RM-310

Installation, Operation and Maintenance Instructions

DYNAMIC PULLEY SEPARATOR

ERIEZ HEADQUARTERS: 2200 ASBURY ROAD, ERIE, PA 16506–1402 U.S.A.
GLOBAL LEADER IN SEPARATION TECHNOLOGIES

Introduction

This manual details the proper steps for installing, operating and maintaining the Dynamic Pulley Separator.

Careful attention to these requirements will assure the most efficient and dependable performance of this equipment.

If there are any questions or comments about the manual, please call Eriez at 814-835-6000 for assistance.

⚠ CAUTION

Safety labels must be affixed to this product. Should the safety label(s) be damaged, dislodged or removed, contact Eriez for replacement.

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DYNAMIC PULLEY SEPARATOR

General

Please read and understand the cautions in the adjacent column before installing or operating your Eriez Dynamic Pulley Separator (DPS). Please make sure that all personnel who will come into contact with this equipment are aware of these cautions. Please contact Eriez for additional assistance in the installation, operation, or maintenance of this equipment, as well as for application advice.

⚠ CAUTION: ROTATING MACHINERY

As with all equipment involving rotating parts and moving belts, there is potential for property damage or serious personal injury if not treated with caution during all installation and maintenance procedures. Equipment should be switched off and locked out during all procedures that involve contact with the machine. Avoid pinch points between belt and pulleys. Never operate with drive guards removed.

⚠ CAUTION: STRONG MAGNET

The Dynamic Pulley Separator (DPS) incorporates exceptionally powerful magnetic circuits. Steel, iron tools, and other objects may be attracted suddenly and strongly to the magnet, creating the risk of serious pinch-type injuries. Keep all mild steel, iron tools, and equipment well away from the magnetic pulley at all times. Avoid situations in which hands, fingers, or other body parts could become trapped between a steel or iron object and the magnetic pulley. Personnel using heart pacemakers should not service or operate this equipment. Such personnel should remain at least 3 feet (1 meter) from the magnet at all times.

Description of Equipment

Principles of Operation

The DPS is a strong magnetic pulley with an agitating magnetic field. Customer will install a non-ferrous splitter. Moving the non-ferrous splitter closer to the DPS or increasing the belt speed will increase the material thrown over the non-ferrous splitter. The reverse adjustments will decrease the material thrown over the non-ferrous splitter.

The magnetic fraction will cling to the pulley and will be pulled under the pulley and the non-magnetic material will follow its natural trajectory. The magnetic element inside the DPS rotates at a slower speed than the belt with the rotational differential carefully controlled.

This separate magnet rotation causes the magnetic particulates to roll down towards the bottom of the pulley, a phenomenon long exploited to separate fine magnetic material from fine powders. The rolling action helps pull ferrous material from non-magnetic material that might be entangled with it. Too little differential in rotation will limit the separation of entangled material and make the final ferrous concentrate less pure. Too much differential will increase the horsepower requirements unreasonably with little or no gain in purity.

The belt speed of the DPS controls the centrifugal separation. High speeds will tend to throw off all but the most magnetic material. Low speeds will tend to pull more weakly magnetic material under the pulley.

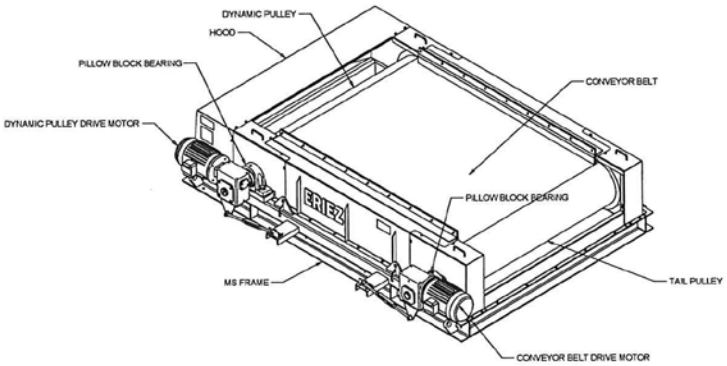
The DPS belt speed not only controls both the ferrous and non-ferrous fractions, it also controls the quality of those separations. Slow belt speeds will cause the feed to pile up thicker and will decrease the likelihood of separation of components. Fast belt speeds thin the burden and improve the likelihood of complete separation. These conflicting requirements seem to be met best at a belt speed of about 575 feet per minute (3 meters per second) but will vary with the incoming feed.

Feed and Operating Speed

The Dynamic Pulley Separator requires a high belt speed approximately 575 feet per minute (3 meters per second), a slower speed causes the material to build up and decrease the separation. The pulley speed is slower and based on the conveyor belt speed. A 100 feet per minute differential is recommended between the conveyor belt and pulley. If the differential is too little the ferrous concentrate will be less pure.

Construction

An outline drawing of your Dynamic Pulley Separator is provided with this manual, and/or attached to the equipment itself. This should be reviewed carefully for special features not covered in the following discussion.



Overall Assembly
The Dynamic Pulley Separator consists of a 14" (356 mm) diameter dynamic pulley and a 14" (356 mm) diameter tail pulley mounted on a mild steel frame with a hood. The tail pulley is supported on bearings mounted to a support. Belt tension is adjusted by increasing or decreasing the belt tension bolts at the rear corners of the belt on the tail pulley.

Conveyor Belt
The standard belt supplied with this unit is a 0.125" (3.18 mm) thick urethane belt with sidewalls.

Belt Tensioner
The belt tensioner consists of belt tension bolts located on pillow blocks on either side of the tail pulley. The tension of the belt is adjusted by increasing or decreasing the belt tension bolts at the rear corner of the belt.

Drive
The dynamic pulley and the conveyor belt are both driven by a reduction worm gear motor. One motor is connected directly to the dynamic pulley shaft and the other motor is attached to the tail pulley shaft. Both motors are attached to the support structure by a torque arm. The motor is “inverter duty” to handle a variable frequency control.

Splitter
The splitter is supplied and mounted by the customer. Remember it needs to be stainless steel or aluminum.

Installation

The unit has been fully assembled, adjusted, and tested at the factory prior to shipment. Use care when transporting and uncrating to avoid damage to the equipment. Also, take note of the cautions presented in the introduction to this manual. These precautions should be made known to all operating and maintenance personnel involved with this equipment. When moving the components, use the lift lugs provided. Use a substantial spreader bar to avoid damaging the conveyor frames, belts etc. If moving an entire system mounted on a common frame, only use the common frame lift lugs to move and install the equipment. Make lifts as level as possible.

Alignment and Level Requirements
When preparing to bolt the frames in the installation, shims should be used to ensure that the frame is sitting on a firm surface. The Dynamic Pulley Separator should be level and square. If necessary, adjust for level and square with shims beneath the frame at each vertical foundation support location. Do not pull bolts to frame by tightening, but shim from mounting surface to each leg to prevent twisting of the frame when hold down bolts are tightened. Avoid damaging the equipment during installation.

Clearances
Sufficient clearance must be allowed to replace the belt when necessary.

Electrical Connections
The Dynamic Pulley Separator has two motors requiring 460 VAC 60 Hz three phase power. Customer will supply a control that will require variable frequency controllers to set the conveyor belt speed and pulley RPM.

Belt Rotation Direction
After making electrical connections, start the roll at low speed and verify correct pulley and belt rotation direction. Correct electrical polarity if necessary.

Belt Tracking and Tension
Observe the unit operating at low speed long enough to be certain that the belt tracking has not been disturbed by shipping and installation. If the belt needs to be re-tracked, refer to the section on Maintenance - Belt Tracking, below.

Adjust the speed to the desired operating speed and observe the belt motion carefully to be certain that it continues to track properly.

Operation

Prior to Operation
Prior to operating the Dynamic Pulley Separator at any time, the following conditions should be checked.

Belt Alignment
If a belt is significantly misaligned, follow the directions in the Maintenance section below to restore alignment before operating the separator.

Belt Wear
If any belt is worn excessively, replace it, following the procedure described in the Maintenance section. Pay particular attention to the edges of the belts where fraying may occur, keeping in mind that a slight amount of fraying is normal but significant tears should be cause for replacement.

Dust Build-up
Remove any significant dust build up on the magnetic pulley.

Startup and Shutdown
To prevent loss of material and/or build up of material, the Dynamic Pulley Separator should always be started prior to starting the feeder equipment. Start the feeder equipment only when proper roll operation — speed, belt tracking, etc. — has been verified.

For the reasons given above, the feed equipment should always be stopped prior to stopping the Dynamic Pulley Separator. Allow the Dynamic Pulley Separator to run for long enough to clear all material out of the machine to prevent migration of material to the pulley surface during the machine downtime.

Operating Adjustments
Many combinations of operating settings are possible on the Dynamic Pulley Separator. The precise combination of adjustments appropriate to your material can only be determined by experimentation. Please contact Eriez' technical experts for assistance in setting operating settings for your specific application. Eriez can also carry out laboratory tests on your feed materials to help in optimizing these settings.

Three primary operating parameters can be adjusted to affect the separation performance of the unit. These are:

- Conveyor belt speed
- Magnetic pulley speed
- Splitter position

Maintenance

⚠ CAUTION

Rotating parts, moving belts and pinch points may cause severe personal injury. Properly lock out the separator before performing any maintenance that requires contact with the machine. To avoid eye injury, wear goggles when cleaning off dust accumulations.

Routine Maintenance
The procedures described here should be carried out at least daily (or as noted in the discussion); more often if your process demands it. The machine should be checked hourly during the first few days of operation, and at least once per shift thereafter.

Cleaning
The machine should be inspected for debris that could hinder machine performance. This inspection should be performed on a daily basis between shifts and during planned/unplanned shutdowns. The magnetic pulley on the Dynamic Pulley Separator should be inspected for accumulated material on and under the belt. Ferrous material trapped under the belt will gouge the pulley shell and shorten it's life. If it wears through the magnet may be damaged.

Check Belt Tracking
Verify that the belt remains essentially centered on the pulleys.

Check Bearing Lubrication
The Dynamic Pulley Separator has four bearings, two on the magnetic roll and two on the tail pulley.

Bearings
The Dynamic Pulley Separator incorporates three pairs of bearings: The magnetic pulley pillow blocks, the inner shell bearings, and the tail pulley pillow blocks. The magnetic pulley bearings are Sealmaster Type MP. The tail pulley bearings are Sealmaster Type NP. They should be checked periodically for overheating or other signs of inadequate lubrication. They should be re-lubricated periodically according to the following table.

Temperature	Cleaniness	Greasing Interval
Up to 150°F (Up to 66°C)	Dirty (normal RE roll operation)	1 week to 1 month
Up to 150°F (Up to 66°C)	Dirty	Daily to 2 weeks
Any temp	Very dirty	Daily to 1 week

Re-Lubricating

When re-lubricating, the grease should be a good quality conforming to NLGI Grade 2. It should be free of dust, rust, metal particles, or abrasives. Approximately 3/4 oz (22 cc) of grease is required to fill the grease chamber. For best results, the grease should be added while the roll is in operation. **CAUTION: Only the grease gun should contact the machine during this procedure.** The grease should be pumped in slowly until a slight discharge is noted around the bearing seal. Note that during operation immediately following re-lubrication there may be a temperature rise of 10-30˚F (6-17˚C). This is normal and will disappear as operation continues.

Belt Replacement and Repair

Check the conveyor belt for holes cuts, etc. that go all the way through. They should be patched, as fine materials will go through to the shell and cause unnecessary wear. Worn areas of the belt should also be repaired to prevent the eventual formulation of holes. The belt is a urethane conveyor belt with cleats and sidewalls. Most rips, punctures, cuts, etc can be quickly repaired with the optional belt repair kit, which includes a heat gun, fabric, tools, clamps, and instructions in a plastic case. The kit, Eriez part number 425508, is highly recommended.

Observe the belt tracking while the machine is warm and running. If necessary, adjust.

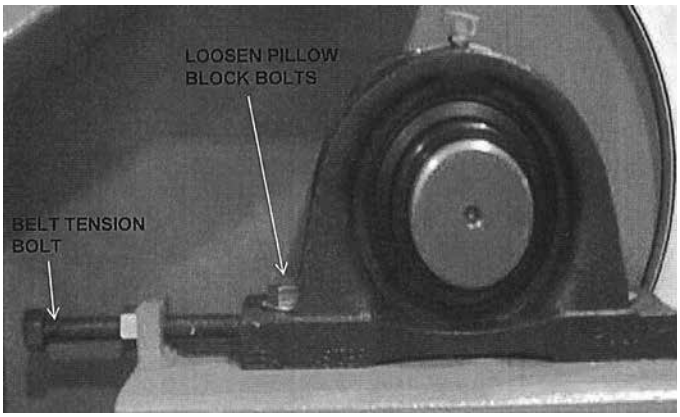
If a spliced belt is used, make sure the lacing is non-metallic and is covered both top and bottom with a flexible flap cold vulcanized to the belt.

Exact replacement endless belts are available from Eriez. Eriez part number is 451973.

To replace the belt with an endless belt first remove all guards. Relieve the belt tension and remove all covers and the slider plate. Loosen the torque arm on the conveyor drive pulley. Remove the pillow block bearings from the frame on the non-drive side. Temporarily support the shafts and remove the pillow block bearings. Locate two 6-foot lengths of 2-3/4 inch ID pipe or tubing. Place the new belt on the pipes or tubes and slide them over the ends of the shafts. Use slings on the outside of their ends to lift the pipes or tubes, then remove the temporary supports. Lift the assembly high enough so the new belt can slide over the pulleys. Re-install the bearings, guards, and covers. Re-tension the belt.

Belt Tensioning and Tracking

Observe the belt tracking while the machine is warm and running. If a belt is not tracking properly, the belt can be adjusted by increasing or decreasing the belt tension bolts at the rear corners of the belt. Referring to figure 3.1, the belt tension is either increased with a turn of the bolt. Note that the pillow block bolts, and locknut must be loosened before adjustment, and re-tightened afterward. Increasing the belt tension on one side of the belt will force the belt to track away from this side. Decreasing the belt tension on one side will draw the belt closer to this side. It is best not to over tension the belt on one side, but instead attempt to adjust the belt track by adjusting both sides until the belt is tracking down the middle of the pulley.



Typical Belt Takeup Adjustments

Bearings

Pillow Block Bearings

The Sealmaster MP pillow block mounted bearings furnished on the magnetic pulley of the separator and the NP pillow block mounted bearings on the tail pulley have inside diameters ground for a sliding fit over the shaft. They are easily and securely locked to the shaft by means of self-locking, cup point, socket head setscrews. Two setscrews are furnished on each bearing sleeve, and both setscrews must be used for satisfactory performance.

To install a new bearing on a shaft:

1. Make certain that the shaft is free of burrs and foreign material.
2. Back the bearing setscrews out so that the tips are clear of the bore.
3. Slide the bearing onto the shaft to the approximate final position. Never hammer the ends of the inner race, since they are relatively soft. If necessary to apply force, use a brass bar or pipe against the inner race to drift the bearing into place. Do not tighten the setscrews at this time.
4. Mount the bearing flange securely to the supporting frame, adjusting the bearing position on the shaft as required.
5. Rotate shaft to make sure it turns freely.
6. Tighten the setscrews securely onto the shaft. Recommended torque: 126 in-lb (14.2 Nm).

Replacement of Inner Shell Bearings and Shell

Refer to drawing 4P-20086757 showing the magnetic pulley inner bearing parts and shell. Remove the magnetic pulley from the machine for easier access to the inner bearings and shell by loosening the belt tension and removing any guards or covers that will interfere with its removal.

CAUTION

the magnetic pulley is a very strong permanent magnet and will attract magnetic tools and items as well as being attracted to magnetic surfaces and equipment.

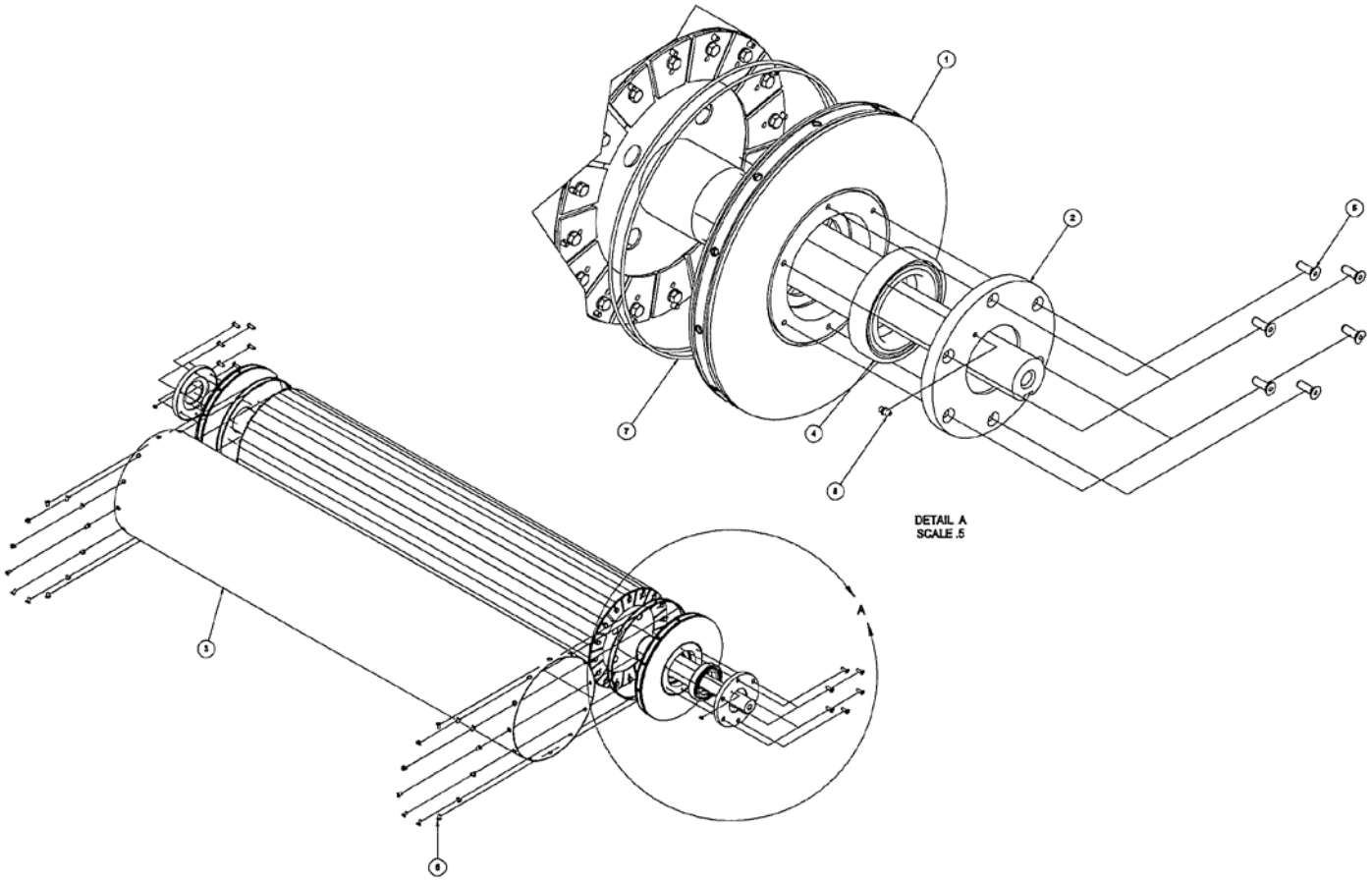
Lift the magnetic pulley with the pillow block bearings enough to remove it from under the belt. Place the assembly on a suitable non-ferrous non-magnetic work surface. Remove the pillow block bearings. Use the drawing as a guide to remove/replace the inner bearing.

To replace the shell, remove a pillow block from one end. Support the one end of the shaft with a 6-foot long 2-3/4 inch I.D. pipe or tube slid over its end. Remove the flat head screws from the perimeter of the shell Slide the shell from the magnetic pulley onto the pipe or tube being careful not to damage the magnet. Re-position the support from the end of the pipe or tube to near the magnetic pulley so the shell can be removed from the pipe or tube. Slide the replacement shell on the pipe or tube and move the support to the end of the pipe or tube. Slide the shell over the magnet and re-install the flat head screws.

Motor/Gear Reducer

Refer to manufacturer's instructions.

Spare Parts



Key	Qty.	PART No.	DESCRIPTION
1	2	136121	Magnetic pulley head
2	2	136122	Magnetic pulley head
3	1	136124	Otter rolled shell
4	2	452296	Bearing
5	12	232317	Screw soclet FLHD, 5/16-18 x 1
6	24	452331	Screw FLHD, M8-1.25 x 16 MM
7	4	452337	O-ring, 13.263 OD x 12.985 ID nom 1/8 dia.
8	2	406692	Zerk fitting, 1/4-28 SS

Manufacturer's Information

Baldor-Reliance ® Integral Horsepower AC Induction Motors

ODP, WPI Enclosures, TENV, TEAO, TEFC Enclosure, Explosion Proof

Installation and Operating Manual

BALDOR • RELIANCE

January 2021

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Important:
Be sure to check www.baldor.com to download the latest version of this manual in Adobe Acrobat PDF format.

Note! The manufacturer of these products, Baldor Electric Company became ABB Motors and Mechanical Inc. on March 1, 2018. Nameplates, Declaration of Conformity and other collateral material may contain the company name of Baldor Electric Company and the brand names of Baldor-Dodge and Baldor-Reliance until such time as all materials have been updated to reflect our new corporate identity.

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:

This instruction manual is not intended to include a comprehensive listing of all details for all procedures required for installation, operation and maintenance. This manual describes general guidelines that apply to most of the motor products shipped by Baldor. If you have a question about a procedure or are uncertain about any detail, Do Not Proceed. Please contact your Baldor distributor for more information or clarification.

Before you install, operate or perform maintenance, become familiar with the following:

- NEMA Publication MG-2, Safety Standard for Construction and guide for Selection, Installation and Use of Electric Motors and Generators.
- IEC 34–1 Electrical and IEC72–1 Mechanical specifications
- ANSI C51.5, the National Electrical Code (NEC) and local codes and practices.

Limited Warranty

www.baldor.com/support/warranty_standard.asp

Safety Notice: **This equipment contains high voltage! Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt installation, operation and maintenance of electrical equipment. Be sure that you are completely familiar with NEMA publication MG-2, safety standards for construction and guide for selection, installation and use of electric motors and generators, the National Electrical Code and local codes and practices. Unsafe installation or use can cause conditions that lead to serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.**

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.**

WARNING: **Disconnect all electrical power from the motor windings and accessory devices before disassembly of the motor. Electrical shock can cause serious or fatal injury.**

WARNING: **Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that all grounding instructions have been followed. Electrical shock can cause serious or fatal injury. National Electrical Code and Local codes must be carefully followed.**

WARNING: **Avoid extended exposure to machinery with high noise levels. Be sure to wear ear protective devices to reduce harmful effects to your hearing.**

WARNING: **Surface temperatures of motor enclosures may reach temperatures which can cause discomfort or injury to personnel accidentally coming into contact with hot surfaces. When installing, protection should be provided by the user to protect against accidental contact with hot surfaces. Failure to observe this precaution could result in bodily injury.**

WARNING: **This equipment may be connected to other machinery that has rotating parts or parts that are driven by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt to install operate or maintain this equipment.**

WARNING: **Do not by-pass or disable protective devices or safety guards. Safety features are designed to prevent damage to personnel or equipment. These devices can only provide protection if they remain operative.**

WARNING: **Avoid the use of automatic reset devices if the automatic restarting of equipment can be hazardous to personnel or equipment.**

WARNING: **Be sure the load is properly coupled to the motor shaft before applying power. The shaft key must be fully captive by the load device. Improper coupling can cause harm to personnel or equipment if the load decouples from the shaft during operation.**

WARNING: **UL Listed motors must only be serviced by UL Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.**

WARNING: **Thermostat contacts automatically reset when the motor has slightly cooled down. To prevent injury or damage, the control circuit should be designed so that automatic starting of the motor is not possible when the thermostat resets.**

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 carrying conductors and permanent magnet motors can result result in a serious health hazard to persons with cardiac pacemakers, metal implants, and hearing aids. To avoid risk, stay way 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.**

Safety Notice Continued

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.**

WARNING: **Depending on operating conditions, sound levels for electric motors may exceed 70 dB. Protective measures such as hearing protection may be needed when in close proximity to a motor in operation.**

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

Caution: **Do not over tension belts. Excess tension may damage the motor or driven equipment.**

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 º angle from the shank of the eye bolt or lifting lug. Excessive lifting angles can cause damage.**

Caution: **To prevent equipment damage, be sure that the electrical service is not capable of delivering more than the maximum motor rated amps listed on the rating plate.**

Caution: **If a HI POT test (High Potential Insulation test) must be performed, follow the precautions and procedure in NEMA MG1 and MG2 standards to avoid equipment damage.**

Caution: **The space heaters are designed to operate at or below the maximum surface temperature stated on the nameplate. If the marked ambient and/or voltage are exceeded this maximum surface temperature can be exceeded and can damage the motor windings. If applied in a division 2 or zone 2 environment this excessive temperature may cause ignition of hazardous materials.**

Caution: **Shaker Duty motors must be properly lubricated prior to Start Up to prevent damage. See Section 3.**

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 only the motor. Never lift the motor by the motor shaft or the hood of a WPII motor.
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. When lifting a WPII (Weather Proof Type 2) motor, do not lift the motor by inserting lifting lugs into holes on top of the cooling hood. These lugs are to be used for hood removal only. 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. 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

Storage requirements for motors and generators that will not be placed in service for at least six months from date of shipment.

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, which ever is greater. Minimum resistance is calculated as follows: Rm = kV + 1

where: (Rm is minimum resistance to ground in Meg–Ohms and kV is rated nameplate voltage defined as Kilo–Volts.)

Example: For a 480VAC rated motor Rm =1.48 meg–ohms (use 5 M Ω).

For a 4160VAC rated motor Rm = 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 peak-to-peak 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. Space heaters are optional.

Note: Remove motor from containers when heaters are energized, reprotect if necessary.

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. 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 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 fully operable while in storage (drain plugs removed). The motors must be stored so that the drain is at the lowest point. All breathers and automatic “T” drains must be operable to allow breathing and draining at points other than through the bearings around the shaft. Vertical motors should be stored in a safe stable vertical position.
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, by the brush holder fingers. The commutator should be wrapped with a suitable material such as cardboard paper as a mechanical protection against damage.

Non–Regreaseable 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 prior to lubricating the motor.
2. The motor with regreasable bearing must be greased as instructed in Section 3 of this manual.
3. Replace the grease drain plug after greasing.
4. The motor shaft must be rotated a minimum of 15 times after greasing.
5. Motor Shafts are to be rotated at least 15 revolutions manually every 3 months and additional grease added every nine months (see Section 3) to each bearing.
6. Bearings are to be greased at the time of removal from storage.

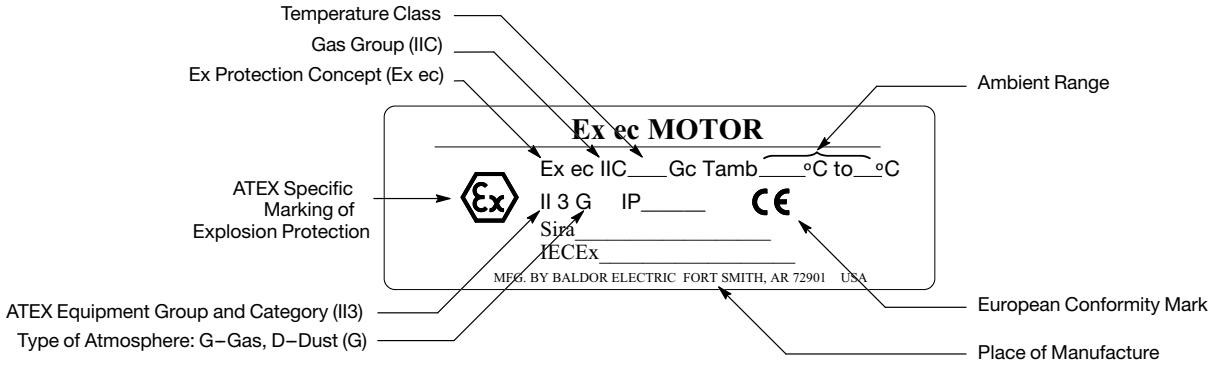
Removal From Storage

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% from the initial reading recorded when the motor was placed into storage. 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 3 of this manual.
4. Reinstall the original shipping brace if motor is to be moved. This will hold the shaft firmly against the bearing and prevent damage during movement.

Equipment Marking for IEC Certified Product

IEC certified products have special markings that identify the protection concept and environment requirements. An example is shown in Figure 1-1.

Figure 1-1 IEC Certified Product Markings



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 certificate in conjunction with this instruction manual.

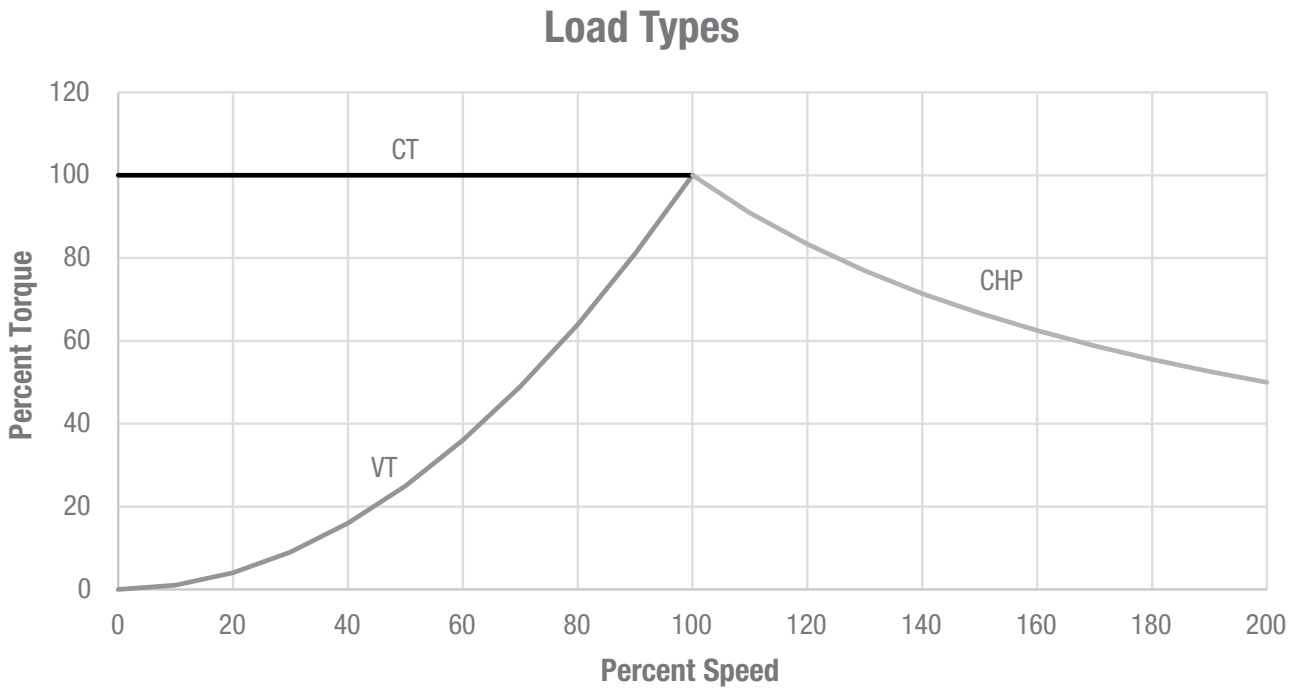
Operation On Frequency Converters:

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 ranges (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. IECEx Certificates are available online at www.iecex.com

Unit Conversions	
Inches to Millimeters	Inches x 25.4 = mm
Millimeters to Inches	mm x .03937 = Inches
Horsepower to Kilowatts	Hp x .746 = Kw
Kilowatts to Horsepower	Kw x 1.341 = Hp
Pounds to Kilograms	Lbs x .454 = Kg
Kilograms to Pounds	Kg x 2.205 = Lbs

Typical Speed vs Torque Curves are shown in Figure 1-2. For values relative to your specific motor, consult the motor nameplate marking.

Figure 1-2 Typical Speed vs Torque Curves



EMC Compliance Statement for European Union

The motors described in this instruction manual are designed to comply 2014/30/EU. These motors are commercial in design and not intended for residential use. When used with converters, please consult converter manufacturers literature regarding recommendations on cable types, cable shielding, cable shielding termination, connection recommendations and any filters which may be recommended for EMC compliance. For additional information, consult Baldor MN1383.

Section 2

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.

For Group I Mining Motors where breather drains are used specified, Breather drain shall be mounted or protected in installation such that it is guarded from direct impact."

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

1. **Open Drip–Proof/WPI** motors are intended for use indoors where atmosphere is relatively clean, dry, well ventilated and non–corrosive.
2. **Totally Enclosed and WPII** motors may be installed where dirt, moisture or dust are present and in outdoor locations.

Severe Duty, IEEE 841 and Washdown Duty enclosed 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. IEEE841 motors are suitable for application in Class I Division 2 and Class I Zone 2 areas on sine wave power in accordance with the applicable codes and standards.

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.

EMC Compliance Statement for European Union

The motors described in this instruction manual are designed to comply 2014/30/EU . These motors are commercial in design and not intended for residential use.

Mounting Location

The motor should be installed in a location compatible with the motor enclosure and specific ambient. To allow adequate air flow, the following clearances must be maintained between the motor and any obstruction:

Table 2-1 Enclosure Clearance

TEFC / TENV (IC0141) Enclosures	
Fan Cover Air Intake	180 – 210T Frame 1" (25mm)
Fan Cover Air Intake	250 – 449T Frame 4" (100mm)
	IEC 112 – 132 1" (25mm)
	IEC 160 – 280 4" (100mm)
Exhaust	Envelope equal to the P Dimension on the motor dimension sheet
OPEN/Protected Enclosures	
Bracket Intake	Same as TEFC
Frame Exhaust	Exhaust out the sides envelope A minimum of the P dimension plus 2" (50mm) Exhaust out the end same as intake.

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.

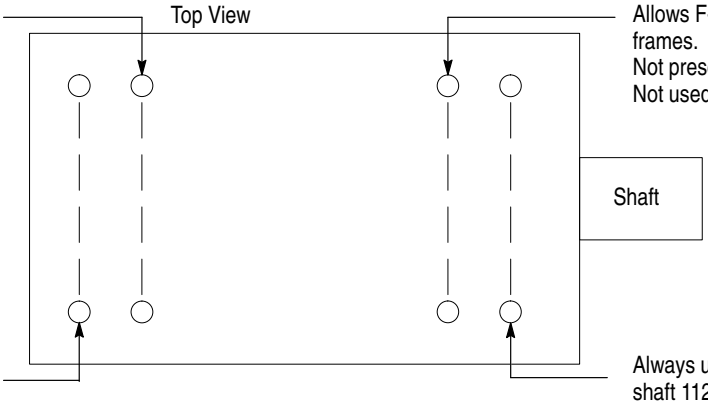
When installation is complete and accurate alignment of the motor and load is accomplished, the base should be grouted to the foundation to maintain this alignment.

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.

Frame Mounting Holes

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

Figure 2-1 6 & 8 Hole Motor Frame Mounting



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

Allows F-1 to F-2 Conversion on 8 hole frames.
Not present on 6 hole frames.
Not used on 8 hole frames.

For long frame designations 184, 215, 256, 286, 326, 365, 405, 445 (NEMA) (IEC) 112M, 132M, 160L, 200L, 225M, 250M, 280M

Always use these holes, closer to the shaft 112S, 132S, 160M, 180M, 200M, 225S, 250S, 280S, (IEC)

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.

Alignment

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. It is recommended to heat the pulley, sprocket, or gear before installing on the motor shaft. Forcibly driving a unit on the motor shaft will damage the bearings.

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 cause failure.
3. Pulley Ratio
   The best practice is to not exceed an 8:1 pulley ratio.

Caution: **Do not over tension belts. Excess tension may damage the motor or driven equipment.**

4. Belt Drive
   Align sheaves carefully to minimize belt wear and axial bearing loads (see End-Play Adjustment). Belt tension should be sufficient to prevent belt slippage at rated speed and load. However, belt slippage may occur during starting.

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. (Baldor•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 keys, 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.

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. Fully insulated and lugged terminations must be bolted and provided with lock washer to prevent rotation. Flying leads must be insulated with two full wraps of electrical grade insulating tape or heat shrink tubing.

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 motors with bonded cushion rings are used in multimotor installations employing group fusing or group protection, the bonding of the cushion ring should be checked to determine that it is adequate for the rating of the branch circuit over current protective device being used.

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

Select a motor starter and over current protection suitable for this motor and its application. Consult motor starter application data as well as the National Electric Code and/or other applicable local codes.

For motors installed in compliance with IEC requirements, the following minimum cross sectional area of the protective conductors should be used:

Crosssectional area of phase conductors, *S*	Minimum crosssectional area of the corresponding protective conductor, S_p
mm2	mm2
6	6
10	10
16	16
25	25
35	25
50	25
70	35
95	50
120	70
150	70

Equipotential bonding connection shall made using a conductor with a cross-sectional area of at least 4 mm^2.

Conduit Box For ease of making connections, an oversize conduit box is provided. Most conduit boxes can be rotated 360 ° in 90 ° increments. In the case that a conduit box needs to be adjusted, remove conduit box mounting screws. Rotate conduit box in 90 ° increments to desired location. Reinsert mounting screws and tighten to grade 2 torque.

Auxiliary conduit boxes are provided on some motors for accessories such as space heaters, RTD's etc.

AC Power Motors with flying lead construction must be properly terminated and insulated.

Connect the motor leads as shown on the connection diagram located on the name plate or inside the cover on the conduit box. Be sure the following guidelines are met:

1. AC power is within ±10% of rated voltage with rated frequency. (See motor name plate for ratings).

OR

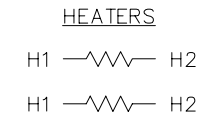
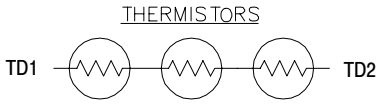
2. AC power is within ±5% of rated frequency with rated voltage.

OR

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.

Performance within these voltage and frequency variations are shown in Figure 2-3.

Figure 2-2 Accessory Connections

	One heater is installed in each end of motor. Leads for each heater are labeled H1 & H2. (Like numbers should be tied together).
	Three thermistors are installed in windings and tied in series. Leads are labeled TD1 & TD2.
	Winding RTDs are installed in windings (2) per phase. Each set of leads is labeled 1TD1, 1TD2, 1TD3, 2TD1, 2TD2, 2TD3 etc.
	* One bearing RTD is installed in Drive endplate (PUEP), leads are labeled RTDDE. * One bearing RTD is installed in Opposite Drive endplate (FREP), leads are labeled RTDODE. * Note RTD may have 2–Red/1–White leads; or 2–White/1–Red Lead.

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.

Adjustable Frequency Power Inverters used to supply adjustable frequency power to induction motors produce wave forms with lower order harmonics with voltage spikes superimposed. Turn–to–turn, phase–to–phase, and ground insulation of stator windings are subject to the resulting dielectric stresses. Suitable precautions should be taken in the design of these drive systems to minimize the magnitude of these voltage spikes. Consult the drive instructions for maximum acceptable motor lead lengths, and proper grounding.

Note: Main power leads for CE Marked Motors may be marked U,V,W – for standard configurations, please consult connection diagrams.

Caution: **The space heaters are designed to operate at or below the maximum surface temperature stated on the nameplate. If the marked ambient and/or voltage are exceeded this maximum surface temperature can be exceeded and can damage the motor windings. If applied in a division 2 or zone 2 environment this excessive temperature may cause ignition of hazardous materials.**

AC Motor Connection Diagram

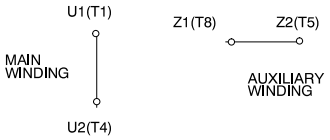
IEC VERSUS NEMA LEAD MARKING

EXAMPLE COMPARISIONS OF IEC AND NEMA LEADING MARKINGS FOR COMMON CONNECTION TYPES ARE SHOWN BELOW.

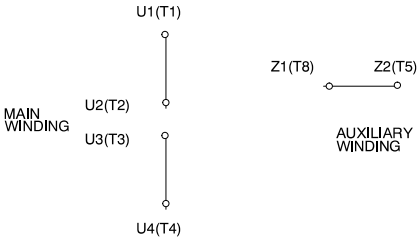
SINGLE PHASE MOTORS

SINGLE VOLTAGE NON REVERSIBLE

SINGLE VOLTAGE REVERSIBLE



DUAL VOLTAGE REVERSIBLE



AC Motor Connection Diagram

THREE PHASE

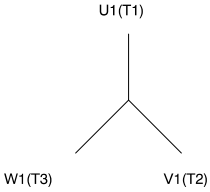
FOR SINGLE WINDING 3 PHASE MOTORS, LEAD MARKINGS CAN BE DIRECTLY TRANSLATED BETWEEN IEC AND NEMA DESIGNATIONS. FOR THESE MOTORS, THE LEAD MARKINGS ARE EQUIVALENT AS FOLLOWS:

U1=T1	U2=T4	U5=T7	U6=T10
V1=T2	V2=T5	V5=T8	V6=T11
W1=T3	W2=T6	W5=T9	W6=T12

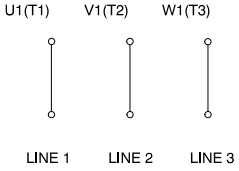
EXAMPLES OF COMMON CONNECTIONS ARE GIVEN BELOW.

THREE LEADS

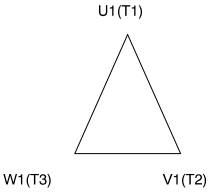
WYE CONNECT



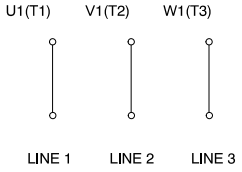
WIRING DIAGRAM



DELTA CONNECT



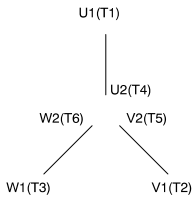
WIRING DIAGRAM



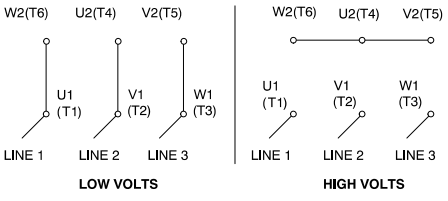
AC Motor Connection Diagram

SIX LEADS

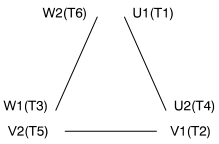
DELTA-WYE CONNECT



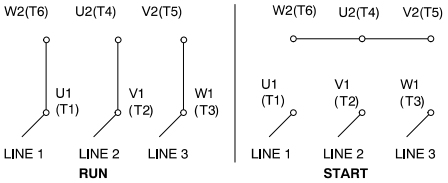
DUAL VOLTAGE-HIGH TO LOW VOLTAGE RATIO 1.73:1



WYE-DELTA CONNECT



WYE START-DELTA RUN SINGLE VOLTAGE

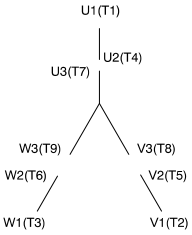


AC Motor Connection Diagram

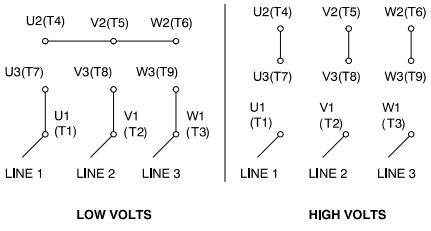
NINE LEADS

DUAL VOLTAGE-HIGH TO LOW VOLTAGE RATIO 2:1

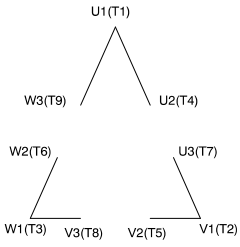
WYE CONNECT



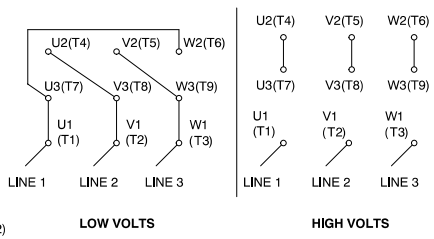
WIRING DIAGRAM



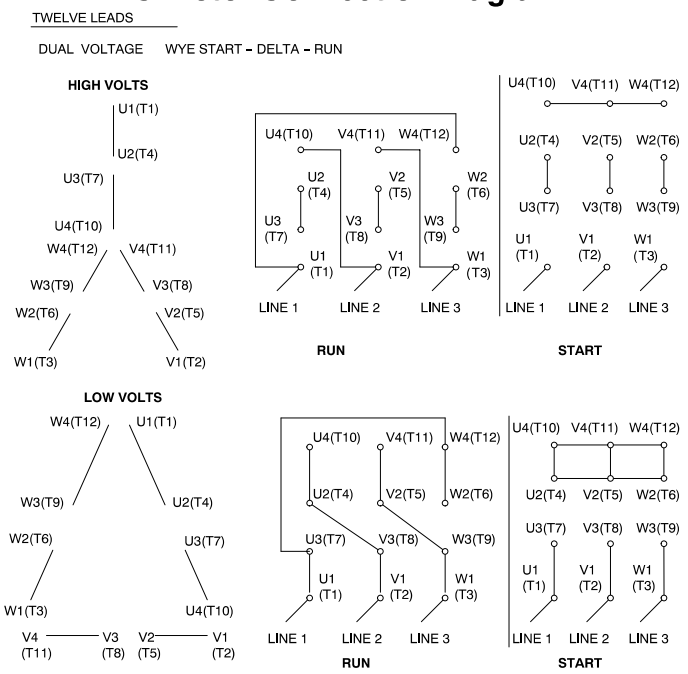
DELTA CONNECT



WIRING DIAGRAM

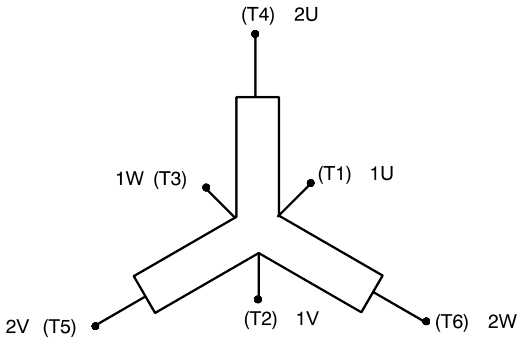


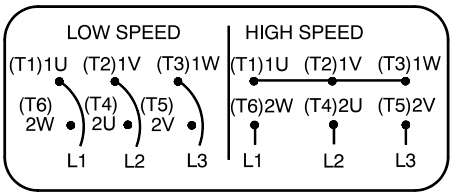
AC Motor Connection Diagram



AC Motor Connection Diagram

SINGLE WINDING MULTI-SPEEDS CONSTANT TORQUE

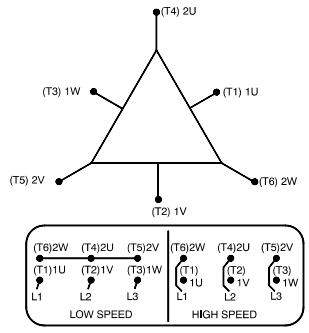




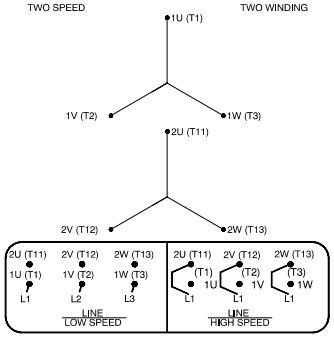
(N.P. 1634-DE)

AC Motor Connection Diagram

SINGLE WINDING MULTI-SPEEDS CONSTANT HP.

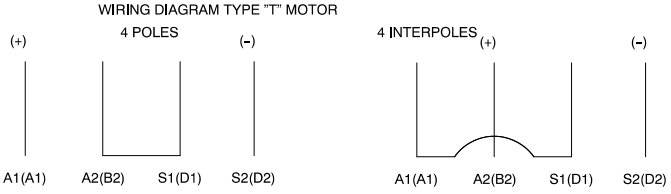


TWO SPEED TWO WINDING



DC Motor Connection Diagram

WIRING DIAGRAM TYPE "T" MOTOR



COUNTERCLOCKWISE ROTATION

CLOCKWISE ROTATION

ROTATION – FACING COMMUTATOR END

COMPARISON OF IEC AND NEMA LEAD MARKINGS
FOR DIRECT CURRENT MOTORS

A1--A1
A2--B2
S1--D1
S2--D2

MOTOR WINDING THERMOSTATS

CONTACTS _____ @ _____ °C
FIGURE NUMBER _____

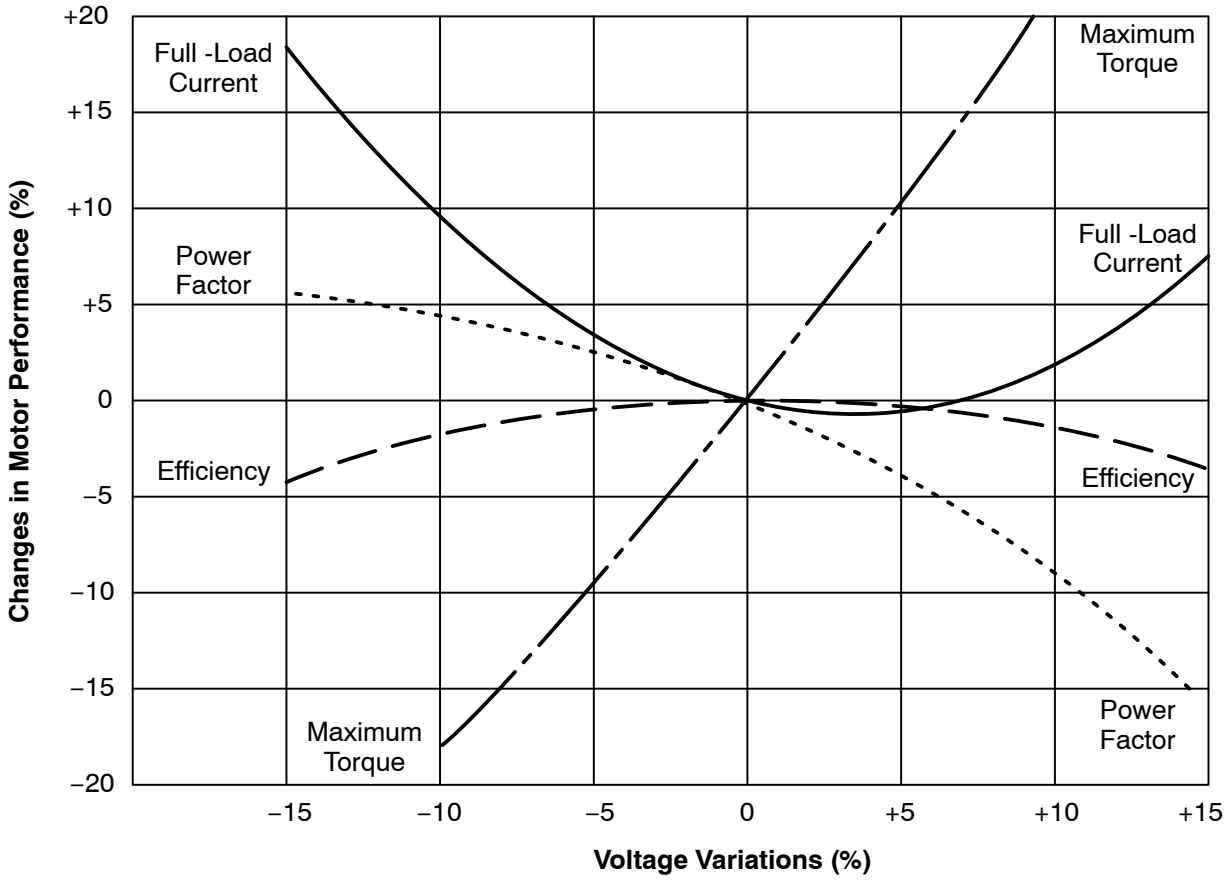
CONTACT RATING

VOLTS	CONTINUOUS AMPERES	INRUSH AMPERES
110 - 120	3.0	30
220 - 240	1.5	15
440 - 480	0.75	7.5
550 - 600	0.60	6.0

THERMOSTATS

NORMALLY CLOSED	NORMALLY OPEN
FIGURE 1	FIGURE 4
FIGURE 2	FIGURE 5
FIGURE 3	FIGURE 6

Figure 2-3 Typical Motor Performance VS Voltage Variations



Initial Lubrication

Baldor•Reliance motors are shipped from the factory with the bearings properly packed with grease and ready to operate. Where the unit has been subjected to extended storage (6 months or more) the bearings should be relubricated (regreasable type) prior to starting. When motors are equipped for oil mist lubrication refer to the instruction manual for installation, operation, and maintenance of oil mist lubrication systems.

Caution: **Shaker Duty motors must be properly lubricated prior to Start Up to prevent damage. See Section 3.**

First Time Start Up

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

1. Make sure that the mechanical installation is secure. All bolts and nuts are tightened etc.
2. If motor has been in storage or idle for some time, check winding insulation integrity.
3. Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity.
4. Be sure all shipping materials and braces (if used) are removed from motor shaft.
5. Manually rotate the motor shaft to ensure that it rotates freely.
6. Replace all panels and covers that were removed during installation.
7. Momentarily apply power and check the direction of rotation of the motor shaft.
8. If motor rotation is wrong, be sure power is off and change the motor lead connections. Verify rotation direction before you continue.
9. Start the motor and ensure operation is smooth without excessive vibration or noise. If so, run the motor for 1 hour with no load connected.
10. After 1 hour of operation, disconnect power and connect the load to the motor shaft. Verify all coupling guards and protective devices are installed. Ensure motor is properly ventilated.

11. If motor is totally enclosed fan–cooled or non–ventilated it is recommended that condensation drain plugs, if present, be removed. These are located in the lower portion of the end–shields. 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 up 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 though 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.
Do not exceed these values. If there is any question regarding safe operation, contact your local Baldor distributor or Baldor Service Center.

Hazardous Locations

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.

Selection

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. In international hazardous location areas, guidance for gas / vapor / mist classification is given in IEC60079–14, or for dust in IEC61241–14. This classification process lets the installer know what equipment is suitable for installation in that environment, and identifies what the maximum safe temperature or temperature class is required.
It is the customer or users responsibility to determine the area classification and select proper equipment.

Areas are classified with respect to risk and exposure to the hazard. In the US market, areas are typically classified as follows Class, Division, Group and Temperature Class. In some newer installations in the US and in most international markets, areas are classified in Zones.

Protection Concepts

Class I Division 1 / Zone 1 [Equipment Group I (mining) or II (surface), Equipment Protection Level (EPL) Gb, Mb]

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.
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 or quench the flame of an explosive gas atmosphere 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 70–2008) – 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 flameproof or explosion proof 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.

When explosion proof or flameproof motors are provided with intrinsically safe sensors, the integrity of that system relies upon the proper application and selection of barriers and cables as described in the sensor manufacturers control drawing. The control drawing will be shipped with the motor, and it is important that those instructions be provided to the equipment installer.

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. Where intermediate circuitry is involved the circuit shall fall within the scope of a safety, controlling and regulating device as defined in article 1(2) of European Directive 2014/34/EU, and shall be covered by an appropriate EC Type Examination Certificate.

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. Openings in connection boxes must be closed with suitably certified and dimensioned device.

Hazardous location motors equipped with NPT pipe nipples are designed and built such that the pipe nipple is securely attached to the motor frame. This is accomplished externally by interference between the threads as well as tack welding. The conduit box is securely attached to the pipe nipple at the factory per:

1. Standard Commercial NPT & Explosion Proof IEC/ATEX parts : L-1 gauging notch +/- 1 thread (ref. ANSI/ASME B1.20.1 and Clarification Sheet ExNB/98/06/010/CS) Note: Clarification Sheet ExNB/98/06/010/CS provides inspection criteria to meet (6 threads minimum per engineering part drawing for ATEX parts).
2. Explosion Proof UL conduit boxes & MSHA parts: L-1 gauging notch "+1 min to + 3 1/2 max threads. Note: Provides inspection criteria to meet (5 threads minimum per engineering part drawing for MSHA parts and meet UL 1203 requirement for L-1 gauging notch flush to + 3 1/2 max threads).

This allows the end user to position the conduit box according to the application then secure when in place. For obvious reasons having the conduit box snug prior to affixing to the pipe nipple is preferable. However, the guidance in numbers 1 and 2 above can be used in determining thread engagement.

Note: In the United States most non-mining applications have rigid conduit for cabling, therefore not tack welding the conduit box to the pipe nipple is standard. In markets outside the United States, flexible conduit/cabling are common and end users should take note to secure the conduit box to the pipe nipple once in position. Further, the flexible leads should be secured to inhibit forces acting on the conduit box.

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–Code) stated on the nameplate. Failure to operate the motor properly 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 temperatures above nameplate value
3. Voltages above or below nameplate value
4. Unbalanced voltages
5. Loss of proper ventilation
6. Altitude above 3300 feet / 1000 meters
7. Severe duty cycles of repeated starts
8. Motor stall
9. Motor reversing
10. Single phase operation of polyphase equipment
11. Variable frequency operation

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–Code) stated on the nameplate.
Failure to operate the motor properly 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. Unstable current wave forms
10. Lower than name plate minimum carrier frequency

Thermal Limiting
Thermal limiting devices are temperature sensing control components installed inside the motor to limit the internal temperature of the motor frame by interrupting the circuit of the holding coil of the magnetic switch or contactor. They are required for most Division 1 and Zone 1 applications. For Division 2 or Zone 2 applications, motors should be selected that preclude running temperatures from exceeding the ignition temperatures for the designated hazardous material. In Division 2 or Zone 2 classified locations, thermal limiting devices should only be used for winding protection and not considered for limiting all internal motor temperatures to specific ignition temperatures.

Equipotential Bonding and Shaft Current Reduction
Larger motors (ie WP construction) may require proper bonding between motor enclosures and covers to avoid the risk of stray currents during start up. Fastening methods and bonding straps must not be modified. Bearing currents can exist in some motors for both line–fed and inverter–fed applications. Larger line–fed motors may require at least one insulated bearing to prevent a flow of current through the bearings. Do not defeat such insulation whether the motor is line–fed or inverter–fed applications. Inverter–fed motors may require additional bearing insulation or even a shaft brush. Do not defeat such features. When the motor and the coupled load are not on a common conductive baseplate, it may also be necessary to electrically bond together the stationary parts of the motor and the coupled equipment.

Repair of Motors used in Hazardous Locations

Repair of hazardous certified motors requires additional information, skill, and care. It is the customer's responsibility to select service shops with proper qualifications to repair hazardous location motors. Contact the manufacture for additional repair details. Use only original manufacturer's parts.

Repair of Explosion Proof or Flame Proof Motors Class I Division 1 and Zone 1

In the North American market, recertification programs are offered by Underwriters Laboratories and Canadian Standards Association which allow authorized service shops to mark the rebuilt motors as certified. In the international markets using IEC based requirements, repair should be undertaken only after consulting IEC60079–19 Explosive Atmospheres–Part 19 Equipment repair, overhaul and reclamation. If use of a certified repair facility is desired, consult the IECEX Repair Scheme at http://www.iecex.com/service_facilities.htm

Explosion proof and flameproof motors achieve their safety based on the mechanical construction – flameproof joints and bearing clearance, and the electrical design including any thermal limiting devices. If it is necessary to repair a flameproof or explosion proof motor, it is critical that the mechanical flameproof joints be maintained. Consult Baldor Electric Company for flameproof joint construction details.
Use only Baldor•Reliance supplied parts. Baldor does not recommend reclamation of parts.
Since this protection method also relies on temperature being maintained, make sure that any rewinding uses the original electrical designs, including any thermal protection that may be present.

Repair of Dust Ignition Proof Motors – Class II Division 1 and 2, Zone 21 and 22.

For Dust Ignition Proof, proper sealing is required. Do not modify the motor construction to add any additional opening, and ensure that proper sealing is maintained in the connection box and at the shaft seal. Since this protection method also relies on temperature being maintained, make sure that any rewinding uses the original electrical designs, including any thermal protection that may be present

Repair of Class I Division 2 and Zone 2 motors

For Division 2 and Zone 2, the internal and external temperatures are of concern. Since this protection method also relies on temperature being maintained, make sure that any rewinding uses the original electrical designs, including any thermal protection that may be present. Use only Baldor replacement thermostats, if provided.

Disposal of Electric Motors

WEEE EU Directive 2012/19/EU

Products that are marked with the crossed-out wheeled bin symbol as shown here; shall be handled by applying following information:

The crossed-out wheeled bin symbol on the product(s) and / or accompanying documents means that used electrical and electronic equipment (WEEE) should not be mixed with general household waste. For users in the European Union, please contact your dealer or supplier for more information on how to discard electrical and electronic equipment (EEE).

Section 3

Maintenance & Troubleshooting

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:

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.**

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. Baldor motors are pregreased, normally with Polyrex EM (Exxon Mobil) or as stated on the nameplate.
Do not mix greases unless compatibility has been checked and verified.

Ball Bearing Motors

Operating Temperature –25 ºC (–15 ºF) to 50 ºC (120 ºF)

EXXON	POLYREX EM (Standard on Baldor motors)
EXXON	UNIREX N2
EXXON	BEACON 325
CHEVRON OIL	SRI NO. 2 (Compatible with Polyrex EM)
CHEVRON OIL	BLACK PEARL
TEXACO, INC.	PREMIUM RB
TEXACO, INC.	POLYSTAR
AMOCO	RYKON # 2
PENNZOIL	PENNZLUBE EM–2
DARMEX	DARMEX 707
DARMEX	DARMEX 711
PETRO–CANADA	PEERLESS LLG
SHELL OIL	DOLIUM BRB

Minimum Starting Temperature –60 ºC (–76 ºF)

SHELL OIL CO.	AEROSHELL 7 (Standard on Baldor motors)
MOBIL	MOBIL 28
MOBIL	MOBILITH SHC 100 (Low Temperature – Arctic Duty)

Roller Bearing Motors

Operating Temperature –25 ºC (–15 ºF) to 50 ºC (120 ºF)

TEXACO, INC.	PREMIUM RB
MOBIL	MOBILITH SHC 220 (Standard on Baldor motors)
CHEVRON OIL	BLACK PEARL

Relubrication Intervals

Recommended relubrication intervals are shown in Table 3-1. It is important to realize that the recommended intervals of Table 3-2 are based on average use.

Refer to additional information contained in Tables 3-2, 3-3 and 3-4.

Table 3-1 Relubrication Intervals *

NEMA / (IEC) Frame Size	Rated 60 Hz (50 Hz) Speed - RPM					
	10000	**6000**	**3600 (3000)**	**1800 (1500)**	**1200 (1000)**	**900 (750)**
Up to 210 incl. (132)	**	2700 Hrs.	5500 Hrs.	12000 Hrs.	18000 Hrs.	22000 Hrs.
Over 210 to 280 incl. (180)		**	3600 Hrs.	9500 Hrs.	15000 Hrs.	18000 Hrs.
Over 280 to 360 incl. (225)		**	* 2200 Hrs.	7400 Hrs.	12000 Hrs.	15000 Hrs.
Over 360 to 449 incl. (315)		**	*2200 Hrs.	3500 Hrs.	7400 Hrs.	10500 Hrs.

* 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 3-2 Service Conditions

Severity of Service	Hours per day of Operation	Ambient Temperature Maximum	Atmospheric Contamination
Standard	8	40 ºC	Clean, Little Corrosion
Severe	16 Plus	50 ºC	Moderate dirt, Corrosion
Extreme	16 Plus	>50 ºC* or Class H Insulation	Severe dirt, Abrasive dust, Corrosion, Heavy Shock or Vibration
Low Temperature		<–29 ºC **	

* 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 & cavity before adding grease.

** Special low temperature grease is recommended (Aeroshell 7).

Table 3-3 Relubrication Interval Multiplier

Severity of Service	Multiplier
Standard	1.0
Severe	0.5
Extreme	0.1
Low Temperature	1.0

Some motor designs use different bearings on each motor end. This is normally indicated on the motor nameplate. In this case, the larger bearing is installed on the motor Drive endplate. For best relubrication results, only use the appropriate amount of grease for each bearing size (not the same for both).

Table 3-4 Bearings Sizes and Types

Frame Size NEMA (IEC)	Bearing Description (These are the "Large" bearings (Shaft End) in each frame size)			
	Bearing	Weight of Grease to add * oz (Grams)	Volume of grease to be added	
			in^3	teaspoon
56 to 140 (90)	6203	0.08 (2.4)	0.15	0.5
140 (90)	6205	0.15 (3.9)	0.2	0.8
180 (100–112)	6206	0.19 (5.0)	0.3	1.0
210 (132)	6307	0.30 (8.4)	0.6	2.0
250 (160)	6309	0.47 (12.5)	0.7	2.5
280 (180)	6311	0.61 (17)	1.2	3.9
320 (200)	6312	0.76 (20.1)	1.2	4.0
360 (225)	6313	0.81 (23)	1.5	5.2
400 (250)	6316	1.25 (33)	2.0	6.6
440 (280)	6318	1.52(40)	2.5	8.2
440 (280)	6319	2.12 (60)	4.1	13.4
5000 to 5800 (315–355)	6328	4.70 (130)	9.2	30.0
5000 to 5800 (315–355)	NU328	4.70 (130)	9.2	30.0
360 to 449 (225–280)	NU319	2.12 (60)	4.1	13.4
AC Induction Servo				
76 Frame 180 (112)	6207	0.22 (6.1)	0.44	1.4
77 Frame 210 (132)	6210	0.32 (9.0)	0.64	2.1
80 Frame 250(160)	6213	0.49 (14.0)	0.99	3.3

* Weight in grams = .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.

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

Relubrication Procedure Be sure that the grease you are adding to the motor is compatible with the grease already in the motor. Consult your Baldor distributor or an authorized service center if a grease other than the recommended type is to be used.

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

With Grease Outlet Plug

1. With the motor stopped, clean all grease fittings with a clean cloth.
2. Remove grease outlet plug.

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

3. Add the recommended amount of grease.
4. Operate the motor for 15 minutes with grease plug removed. This allows excess grease to purge.
5. Re-install grease outlet plug.

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 it's 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.

Sample Relubrication Determination

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

1. Table 3-2 list 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.

Note: Smaller bearings in size category may require reduced amounts of grease.

Shaker Duty Motors only

Caution: **Shaker Duty motors must be properly lubricated prior to Start Up to prevent damage. See Table 3-6.**

Lubrication should be performed before Start Up and at regular maintenance intervals. Follow these recommendations to ensure proper lubrication.

Recommended Lubricant

For ambient temperatures between –15 ºF to 120 ºF the following lubricants are recommended: Mobil PolyrexEM, Texaco Premium RB, Exxon Unirex N–2.

Do not mix greases unless compatibility has been checked and verified.

Table 3-5 Lubrication Volume

NEMA Frame Size	Volume in Cubic Inches					
	Normal Duty		Severe Duty		Extreme Duty	
	Start Up	Relub	Start Up	Relub	Start Up	Relub
184TY	1.4	0.5	1.4	0.5	2.7	0.5
215TY	1.6	0.5	1.6	0.5	4.5	1
256TY	7	1			11	2
286TY	9	1			15	3

Lubrication Frequency

Normal Duty 8 hours per day (16 hours per day in a clean environment). Lubricate every 2 months.

Severe Duty 16 hours per day or more in a dirty environment (corrosive atmosphere, chemical fumes, acids, alkalies or extreme high humidity). Lubricate every month or 700 hours of operation.

Extreme Duty operation in extremely dirty or dusty environments and high ambient temperatures exceeding 104 ºF (40 ºC). Lubricate twice a month or 350 hours of operation.

Lubrication Procedure

1. Locate the grease inlet and outlet. Clean the areas.
2. Remove the plug(s) and install a grease fitting in the inlet if grease fitting is not already installed.
3. Add the recommended amount of lubricant.
4. Run the motor for two hours with the outlet plug removed.
5. Install outlet plug.

Note: To loosen hardened grease it may be necessary to insert a rod or wire into the grease inlet and outlet holes.

Table 3-6 Troubleshooting Chart

Symptom	Possible Causes	Possible Solutions
Motor will not start	Usually caused by line trouble, such as, single phasing at the starter.	Check source of power. Check overloads, fuses, controls, etc.
Excessive humming	High Voltage. Eccentric air gap.	Check input line connections. Have motor serviced at local Baldor service center.
Motor Over Heating	Overload. Compare actual amps (measured) with nameplate rating.	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 across cooling fins. Excessive dirt build-up on motor. Clean motor.
	Unbalanced voltage.	Check voltage at all phases (should be approximately equal) to isolate and correct the problem.
	Rotor rubbing on stator.	Check air gap clearance and bearings. Tighten “Thru Bolts”.
	Over voltage or under voltage.	Check input voltage at each phase to motor.
	Open stator winding.	Check stator resistance at all three phases for balance.
	Grounded winding.	Perform dielectric test and repair as required.
	Improper connections.	Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity. Refer to motor lead connection diagram.
Bearing Over Heating	Misalignment.	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.
	Dirt in bearing.	Clean bearing cavity and bearing. Repack with correct grease until cavity is approximately 3/4 filled.
Vibration	Misalignment.	Check and align motor and driven equipment.
	Rubbing between rotating parts and stationary parts.	Isolate and eliminate cause of rubbing.
	Rotor out of balance.	Have rotor balance checked are repaired at your Baldor Service Center.
	Resonance.	Tune system or contact your Baldor Service Center for assistance.
Noise	Foreign material in air gap or ventilation openings.	Remove rotor and foreign material. Reinstall rotor. Check insulation integrity. Clean ventilation openings.
Growling or whining	Bad bearing.	Replace bearing. Clean all grease from cavity and new bearing. Repack with correct grease until cavity is approximately 3/4 filled.

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 ºC) 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 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.

Table 3-7 Winding RTDs – Temperature Limit In ºC (40 ºC Maximum Ambient)

Motor Load (Typical Design)	Class B Temp Rise ≤ 80 ºC		Class F Temp Rise ≤ 105 ºC		Class H Temp Rise ≤ 125 ºC	
	Alarm	Trip	Alarm	Trip	Alarm	Trip
≤ Rated Load	130	140	155	165	175	185
Rated Load to 1.15 S.F.	140	150	160	165	180	185

Note: • Winding RTDs are factory production installed, not from Mod–Express.

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

Table 3-8 Bearing RTDs – Temperature Limit In oC (40 ºC Maximum Ambient)

Bearing Type Oil or Grease	Anti–Friction		Sleeve	
	Alarm	Trip	Alarm	Trip
Standard*	95	100	85	95
High Temperature**	110	115	105	110

Notes: * Bearing temperature limits are for standard design motors operating at Class B temperature rise.

** High temperature lubricants include some special synthetic oils and greases.

Greases that may be substituted that are compatible with Polyrex EM (but considered as “standard” lubricants include the following:

– Texaco Polystar – Rykon Premium #2 – Chevron SRI #2

– Mobilith SHC–100 – Pennzoil Pennzlube EM–2 – Chevron Black Pearl

– Darmex 707 – Darmex 711 – Petro–Canada Peerless LLG

See the motor nameplate for replacement grease or oil recommendation.

Contact Baldor application engineering for special lubricants or further clarifications.

Section 4

Appendix - IEC 60079 Series

INFORMATION REQUIRED PER IEC 60079-0:2017 Ed7

All *italicized* information below is quoted from the standard, clause 30.

Clause 30 (instructions) – Instructions are provided with each motor, the most recent version of this manual can be download at baldor.com.

Instructions for purposes of this standard consists of the following that are shipped with your motor in the literature package:

- Instruction Manual MN408
- Ex Certificates applicable for your motor
- Nameplate marking photos for your motor

Clause 30.1 (general)

The instructions prepared by the manufacturer shall include the following particulars as a minimum.

Marking

A recapitulation of the information with which the equipment is marked, except for the serial number (see Clause 29), together with any appropriate additional information to facilitate maintenance (for example, address of the importer, repairer, etc.)

A copy of the nameplates is included in the literature package and is shipped with each motor. These instructions are used for a range of mining motors. An example of typical certification marking is shown in Section 1. For motor specific information, please refer to the certification nameplate photos, electrical rating information and any specific conditions conveyed in the motor marking such as but not limited to ambient range, water flow, converter set up parameters and refer to the data package shipped with the product.

on-site assembling:

Not typically required.

installation and erection:

iii) guidance for the selection of flameproof entry devices for termination compartments with reference pressure greater than ...1 333 kPa for Group I and 2 000 kPa for Group II .

The reference pressure encountered in this Group I range of motors is below 1 333 kPa and is below 2 000 kPA for the Group II range of motors.

adjustment and parameter setting

If operated on a converter, refer to nameplate marking for set-up parameters.

putting into service - of the equipment / of the whole installation:

i) information about verifications / tests prior to (first) use

Refer to Section 2, Installation and Operation

ii) detailed information about any special installation requirements for the Type of Protection(s) employed

For flanged joints, inspect with feeler gauge 0,40mm maximum

Use and setting-up;

Ratings such as electrical values, ambient temperatures and pressures, maximum surface temperatures and other limit values related to a designated use are included on the product nameplate photos and in the product data package..

- maintenance;

ii) Information such as cleaning, oil level check or recalibration requirements;

Information on bearing inspection is in the Maintenance Section 3

iii) Requirements for the maintenance of the explosion protection.

Flameproof joints should be inspected during repair and overhaul contact manufacturer for schedule drawings if needed for repair.

- repair

i) Repair should be conducted in accordance with the requirements given in IEC 60079-19

Refer to Repair of Motors used in Hazardous Locations

Information related to the fitting or removal of parts / components; As each motor design is unique, it is necessary to Contact the manufacture for additional repair details. Use only original manufacturer's parts.

ii) information related to the fitting or removal of parts / components

Contact ABB regarding any spare parts.

iii) Information about spare parts

Contact ABB regarding any spare parts.

iv) Requirements for a documentation of such repairs.

As any repair is undertaken after consultation with IEC60079-19, the documentation requirements for the repair in this standard apply.

- taking out of service and dismantling

i) Use appropriate lock out tag out procedures to prevent restart and prior to making or breaking any electrical connection.

- ***where applicable, Specific Conditions of Use according to 29.3 e)***

As Specific Conditions of Use may vary with each certificate, if Specific Conditions are applied, the certificate is shipped with each motor forming part of the Instructions. Refer to Marking and Acceptance section for an explanation of the "X" suffix to certificate numbers.

Clause 30.3 (electrical machines)

In addition to the information required according to 30.1, the following additional information shall be prepared for electrical machines, as applicable:

machines intended to be supplied by a converter

For speed torque information on motors intended to be supplied by converter, consult motor nameplate.

bearing lubrication requirements for both commissioning and maintaining;

Instructions for lubrication are included in the Bearing Maintenance Section. Only use ABB recommended grease or contact ABB Motors and Mechanical Inc., product support team for guidance on equivalents suitable for hazardous locations.

the permitted axial and radial loading of the shaft;

Table 4-1 Table to Address Permissible Radial and Axial Shaft Loads

AC Motors		
Frame Size	Permissible Radial Shaft Load (kN)*	Permissible Axial Shaft Thrust (kN)*
150	0.60	0.67
188	0.70	0.67
210	0.80	0.67
X215TCZ	0.90	0.67
240	0.95	0.67
XRL25OAY	4.30	1.60
XRL25OAY	3.80	1.50
XRL25OAY	11.60	15.00
250	1.00	0.67
0280	1.00	1.00
X286TCZ	1.40	1.00
320	1.60	1.00
X326TCZ	1.70	1.00
350	1.90	1.00
360	2.00	1.00
400	4.50	1.00
440	4.50	3.00
470	4.80	3.00
500	5.00	3.00
580	7.50	4.00
Furnace Fan Ex ec Motors		
Frame Size	Permissible Radial Shaft Load (kN)*	Permissible Axial Shaft Thrust (kN)*
326TY	5.9	2.2
Medium AC Ex d Motors (at 1800 RPM L10 of 100,000 hours)		
Frame Size	Permissible Radial Shaft Load (kN)*	Permissible Axial Shaft Thrust (kN)*
180	.5	--
210	.7	--
250	1.6	--
280	1.8	--
320	2.0	--
360	2.6	--
400	3.3	--
440	2.8	--

DC Motors		
Frame Size	Permissible Radial Shaft Load (kN)*	Permissible Axial Shaft Thrust (kN)*
41-6,9	2.00	1.00
48-9,12	2.00	1.00
51-7,11,15	2.00	1.60
51-9	2.00	1.60

*Permissible shaft loads are for specified frame size mounted horizontally and are calculated for an extended service life of 17,500 operating hours of bearing according to DIN ISO 281. Consult engineering for application specific solutions that require larger permissible shaft loads than those provided in this table. This table assumes pure radial loading for permissible radial shaft loads and pure axial loading for permissible axial shaft thrust.

- ***the thermal expansion of the shaft and housing under rated conditions***

  Maintain minimum clearances necessary to accommodate thermal growth of up to 3mm of the frame and up to 5mm (8mm for Furnace Fan Motor Designs) of the shaft during design operating conditions. Consult engineering for application specific solutions where these minimum clearances are not permissible.

- ***any necessary maintenance of the protection provided by the manufacturer against stray circulating currents in the bearings or shafts.***

  Ensure that the motor is properly earthed and bonded. For motors operated by converter, consult converter manufacturers instructions relative to cable recommendations.

- ***any necessary protection of the bearings from vibration, including during transportation, storage, or standby service;***

  Protection of bearings from vibration during storage and transportation are addressed in General. Bearings requiring blocking are blocked during shipment.

- ***guidance on maintenance and replacement intervals for bearings based on the operating conditions.***

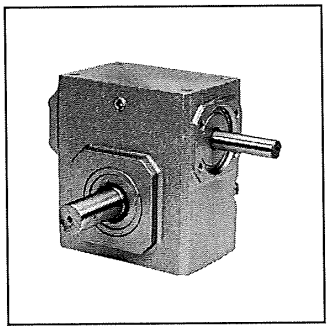
  Instructions for lubrication are included in the Bearing Maintenance Section

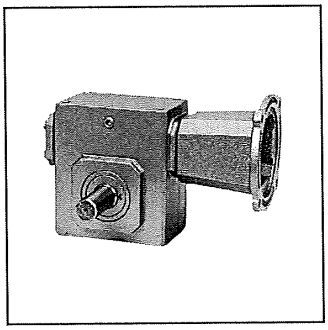
INFORMATION REQUIRED PER IEC 60079-1:2014

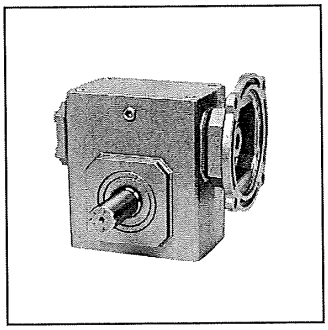
If it is necessary to repair a flameproof or explosion proof motor, it is critical that the mechanical flameproof joints be maintained. Consult ABB Motors and Mechanical Inc., product support team for flameproof joint construction details. Use only Baldor/Reliance supplied parts. ABB does not recommend reclamation of Baldor/Reliance parts.

GROVE GEAR

FLEX-A-LINE SPEED REDUCERS







Installation, Lubrication and Maintenance Instructions

Selection Information

Read ALL instructions prior to operating reducer. Injury to personnel or reducer failure may be caused by improper installation, maintenance or operation.

Written authorization from Grove Gear is required to operate or use reducers in man lift or people moving devices.

Check to make certain application does not exceed the allowable load capacities published in the current catalog.

Buyer shall be solely responsible for determining the adequacy of the product for any and all uses to which Buyer shall apply the product. The application by Buyer shall not be subject to any implied warranty of fitness for a particular purpose.

Safety Alert

⚠WARNING

- For safety, Buyer or User should provide protective guards over all shaft extensions and any moving apparatus mounted thereon. The User is responsible for checking all applicable safety codes in his area and providing suitable guards. Failure to do so may result in bodily injury and/or damage to equipment.
- Hot oil and reducers can cause severe burns. Use extreme care when removing lubrication plugs and vents.
- Make certain that the power supply is disconnected before attempting to service or remove any components. Lock out the power supply and tag it to prevent unexpected application of power.
- Reducers are not to be considered fail safe or self-locking devices. If these features are required, a properly sized, independent holding device should be utilized. Reducers should not be used as a brake.
- Any brakes that are used in conjunction with a reducer must be sized or positioned in such a way so as to not subject the reducer to loads beyond the catalog rating.
- Lifting supports including eyebolts are to be used for vertically lifting the gearbox only and no other associated attachments or motors.
- Use of an oil with an EP additive on units with backstops may prevent proper operation of the backstop. Injury to personnel, damage to the reducer or other equipment may result.
- Overhung loads subject shaft bearings and shafts to stress which may cause premature bearing failure and/or shaft breakage from bending fatigue, if not sized properly.

⚠CAUTION

- Test run unit to verify operation. If the unit tested is a prototype, that unit must be of current production.
- If the speed reducer cannot be located in a clear and dry area with access to adequate cooling air supply, then precautions must be taken to avoid the ingestion of contaminants such as water and the reduction in cooling ability due to exterior contaminants.
- Mounting bolts should be routinely checked to ensure that the unit is firmly anchored for proper operation.

Important Information

In the event of the resale of any of the goods, in whatever form, Resellers/Buyers will include the following language in a conspicuous place and in a conspicuous manner in a written agreement covering such sale:

> *The manufacturer makes no warranties or representations, express or implied, by operation of law or otherwise, as to the merchantability or fitness for a particular purpose of the goods sold hereunder. Buyer acknowledges that it alone has determined that the goods purchased hereunder will suitably meet the requirements of their intended use. In no event will the manufacturer be liable for consequential, incidental or other damages. Even if the repair or replacement remedy shall be deemed to have failed of its essential purpose under Section 2-719 of the Uniform Commercial Code, the manufacturer shall have no liability to Buyer for consequential damages.*

Resellers/Buyers agree to also include this entire document including the warnings above in a conspicuous place and in a conspicuous manner in writing to instruct users on the safe usage of the product.

This instructions manual should be read together with all other printed information such as catalogs, supplied by Grove Gear.

General Operation

1. Run the motor which drives the reducer and check the direction of reducer output rotation. Consult motor nameplate for instructions to reverse the direction of rotation.
2. Attaching the load: On direct coupled installations, check shaft and coupling alignment between speed reducer and loading mechanism. On chain/sprocket and belt/pulley installation, locate the sprocket or pulley as close to the oil seal as possible to minimize overhung load. Check to verify that the overhung load does not exceed specifications published in the catalog.
3. High momentum loads: If coasting to a stop is undesirable, a braking mechanism should be provided to the speed reducer output or the driven mechanism.

⚠CAUTION The system of connected rotating parts must be free from critical speed, torsional or other type vibration, no matter how induced. The responsibility for this system analysis lies with the purchaser of the speed reducer.

Installation

1. Mount the unit to a rigid flat surface using grade 5 or higher fasteners. The mounting fasteners should be the largest standard size that will fit in the base mounting hole. Shim as required under flange or base feet which do not lie flat against the mounting surface.
2. For shipment, pipe plugs are installed in the unit and a vent plug is packed separately. After mounting the unit in position, remove the appropriate pipe plug and install the vent plug in the location shown on page 5. On double reduction units both the primary and the secondary must be vented. Failure to vent the unit can cause premature seal wear or loss of seal and oil. These conditions are not covered by warranty. Check for correct oil level. Contact the factory for level and vent recommendations on non-standard mounting positions. **Grove Gold** units with optional internal pressure compensating system do not use vents. See (internal pressure compensating system) under **Lubrication** for further information.
3. **Grove Gold** units include synthetic oil and an internal pressure compensation system pre-installed at the factory. It is not necessary to vent these units, and they can be used as supplied from the factory. Do not loosen the nut holding the stem of the pressure compensator, and do not block the hole in the stem. Do not blow pressurized air into the hole, and avoid spraying washdown chemicals directly into the hole.
4. Connect motor to speed reducer.

⚠WARNING Depending upon gear geometry and operating conditions worm gear reducers may or may not backdrive. Special consideration should be given to high inertia loads connected to the output shaft. Consult the factory for further details.

⚠CAUTION DO NOT CHANGE MOUNTING POSITIONS WITHOUT CONTACTING FACTORY.
Altering the mounting position may require special lubrication provisions which must be factory installed.

⚠CAUTION Do not operate the reducer without making sure it contains the correct amount of oil. Do not overfill or underfill with oil, or injury to personnel, reducer or other equipment may result. **Grove Gold** units are lubed and sealed for life, so in most applications it will not be necessary to drain or re-fill the unit.

⚠CAUTION A unit cannot be used as an integral part of a machine superstructure which would impose additional loads on the unit other than those imposed by the torque being transmitted either through a shaft-mounted arrangement, and any shaft mounted power transmitting device. *(e.g., sprockets, pulleys, couplings)*

⚠CAUTION For safe operation and to maintain the unit warranty, when changing a factory installed fastener for any reason, it becomes the responsibility of the person making the change to properly account for fastener grade, thread engagement, load, tightening torque and the means of torque retention.

Lubrication - Standard Units

With the exception of unit sizes 2700, 2800 and 21000 which are shipped dry, all standard reducers ordered from the factory are filled with lubricant to operate within a 30° to100° F ambient temperature range. Double and triple reduction units have separate oil sumps and must be filled/checked independently. Prior to startup, verify that the oil is at the level shown on the drawings on page 5. If the ambient temperature will be outside the range for the lubricant installed at the factory, drain and refill the reducer with the proper viscosity lubricant prior to use. Consult the chart on page 4 or the factory for alternate lubricants.

Change Intervals: Standard compounded lubricants should be changed every six months or 2500 operating hours, whichever comes first. Factory installed synthetic lubricants should be changed every two years or 6000 hours, whichever comes first.

Internal pressure compensating system: Grove Gold and stainless steel reducers come standard with an internal pressure compensating system and synthetic oil pre-installed at the factory. It is not necessary to vent these reducers, and they can be used as supplied from the factory.

⚠CAUTION Oil should be changed more often if reducer is used in a severe environment. *(i.e. dusty, humid)*

⚠CAUTION In the Food and Drug Industry (including animal food), consult the lubrication supplier for recommendation of lubricants which are acceptable to the Food and Drug Administration and/or other authoritative bodies having jurisdiction. Factory supplied oil is not suitable for these applications or this industry.

⚠CAUTION Do not mix different oils in the reducer. Oils should be compatible with Viton® seal material.

Special Lubrication Requirements - Sizes 218 & Larger

Units shipped from the factory are assembled to properly lubricate all internal components based on a specific assumed mounting orientation. The factory assumed mounting orientations are given below. If a size 218 or larger unit will be mounted in a different orientation than listed below, or run with sustained input speeds less than 900 RPM, it should be specified with the order. The unit can then be modified to assure proper lubrication.

Factory Assumed Mounting Orientation	Applicable Unit Styles*	
Worm Over	B, T, F, H, FH, C, D, DT, DF, DH, DFH DX, DXT, DXH, DXFH, TT	Single Reduction Double Reduction Worm-Worm Double Reduction Helical-Worm Triple Reduction Worm-Worm-Worm
Worm Under	U DU	Single Reduction Double Reduction Worm-Worm
Vertical Output	VL/VH, FE DVL/DVH, DFE DXVL/DXVH, DXFE	Single Reduction Double Reduction Worm-Worm Double Reduction Helical-Worm
Vertical Input	J DJ DXJ	Single Reduction Double Reduction Worm-Worm Double Reduction Helical-Worm
	** Includes "M" and "MQ" versions of all styles listed*	

The precision-made gears and bearings in Grove Gear Speed Reducers require high-grade lubricants of the proper viscosity to maintain trouble-free performance. For best results, use lubricants on the following chart for worm gear reducers:

Manufacturer	30° to 100° F Ambient Temperature AGMA Compounded No. 7	50° to 125° F Ambient Temperature AGMA Compounded No. 8
Amoco Oil Co.	Worm Gear Oil	Cylinder Oil #680
Chevron USA, Inc.	Cylinder Oil #460X	Cylinder Oil #680X
Exxon Co. USA	Cylesstic TK-460	Cylesstic TK-680
Gulf Oil Co.	Senate 460	Senate 680D
Mobile Oil Corp.	600 W Super Cylinder	Extra Hecla Super
Shell Oil Co.	Valvata Oil J460	Valvata Oil J680
Sun Oil Co.	Gear Oil 7C	Gear Oil 8C
Texaco	Honor Cylinder Oil	650T Cylinder Oil
Union Oil Co. of CA	Steaval A	Worm Gear Lube 140

Standard factory-installed lubricant, shipped with 6.00" C.D. and smaller units.

Some gear lubricants contain E.P. additives that can be corrosive to gear bronze. Avoid lubricants that are compounded with sulfur and/or chlorine.

For temperature ranges not shown, contact factory.

For lubrication requirements of **Grove Gold** or helical reducers (primaries of helical/worm reducers, ratio multipliers, and styles BAMCQ, BAMC, and BA), contact factory.

Oil Capacities (pints) - Standard Units

Mounting Position	UNIT SIZE													
	213	215	217	220	224	226	230	232	242	252	2600	2700*	2800*	21000*
Worm Over	1/2	3/4	1	1 1/2	1 3/4	3	3 3/4	5	8 1/4	12 1/2	19 1/2	35	48	72
Worm Under	1/2	3/4	1	1 1/2	1 3/4	3	3 3/4	5 1/2	8	13 1/2	20 1/2	32 3/4	51 1/4	80
Vertical Output	1/2	3/4	1	1 1/2	1 3/4	3	3 3/4	5	8	13 1/2	20	20 3/4	28 3/4	40
Vertical Input	1/2	3/4	1	1 1/2	1 3/4	3	3 3/4	5	8	13 1/2	20 1/3	36 1/2	50	75
Extended Bearing	N/A	N/A	N/A	N/A	N/A	N/A	N/A	8	12	17	27	40	63	102
Worm over on Secondary Unit of Double Reduction				N/A	N/A	N/A	N/A	12	19 1/4	20	30 1/3	50 1/3	71 1/2	107 1/4

**Shipped Dry*

16 oz. = 1 pint
2 pints = 1 quart
4 quarts = 1 gallon
1 gallon = 128 oz. = 231 cu. in.

CAUTION Always check for proper oil level after filling. Capacities vary somewhat with model and mounting position. Oil should rise to bottom edge of level hole. Do not overfill.

Synthetic Lubricants

Synthetic lubricants provide the potential for numerous benefits including wider temperature range and increased interval between changes. Use of synthetics can cause problems if they are not compatible with the seals or the conventional lubricants they replace. For continuous duty at normal ambient temperatures (-10°F to 105°F) we recommend the use of Mobil SHC 634 which is compatible with the standard compounded oil shipped in our product and the Viton® seal material used through size 252. For other temperatures, or for intermittent operation below 20° F, contact the factory for a recommendation.

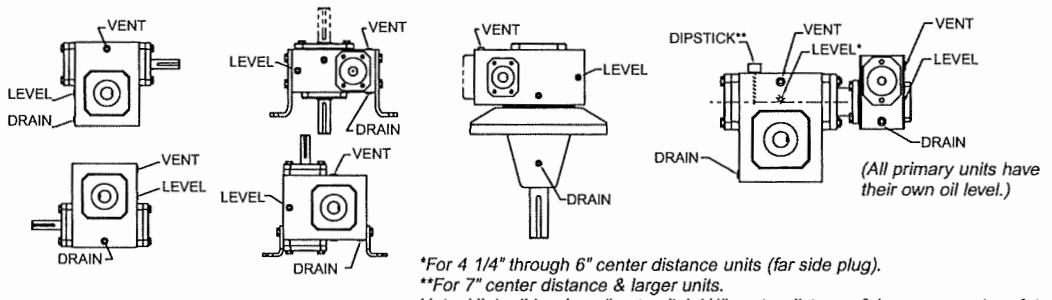
For synthetic lubrication to be used in helical reducers (primaries of helical/worm reducers, ratio multipliers, and styles BAMCQ, BAMC, and BA), contact factory.

Lubrication - Grove Gold

All **Grove Gold** reducers are shipped from the factory filled with synthetic lubricant suitable for continuous operation within a -10° F to 105° F ambient environment. If ambient temperature will be outside the above range, or if operation will be intermittent at temperatures below 20° F, consult the factory for lubrication recommendations. The unit is factory filled with the correct amount of oil for most mounting positions. If the unit will operate at input speeds below 900 RPM, or if a 230 or larger unit is to operate with one of its shafts in a vertical position, consult the factory for special lubrication considerations.

CAUTION In the Food and Drug Industry (including animal food), consult the lubrication supplier for recommendation of lubricants which are acceptable to the Food and Drug Administration and/or other authoritative bodies having jurisdiction. Factory supplied oil is not suitable for these applications or this industry.

Standard Speed Reducer Mounting Positions & Vent Plug, Level and Drain Locations



**For 4 1/4" through 6" center distance units (far side plug).*
***For 7" center distance & larger units.*
Note: High oil level applies to all 4 1/4" center distance & larger secondary & tertiary units regardless of primary unit type.

Maintenance - Standard Units

Your Grove Gear reducer has been tested and adjusted at the factory. Dismantling or replacement of components must be done by Grove Gear to maintain the warranty.

Frequently check the oil level of the reducer. If oil level is low, (refer to reducer vent and level position chart) add proper lubrication through the filler plug until it comes out the oil level plug.

Inspect vent plug often to insure it is clean and operating.

CAUTION Mounting bolts should be routinely checked to ensure that the unit is firmly anchored for proper operation.

Seals: The Grove Gear line of speed reducers utilize premium quality seals which are the state-of-the-art in sealing technology. Seals are, however, a wear item and eventually need to be replaced. Replacement can be easily accomplished by following the steps below:

1. Remove the worn seal without damaging the shaft surface or the seal bore. This can be done by drilling a .062 diameter hole in the seal casing (being careful not to drill into the bearing behind the seal). Screw a #10 sheet metal screw into the hole and pry out the seal.
2. Clean the seal bore of sealant.
3. Before installing the new seal, use electrical tape to cover any keyways on the shaft to prevent seal lip damage.
4. Grease the seal lips with bearing grease and apply a sealant to the seal bore.
5. Slide the seal into the shaft being careful not to fold the inner lip over on any shaft steps.
6. Press the seal into its bore with a sleeve that presses on the seal casing, being careful to keep the seal square in its bore.

Maintenance - Grove Gold

Your **Grove Gold** reducer has been tested and adjusted at the factory. Dismantling or replacement of components must be done by Grove Gear to maintain the warranty.

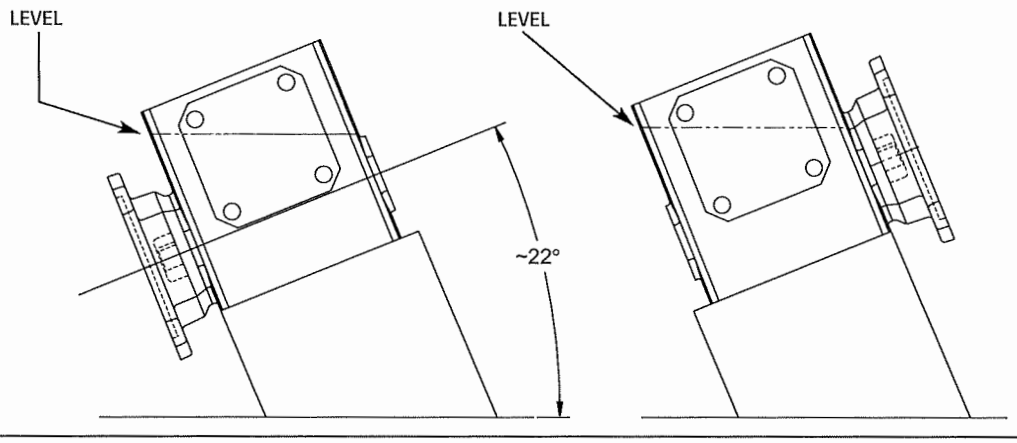
Inspect the stem of the pressure compensating system often to ensure it is clean and operating properly.

CAUTION Mounting bolts should be routinely checked to ensure that the unit is firmly anchored for proper operation.

Seals: The **Grove Gold** line of speed reducers utilize premium quality seals which are state-of-the-art in sealing technology. Seals are, however, a wear item and eventually need to be replaced. Replacement can easily be accomplished by following the procedure given under **Maintenance - Standard Units** above.

If seal leakage has resulted in the loss of a significant amount of oil, it may be necessary to add more lubricant. For normal ambient temperature conditions, Grove Gear recommends Mobil SHC 634 synthetic gear oil for worm drives, and Mobil SHC 150 for helical drives. For all worm drives, fill the gearbox to the level indicated in the diagram below.

Standard Oil Level for Grove Gold Reducers



CAUTION Always check for proper oil level after filling. Do not overfill or underfill with oil, or injury to personnel, reducer, or other equipment may result.

CAUTION Do not mix different oils in the reducer.

Item #	Description
	Basic Single Reduction Unit
1.	Gear Housing
2.	Pipe Plug
3.	Vent Plug
4.	Splash Guard
5.	Input Cover
6.	O-Ring
7.	Hex Head Cap Screw
8.	Input Oil Seal
9.	Input Bearing
10.	Input Bearing
*11.	Retaining Screw
12.	Input Shaft
13.	Output Cover
14.	Output Cover
15.	O-Ring
16.	Output Cover Gasket (as required)
17.	Output Oil Seal
18.	Output Bearing
19.	Hex Head Cap Screw
***20.	Single Output Shaft
***21.	Double Output Shaft
22.	Gear Spacer
23.	Gear Key (only used on size 2-5/8" center distance and larger units)
24.	Output Gear (supplied only as output assembly on size 1-1/3" through 2-3/8" center distance units)
25.	Input Cover (only used on size 4-1/4" center distance and larger units)
26.	Input Cover
27.	Input Oil Seal
*28.	Retaining Ring - Shaft
29.	Double Input Shaft
170.	Internal Pressure Compensation Chamber (optional)
171.	Internal Pressure Compensation Chamber Stem Plug
172.	Internal Pressure Compensation Chamber Stem Nut

**not used on 4-1/4" center distance and larger units*

	Quill Motor Flange Unit
30.	Double Input Shaft
40.	Quill Motor Flange
41.	Input Oil Seal
42.	Hex Head Cap Screw
43.	Retaining Ring - Shaft
44.	Retaining Ring - Housing (only used on size 4-1/4" center distance and larger units)
45.	Quill Input Shaft

	Hollow Output Shaft Unit
50.	Gear Housing
51.	Output Cover
52.	Output Oil Seal
53.	Output Bearing
54.	Gear Spacer
***55.	Output Shaft
56.	Setscrew
57.	Gear Key (only used on size 2-5/8" center distance and larger units)

Item #	Description
58.	Output Gear (supplied only as output assembly on size 1- 1/3" through 2-3/8" center distance units)
	Mounting Bracket Options
70.	Horizontal Mounting Foot
71.	Cap Screw
72.	High and Low Riser Bracket
73.	Hex Head Cap Screw
74.	"J" Mount Bracket
75.	Output Flange
76.	Machine Faced Output Cover (only used on size 2-3/8" center distance and larger solid output shaft units)
77.	Hex Head Cap Screw
78.	Torque Bracket
79.	Hex Head Cap Screw
	Extended Bearing Unit
90.	Flange
91.	Output Shaft
92.	Bearing
93.	Output Oil Seal
94.	Hex Head Cap Screw
95.	Pipe Plug
96.	Expansion Plug
*97.	Flange Cover
*98.	Gasket
*99.	Hex Head Cap Screw

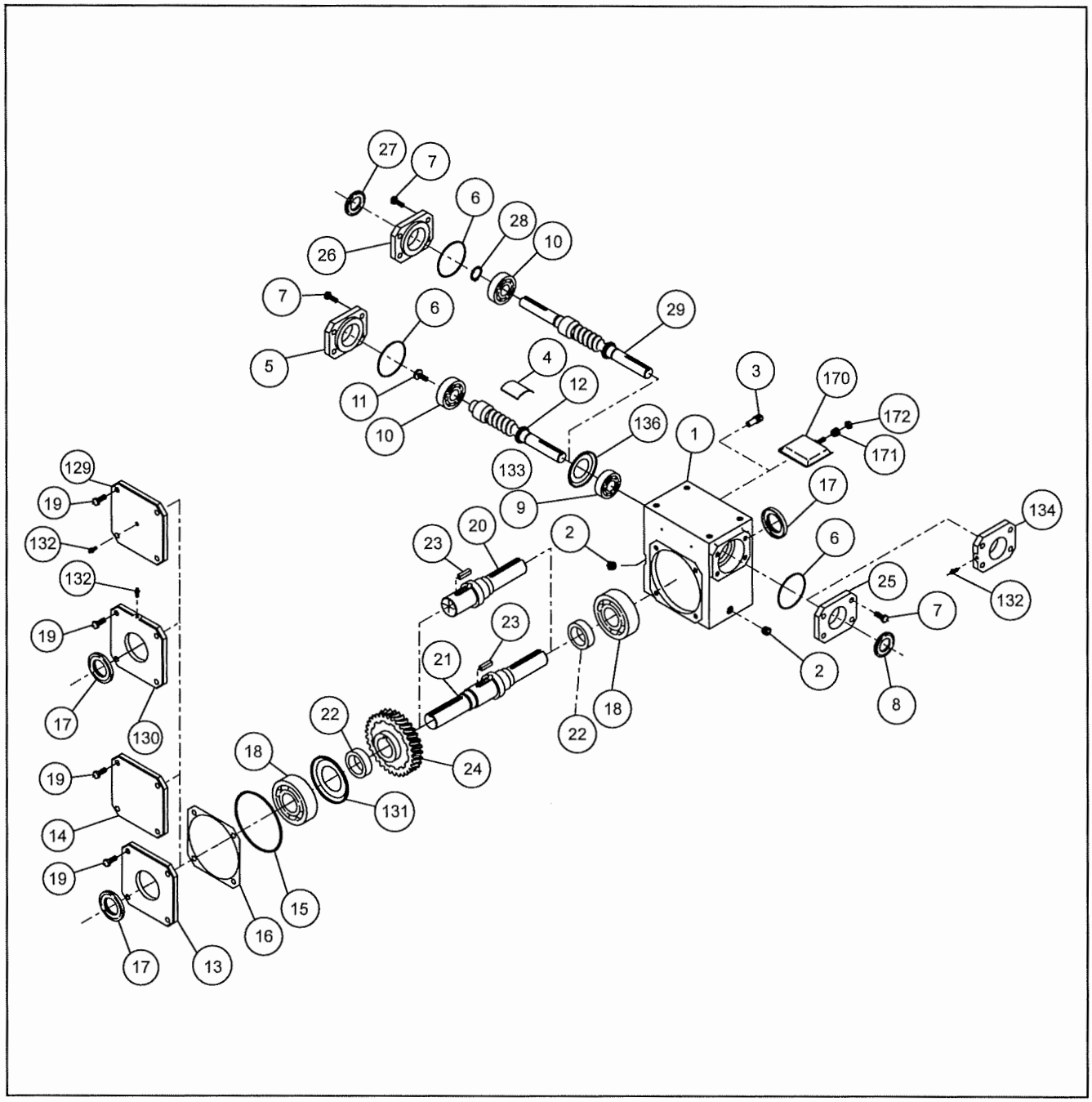
**only used on size 5-1/4" center distance and larger units*

	Long Motor Flange and Coupling Kit
110.	"C" Face Motor Flange
111.	Hex Head Cap Screw
112.	Coupling Key - Reducer Shaft
113.	Setscrew - Reducer Shaft
114.	Coupling Gear - Reducer Shaft
115.	Coupling Sleeve
116.	Setscrew - Motor Shaft
117.	Coupling Gear - Motor Shaft
118.	Coupling Key - Motor Shaft

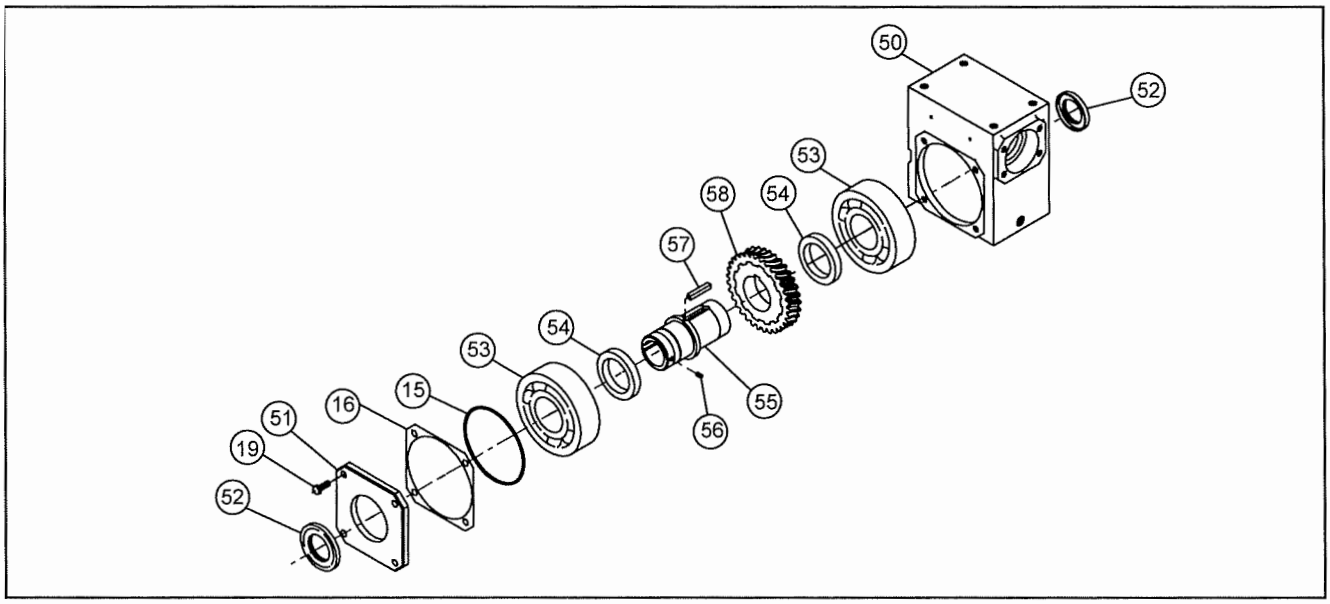
	Vertical Shaft Required Parts (Supplied only when mounting position involves a vertical shaft.)
*129.	Output Cover
*130.	Output Cover
*131.	Output Bearing Grease Retainer
132.	Grease Fitting
133.	Sealed Ball Bearing (only used on size 1-3/4" through 2-5/8" center distance units)
**134.	Input Cover
**136.	Input Bearing Grease Retainer

** Only used on size 4-1/4" center distance and larger units.*
*** Only used on size 3" center distance and larger units.*
**** Supplied only as output assembly on size 1-1/3" through 2-3/8" center distance units.*

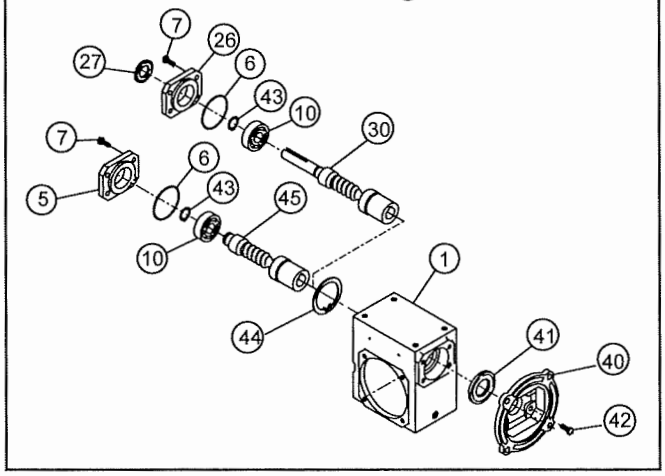
Basic Single Reduction Unit



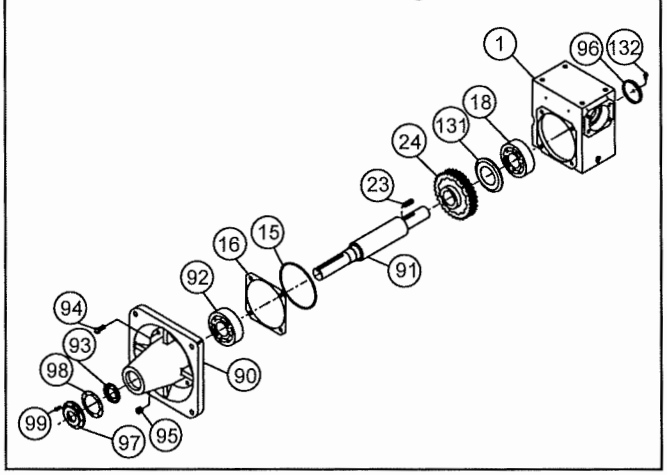
Hollow Output Shaft Unit



Quill Motor Flange Unit

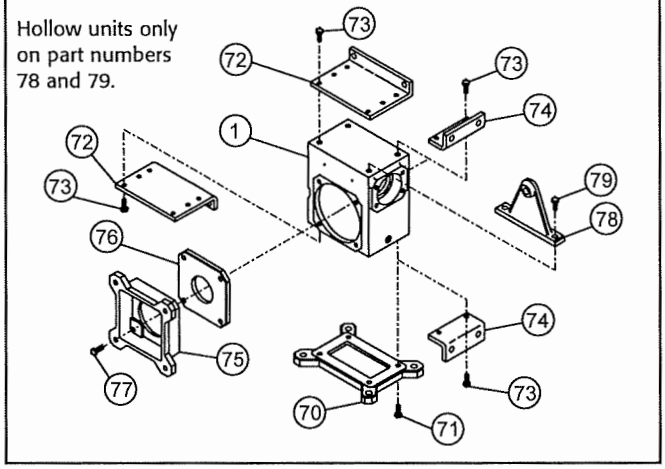


Extended Bearing Unit

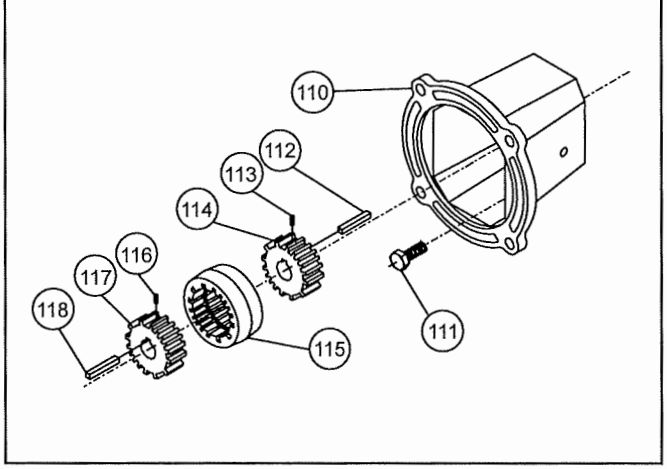


Mounting Bracket Options

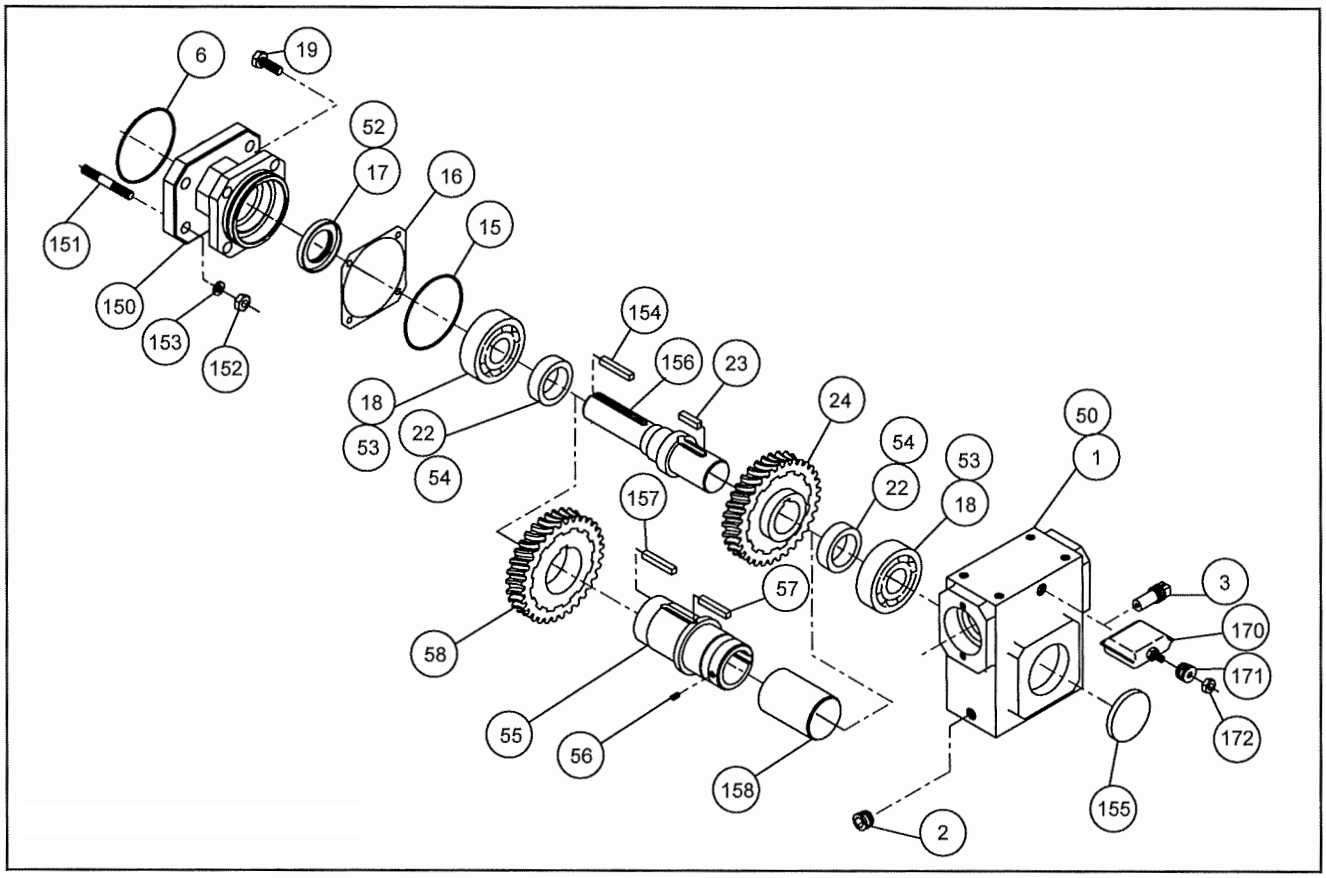
Hollow units only on part numbers 78 and 79.



Long Motor Flange & Coupling Kit



Primary Unit for Double Reduction Worm/Worm Styles & Triple Reduction Worm/Worm/Worm Styles

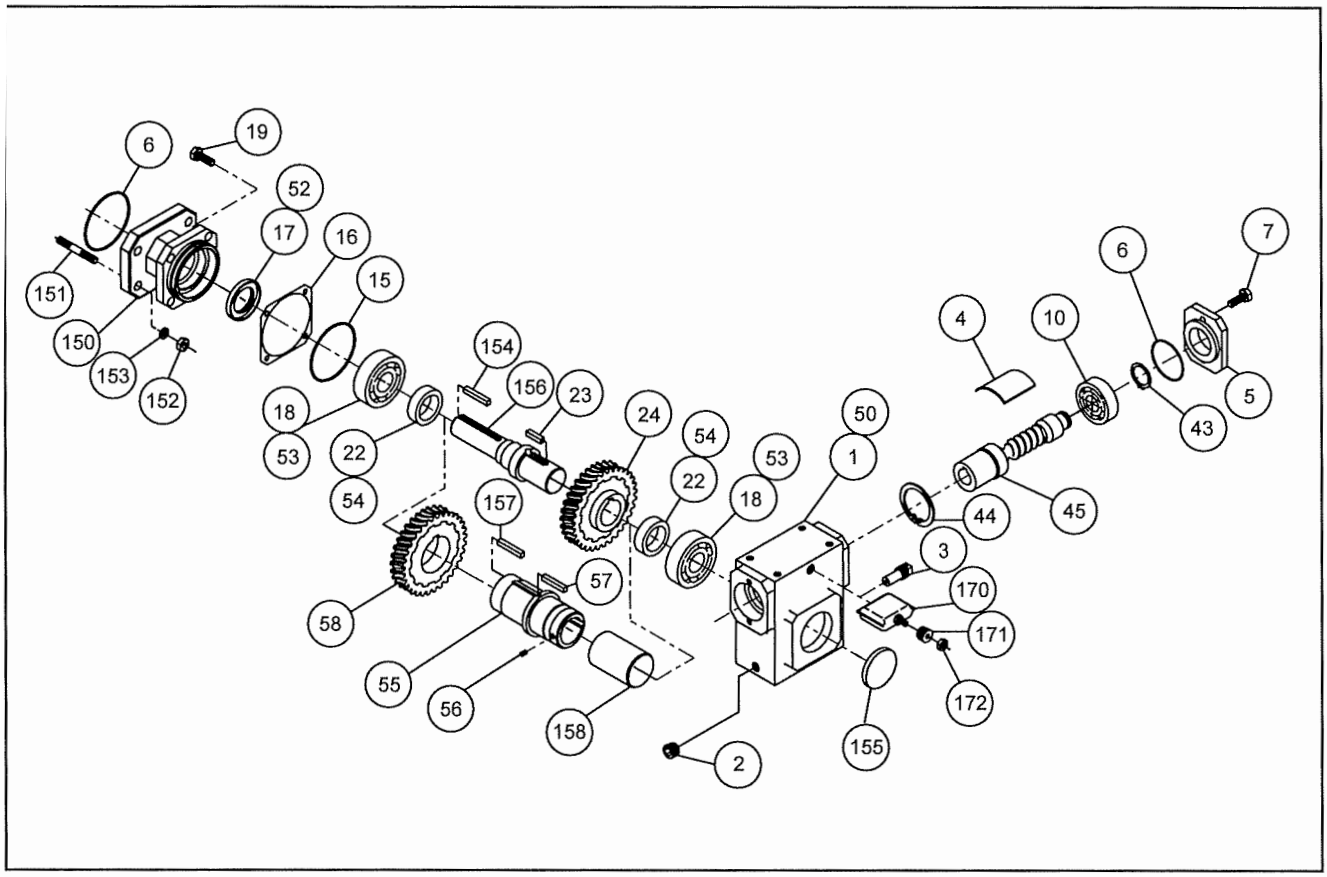


Item #	Description
1.	Gear Housing
2.	Pipe Plug
3.	Vent Plug
6.	O-Ring
15.	O-Ring
16.	Output Cover Gasket (as required)
17.	Output Oil Seal
18.	Output Bearing
19.	Hex Head Cap Screw
22.	Gear Spacer
23.	Gear Key (only used on size 2-5/8" center distance and larger primary units)
24.	Output Gear (supplied only as output assembly on size 1-1/3" through 2-3/8" center distance primary units)
*50.	Gear Housing
*52.	Output Oil Seal
*53.	Output Bearing
*54.	Gear Spacer

Item #	Description
**55.	Output Shaft
*56.	Setscrew
*57.	Gear Key (only used on size 2-5/8" center distance and larger primary units)
*58.	Output Gear (supplied only as output assembly on size 1-1/3" through 2-3/8" center distance primary units)
150.	Double Reduction Adaptor
151.	Stud
152.	Hex Nut
153.	Lock Washer
154.	Primary Solid Output Key
155.	Expansion Plug
156.	Primary Solid Output Shaft
*157.	Primary Hollow Output Key
*158.	Hollow Shaft Plug
170.	Internal Pressure Compensation Chamber (optional)
171.	Internal Pressure Compensation Chamber Stem Plug
172.	Internal Pressure Compensation Chamber Stem Nut

** Only used on size 7", 8", and 10" center distance secondary units for double reduction worm/worm styles.*
***Supplied only as output assembly on size 1-1/3" through 2-3/8" center distance units.*

Secondary Unit For Triple Reduction Worm / Worm / Worm Styles

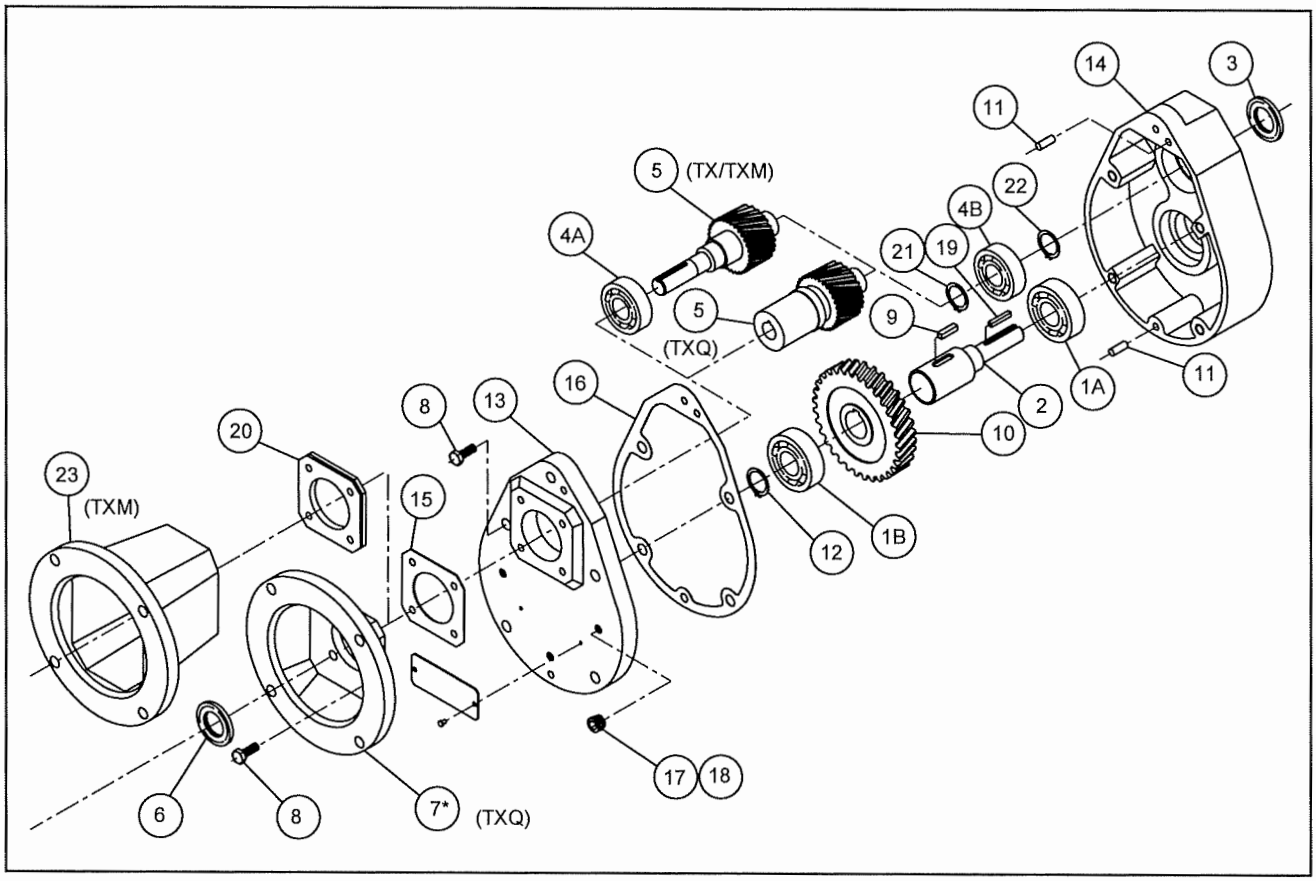


Item #	Description
1.	Gear Housing
2.	Pipe Plug
3.	Vent Plug
6.	O-Ring
15.	O-Ring
16.	Output Cover Gasket (as required)
17.	Output Oil Seal
18.	Output Bearing
19.	Hex Head Cap Screw
22.	Gear Spacer
23.	Gear Key (only used on size 2-5/8" center distance and larger secondary units)
24.	Output Gear (supplied only as output assembly on size 1-1/3" through 2-3/8" center distance secondary units)
*50.	Gear Housing
*52.	Output Oil Seal
*53.	Output Bearing
*54.	Gear Spacer

Item #	Description
*55.	Output Shaft
*56.	Setscrew
*57.	Gear Key (only used on size 2-5/8" center distance and larger secondary units)
*58.	Output Gear (supplied only as output asssembly on size 1-1/3" through 2-3/8" center distance secondary units)
150.	Triple Reduction Adaptor
151.	Stud
152.	Hex Nut
153.	Lock Washer
154.	Secondary Solid Output Key
155.	Expansion Plug
**156.	Secondary Solid Output Shaft
*157.	Secondary Hollow Output Key
*158.	Hollow Shaft Plug
170.	Internal Pressure Compensation Chamber (optional)
171.	Internal Pressure Compensation Chamber Stem Plug
172.	Internal Pressure Compensation Chamber Stem Nut

** Only used on size 7", 8", and 10" center distance tertiary units for triple reduction worm/worm/worm styles.*
***Supplied only as output assembly on size 1-1/3" through 2-3/8" center distance units.*

Helical Primary



Item # Description

1A. Bearing, Output (Ball) – Extension End
1B. Bearing, Output (Ball) – Inboard End
2. Shaft, Output (state output frame size)
3. Seal, Oil (Output)
4A. Bearing, Input (Ball) – Extension End (N/A for TXQ)
4B. Bearing, Input (Ball) – Inboard End
5. Shaft, Input (state ratio); on TXQ also state frame size.
6. Seal, Oil (Input)
*7. Flange, Motor (TXQ only)
8. Screw – 8 req. on Model I & II; 11 req. on Model III
9. Key, Gear
10. Gear, Output (state ratio)

Item # Description

11. Pin, Dowel – 2 req.
12. Spacer, Low Speed – 2 req.
13. Cover, Housing
14. Housing, Gear
15. Gasket, Input Cover
16. Gasket, Housing
17. Plug, Pipe – 2 req.
18. Plug, Vent
19. Key, Output Shaft
20. Cover, Input, Seal Retainer
21. Ring, Retaining, Internal, Input Shaft
22. Ring, Retaining, External, Input Shaft
23. Flange, Motor (TXM only)

**Motor Flange replaces input cover on 'TXQ' Model.*

Include the complete model description and serial number of the reducer when ordering replacement parts.

INTRODUCTION

Lubricant is a basic element in rolling element bearings. It is as essential to proper operation as are the races and rolling elements. Oil provides a separating layer between rolling elements and raceways and lubricates the sliding surfaces between the rolling elements and retainer. This lubricating layer eliminates or minimizes metal to metal contact and distributes stresses. Lubrication can also provide protection against corrosion, a barrier to contamination, and dissipation of heat.

GREASE

Grease is the primary lubricant used in most industrial mounted bearing units. Grease usually consists of three primary components: oil, thickener, and additives

Grease comes in various thicknesses. Standard bearings are generally packed with grease of NLGI-grade 2 thickness. For most applications this grade is sufficient for retention in the bearing, is easily pumped through most grease guns, and operate under most speed conditions. Other greases can be used for special situations.

THICKENERS

The thickener's primary purposes are to retain the oil so that it remains in the bearing, release the oil as needed, and reabsorb the oil as needed. The thickener can also provide additional sealing and protection from contamination and heat dissipation. There are many types of grease thickeners including lithium, calcium, sodium, aluminum, etc. Lithium thickeners are the most common type with the others being useful in specialized situations, such as high temperature, low drag, and low temperature, etc.

OIL

Oil is the primary lubricating component in grease and consists of two types: petroleum and synthetic. Petroleum oils are the primary oils used today. Synthetic hydrocarbons can be thought of as synthetic petroleum oils. Other synthetics include esters, silicones. fluorinated hydrocarbons, etc

Oil is a fluid and can be obtained in varying viscosities. Viscosity refers to the "thickness" of the oil and is usually directly related to an oils' shear strength or its ability to resist loading.

Elastohydrodynamic (EHL) lubrication is the model that explains the lubrication of anti-friction bearings. EHL takes into account the deformation of the rolling elements and raceways as well as the increased viscosity of the lubricant in the load zone.
In a rotating rolling element bearing there is one of (3) types of lubrication conditions present; 1.) Boundry 2.) thin film 3.) thick film. Bearing operating speed is an important element in determining the lubrication condition. Boundry lubrication occurs when there is metal on metal contact between rolling elements and races. This may be due to low speed and/or oil viscosity too low to separate the surfaces. Boundry lubrication is the most severe condition for anti-friction bearings and distress of the rolling elements and races will occur. In the thin film condition, partial separation of the surfaces of the rolling elements and races occur with some asperities in contact. This condition may be due to low speed and/or oil viscosity too low to separate the surfaces completely. Some distress of the bearing surfaces will take place in thin film lubrication. Thick film lubrication is the preferred condition for optimum bearing performance The speed of the bearing and/or the lubricant viscosity is sufficient to separate the rolling elements and raceways. Higher viscosity oils (or higher operating speeds) can help to attain the thick film lubrication condition, but excessively high oil viscosities may lead to higher operating temperatures from churning of the oil or skidding of the rolling elements. Lower viscosity oils sufficient to attain a thick film lubrication condition at the operating speed are selected in high speed applications as they have less tendency to churn or cause skidding

ADDITIVES

Greases also contain additives These additives may increase load capacity, resist corrosion, resist temperature extremes, resist oxidation, effect oil viscosity, thickener consistency characteristics, as well as many other characteristics.

Consult SEALMASTER Application Engineering when using EP additives or other solid additives such as molybdenum disulfide, graphite, brass, nickel, etc

COMPATIBILITY

Combinations of different types of thickeners (soaps) may cause reactions that can reduce bearing performance.

Petroleum oils and synthetic hydrocarbons are, generally speaking, compatible. Other synthetic oils are, more often than not, incompatible with other oils

Additives may cause compatibility problems in some cases.

Caution should be used when relubricating with or combining different greases. Contact SEALMASTER Application Engineering for current grease specifications and your grease manufacturer to verify grease compatibility.

OIL SATURATED POLYMER (OSP)

Oil saturated polymers are generally porous plastics that retain oil and are used in place of grease. This option may be used in inaccessible areas where relubrication is difficult. SEALMASTER's solid lubricant OSP is an option in these applications since OSP can hold more oil in the bearing chamber, thus providing a longer lived lubricant supply. OSP should not be used over 200° F.

FOOD GRADE GREASE

"Food Grade" grease is an option in all SEALMASTER Bearings. Consult SEALMASTER Application Engineering for current specifications

REDUCED MAINTENANCE

Some bearings are considered "lubricated for life" and are not provided with provisions for relubrication. This type of bearing may be limited by the life of the original grease fill and the ability of the seals to protect the bearing from contamination. SEALMASTER has many seal and grease options for lubricated for life bearings.

HIGH TEMPERATURE GREASE

High temperature greases are available in SEALMASTER ball and roller Bearings. SEALMASTER tapered roller bearings are lubricated with a lithium complex soap and synthetic hydrocarbon oil grease (N suffix). SEALMASTER ball bearings can be specified with silicone oil or synthetic hydrocarbon oil greases, or other options. Consult SEALMASTER Application Engineering for proper lubricant for your application.

Contact SEALMASTER Application Engineering for further information.

LUBRICANT
* Most Sealmaster bearing product lines are lubricated at the factory with a high quality NLGI #2 grease as follows:

	BALL	TAPERED ROLLER
Thickener (Soap)	Lithium Complex	Lithium Calcium
Oil	Petroleum	Petroleum
High Temperature	Optional *	Lithium Complex/Synthetic Hydrocarbon (N Suffix)

These greases were selected to provide high performance in general applications operating at -20 to 200° F (intermittent to 250° F). The high viscosity index oils in these greases include additive packages to provide oxidation stability and corrosion protection.
* Some Sealmaster Bearings are used in applications where a specialty lubricant is required. These include:
HF - HFT Bearings
Corrosion Duty Bearings
High Temperature Bearings (Including RPB-xxxN)
Low Drag Bearings
Low Temperature Bearings
* Grease specified may change from time to time, consult Sealmaster Application Engineering for current specifications.

RELUBRICATION
* Most Sealmaster Bearings can be relubricated with a high quality NLGI #2, lithium soap grease with petroleum oil.
* Compatibility of grease is critical, therefore consult with Sealmaster Application Engineering for current grease specifications and your grease supplier to insure greases are compatible.

Greases should always be stored in a clean, dry area and carefully protected from any contaminants.

Relubricatable Sealmaster Bearings are supplied with grease fittings or zerks for ease of lubrication. (See page 198) with hand or automatic grease guns. Always wipe the fitting and grease gun nozzle clean. For safety, stop rotating equipment. Add grease slowly until a small bead of grease is present at the seals. Start equipment slowly, if more purging of the grease is necessary, stop equipment and repeat above.

A temperature rise (sometimes 30° F) after relubrication is normal. Typically the temperature will decrease after a short operating time when excess grease has purged and bearing has stabilized.

RECOMMENDED RELUBRICATION SCHEDULE

Table No. 18 Ball Bearings

LUBRICATION INSTRUCTIONS			
SPEED	**TEMPERATURE**	**CLEANLINESS**	**GREASING INTERVALS**
100 RPM	Up to 120°F	Clean	6 to 12 Months
500 RPM	Up to 150°F	Clean	2 to 6 Months
1000 RPM	Up to 210°F	Clean	2 Weeks to 2 Months
1500 RPM	Over 210°F - 250°F	Clean	Weekly
	Up to 150°F	Dirty	1 Week to 1 Month
1500 to Max.	Over 150°F - 250°F	Dirty	Daily to 2 Weeks
Catalog Rating	Up to - 250°F	Very Dirty	Daily to 2 Weeks
	Up to - 250° F	Extreme Conditions	Daily to 2 Weeks

Table No. 19

LUBRICATION OF SEALMASTER BALL BEARINGS	
SHAFT SIZE (INCHES)	**RECOMMENDED RELUBRICATION GREASE CHARGE (OUNCES)**
1/2 - 3/4	.02
7/8 - 1 3/16	.06
1 1/4 - 1 1/2	.09
1 11/16 - 1 15/16	.19
2 - 2 7/16	.28
2 1/2 - 2 15/16	.50
3 - 3 7/16	1.00
3 1/2 - 4	1.70
4 3/16 - 4 15/16	3.0

Table No. 20 Roller Bearings

ROLLER LUBRICATION INSTRUCTIONS			
SPEED	**TEMPERATURE**	**CLEANLINESS**	**GREASING INTERVALS**
100 RPM	Up to 125°F	Clean	6 Months
500 RPM	Up to 150°F	Clean	2 Months
1000 RPM	Up to 210°F	Clean	2 Weeks
	Up to 150°F	Dirty	1 Week to 1 Month
1500 to Max.	Over 150°F	Dirty	Daily to 1 Week
Catalog Rating	Up to - 250°	Very Dirty	Daily to 1 Week
	Up to - 250°	Extreme Conditions	Daily to 1 Week

Table No. 21

LUBRICATION OF RPB ROLLER BEARINGS	
SHAFT SIZE (INCHES)	**RECOMMENDED RELUBRICATION GREASE CHARGE (OUNCES)**
1 3/16 - 1 1/4	.10
1 3/8 - 1 7/16	.22
1 1/2 - 1 11/16	.32
1 3/4 - 2	.50
2 3/16	.55
2 1/4 - 2 1/2	.65
2 11/16 - 3	.85
3 3/16 - 3 1/2	1.25
3 15/16 - 4	2.50
4 7/16 - 4 1/2	3.10
4 15/16 - 5	4.75

LUBRICATION FITTING

Lubrication fittings are provided on most Sealmaster Mounted Bearings. The grease fitting provides a means for adding fresh lubricant to the bearing.

Ball Bearings - The lubrication fitting on Sealmaster Goldline Ball Bearings also functions to position the lock pin utilized in the unique lock pin and dimple system.

Adjustment or Replacement of the fitting may result in the bearing not performing to expectations. When using lube lines, an adapter is recommended to insure proper lock pin positioning.

Standard Lubrication Fittings

Ball Bearings

Roller Bearings
Every Sealmaster RPB Tapered Roller Bearing has a style “B” lubrication fitting. When replacing cartridge inserts always check to be sure that the rubber grommet is located in the recess beneath the housing cap. This ensures positive lubrication flow into the bearing insert.

Rod Ends
Sealmaster Rod Ends can be ordered with a lubrication fitting. Attach the suffix “N” to specify zerk type threaded grease fittings or the suffix “FN” to specify a flush type fitting. Table No. 22 indicates thread size for rod end grease fittings.

Table No. 22

BORE SIZE (INCHES)	THREAD
1/4 - 7/16	6-40 UNF
1/2 - 1	10-32 UNF

Optional Fittings
Optional fittings can be ordered factory installed to meet most customer requirements. Some of the optional fittings are shown at the right. Other optional fittings include:
– Connectors for lube lines
– Button head fittings
– Relief fittings
– Angled adapter fittings

Table No. 23 FITTING STYLES

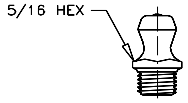
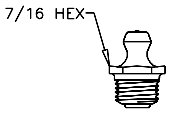
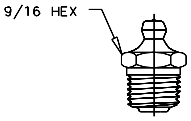
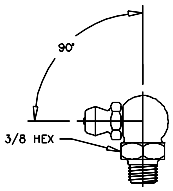
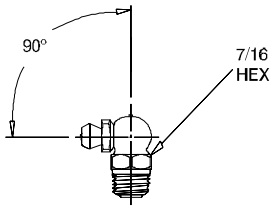
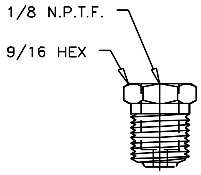
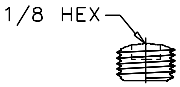
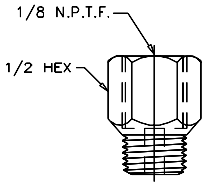
STYLE “A”  1/4" - 28 NF Taper Thd. (SAE-Lt)	**STYLE “B”**  1/8” P.T.F. SAE Spec. Extra Short
STYLE “C”  1/4" P.T.F. SAE Spec. Extra Short	**STYLE “D”**  1/4" - 28NF Taper Thd. (SAE-Lt)
STYLE “E”  1/8" P.T.F. SAE Spec. Short	**STYLE “F”**  1/4" N.P.T.F.
STYLE “G”  1/4” - 28 NF / 1/8 P.T.F.	**STYLE “H”**  1/8" N.P.T.F. SAE Spec. Short

Table No. 24 Gold Line Ball Bearings

LUBRICATION FITTING CHART										
UNITS		BORE SIZES								
STD. DUTY	MED. DUTY	1/2 - 3/4	15/16 - 1 7/16	1 1/2	1 11/16 - 1 3/4	1 13/16 - 2 1/8	2 3/16 - 2 7/16	2 1/2 - 2 11/16	2 15/16	3 AND UP
-	EMP	-	A	A	A	B	B	B	B	C
-	EMP-T	-	A	A	A	B	B	-	-	-
-	EMSF	-	-	B	B	B	B	B	C	C
-	EMSF-T	-	-	B	B	B	B	-	-	-
ENP	-	A	A	A	A	B	-	-	-	-
ENP-T	-	A	A	A	A	B	B	-	-	-
ESF	-	A	A	A	A	B	B	B	B	-
ESF-T	-	A	A	A	A	B	B	-	-	-
ETXP	-	-	B	B	B	B	B	-	-	-
FB	-	A	A	-	-	B	-	-	-	-
FB-T	-	A	A	-	-	B	-	-	-	-
-	MFC	-	A	A	B	B	B	B	C	C
-	MFC-T	-	A	A	B	B	B	-	-	-
-	MFP	-	-	-	-	B	B	B	C	C
-	MP	-	A	A	B	B	B	B	C	C
-	MP-T	-	A	A	B	B	B	-	-	-
-	MPD	-	A	A	B	B	B	B	C	C
-	MSC	-	A	A	A	A	B	B	B	B
-	MSC-T	-	A	A	A	A	B	-	-	-
-	MSF	-	A	A	B	B	B	B	C	C
-	MSF-T	-	A	A	B	B	B	-	-	-
-	MSFPD	-	-	-	-	-	-	-	-	
-	MSFT	-	A	A	-	B	-	-	-	-
-	MSFT-T	-	A	A	-	B	-	-	-	-
-	MSPD	-	-	-		-	-	-	-	
-	MST	-	D	D	E	E	E	E	E + F	E + F
-	MST-T	-	D	D	E	E	E	-	-	-
NP	-	A	A	A	A	B	B	-	-	-
NP-T	-	A	A	A	A	B	B	-	-	-
NPD	-	A	A	A	A	B	B	-	-	-
NPL	-	A	A	A	A	B	B	-	-	-
NPL-T	-	A	A	A	A	B	B	-	-	-
SC	-	A	A	A	A	A	A	B	B	-
SC-T	-	A	A	A	A	A	A	-	-	-
SCHB	-	-	G	G	H	H	H	H	H	F
SEHB	-	A	A	A	B	B	B	B	B	C
SF	-	A	A	A	A	B	B	B	B	-
SF-T	-	A	A	A	A	B	B	-	-	-
SFC	-	-	A	A	A	B	B	B	B	C
SFC-T	-	-	A	A	A	B	B	-	-	-
SFT	-	A	A	A	A	B	B	B	B	C
SFT-T	-	A	A	A	A	B	B	-	-	-
SP	-	-	A	A	A	B	B	B	B	C
SP-T	-	-	A	A	A	B	B	-	-	-
SPD	-	-	A	A	A	B	B	B	B	C
-	SPM	-	A	A	-	B	B	B	C	-
ST	-	D	D	D	E	E	E	E	E	E
ST-T	-	D	D	D	E	E	E	-	-	-
TB	-	A	A	A	A	B	-	-	-	-
TB-T	-	A	A	A	A	B	-	-	-	-
TFT	-	A	A	-	-	-	-	-	-	-
TXP	-	-	A	-	-	-	B	-	-	-

SHAFT MOUNTING INSTALLATION PROCEDURES FOR BALL AND ROLLER BEARINGS

Note: Setscrew marks on the shaft can be removed by backing out the setscrews and using a flat punch to tap down the setscrew burrs on the shaft.

SETSCREW LOCKING:

¶ INSPECT SHAFT

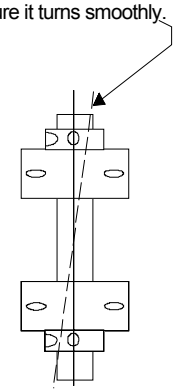
- Clean/remove burrs.
- Check diameter
- Clean Mounting Surface.

• PLACE BEARING ON SHAFT

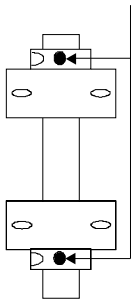
- Apply light film of oil on shaft.
- Do not hammer bearing onto shaft.

¸ BOLT HOUSING TO SUPPORT SURFACE

- Bearing and shaft must be in alignment within 2°.
- Rotate shaft to make sure it turns smoothly.



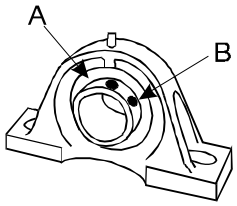
¹ ALIGN SETSCREWS ON EITHER END OF SHAFT



º ALTERNATE TORQUING OF SETSCREWS

- Step 1: Torque setscrew “A” to 1/2 recommended torque.
- Step 2: Torque setscrew “B” to full recommended torque.
- Step 3: Torque setscrew “A” to full recommended torque.

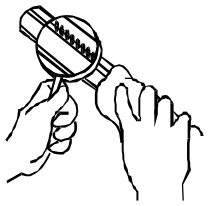
- Double Lock: Repeat on opposite end.



SKWEZLOC® LOCKING COLLAR:

¶ INSPECT SHAFT

- Clean/remove burrs.
- Check diameter
- Clean Mounting Surface.

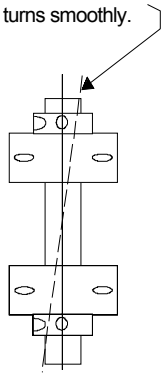


• PLACE BEARING ON SHAFT

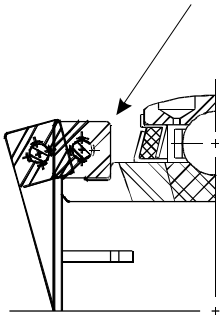
- Do not hammer bearing onto shaft.

¸ BOLT HOUSING TO SUPPORT SURFACE

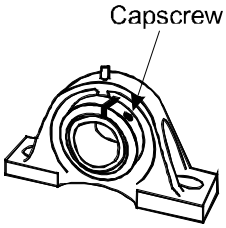
- Bearing and shaft must be in alignment within 2°.
- Rotate shaft to make sure it turns smoothly.



¹ PUSH LOCKING COLLAR TIGHTLY AGAINST INNER RING SHOULDER

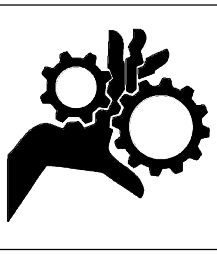


º TORQUE CAPSCREW TO RECOMMENDED VALUE



⚠WARNING

Failure to observe safety precautions could cause personal injury or equipment damage.



⚠WARNING

Do not operate without guards. Turn off power to install or service.

⚠CAUTION

High voltage and rotating parts may cause serious or fatal injury. Turn off power to install or service.

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