TOSHIBA

Leading Innovation

October, 2017

Tosh-ECO Series Low-Voltage 50 Hz IEC Motor Installation & Maintenance Manual

DN: 98170-000

Tosh-ECO Series Low-Voltage 50 Hz IEC Motor Installation & Maintenance Manual

DN: 98170-000
October, 2017

Introduction

This manual provides information on how to safely install, couple to the driven equipment, and maintain the Tosh-ECO Series Low-Voltage 50 Hz IEC Motor.

The squirrel cage induction motor was designed for an extended service life under very demanding conditions. However, should the motor require service, this manual includes a section that assists the repair technician with maintenance, disassembly/assembly, part replacement, testing, troubleshooting, and warranty information.

Maintenance recommendations include inspection requirements, cleaning methods, bearing lubrication, disassembly support, and testing methods.

To maximize the abilities of the Tosh-ECO Series Low-Voltage 50 Hz IEC Motor, a working familiarity with this manual will be required. This manual has been prepared for the Installer and Maintenance Personnel.

All Tosh-ECO Series motors are manufactured to international standard IEC 60034-30-1. The standard is further delineated by the following codes: IE1 (Standard Efficiency), IE2 (High Efficiency), IE3 (Premium Efficiency), and IE4 (Super Premium Efficiency).

Important Notice

The instructions contained in this manual are not intended to cover all details or variations in equipment types, nor may it provide for every possible contingency concerning the installation, operations, or maintenance of this equipment. Should additional information be required, contact the TIC Customer Support Center.

The contents of this manual shall not become a part of or modify any prior or existing agreement, commitment, or relationship. The sales contract contains the entire obligation of Toshiba International Corporation (TIC). The warranty contained in the contract between the parties is the sole warranty of TIC and any statements contained herein do not create new warranties or modify the existing warranty.

Any electrical or mechanical modifications to this equipment without prior written consent of TIC may void all warranties or other safety certifications. Unauthorized modifications may also result in a safety hazard or equipment damage.

Misuse of this equipment could result in injury and equipment damage. In no event will TIC be responsible or liable for direct, indirect, special, or consequential damage or injury that may result from the use or misuse of this equipment.

Purpose and Scope of Manual

This manual provides information on how to safely install, operate, maintain, and dispose of your Tosh-ECO Series Low-Voltage IEC Motor. The information provided in this manual is applicable to the Tosh-ECO Series Low-Voltage IEC Motor only.

This manual provides information on the various features and functions of this powerful cost-saving motor, including

- Installation,
- Operation,
- Maintenance, and
- Mechanical and electrical specifications.

Included is a section on general safety instructions that describe the warning labels and symbols that are used on the device and throughout the manual. Read the manual completely before installing, operating, performing maintenance, or disposing of this equipment.

This manual and the accompanying drawings should be considered a permanent part of the equipment and should be readily available for reference and review. Dimensions shown in the manual are in imperial units and/or the metric equivalent. Connection drawings within this document convey the typical connectivity of the motor and do not include every possible connection variation.

Because of our commitment to continuous improvement, Toshiba International Corporation reserves the right, without prior notice, to update information, make product changes, or to discontinue any product or service identified in this publication.

Toshiba International Corporation shall not be liable for direct, indirect, special, or consequential damages resulting from the use of the information contained within this manual.

Printed in the U.S.A.

Contacting TIC's Customer Support Center

Toshiba International Corporation's Customer Support Center can be contacted to obtain help in resolving any motor system problem that you may experience or to provide application information.

The Support Center is open from 8 a.m. to 5 p.m. (CST), Monday through Friday. The Center's toll free number is US (800) 231-1412/Fax (713) 466-8773. For after-hours support follow the directions of the outgoing message when calling.

You may also contact Toshiba International Corporation by writing to:

Toshiba International Corporation

13131 West Little York Road

Houston, Texas 77041-9990

Attn: Motors.

For further information on Toshiba International Corporation's products and services, please visit our website at www.toshiba.com/tic/motors-drives.

Table of Contents

Tosh-ECO Series Installation & Maintenance Manual

General Safety Information

DO NOT attempt to install, operate, maintain, or dispose of the motor until you have read and understood all of the product safety information and directions that are contained in this manual.

Safety Alert Symbol

The Safety Alert Symbol is comprised of an equilateral triangle enclosing an exclamation mark. This indicates that a potential personal injury hazard exists.

Signal Words

Listed below are the signal words that are used throughout this manual followed by their descriptions and associated symbols. When the words DANGER, WARNING, or CAUTION are used in this manual, they will be followed by important safety information that must be carefully followed.

The word DANGER preceded by ⚠ **DANGER** the safety alert symbol indicates that an imminently hazardous situation exists that, if not avoided or if instructions are not followed precisely, will result in serious injury to personnel or loss of life.

The word WARNING preceded by ⚠ **WARNING** the safety alert symbol indicates that a potentially hazardous situation exists that, if not avoided or if instructions are not followed precisely, could result in serious injury to personnel or loss of life.

The word CAUTION preceded by ⚠ **CAUTION** the safety alert symbol indicates that a potentially hazardous situation exists that, if not avoided or if instructions are not followed precisely, may result in minor or moderate injury.

The word CAUTION without the safety alert **CAUTION** symbol indicates a potentially hazardous situation exists that, if not avoided or if instructions are not followed precisely, may result in equipment and property damage.

Special Symbols

To identify special hazards, other symbols may appear in conjunction with the DANGER, WARNING, and CAUTION signal words. These symbols indicate areas that require special and/or strict adherence to the procedures to prevent serious injury to personnel or loss of life.

Electrical Hazard Symbol

A symbol that is comprised of an equilateral triangle enclosing a lightning bolt indicates a hazard of injury from electrical shock or burn.

Explosion Hazard Symbol

A symbol that is comprised of an equilateral triangle enclosing an explosion indicates a hazard of injury from exploding parts.

Equipment Warning Labels

DO NOT attempt to install, operate, perform maintenance, or dispose of this equipment until you have read and understood all of the product labels and user directions that are contained in this manual.

Warning labels that are attached to the motor will include the exclamation mark within a triangle. DO NOT remove or cover any of these labels. If the labels are damaged or if additional labels are required, contact the TIC Customer Support Center.

Labels attached to the equipment are there to provide useful information or to indicate an imminently hazardous situation that may result in serious injury, severe property and equipment damage, or loss of life if safe procedures or methods are not followed as outlined in this manual.

Qualified Personnel

Installation, operation, and maintenance shall be performed by Qualified Personnel ONLY. A Qualified Person is one that has the skills and knowledge relating to the construction, installation, operation, and maintenance of the electrical equipment and has received safety training on the hazards involved (Refer to the latest edition of NFPA 70E for additional safety requirements).

Qualified Personnel shall:

- Have carefully read the entire manual.
- Be familiar with the safety regulations, accident prevention, and handling of this equipment.
- Be familiar with the construction and function of the motor, the equipment being driven, and the hazards involved.
- Be able to recognize and properly address hazards associated with the application of motor-driven equipment.
- Be trained and authorized to safely energize, de-energize, ground, lock-out/tag-out circuits and equipment, and clear faults in accordance with established safety practices.
- Be trained in the proper care and use of personal protective equipment such as safety shoes, rubber gloves, hard hats, safety glasses, face shields, flash clothing, etc., in accordance with established safety practices.

For further information on workplace safety, visit www.osha.gov.

Equipment Inspection

CAUTION

If the motor has been exposed to a low temperature, do not remove the coverings until the motor has had sufficient time to attain a temperature that is close to that of the room in which it is to be unpacked.

Otherwise, when opened, moisture will condense on the cold parts. This may reduce the electrical resistance of the insulation or cause rust or corrosion of metallic parts.

If the motor is to be stored in temperatures below 5° F (-15° C), it should be specified during ordering to allow for the proper shipping precautions and packaging.

- Upon receipt of the equipment, inspect the packaging and equipment for shipping damage.
- Ensure that the rated capacity and the model number specified on the nameplate conform to the order specifications.
- Carefully unpack the motor and check for parts that may have been damaged during shipping, missing parts, or concealed damage.
- Check for scratches, dents, or rattles indicating loose components, presence of oil, or any other irregularities.
- If any discrepancies are discovered, it should be noted with the carrier prior to accepting the shipment, if possible. File a claim with the carrier if necessary and immediately notify your TIC Customer Support Center.
- DO NOT install the motor if it is damaged or if it is missing any component(s).
- Modification of this equipment is dangerous and is to be performed by factory trained personnel ONLY. When modifications are required contact your TIC Customer Support Center.
- Turn the rotor by hand if possible as a preliminary check for bearing damage.
- Inspections may be required after moving the equipment.
- Contact your TIC Customer Support Center to report discrepancies or for assistance if required.

Receiving and Storage

Receiving

Each Toshiba International Corporation electric motor is thoroughly tested at the factory and carefully packaged for standard shipping. Confirm the overall packaging condition upon receipt.

Ensure that the nameplate data is consistent with the order specifications.

Check whether any damage has occurred during transportation. Typically, motors are shipped FCA TIC factory or warehouse. Freight Claims must be submitted by the consignee to the carrier.

Remove the bearing lock plate before start up (if used). Save the plate for reuse if subsequent shipping is required.

Note: If unable to reinstall the bearing lock plate, use wooden wedges to block the shaft to prevent any movement during shipping.

Turn the shaft by hand (if possible) to ensure that it turns freely.

Use proper lifting techniques when moving the motor; including properly sizing up the load, getting assistance, and using a forklift if required.

The 140 frame motor is rated as a two-man lift.

Storage

If the motor is not used upon receipt, store upright in the original packaging in a clean, dry, and vibration-free environment.

Care should be taken to keep the equipment covered when moving from a cold location to a warm location, otherwise condensation may occur. If condensation does occur, allow the motor to dry thoroughly before applying power. Using a megohmmeter, test the insulation resistance of the windings before applying power. A minimum of 10 megohms is recommended.

Toshiba recommends turning the shaft by hand every month when stored for long periods (longer than 3 months) to redistribute the lubricant in the bearings. Oil or grease should be added every 6 months.

For long-term storage or when indoor storage is not available, the motor must be covered with plastic or weather-proof tarp. Cover the motor completely. To ward off the formation of condensation, do not wrap the motor tightly. This will allow for adequate ventilation. Precautions must also be taken to protect the motor from flooding or being exposed to harmful chemical vapors.

Ensure that any unpainted sections are covered. Retouch any scratched or flaked painted areas.

If condensate plugs or drain plugs are used, ensure that they are functional.

Whether indoors or outdoors, the area should be free from vibration. Excessive vibration can cause bearing damage. Any motor which must be stored in an area that is exposed to vibration must have the shaft locked to prevent any movement.

If the motor is stored in a temperature less than 5° F (-15° C), the motor must be allowed to return to the specified operating temperature before installation or operation.

If the motor is equipped with space heaters, ensure that the space heaters are properly connected and functional. The motor interior temperature should be maintained approximately 10° F (5.6° C) above ambient.

A systematic inspection and maintenance schedule should be established. If the motor is to be stored for 6 months or longer, in addition to the precautions above, the insulation resistance of the windings should be tested every 3 to 6 months. A minimum of 10 megohms is recommended. A record of the readings, temperature, time, humidity, and length of applied voltage should be recorded to show the winding conditions prior to start up.

If the windings are designed for outdoor operation, they will not be affected by extreme or sudden temperature changes, or inclement weather in general. However, a weather proof cover with provisions for adequate ventilation should be used to guard against intrusion of salt, dust, or other abrasive or corrosive material.

Frame Size, Standards, & Compatibility

Frame Sizes

Available frame sizes are 71 through 400 Totally Enclosed Fan Cooled (TEFC).

The Toshiba Tosh-ECO IEC Low voltage motor is manufactured in accordance with standard IEC/EN 60072 dimensions.

The Toshiba Tosh-ECO IEC low voltage motor may be CE marked. Marking indicates compliance with the relevant EU Directives. A Declaration of Conformity and/or Declaration of Incorporation shall accompany the product, where applicable. In the event that any documentation is found to be missing, please contact the TIC Customer Support Center for assistance.

Tosh-ECO Series motors in frames 71 – 400 are dual voltage and designed for both Wye and Delta connections. Refer to the connection diagram received with the unit.

Tosh-ECO Series motors are built to F-3 assembly specifications. The motor uses the standard connection configuration and, while facing the non-drive end of the motor, the standard rotation is counter-clockwise (CCW). In most cases Tosh-ECO Series motors are bi-directional. For specific designs with unidirectional fans there will be rotation arrows identifying the direction of rotation on the fan cover of the motor.

Declaration of Conformity

Low voltage Tosh-ECO motors bearing the CE marking will, at a minimum, meet the Low Voltage Directive (2014/35/EU). Other Directives may also apply based on the product scope.

Declaration of Incorporation

Final conformity to the Machinery Directive 2006/42/EC has to be established by the installer or commissioning party once incorporated into the final application.

Installation, operation, and maintenance shall be performed in accordance with the instructions provided by Toshiba to ensure compliance with the Directive.

Electromagnetic Compatibility

Installation of the Toshiba Tosh-ECO low-voltage IEC motor shall be performed as described in this manual to ensure compliance with the EMC Directive.

In the case of an installation or application in which an ASD, soft starter, or electronic control is being used, the installer/system integrator or commissioning party will be required to verify that the system/application meets the EMC Directives.

When used in accordance with the directive and operated in an electrical supply system as characterized by EN 50160, the Toshiba Tosh-ECO IEC MOTOR complies with the requirements of the EC Directive concerning electromagnetic compatibility 2004/108/EC.

CAUTION

- Motor protection from overloads, peak starting currents, short circuit current, and ground fault currents, should be in strict accordance with the IEC, local electrical codes, and building codes.

⚠ CAUTION

- Avoid touching the hot surfaces of the electric motor without wearing the proper protection.
- Keep the terminal box cover in place and secured while the motor circuits are powered.
- Personal hearing protection is required when exposed to noise levels exceeding 80 dBA.

⚠ WARNING

- Only Qualified Personnel are to perform maintenance.

⚠ DANGER

- To reduce the risk of fire or explosion, do not install Toshiba Tosh-ECO motors in hazardous environments. Tosh-ECO motors are not certified for Zone 1 or 2 applications.
- To reduce the risk of fire or explosion, do not install a Toshiba Tosh-ECO motor in areas where the operating temperature code (shown on the motor nameplate or Division 2 label) exceeds the ignition temperature of a hazardous environment.

- Do not disable or bypass any safety guards or protective devices.
- Proper circuit protection is required to prevent automatic reset devices from automatically restarting the motor.

Note: The equivalent lead wire markings per IEC are: TI (U1), T2 (V1), T3 (W1), T4 (U2), T5 (V2), T6 (W2), T7 (U5), T8 (V5), T9 (W5), T10 (U6) T11 (V6), T12 (W6).

All dimensions are in inches (millimeters). Multiply the inch value by 25.4 to convert to millimeters (mm).

Any motor operated using an Adjustable Speed Drive is subject to potential premature bearing failures due to the increased shaft currents. This condition is caused by inherent common mode voltages that occur when operating using a sinusoidal 3-phase power source.

For drive recommendations and/or support, consult the TIC Customer Support Center.

TIC recommends insulating both bearings on frame sizes 444 and larger. Smaller motors are at risk as well and should be considered after review of the application and installation.

The user is responsible for protecting the couplings and driven equipment from shaft currents from the motor. Insulated couplings are recommended. Shaft grounding devices provide additional protection, but cannot be used in hazardous areas because of arcing.

Contact TIC for a complete copy of the TIC Standard Motor Warranties HBB0001 policy.

Match the nameplate rating of the motor, connection diagram, and lead numbers with the appropriate category for the applicable connection requirement. TIC special-built or special-rated motors may follow different connections.

Contact the TIC Customer Support Center if more information is required — have the nameplate model number and serial number of the motor for connection information.

Motor Installation and Coupling

Motor Installation

Installation of the motor includes preparing the mounting location, installing the bedplate, grouting, and coupling the motor to the load.

Each of these requirements are discussed in this section.

Location

Unless otherwise specified, the ambient operating temperature is 5° to 104° F (-15° to 40° C).

Install the motor securely on a firm and flat base. Ensure that the installation is in a well-ventilated location that is easily accessible for cleaning, inspection, and maintenance — this includes being away from walls and other obstructions to permit a free passage of air. Ensure that there are no obstructions to the operation of the motor.

All ball and roller bearing normal-thrust motors through frame 315 are mechanically capable of being mounted in any position. Consult with TIC for motor sizes larger than 250 frame. Special drains, seals, or support construction may be required — application specific.

Avoid installation locations that would allow exposure to coal and mill dust, leaky pipes, steam/moisture, acids, or the fumes thereof, or any other harmful substances.

Do not install the motor in an area where flammable gases or combustible material may be present, or around any hazardous processes, unless designed for such an application.

Drip Proof motors are designed for indoor installations in a well ventilated area where the atmosphere is reasonably free of dirt, moisture, and corrosion. Contact TIC for any required modifications.

Totally-enclosed motors may be installed where dirt, moisture (not running water), and corrosion are present. Outdoor applications are acceptable; additional application-specific measures may be required. Contact TIC for any required modifications.

Foundation

A rigid foundation is necessary for smooth, stable, and reliable operation.

A satisfactory bond between the foundation and the grouting is required. The foundation surface must be roughened (if not cured rough) and cleaned before the bedplate or soleplate (hence forth will be referred to as bedplate) is secured to it.

Foundation Anchor Bolt

The purpose of foundation bolts is to anchor the motor and bedplate to the foundation such that, structurally, the foundation, motor, and bedplate become a single mass (see Figure 1.).

The bolt is enclosed in a casing three or four diameters larger than the bolt. This allows the bolt to be sprung horizontally when placing the motor bedplate in position for mounting — this permits slight adjustments for errors in the bolt position. Concrete is not placed inside of the casing at the time that the foundation is poured. Instead, the casing is filled with grout at the time that the motor is finally grouted into position.

Note: If ever a hammer is used to make frame position adjustments, a light tap is all that is ever required. NEVER hammer the shaft of the motor to adjust its position.

A foundation template, pattern, or frame, usually fabricated from wood, should be used to support the bolts and casings while the foundation is being built up around them. The dimensions required in constructing the supporting frame for the bolts and casings may be obtained from construction diagrams or by measuring the base of the motor.

Figure 1. Foundation Anchor Bolt.

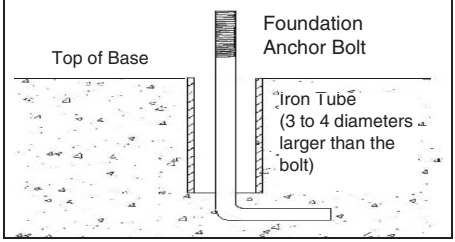
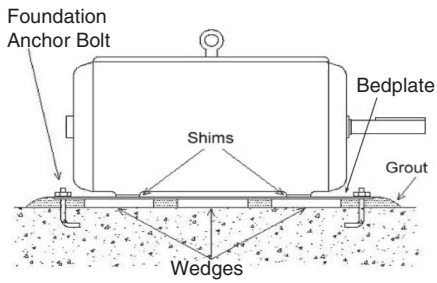


Figure 2. Mounting Foundation.



The motor is to be mounted securely onto a bedplate that is rigid enough to prevent any base-to-motor or motor-to-base vibration. The base must not impose bending or twisting strains on the motor housing.

Slotted shims are recommended when mounting the motor as it may be necessary to remove or add shims when aligning the shafts. The use of proper shims inserted under each mounting foot will prevent distortion of the motor housing when the foundation bolts are secured.

The following procedure is recommended for mounting the motor.

Note: Where available, use the Jacking Screw to raise or lower the motor when shimming. Shims used shall be the same size as the foot print of the motor.

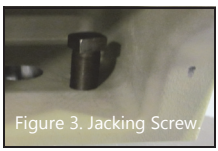


Figure 3. Jacking Screw.

1. Identify the mounting foot of the motor that will require the most shims and install shim(s) to that mounting foot.

Note: Use a small number of thick shims rather than a large number of thin shims (0.20" [5.0 mm] max.).

2. Tighten the shimmed foundation bolt.
3. Insert feeler gauges under the remaining mounting feet to determine the thickness of shims required.
4. Insert the required number of shims under each mounting foot and tighten the foundation bolts.
5. Measure the alignment and, using shims, continue to adjust as required.

Bedplate Installation and Leveling

Install the bedplate onto the foundation by performing the following procedure.

1. Place ¾" – 1" (19 – 25.4 mm) thick iron wedges onto the foundation at the motor mounting location.

Note: The iron wedges shall cover at least 75% of the motor mounting footprint.

2. Position the iron wedges equally spaced and close to the foundation bolts.
3. Place the bedplate onto the foundation.
4. Use the iron wedges to position and level the bedplate onto the foundation.
5. Secure the bedplate onto the foundation using the foundation bolts.
6. Torque the foundation bolts securely.

The ¾" – 1" (19 – 25.4 mm) of space between the foundation and the bedplate is to be filled with grout.

DO NOT remove the wedges when grouting the bedplate — wedges are to be sized for the application so as not to interfere with the grout form.

Grouting

The foundation mounting surface must be rough and clean to provide good grout anchorage. The grout shall be of the non-shrinking type.

Apply the grouting between the foundation and the bedplate by performing the following procedure.

1. Wash the top of the foundation.
2. Where possible, build a form (border) that extends 2" (50.8 mm) around the periphery of the bedplate area. The form is used to contain the grout during the grout application.
3. Pour and pack in the grout.
4. Grout in by building a low dam around the inside and outside of the bedplate. Where possible, allow grout to extend beyond the bedplate periphery 2" (50.8 mm) on all sides.
5. Pack the grout to a height of ½" (12.7 mm) above the underside of the bedplate.

Note: Too deep of a grouting will cause difficulty if the motor must be removed at a later date.

Motor Coupling

Motor Coupling and Alignment

When the base has been adjusted, leveled, and grouted, the correct motor leveling and coupling alignment are obtained with the aid of shims between the motor and the base. Align the motor using a flexible coupling if possible.

Roller bearings may be used with flexible couplings — ensure proper alignment. Ball bearings are recommended for direct coupled applications. Rigid couplings require extra allowance for thermal shaft growth toward the coupling. Skidding noise may result from the combination of internal bearing clearances and alignment tolerances. **DO NOT RUN A ROLLER BEARING WITHOUT A LOAD CONNECTED**.

To give the motor proper support, it is important that the base and shims combine to create a level and stable platform.

Motor coupling can be measured using a dial indicator or using a feeler gauge. The preferred method is with the dial indicator; both methods will be discussed.

Rigid Coupling

Shaft Alignment

Extreme care must be taken to obtain correct shaft alignment when using rigid couplings. Circular concentric peripheral surfaces and the separation between the faces of the two coupling halves must fall within the range of 0.0005" to 0.001" (0.013 to 0.025 mm) when the two coupling halves are rotated together.

The alignment may be checked by using a dial indicator, or with the aid of a straight-edge and thickness gauge or feelers as shown in Figure 4 on pg. 8 and Figure 5. on pg. 9, respectively.

The preferred method of checking alignment is with the dial indicator. Bolt the indicator to one of the coupling halves and indicate the position of the dial button on the opposite coupling half with a chalk mark. Set the indicator dial to zero at the first position and then rotate both halves of the coupling to a new position where a reading is to be made. All readings must be made with the dial button located at the chalk mark. At least six readings are to be performed.

A variation in the dial reading at different positions of coupling rotation will indicate whether the machine has to be raised, lowered, or moved to either side to obtain alignment of the circular concentric peripheral surfaces of the two coupling halves within the specified tolerance.

Coupling Faces

A check of the separation of the coupling faces must be made to establish correct alignment. The separation between the faces of the coupling may be checked with a dial indicator fastened to one coupling half and a reference surface fastened to the other coupling half. Mark the location of the dial button on the reference surface and make all readings with the indicator in this position.

Set the dial of the indicator to zero for the first reading and use this as the reference. Be sure to rotate both halves of the coupling the same amount, aligning the bottom of the indicator and the mark on the reference surface for each of six readings. A variation of the readings at different positions must not exceed 0.001" (0.03 mm) and will indicate how the machine has to be adjusted to obtain correct alignment. After each adjustment of the motor, repeat the above procedure to ensure that the correct alignment and leveling have been obtained.

Flexible Coupling

Units coupled through flexible couplings should be aligned as accurately as possible. The two halves must fall within 0.002" (0.013 mm) on both the circular concentric peripheral surfaces and separation between faces. Although most flexible couplings will withstand greater misalignment than rigid couplings, extreme misalignment can cause vibration possibly resulting in failure of the motor bearings and/or shaft.

If the method shown in Figure 4 is used to check alignment of the machines, correct alignment exists when:

- The peripheries of the coupling halves are true circles of the same diameter and the faces are flat.
- The separation between the faces is held to within the specified tolerance at all points and a straight-edge lies squarely across the rims at any point.

Non-parallel faces will be indicated by a variation in separation of the coupling halves as they are rotated, and a difference in height of the coupling halves will be indicated by the straight-edge and feeler gauge test.

With the feet of the motor bolted into position and the coupling halves correctly aligned, place temporary bolts in two coupling holes for clamping the halves together.

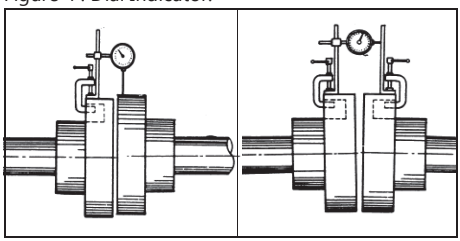
Measure the coupling alignment. Upon completion of a successful test, insert and secure all of the coupling bolts.

The preferred method of measuring coupling alignment is with a dial indicator as shown in Figure 4

Clamp the dial indicator to the coupling as indicated below to measure the circular concentric peripheral surfaces of the coupling halves for parallel alignment.

Also, as shown below, clamping a reference surface to the opposite coupling half allows the dial indicator to be used for measuring the separation of the coupling halves for axial alignment.

Figure 4 . Dial Indicator.



Balance (Direct-Coupled Motors)

Toshiba motors are balanced at the factory to standard commercial tolerances. Field disassembly/assembly may result in unbalanced operation.

To correct this condition, disconnect the coupling halves and rotate one shaft 90° with respect to the other shaft. Re-connect the coupling and run the motor. If the unbalance persists, repeat the procedure until normal operation resumes.

If a chain, gear, V-belt, or flat belt drive is used on the output shaft, perform a minimum sprocket diameter check.

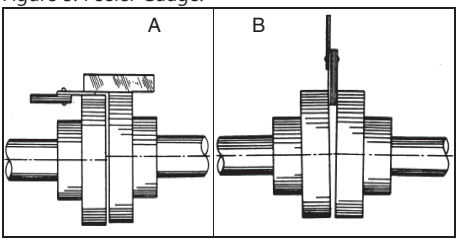
Direct coupling via a flexible means does not require a check for minimum sprocket diameter.

The straight-edge or thickness gauge (feeler gauge) is an alternative method of measuring coupling adjustment as shown in Figure 5.

Use a straight-edge or thickness gauge to check the alignment of the circular concentric peripheral surfaces of the coupling halves as shown in section A of Figure 5. The separation between the faces of the coupling halves can be measured as shown in section B of Figure 5.

Rigid Coupling tolerances and Flexible Coupling tolerances for the circular concentric peripheral surfaces and coupling faces are provided on pgs. 7 and 8, respectively.

Figure 5. Feeler Gauge.



Vibration

On new installations excessive vibration may occur while running. Motors must not be subjected to vibration in excess of 0.5 G's in any application (e.g., shaker screens, vibrating equipment, etc.) Complete isolation may be required.

Note: A vibration detector will be required to measure the system vibration levels.

Listed below are some of the more common causes of excessive vibration.

- Improper shimming and/or a soft foot.
- Misalignment.
- Shafts of the motor and load are not properly aligned.
- Unbalanced load.
- Worn bearings on the motor and/or the driven machine.
- A resonant mounting condition — the effect is increased when the motor is coupled to the load.
- Vibration of the driven equipment.
- Sprung shafting.
- Improper or cracked foundation.
- Electrical imbalance.
- Rotor imbalance.

Seek the simple solution first.

After satisfactory alignment and vibration testing, install dowel pins in the base of the motor and in the bases of the driven equipment. This will prevent creeping and subsequent misalignment during operation.

Belt Installation

1. Prepare the pulley and belt.

   If two or more belts are required, use a matched set of belts of the same peripheral length.

   Provide vent holes on the pulley as large as possible to allow for ventilation cooling of the motor.

2. Ensure correct motor direction.
3. Install the pulley.

   Put the rim end plane of the pulley and the shaft jogging section on the same plane so that the load applied to the shaft jogging section as well as to the bearing is minimized.

   Make the load point nearer to the motor side.

4. Secure the pulley.
5. Ensure that the shafts of the motor and the driven machine are parallel.
6. Ensure that the line drawn between the centers of the two pulleys is perpendicular to the shafts.
7. Install the belt(s) and adjust for the proper distance.
8. Tighten belts enough to prevent slippage **only**. Belt speed should not exceed 6500 ft. (1981 m) per minute. Consult belt/sheave supplier if required.

Power Supply & Connections

Nameplate voltage and frequency should be consistent with the power supply. The motor will operate satisfactorily on line voltages within 10% of the nameplate value. The frequency must be within 5% of the nameplate value. The combined variation shall not exceed 10%. A motor that is rated for 230 volts can be operated on a 208-volt network system per the nameplated amps, but with slightly modified performance characteristics.

Dual voltage and single voltage motors can be connected for the desired voltage by following the connection diagram shown on the inside of the main conduit box cover. Alternate starting connections are also shown in the conduit box of the motor and in Figure 6.

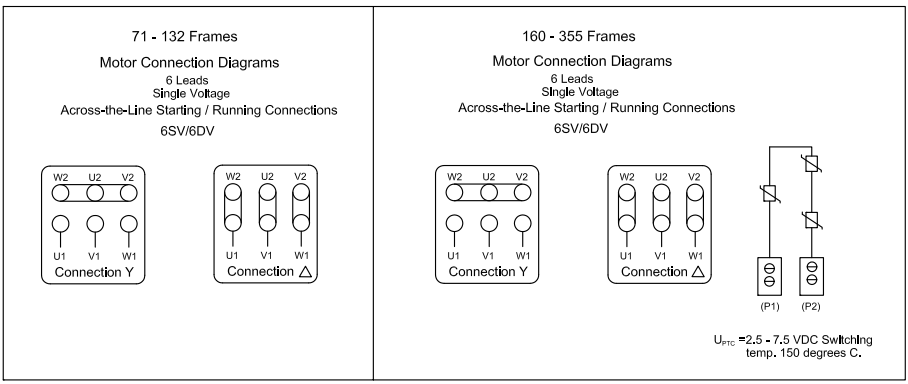
Tosh-ECO Series Low-Voltage IEC Motors 160 frame and above are supplied with temperature limiting devices in the motor enclosure to protect the motor from overheating. The P1 and P2 terminals of the thermal protectors should be connected to the motor control equipment. These are U_{ptc} thermistors which have a positive temperature coefficient (2.5 – 7.5 VDC Switching/ 302° F [150° C]) that are used for the primary thermal protection.

Wiring of the motor and control, overload protection, and grounding, should be in accordance with the IEC Standards and Directives, and local building codes. An optional external grounding terminal on the feet is for a supplemental bonding connection where local codes permit or require such a connection.

Lock-out/tag-out and disconnect the motor from the power supply before opening the conduit box or performing any maintenance or repair on the motor.

Using a megohmmeter, test the insulation resistance of the motor before energizing. A minimum of 10 megohms is recommended.

Figure 6. Typical Connection Diagram.



⚠ WARNING

Disconnect power before working on the motor or any motor-driven equipment. This motor is equipped with an automatic temperature-limiting device. The national electrical code and underwriter's laboratories require the connection of the P1 and P2 leads into the control circuit of a manual reset starter.

⚠ WARNING

Before starting the motor, remove all unused shaft keys and loose rotating parts to prevent them from becoming projectiles during operation.

CAUTION: Check the direction of motor rotation before coupling the motor to a load. To reverse the motor rotation reverse any two of the three-phase input power leads connected to the motor. If the motor is not bi-directional, confirm the connection diagram and rotation arrow or contact the TIC Customer Support Center.

Couplings, pulleys, external fans, unused shaft extensions, and any rotating parts should be permanently guarded against accidental contact with personnel (i.e., hands, clothing, etc.). This is particularly important where the parts have surface irregularities (e.g., keys, key ways, set screws, etc.).

When a lifting means is provided for handling the motor, it should not be used to lift the motor plus additional equipment such as gears, pumps, compressors, or other driven equipment.

When careful consideration of the hazards involved in a particular application indicate the machine frames should not be grounded or when unusual operating conditions dictate that a grounded frame cannot be used, the installer should ensure that the machine is permanently and effectively insulated from ground. In such a case, it is recommended that appropriate warning labels or signs be placed on the equipment or in the area of the equipment by the installer.

Typically, the frames and metal exteriors of motors (except for insulated pedestal bearings) should be grounded to limit their potential to ground in the event of accidental connection or contact between live electrical parts and the metal exteriors.

Motor Operation

Motor Start-Up Precheck

Perform the following checks before the initial start up.

- Inspect the motor for foreign materials and general cleanliness.
- Ensure that the motor is dry — particularly on the first start and after the machine has stood idle for some time.
- Ensure that all drain and fill plugs/caps are secured.
- Ensure that all gaskets are in place and all bolts/fasteners are secured.
- Ensure that the oil level and/or grease quantity is correct.
- Use a megohmmeter to determine the condition of the windings (e.g., moisture present, winding shorts, etc.).
- Check all connections to the motor and ensure that the proper phase connections are applied and are secured.
- Ensure that all auxillary connections are secured.
- Turn off space heaters during motor operation.
- Ensure that the applied input voltage and frequency is within ±10% and ±5%, respectively, of the nameplated voltage and frequency.
- Check the alignment of the motor and coupled load such that the shaft and bearings of the motor will not be subjected to unnecessary strain or wear.
- If possible, ensure that the rotor turns freely.
- Ensure that there are no obstructions or interferences to motor operation. **DO NOT** turn the rotor by inching (short thrusts at reduced power).

⚠ DANGER

Ensure that all personnel are clear of the motor and the driven equipment during the following test.

Motor Testing

- Run the motor without a load to confirm direction of rotation and basic functionality. Motors with unidirectional blowers can be operated only in the direction shown on the rotation plate attached to the motor.

  DO NOT RUN A ROLLER BEARING WITHOUT A LOAD CONNECTED.

  If the opposite direction is required for a 3-phase motor, switch any two of the three-phase input power leads connected to the motor or contact the TIC Customer Support Center for support.

Note: The certified motor outline will define the motor direction.

- Run the motor for approximately one hour to check for any unusual heating of bearings or windings. This also permits lubrication warm-up before torque is applied to rotating parts.
- Run the motor under a load. Check the bearing housing occasionally while running. Using the proper protective gear and/or measuring device, ensure that bearing overheating does not occur.

Maintenance

Inspect the motor at regular intervals. Keep the motor clean and the vent openings unobstructed.

Routine cleaning, lubrication, and inspections are required components of preventive maintenance. Proper maintenance results in extended mean-time between failures (MTBF) and greatly reduced repair requirements.

It is also important to create and retain maintenance records. These records serve as a guide to preventive maintenance and provide an indication of what spare parts should be stocked to prevent lengthy motor outages.

The frequency of routine checks will depend on several variables. A few of the primary operational considerations are:

- Cleanliness,
- Insulation resistance,
- Lubrication and bearings, and
- Environmental factors such as excessive moisture, dust, etc.

Cleanliness

Dirt, dust, and oil are the greatest enemies of electrical equipment. When dirt or dust settles on a machine it may prevent heat dissipation and restrict ventilating passages. This may lead to overheating and insulation breakdown. Some types of dust are electrically conductive and may also cause insulation breakdown.

Dust and dirt may be removed from electrical equipment with dry compressed air, dry cloths, or by brushing. The compressed air must be dry and at a low pressure (less than 25 psi) as not to damage the insulation. Grit, iron and copper dust, graphite, and lamp black should be removed by suction. Hose tips for either pressure or suction should not be metal.

Dust and dirt also have a harmful effect in that they tend to absorb oil or grease. This may result in the formation of gum that is not easily removed.

Oil or grease covered machines should be cleaned thoroughly and have a fresh coating of insulating varnish applied. Most of the oil or grease can be removed with a cloth moistened with an appropriate solvent/cleaner. A brush should be used for surfaces difficult to reach by hand. Use a spray gun to clean inaccessible slots and passages. After using the solvent, be sure to dry the windings with dry compressed air.

DO NOT use a solvent that has toxic effects or that has a deteriorating affect on varnish.

Insulation Resistance

Moisture may develop in a motor during long-term storage or during an extreme low-to-high temperature change. To determine if there is moisture in the motor, an insulation test may be used. A megohmmeter can be used to measure the insulation resistance which is an indicator of the presence of moisture in the motor.

When comparisons are made between present and previous readings, it is possible to observe the winding insulation trend. When correlating periodic readings, it is desirable to test at a definite voltage and time, and to record other pertinent conditions (e.g., ambient temperature, humidity, etc.).

The recommended minimum insulation resistance in megohms at 40° C (104° F) is equal to the rated motor potential in kilovolts plus one megohm (e.g., a motor with a rating of 460 volts would have a minimum insulation resistance limit of 0.5 + 1 resulting in a 1.5 megohms minimum).

Recommended Practice for Drying

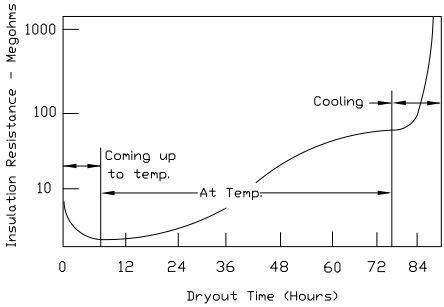
Drying the motor will be required if the insulation resistance value is too low. This may be accomplished by using an external heat source or by circulating direct current through the coils.

Apply External Heat

Place the motor into an enclosure and apply heat from steam pipes or electric strip heaters. The enclosure should have a vent at the top for the evaporated moisture to escape.

This process should be carried out slowly or winding damage could result (see Figure 7. on pg. 14). Sufficient time should be allowed for the process. At no time should the temperature be allowed to exceed 185° F (85° C).

Figure 7. Insulation Resistance vs. Drying Time.



Apply Direct Current

An alternative method of drying the windings requires direct current. Frequently, welding sets are available and can be operated in parallel to obtain the desired current. For suitable drying temperature, the direct current (DC) should be about one-half of the rated alternating current (AC) value specified on the nameplate of the motor.

DO NOT exceed an insulation temperature of 167° F (75° C).

Securely connect the leads of the current transformer and temperature detectors. Current flow and the temperature are to be monitored to protect the motor from damage.

The current **MUST BE LIMITED** so that the maximum temperature of the windings do not exceed 185° F (85° C).

The insulation resistance drops rapidly initially as the winding heats up, then rises slowly as the moisture is driven off, and finally levels off at a steady value. Drying may be concluded when a fairly steady value of insulation resistance is reached.

It is advisable to keep annual records of insulation resistance readings and the conditions (e.g., ambient temperature, humidity, etc.) under which the readings are taken.

Lubrication

Frames 71 – 100 are manufactured with double shielded ball bearings that are lubricated with Mobile Polyrex® EM grease prior to installation. Grease fittings are not supplied and bearings are designed for a typical MTBF of 100,000 hours operation under standard conditions (see Table 1 on page 16).

Frames 112 – 400 are manufactured with double shielded, open ball, or roller bearings. Depending on the kW size and/or the operating speed, it may be necessary to relubricate anti-friction bearings periodically (see Table 1 on page 16).

These motors are supplied with provisions for greasing and have been lubricated prior to shipping. However, before start up, it is recommended that approximately 1 oz. (30 grams) of grease be applied because of possible settling of grease during storage. Any oil leakage around bearing caps indicate over packing — excess grease should be purged by operating motor temporarily with the relief plug open.

Lubricating Instructions

Toshiba motors (160 – 355) are furnished with grease fittings. Before greasing, ensure that the fittings are clean and free of dirt.

Remove the grease relief plug or plate and, using a low pressure grease gun, pump in the required grease amount. Do not over grease. Relubrication intervals are specified in Table 1 on page 16.

After relubricating, allow the motor to run for 10 minutes before replacing relief hardware. All Tosh-ECO 841 motors have grease fittings.

See the Motor Relubrication document #MDS-O-0001 for details on both standard horizontal and vertical motor bearings.

Recommended Greases for Standard Applications

Minimum Ambient Temp. -76° F (-60° C)	
Chevron® SRI 2	Chevron Corp.
Mobil Unirex® N 2	Exxon Mobil Corp.
Mobil Polyrex® EM	Exxon Mobil Corp.
Shell Dolium® R	Shell Oil Co.
Mobilith SHC® 100	Exxon Mobil Corp.

Unless otherwise specified by the grease nameplate of the motor, use the following greases for the listed temperature range. The TIC standard TOSH-ECO IEC motors are greased at the factory with the polyurea base Mobil Polyrex® EM grease.

Recommended Greases for Special Applications

The following greases are recommended for special applications only and should be used only for motors specifically built for such conditions.

Minimum Ambient Temp. -76° F (-60° C)	
Beacon™ 325	Exxon Mobil Corp.
Maximum Ambient Temperature 90° C	
Dow Corning® 44	Dow Corning Corp.
Mobil Unirex® S 2	Exxon Mobil Corp.
Triton® 460	Conoco Phillips Co.
Mobilith SHC® 460	Exxon Mobil Corp.

⚠ CAUTION

Typically, mixing different brands of grease types is not recommended. This practice may destroy the composition and physical properties of the grease. In the event that a different grease is required, the following steps can be taken.

Using the instructions for lubrication, open the grease outlet and purge the system as much as possible of the old or existing grease. Repeat this operation after 1 week of service.

Consult with the TIC Customer Support Center for further recommendations on grease compatibility if required.

Disposal

As with any electrical and/or electronic device, the proper disposal of the item at the end of its useful life is a serious environmental concern.

Contamination of landfills and waterways must be avoided at all costs.

Contact your local, regional, or state agency that is responsible for environmental protection to learn the proper disposal methods for your area.

You may also visit https://www.epa.gov/ for more information on the proper disposal of ewaste.

Table 1. Ball Bearing Relubrication Frequency.

Lubrication Intervals in Duty Hours					
Frame Size	Grease Amount (Oz./Grams)	3000 r/min.	1500 r/min.	1000 r/min.	900 – 500 r/min.
112, 132	0.53/15	4800	7800	10000	10500
160, 180	0.71/20	4200	7000	9000	10000
200, 225	0.88/25	3100	6500	8500	9500
250, 280	1.23/35	2000	6000	8000	9000
315	1.76/50	2000	5500	7500	8000
355, 400	2.12/60	1000	5000	7000	8000

Service Conditions	
Standard Duty	Eight hours per day, light to normal loading, clean condition free of dust.
Severe Duty	Twenty-four hours per day, or light to normal shock loading vibration, exposure to dirt or dusty conditions.
Very Severe Duty	For very severe conditions where the motor is subject to high vibration or heavy shock loading and vibration use 1/3 of the value shown in the severe duty table.

Sync. RPM Range	Frame Range	Type of Service	
		Standard Duty	Severe Duty
3000	90 – 160	5 Years	3 Years
	180	12 Months	4 Months
	200 – 355	9 Months	3 Months
1500	90 – 160	7 Years	3 Years
	180 – 200	4 Years	1.5 Years
	225	2.5 Years	10 Months
	250 – 315	2 Years	8 Months
	355	1.5 Years	6 Months
1000 and Slower	90 – 160	7 Years	3 Years
	180 – 200	4 Years	1.5 Years
	225 – 315	3 Years	1 Year
	315 – 355	2 Years	8 Months

Ordering Information, Spare Parts, and Service Guide

Ordering Information

Toshiba motors may be ordered using the part naming convention listed in the Motors, Drives, Controls, & PLC Catalog 2017.

The catalog may be found at the Toshiba website www.Toshiba.com/tic.

From the homepage enter *Motor Catalog 2017* into the Search field. Click *Motors, Drives, Controls, & PLC Catalog 2017* from the resulting listing.

Note: The 2017 version is the latest released version at the time of the release of this manual.

Spare Parts Listing

Use only genuine Toshiba parts.

When ordering, specify complete motor information. model number and serial number are a minimum requirement. Specify quantity and part description.

For information and service contact the TIC Customer Support Center.

The recommended spare parts listed in Table 2 are wear items and are normally the most susceptible to damage. Though the table will offer a reasonable level of security for normal operations, it is provided as a guide only.

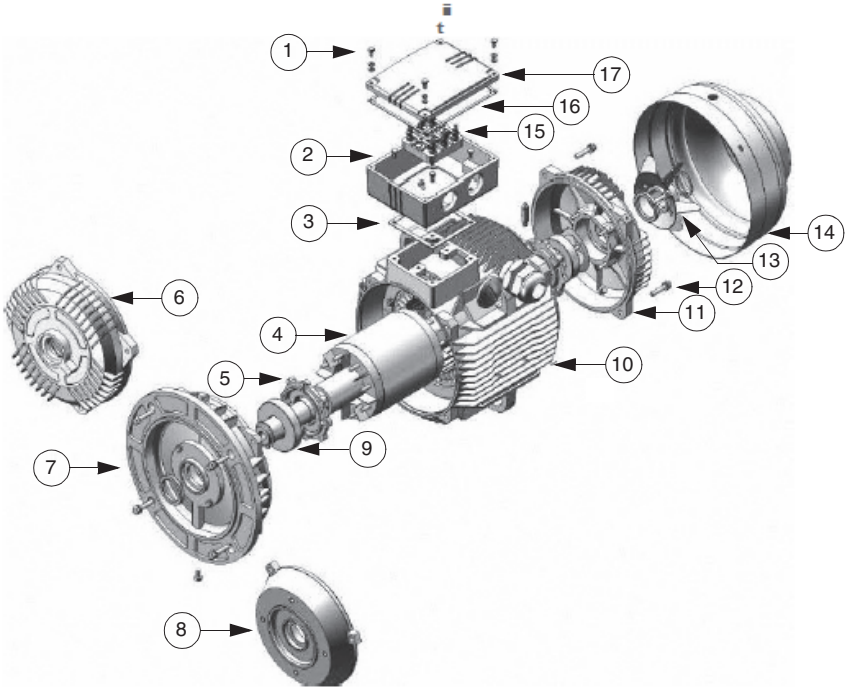
Stock size will depend primarily on the application. Critical applications where continuous operation is of primary importance will require a larger supply of parts.

Each user will have to evaluate the proper requirements in this respect.

Table 2. Recommended Spare Parts.

Item	Part Name	1 – 4 Motors	5 – 9 Motors	10 – 25 Motors
1	DE Bearings (AF)	1	2	2
2	NDE Bearings (AF)	1	2	2
3	Oil Rings (where required)	1 Set	1 Set	2 Sets
4	Sleeve Bearing Liners	1 Set	1 Set	2 Sets

Figure 8. Tosh-ECO IEC Motor Components.



Item	Description	Item	Description
1	C/B Cover Screw	10	Frame/Stator Assembly
2	C/B Case	11	N. D. E. Bracket
3	C/B Base Gasket	12	Bracket, Bolt
4	Rotor Assembly	13	Fan
5	D. E. Inner Bearing Cap	14	Fan Cover
6	D. E. Bracket	15	Terminal Block
7	D. E. Flange (B5)	16	C/B Cover Gasket
8	D. E. Flange (B14)	17	C/B Cover
9	D. E. Bearing		

Shown in Figure 8 are the primary Tosh-ECO IEC motor components.

Use the names shown when ordering additional or replacement parts.

The recommended number of spare parts to be retained in inventory will depend upon the number of operating units installed and the severity of the operating conditions.

See the Spare Parts Listing on pg. 17 for further information on the recommended spare parts quantity for wear items.

Service Guide

The following table lists operational symptoms that may occur, probable causes, and the suggested course of action. This table is intended as both a diagnostic aid and a quick reference tool. If the source of the malfunction is unknown, or the recommendation is ineffective in achieving the desired result, report the matter to the TIC Customer Support Center.

Troubleshooting Assistance		
Symptom	Probable Cause	Remedy
Failure to start	Loose, unattached, or incorrectly fastened electrical connections. Low line voltage. Excessive load. Open circuit in stator windings or in squirrel cage bars. Short circuit in rotor or stator.	• Confirm connectivity. • Tighten all mechanical and electrical connections. • Check panel meters. • Reduce load. • Remove load and retest. • Run a continuity check. Check condition of coils and bars. Repair if possible. If impractical, order renewal parts from the TIC Customer Support Center.
Motor overheating	Overloaded. Improper line voltage or incorrect frequency. Ventilation obstructed. Unbalanced electrical power. Excessive heat, humidity, dirt, etc., has adversely affected insulation.	• Reduce load. • Clean motor. • Check voltage of each phase. • Failing bearings. • Motor/load misalignment. • Perform an insulation resistance check with a megohmmeter.
Noisy or overheating bearings	Misalignment between motor and driven machine. Excessive, low, or improperly packed grease (if grease lubed). Low oil level (if oil lubed). Improper fit of bearings or in Babbitt liners (especially in oil grooves). Excessive belt tension or excessive load side thrust. Contaminated oil.	• Check alignment and correct as necessary. • Clean bearings and repack with proper viscosity grease. Check for damage. • Drain and fill to correct level with correct viscosity. Check for scoring of bearing surfaces. • Replace bearings if damaged. • Reduce belt tension or load side thrust. Check alignment and correct as necessary. • Drain oil, flush clean, and refill with recommended oil.

Troubleshooting Assistance		
Symptom	Probable Cause	Remedy
Abnormal noise or abnormal vibration	Foreign matter between fan and another object. Single-phase operation. Unbalanced electrical power. Air gap is unequal. Loose coupling between motor and the driven equipment. Loose motor and/or driven equipment.	• Check fan path for obstruction. • Remove foreign object — Keep surroundings free of foreign objects. • Check for unbalanced voltage. • Align the rotor to the center of the stator. • Check and/or replace bearings. • Tighten mounting bolts securely.
Vibration	Improper alignment between motor and driven machine. Loose or incorrect base attachment. Worn bearings. Unbalanced load. Warped base.	• Measure vibration amount with vibration sensor at sides of frame and bearings at shaft height. Determine if the source is in the motor or in the driven machine. • Measure around concentric periphery of coupling with both clamps and dial gage, or with feeler gage and straight edge. Realign if required. Check vertical with a bubble scale or plumb bob. • Check coupling and make adjustments as required. • Remove the load and run the motor to determine if the load is unbalanced. • Worn drive gears of the driven machine.
Improper direction	Improper wiring.	• Reverse any two of the three-phase input power leads connected to the motor and observe the direction of rotation. Refer to connection plate, connection drawing, or the certified motor outline.
Poor or intermittent overall performance	Improper grounding. Loose connection.	• Install/secure the ground strap. • Secure connections.

WARRANTY

Toshiba Industrial Corporation (TIC) warrants that the received goods will be free of defects in materials and workmanship.

This warranty shall expire eighteen (18) months after the date that the goods are delivered by TIC to the initial purchaser or twelve (12) months after the goods are first placed into operation, whichever period expires first. Neither shall exceed 18 months from the date of receipt of the goods.

Goods that are received in an unacceptable condition shall, at the sole discretion of TIC, be repaired, replaced, updated, or have the purchase price refunded.

To file a claim, the Purchaser must (1) promptly notify TIC in writing of the nonconformity, (2) furnish TIC satisfactory proof of the nonconformance, and (3) if requested by TIC, return the nonconforming equipment or part to TIC and pay all expenses incurred in connection with such return.

The repaired/replaced item, part, or software, shall be delivered, free of charge, to the Purchaser, FCA TIC designated facility or at TIC's option, FCA TIC-authorized service shop (INCOTERMS 2010). Purchaser shall pay all costs following such delivery, including, without limitation, all handling, transportation, assembly, installation, insurance, testing, and inspection charges.

The warranty excludes (1) normal wear and tear; (2) goods that have not been properly stored, assembled, installed, serviced, maintained, operated, or used within the limits of rated capacity and normal usage; (3) goods not used in accordance with current operating and maintenance instructions furnished by TIC, and (4) goods that have been altered or modified in any manner without the written consent of TIC.

The foregoing obligation to repair, replace, or refund the purchase price paid for the goods shall be the sole and exclusive remedy of the purchaser, its customers and users of the goods for the nonconformance of the received goods.

TIC shall have no obligation to disassemble any nonconforming goods or to install any repaired or replacement part, equipment or software, or to pay any costs incurred in connection with such disassembly or installation.

There are no other warranties and TIC hereby expressly disclaims all other express, statutory, and implied warranties. This includes, without limitation, implied warranties of merchantability and fitness for a particular purpose.

Activating the TIC Motor Warranty

To activate the TIC motor warranty go the Toshiba **General Warranty & Product Registration** site listed below:

https://www.toshiba.com/tic/service-warranty/general-warranty-product-registration.

Complete all of the required fields of the form and click **Submit** and a confirmation of the enacted warranty will be mailed to the registered contact entity.

TOSHIBA

TOSHIBA INTERNATIONAL CORPORATION
MOTORS & DRIVES DIVISION

13131 West Little York Road, Houston, TX 77041-5807

US (713) 466-0277 or (800) 231-1412 CAN (800) 872-2192 MEX 01 (800) 527-1204

FAX: (713) 466-8773

http://www.toshiba.com/tic/

Printed in the U.S.A.