>
<thead>
<tr>
<th>NEMA / (IEC) Frame Size</th>
<th>Rated Speed - RPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 210 incl. (132)</td>
<td>2700 Hrs.</td>
</tr>
<tr>
<td></td>
<td>5500 Hrs.</td>
</tr>
<tr>
<td></td>
<td>12000 Hrs.</td>
</tr>
<tr>
<td></td>
<td>18000 Hrs.</td>
</tr>
<tr>
<td>Over 210 to 280 incl. (180)</td>
<td>3600 Hrs.</td>
</tr>
<tr>
<td>Over 280 to 360 incl. (225)</td>
<td>2200 Hrs.</td>
</tr>
<tr>
<td>Over 360 to 449 incl. (315)</td>
<td>2200 Hrs.</td>
</tr>
</tbody>
</table>

* Relubrication intervals are for ball bearings.

For vertically mounted motors and roller bearings, divide the relubrication interval by 2.

** For motors operating at speeds greater than 3600 RPM, contact Baldor for relubrication recommendations.

Table 3-3 Service Conditions

<table>
<thead>
<tr>
<th>Severity of Service</th>
<th>Hours per day of Operation</th>
<th>Ambient Temperature</th>
<th>Atmospheric Contamination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>8</td>
<td>&lt;= 40°C</td>
<td>Clean, Little Corrosion</td>
</tr>
<tr>
<td>Severe</td>
<td>16</td>
<td>&gt; 40°C</td>
<td>Moderate dirt, Corrosion</td>
</tr>
<tr>
<td>Extreme</td>
<td>16</td>
<td>&gt; 50°C or Class H Insulation</td>
<td>Severe dirt, Abrasive dust, Corrosion, Heavy</td>
</tr>
<tr>
<td>Low Temperature</td>
<td>16</td>
<td>&lt;= -29°C</td>
<td>** Special high temperature grease is recommended (Dow Corning DC44). Note that Dow Corning DC44 grease does not mix with other grease types. Thoroughly clean bearing &amp; cavity before adding grease. ** Special low temperature grease is recommended (Grease 7).</td>
</tr>
</tbody>
</table>

Table 3-4 Relubrication Interval Multiplier

<table>
<thead>
<tr>
<th>Severity of Service</th>
<th>Multiplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>1.0</td>
</tr>
<tr>
<td>Severe</td>
<td>0.5</td>
</tr>
<tr>
<td>Extreme</td>
<td>0.1</td>
</tr>
<tr>
<td>Low Temperature</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Some motor designs use different bearings on each motor end. This is normally indicated on the motor nameplate. For best relubrication results, only use the appropriate amount of grease for each bearing size (not the same for both).
### Table 3-5  Bearings Sizes and Types

<table>
<thead>
<tr>
<th>Frame Size</th>
<th>NEMA (IEC)</th>
<th>Bearing Description</th>
<th>Weight of Grease to add *</th>
<th>Volume of grease to be added</th>
</tr>
</thead>
<tbody>
<tr>
<td>56 to 140 (90)</td>
<td>6203</td>
<td>0.15 (3.9)</td>
<td>0.2</td>
<td>0.8</td>
</tr>
<tr>
<td>140 (90)</td>
<td>6205</td>
<td>0.15 (3.9)</td>
<td>0.2</td>
<td>0.8</td>
</tr>
<tr>
<td>180 (100−112)</td>
<td>6206</td>
<td>0.19 (5.0)</td>
<td>0.3</td>
<td>1.0</td>
</tr>
<tr>
<td>210 (132)</td>
<td>6307</td>
<td>0.30 (8.4)</td>
<td>0.6</td>
<td>2.0</td>
</tr>
<tr>
<td>250 (160)</td>
<td>6309</td>
<td>0.47 (12.5)</td>
<td>0.7</td>
<td>2.5</td>
</tr>
<tr>
<td>280 (180)</td>
<td>6311</td>
<td>0.61 (17)</td>
<td>1.2</td>
<td>3.9</td>
</tr>
<tr>
<td>320 (200)</td>
<td>6312</td>
<td>0.76 (20.1)</td>
<td>1.2</td>
<td>4.0</td>
</tr>
<tr>
<td>360 (225)</td>
<td>6313</td>
<td>0.81 (23)</td>
<td>1.5</td>
<td>5.2</td>
</tr>
<tr>
<td>400 (250)</td>
<td>6316</td>
<td>1.25 (33)</td>
<td>2.0</td>
<td>6.6</td>
</tr>
<tr>
<td>440 (280)</td>
<td>6319</td>
<td>2.12 (60)</td>
<td>4.1</td>
<td>13.4</td>
</tr>
<tr>
<td>5000 to 5800 (315−450)</td>
<td>6328</td>
<td>4.70 (130)</td>
<td>9.2</td>
<td>30.0</td>
</tr>
</tbody>
</table>

* Weight in grams = 0.005 DB of grease to be added

Note: Not all bearing sizes are listed. For intermediate bearing sizes, use the grease volume for the next larger size bearing.

For AC Induction Servo:

<table>
<thead>
<tr>
<th>Frame Size</th>
<th>NEMA (IEC)</th>
<th>Bearing Description</th>
<th>Weight of Grease to add *</th>
<th>Volume of grease to be added</th>
</tr>
</thead>
<tbody>
<tr>
<td>76 Frame 180 (112)</td>
<td>6207</td>
<td>0.22 (6.1)</td>
<td>0.44</td>
<td>1.4</td>
</tr>
<tr>
<td>77 Frame 210 (132)</td>
<td>6210</td>
<td>0.32 (9.0)</td>
<td>0.64</td>
<td>2.1</td>
</tr>
<tr>
<td>80 Frame 250 (160)</td>
<td>6213</td>
<td>0.49 (14.0)</td>
<td>0.99</td>
<td>3.3</td>
</tr>
</tbody>
</table>

These are the "large" bearings (shaft end) in each frame size.

---

**Table 3-5**  Bearings Sizes and Types

- **Frame Size**: The size of the frame for the motor.
- **Bearing Description**: Description of the bearing being used.
- **Weight of Grease to add ***: The weight of grease in grams to be added.
- **Volume of grease to be added**: The volume of grease in teaspoons to be added.

*Note: DB = Desired Bearing.*
Caution: To avoid damage to motor bearings, grease must be kept free of dirt. For an extremely dirty
environment, consult your Baldor distributor or an authorized Baldor Service Center. For additional
information, consult your Baldor distributor or an authorized Baldor Service Center.

**Relubrication Procedure**

**With Grease Outlet Plug**

1. With the motor stopped, clean all grease fittings with a clean cloth.
2. Remove grease outlet plug.
3. Add recommended amount of grease to bearing and bearing cavity. (Bearing should be about 1/3
full of grease and outboard bearing cavity should be about 1/2 full of grease.)
4. Operate the motor for 15 minutes with grease plug removed.
5. Re-install grease outlet plug.
6. This allows excess grease to purge.

**Without Grease Provisions**

Note: Only a Baldor authorized and UL or CSA certified service center can disassemble a UL/CSA listed
explosion proof motor to maintain its UL/CSA listing.

1. Disassemble the motor.
2. Add recommended amount of grease to bearing and bearing cavity. (Bearing should be about 1/3
full of grease and outboard bearing cavity should be about 1/2 full of grease.)
3. Assemble the motor.
4. Operate the motor for 15 minutes with grease plug removed.
5. Remove grease outlet plug.
6. This allows excess grease to purge.

**Sample Relubrication Determination**

Assume - NEMA 286T (IEC 180), 1750 RPM motor driving an exhaust fan in an ambient temperature of
43°C and the atmosphere is moderately corrosive.

1. Table 3-2 lists 9500 hours for standard conditions.
2. Table 3-3 classifies severity of service as "Severe".
3. Table 3-5 shows that 1.2 in 3 or 3.9 teaspoon of grease is to be added.
4. Table 3-2 lists 9500 hours for standard conditions.
5. Table 3-3 classifies severity of service as "Severe".
6. Table 3-5 shows that 1.2 in 3 or 3.9 teaspoon of grease is to be added.

Note: Smaller bearings in same category may require reduced amount of grease.

Note: Only a Baldor authorized and UL or CSA certified service center can disassemble a UL/CSA listed
explosion proof motor to maintain its UL/CSA listing.

Caution: Do not over-lubricate motor as this may cause premature bearing failure.

Caution: To avoid damage to motor bearings, grease must be kept free of dirt. For extremely dirty
environment, consult your Baldor distributor or an authorized Baldor Service Center. For additional
information, consult your Baldor distributor or an authorized Baldor Service Center.

Relubrication Procedure:

1. With the motor stopped, clean all grease fittings with a clean cloth.
2. Remove grease outlet plug.
3. Add recommended amount of grease to bearing and bearing cavity. (Bearing should be about 1/3
full of grease and outboard bearing cavity should be about 1/2 full of grease.)
4. Operate the motor for 15 minutes with grease plug removed.
5. Re-install grease outlet plug.
6. This allows excess grease to purge.

Caution: Over-lubricating can cause excessive bearing temperatures, premature lubrication breakdown
and bearing failure.

Note: Smaller bearings in same category may require reduced amount of grease.
## Table 3-6: Troubleshooting Chart

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Causes</th>
<th>Possible Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor will not start</td>
<td>Usually caused by line trouble, such as, single phasing at the starter.</td>
<td>Check source of power. Check overloads, fuses, controls, etc.</td>
</tr>
<tr>
<td>Excessive humming</td>
<td>High Voltage.</td>
<td>Check input line connections. Eccentric air gap. Have motor serviced at local Baldor service center.</td>
</tr>
<tr>
<td>Motor Over Heating</td>
<td>Overload. Compare actual amps (measured) with nameplate rating.</td>
<td>Locate and remove source of excessive friction in motor or load. Reduce load or replace with motor of greater capacity. Single Phasing. Check current at all phases (should be approximately equal) to isolate and correct the problem. Improper ventilation. Check external cooling fan to be sure air is moving properly. Insufficient ventilation. Open stator windings as field phases for over voltage of under voltage.</td>
</tr>
<tr>
<td>Vibration</td>
<td>Misalignment.</td>
<td>Check and align motor and driven equipment. Excessive belt tension. Reduce belt tension to proper point for load. Excessive end thrust. Reduce the end thrust from driven machine. Excessive grease in bearing. Remove grease until cavity is approximately 3/4 filled. Insufficient grease in bearing. Add grease until cavity is approximately 3/4 filled.</td>
</tr>
<tr>
<td>Growling or whining</td>
<td>Single Phasing.</td>
<td>Check and align motor and driven equipment. Press or bearing. Check insulation integrity. Clean ventilation openings.</td>
</tr>
<tr>
<td>Tightening</td>
<td>Improper connections.</td>
<td>Refer to motor lead connection diagram.</td>
</tr>
<tr>
<td>Poor alignment</td>
<td>Check electrical connections for proper alignment.</td>
<td>Check and align motor and driven equipment.</td>
</tr>
<tr>
<td>Bad Bearing</td>
<td>Bearing Over Heating</td>
<td>Check and align motor and driven equipment.</td>
</tr>
<tr>
<td>Overheating</td>
<td>Improper connections.</td>
<td>Refer to motor lead connection diagram.</td>
</tr>
<tr>
<td>Insufficient cooling</td>
<td>Overheating of windings.</td>
<td>Check and align motor and driven equipment.</td>
</tr>
<tr>
<td>Overload</td>
<td>Improper connections.</td>
<td>Refer to motor lead connection diagram.</td>
</tr>
<tr>
<td>Improper voltage</td>
<td>Over voltage of under voltage.</td>
<td>Check and align motor and driven equipment.</td>
</tr>
<tr>
<td>High Voltage</td>
<td>Improper connections.</td>
<td>Refer to motor lead connection diagram.</td>
</tr>
<tr>
<td>Motor Over Heating</td>
<td>Improper connections.</td>
<td>Refer to motor lead connection diagram.</td>
</tr>
<tr>
<td>Vibration</td>
<td>Improper connections.</td>
<td>Refer to motor lead connection diagram.</td>
</tr>
<tr>
<td>Noise</td>
<td>Improper connections.</td>
<td>Refer to motor lead connection diagram.</td>
</tr>
<tr>
<td>Growling or whining</td>
<td>Improper connections.</td>
<td>Refer to motor lead connection diagram.</td>
</tr>
<tr>
<td>Tightening</td>
<td>Improper connections.</td>
<td>Refer to motor lead connection diagram.</td>
</tr>
<tr>
<td>Poor alignment</td>
<td>Improper connections.</td>
<td>Refer to motor lead connection diagram.</td>
</tr>
<tr>
<td>Bad Bearing</td>
<td>Improper connections.</td>
<td>Refer to motor lead connection diagram.</td>
</tr>
<tr>
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<td>Over voltage of under voltage.</td>
<td>Check and align motor and driven equipment.</td>
</tr>
</tbody>
</table>
Suggested bearing and winding RTD setting guidelines for Non-Hazardous Locations ONLY

Most large frame AC Baldor motors with a 1.15 service factor are designed to operate below a Class B (80°C) temperature rise at rated load and are built with a Class H winding insulation system. Based on this low temperature rise, RTD (Resistance Temperature Detectors) settings for Class B rise should be used as a starting point. Some motors with a 1.0 service factor have Class F temperature rise.

The following tables show the suggested alarm and trip settings for RTDs. Proper bearing and winding RTD alarm and trip settings should be selected based on these tables unless otherwise specified for specific applications.

If the driven load is found to operate well below the initial temperature settings under normal conditions, the alarm and trip settings may be reduced so that an abnormal machine load will be identified.

The temperature limits are based on the installation of the winding RTDs imbedded in the winding as specified by NEMA. Bearing RTDs should be installed so they are in contact with the outer race on ball or roller bearings or in direct contact with the sleeve bearing shell.

### Winding RTDs - Temperature Limit In °C (40°C Maximum Ambient)

<table>
<thead>
<tr>
<th>Motor Load</th>
<th>Class B Temp Rise °C (Typical Design)</th>
<th>Class F Temp Rise °C</th>
<th>Class H Temp Rise °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm</td>
<td>130</td>
<td>140</td>
<td>155</td>
</tr>
<tr>
<td>Trip</td>
<td>140</td>
<td>150</td>
<td>160</td>
</tr>
<tr>
<td></td>
<td>Rated Load to 1.15 S.F.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alarm</td>
<td>140</td>
<td>150</td>
<td>160</td>
</tr>
<tr>
<td>Trip</td>
<td>165</td>
<td>180</td>
<td>185</td>
</tr>
</tbody>
</table>

#### Bearing RTDs - Temperature Limit In °C (40°C Maximum Ambient)

<table>
<thead>
<tr>
<th>Bearing Type</th>
<th>Alarm °C</th>
<th>Trip °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard*</td>
<td>95</td>
<td>100</td>
</tr>
<tr>
<td>High Temperature**</td>
<td>110</td>
<td>115</td>
</tr>
</tbody>
</table>

#### Note:
- Bearing and winding RTD settings are for standard design motors operating at rated load.
- When Class H temperatures are used, consider bearing temperatures and relubrication requirements.
- **High temperature lubricants include some special synthetic oils and greases.
-** Bearing temperature limits are for standard design motors operating at rated load.

~ Winding RTDs are factory production installed, not from ModExpress.

**When Class H temperatures are used, consider bearing temperatures and relubrication requirements.

#### Winding RTD - Temperature Limit In °C (40°C Maximum Ambient)

<table>
<thead>
<tr>
<th>Class H Temp Rise °C (Typical Design)</th>
<th>Alarm °C</th>
<th>Trip °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class F Temp Rise &gt; 105°C</td>
<td>115</td>
<td>120</td>
</tr>
</tbody>
</table>

#### Note:
- Winding RTDs must be factory production installed, not from ModExpress.

- **High temperature lubricants include some special synthetic oils and greases.
-** Bearing temperature limits are for standard design motors operating at rated load.

- When Class H temperatures are used, consider bearing temperatures and relubrication requirements.
- **High temperature lubricants include some special synthetic oils and greases.
-** Bearing temperature limits are for standard design motors operating at rated load.

#### Special Application:
- RTD alarms and settings should be selected based on these tables unless otherwise specified for specific applications.
- The following limits show the suggested alarm and settings for RTDs. Proper bearing and winding RTD setting guidelines for Non-Hazardous Locations ONLY.

- Contact Baldor application engineering for special lubricants or further clarifications.

---

Suggested bearing and winding RTD setting guidelines for Non-Hazardous Locations ONLY.
GENERAL

A copy of the Motor and Generator Code, NFPA 70, is available from the National Fire Protection Association. The user must follow the provisions of the code for the particular application. The motor must be installed in accordance with the National Electrical Code. In making connections, the installer should make certain that the connections are properly marked. The wiring, fusing and grounding must comply with the National Electrical Code or the applicable local codes. The user must select a motor starter and overcurrent protection suitable for this motor and its application. Consult the motor starter application data as well as the National Electrical Code and/or applicable local codes. Special motors for use in indoor and outdoor locations are indicated by a National Recognition Testing Laboratory Certification mark and the nameplate rating. These motors are intended only for installation in hazardous locations as described in Article 500 of the NEC. Refer to MN408 for more details.

WARNING: Be sure the system is properly grounded before applying power to the motor. Electrical shock can cause serious or fatal injury.

TESTING

The user must test the motor as shown in the connection diagrams. If this motor is installed as part of a motor control drive system, connect and protect the motor according to the control specifications, master plans, etc. Refer to the applicable master plans and specifications involved.

AC & DC MOTOR INSTALLATION & MAINTENANCE

The user must follow the provisions of the motor and generator code for the particular application. The motor must be installed in accordance with the National Electrical Code. In making connections, the installer should make certain that the connections are properly marked. The wiring, fusing and grounding must comply with the National Electrical Code or the applicable local codes. The user must select a motor starter and overcurrent protection suitable for this motor and its application. Consult the motor starter application data as well as the National Electrical Code and/or applicable local codes. Special motors for use in indoor and outdoor locations are indicated by a National Recognition Testing Laboratory Certification mark and the nameplate rating. These motors are intended only for installation in hazardous locations as described in Article 500 of the NEC. Refer to MN408 for more details.

WARNING: Be sure the system is properly grounded before applying power to the motor. Electrical shock can cause serious or fatal injury.

TESTING

The user must test the motor as shown in the connection diagrams. If this motor is installed as part of a motor control drive system, connect and protect the motor according to the control specifications, master plans, etc. Refer to the applicable master plans and specifications involved.
INSPECTION

Before connecting the motor to an electrical supply inspect for damage. The shaft must be inspected for runout to ensure freedom from vibration. Motor leads must be isolated and locked out before the shaft will turn freely on permanent magnet motors.

WARNING: Do not touch electrical connections before disconnected. Electrical shock can cause serious or fatal injury.

Maintenance Procedures

LUBRICATION INFORMATION

Lubrication Information

This is a ball or roller bearing motor. The bearings have been factory lubricated for the normal life of the motor. New motors that have been stored for a year or more should be relubricated. Lubrication is also recommended at these intervals.

Relubrication Intervals

Relubrication intervals are factory lubricated for the normal life of the motor. New motors that have been stored for a year or more should be relubricated. Lubrication is also recommended at these intervals.

Lubricant

Baldor motors are prelubricated normally with Mobil Polyrex EM unless stated on nameplate. Do not mix lubricants due to possible incompatibility. Look for signs of lubricant incompatibility such as extreme soupiness visible from grease relief, or along the shaft opening.

For Washdown and totally enclosed, fan cooled or non-ventilated motors, the plugs in the lowest portion of the endplates for various motor mounting configurations. Condensation drain plugs are provided at four points on each endplate for various motor mounting configurations. All drains are designed to allow drainage of any water that may collect in the motor. This guard must prevent personnel from coming in contact with any moving parts of the motor or drive and lockout power and interchange any two of the three AC power leads for two-phase four wire, disconnect and lockout power and interchange the AC line leads on any for three phase motors. For two-phase three wire, disconnect and lockout power and interchange phase one and phase two AC line one phase. For two phase three wire, disconnect and lockout power and interchange phase one and phase two AC line leads.

WARNING: Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft plates or lids, must be installed before operating the motor. Brush inspection plates and electrical connection cover safeguards for personnel in case of brake failure.

If a motor mounted brake is installed, provide proper alignment, bolt motor securely in place. Use shim to fill any unevenness in the foundation. Motor feet should sit solidly on the foundation before mounting bolts are tightened.

Mount the motor on a foundation sufficiently rigid to prevent excessive vibration. Grease lubricated ball bearing motors may be mounted with the feet at any angle. After careful check with local Baldor representative for recommendations.

For special temperature applications, consult your Baldor District Office.

LUBRICATION PROCEDURE

Lubrication procedure is as follows:

1. Select service condition from Table 1.
2. Select lubrication frequency from Table 2.
3. Add the recommended volume of lubricant in the grease inlet plug area of the motor.
4. Replace the grease inlet plug and run the motor for two hours.
5. Replace the grease drain plug.

Lubrication Instructions

Cleanliness is important in lubrication. Any grease used to lubricate friction bearings should be free from contamination. Properly clean the grease inlet area of the motor before operating the motor.

Lubrication oil incompatibility, such as extreme soupiness visible from grease relief, or along the shaft opening.

For Washdown and totally enclosed, fan cooled or non-ventilated motors, the plugs in the lowest portion of the endplates for various motor mounting configurations. Condensation drain plugs are provided at four points on each endplate for various motor mounting configurations. All drains are designed to allow drainage of any water that may collect in the motor. This guard must prevent personnel from coming in contact with any moving parts of the motor or drive and lockout power and interchange any two of the three AC power leads for two-phase four wire, disconnect and lockout power and interchange phase one and phase two AC line leads.

WARNING: Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft plates or lids, must be installed before operating the motor. Brush inspection plates and electrical connection cover safeguards for personnel in case of brake failure.

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Lubrication oil incompatibility, such as extreme soupiness visible from grease relief, or along the shaft opening.
### Table 1  Service Conditions

<table>
<thead>
<tr>
<th>Severity of Service</th>
<th>Ambient Temperature</th>
<th>Atmospheric Contamination</th>
<th>Type of Bearing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>40 °C (104 °F)</td>
<td>Clean, Little Corrosion</td>
<td>Deep Groove Ball Bearing</td>
</tr>
<tr>
<td>Severe</td>
<td>50 °C (122 °F)</td>
<td>Moderate dirt, Corrosion</td>
<td>Deep Groove Ball Bearing</td>
</tr>
<tr>
<td>Extreme</td>
<td>&gt;50 °C</td>
<td>Severe dirt, Abrasive dust, Corrosion</td>
<td>All Bearings</td>
</tr>
</tbody>
</table>

* Special high temperature grease is recommended. ** Special low temperature grease is recommended.

### Table 2 Lubrication Frequency (Ball Bearings)

<table>
<thead>
<tr>
<th>NEMA / (IEC) Frame Size</th>
<th>Rated Speed - RPM</th>
<th>Up to 210 incl. (132)</th>
<th>2700 Hrs.</th>
<th>5500 Hrs.</th>
<th>12000 Hrs.</th>
<th>18000 Hrs.</th>
<th>22000 Hrs.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1000</td>
<td>900</td>
<td>600</td>
<td>300</td>
<td>000</td>
<td>000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Over 350 to 5000 HP. (600)</td>
<td>Over 350 to 5000 HP. (600)</td>
<td>Over 350 to 5000 HP. (600)</td>
<td>Over 350 to 5000 HP. (600)</td>
<td>Over 350 to 5000 HP. (600)</td>
<td>Over 350 to 5000 HP. (600)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Over 50 to 100 HP. (180)</td>
<td>Over 50 to 100 HP. (180)</td>
<td>Over 50 to 100 HP. (180)</td>
<td>Over 50 to 100 HP. (180)</td>
<td>Over 50 to 100 HP. (180)</td>
<td>Over 50 to 100 HP. (180)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>U.P. to 210 HP. (132)</td>
<td>U.P. to 210 HP. (132)</td>
<td>U.P. to 210 HP. (132)</td>
<td>U.P. to 210 HP. (132)</td>
<td>U.P. to 210 HP. (132)</td>
<td>U.P. to 210 HP. (132)</td>
</tr>
</tbody>
</table>

\[ \text{Weight in grams} = 0.005 \times \text{DB} \]

### Table 3 Lubrication Interval Multiplier

<table>
<thead>
<tr>
<th>Severity of Service</th>
<th>Multiplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>1.0</td>
</tr>
<tr>
<td>Severe</td>
<td>0.5</td>
</tr>
<tr>
<td>Extreme</td>
<td>0.1</td>
</tr>
</tbody>
</table>

### Table 4 Amount of Grease to Add

<table>
<thead>
<tr>
<th>Frame Size NEMA (IEC)</th>
<th>Bearing Description (Largest bearing in each frame size)</th>
<th>OD</th>
<th>ID</th>
<th>Width</th>
<th>Weight of grease to add</th>
<th>Volume of grease to add</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bearing Description (Largest bearing in each frame size)</td>
<td>206</td>
<td>203</td>
<td>28</td>
<td>0.30 (8.4)</td>
<td>0.6</td>
</tr>
<tr>
<td></td>
<td>Bearing Description (Largest bearing in each frame size)</td>
<td>210</td>
<td>207</td>
<td>30</td>
<td>0.61 (17.4)</td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td>Bearing Description (Largest bearing in each frame size)</td>
<td>215</td>
<td>212</td>
<td>35</td>
<td>0.81 (23.1)</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>Bearing Description (Largest bearing in each frame size)</td>
<td>220</td>
<td>217</td>
<td>40</td>
<td>0.81 (23.1)</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>Bearing Description (Largest bearing in each frame size)</td>
<td>225</td>
<td>222</td>
<td>45</td>
<td>2.12 (60.0)</td>
<td>4.1</td>
</tr>
</tbody>
</table>

* Weight in grams = 0.005 DB
Typical IEC vs NEMA Lead Marking

Single Phase Non-Reversible

Refer to the connection diagram provided on the Baldor motor.

U1(T1)
U2(T4)

Main Winding

Auxiliary Winding

Z1(T8) Z2(T5)

Single Phase Reversible

U1(T1)
U2(T4)

Main Winding

Auxiliary Winding

Z1(T8) Z2(T5)

U3(T3)
U4(T4)

Dual Voltage Reversible

U1(T1)
U2(T2)

Main Winding

Auxiliary Winding

Z1(T8) Z2(T5)

U3(T3)
U4(T4)
U5(T6)
U6(T9)

Three Phase

For single winding 3 phase motors, lead markings can be directly translated between IEC and NEMA designations.

For these motors, the lead markings are:

U1=T1 U2=T4 U3=T7 U4=T10
V1=T2 V2=T5 V3=T8 V4=T11
W1=T3 W2=T6 W3=T9 W4=T12

Refer to the connection diagram provided on the Baldor motor.

Some examples are as follows:

Three Leads

U(T1)
W(T3)
V(T2)

WYE Connection

U(T1)
W(T3)
V(T2)

DELTA Connection

W2(T6) W1(T3)
V2(T5) V1(T2)
W1(T3) W2(T6)

DELTA-WYE Connection

U2(T4)
V2(T5)
W2(T6)

WYE-DELTA Connection

U2(T4)
V2(T5)
W2(T6)

W1(T3) U2(T4)
V1(T2) W2(T6)

Low Volts/Run High Volts/Start

DC Motors

Lead markings can be translated between IEC and NEMA designations as follows:

Armature

Series Field

Shunt Field

NEMA
A1, A2
S2, S2
F1, F2

IEC
A1, A2
D1, D2
E1, E2

Refer to the connection diagram provided on the Baldor motor.

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