File No. : RRDG-200001

HARVEST SERIES

Installation / Operation / Maintenance Manual

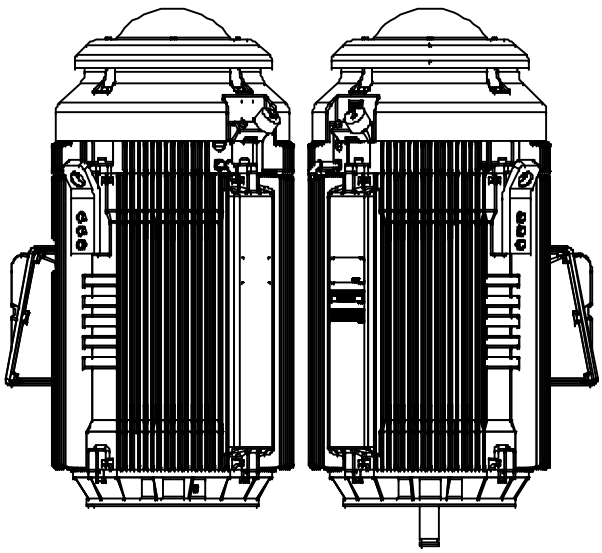
Totally Enclosed Fan-Cooled

Vertical Hollow/Solid Shaft

Frame 213TP/VP~449TP/VP

Premium Efficiency

High Thrust



TATUNG

2010.12 REV 0

I. SAFETY FIRST

High voltage and rotating parts may cause serious injury or loss of life. Installation, operation, and maintenance must be performed by qualified personnel, who familiar with and adherence to the local electrical codes. To protect personnel from possible injury, it is important to observe safety precautions.

Observe all special instructions attached to the equipment. Remove shipping fixtures if so equipped before energizing unit.

Disconnect all power (*) to motor and accessories before initiating any installation, maintenance or repair. Please also make sure the driven equipment connected with the motor will not cause motor to rotate (fans, gears, pump, etc.).

Avoid contact with energized circuits or rotating parts, when operating.

Act with care in accordance with this manual in any installation and maintenance.

Be sure shaft key is fully captive before energize motor.

After installation, maintenance or repairs, making sure all parts and bolts were fitted properly, before energize motor.

Avoid extended exposure to the place with high noise levels.

Check motor and driven equipment with proper rotation and phase sequence prior to coupling, in particular to unidirectional motor.

(*) Motor may retain a lethal charge even after being shut off. Certain accessories (space heaters, etc.) are normally energized when motor is turned off. Other accessories such as power factor correction capacitors, surge capacitors, etc. can retain an electrical charge after being shut off and disconnected.

TABLE OF CONTENTS

II. RECEIVING, SHIPPING AND STORAGE

Receiving the motor:

All Tatung motors have been extensive mechanical and electrical testing, and are thoroughly inspected, before shipping. Please inspect the package for any signs of damage that may have occurred during shipment. Should such damage be evident, unpack the motor at once in the presence of a claims adjuster and immediately report all damage and breakage to the transportation company. When contact with Tatung Electric Co., be sure to include the complete motor series number, frame, and type which will be found on the nameplate.

Shipping the motor:

Motor shall be shipped with packaging intact, carefully. If ship without intact, making sure the motor is vertically and fixed properly.

320T and above, have an oil lubricated upper bearing. Oil must be leak out thoroughly, before shipping them.

Storage the motor:

The motor should be stored in a dry area with factory packaging intact, and to prevent damage from any uncertainty natural or artificial reason.

1. Short period storage

If motor is not put into immediate service (one month or less), no special precautions except that space heater, if supplied, must be energized at any time

2. long period storage

To storage motor more than one month, please follow as below.

- Motor should be stored indoor with clean, dry area.if indoor storage is difficult, motor must be covered with a tarpaulin. This cover should extend to the ground.
- Storage area should be free from excessive ambient vibration which can cause bearing damage.
- When storage time is six months or more, grease lubricated cavities must be completely filled with lubricant. Remove the drain plug and fill cavity with grease until grease begins to purge from drain hole.
- Oil lubricated motor is shipped without oil. When storage time exceeds one month, the oil sumps must be filled to the maximum capacity as indicated on the oil sight gauge.
- Space heater must be energized at any time. (if heater supplied)
- Oil should be inspected monthly for evidence of moisture or oxidation. The oil must be replaced whenever contamination is noted or every twelve months, which ever occurs first.
- Grease lubricated bearings must be inspected once a month for moisture and oxidation by purging a small quantity of grease through the drain. If any contamination is present, the grease must be completely removed and replaced.
- Motor must have the shaft rotated once a month to maintain a lubricant film on the bearing races and journals.

III. INSTALLATION

Installation should be in accordance with the local electrical code and consistent with sound local practices. Coupling guards should be installed as needed to protect against accidental contact with moving parts. Machines accessible to personnel should be further guarded by screening, guardrails or other suitable enclosure to prevent anyone from coming in contact with the equipment. This is especially important for motors that are remotely or automatically controlled or have automatic resetting overload relays, since such motors may start unexpectedly. People may be injury or death in neglect.

Motor must be lifted by the lugs provided. The lugs are intended for lifting motor only and must not be used to lift any additional weight. Be careful not to touch overhead power lines when lifting motor. People may be injury or death in neglect.

Mounting the motor:

Locate the motor in a place that is clean and well ventilated. The ambient air temperature should not exceed 40°C (104°F), unless the motor has been specially designed or otherwise cleared for use in a higher ambient temperature. Bolt the motor to the pump head or rigid foundation using bolts of the largest size permitted by the holes in the motor bracket. 320T and above, have an oil lubricated upper bearing. Those motor should be mounted vertically. If those motors must be mounted with non-vertically, the angle between motor and vertical line should not exceed 15 degree.

Non-vertically mounting will affect bearing life significantly. User shall avoid such kind of application.
Oil level will be different for non-vertically mounting. Please contact with Tatung Electric Co. for detail.

If motor located higher than 1000 meters(3300 feet) above sea level, operating temperature will 5°C(9°F) to 10°C(18°F) higher than standard. Motor may need de-rating to allow for this application.

For oil lubricated ball or roller bearing motors, drain oil from reservoir that was put in at the time of receipt of the motor or during storage by removing the drain plug located at the bottom of the oil sump in the bottom of the casting. Do not run the motor until the bearing housings have been filled to the proper level with oil as indicated on the oil lubrication plate and allowed to stand one (1) hour with oil in the bearings.

The axial thrust load imposed upon the motor by the pump shaft and impellers plus the hydraulic load should not exceed the value for which the motor was designed. (Refer to the maximum down thrust in catalog)

Motor is equipped with a non-reverse ratchet that permits rotation in the signal direction (The standard is CCW direction when viewed from the coupling end of motor. If CW is necessary, please contact with Tatung Electric Co.). The non-reverse ratchet consists of a stationary ratchet plate with slotted ramps and a rotating ball carrier that retains the steel balls. When the motor starts in the forward (CCW) direction, the slotted ramps in the ratchet plate lift the balls where they are held in place by centrifugal force when the motor speed increases. When the motor speed decreases, the balls move down due to the decreasing centrifugal force and prevent reverse rotation by locking against the vertical edge of the slots in the ratchet plate.

Install the hollow shaft motor:

Remove the drain cover and coupling. Lower the motor onto the pump head with the pump shaft extending through the hollow shaft. The motor bracket should bolt down square with the pump head and at right angles with the pump head shaft. The pump head shaft should be centered within the motor hollow shaft (Maximum allowable angular misalignment is 0.1 mm (0.003”)). Fit the coupling onto the motor and key it to the pump shaft using the gib key. Put on the adjusting nut supplied with the pump and draw up on the impellers. Lock the adjusting nut in place with a screw through the nut into a tapped hole in the coupling. Making sure the coupling has been fitted properly, before assemble the drain cover.

Install the solid shaft motor:

Motor with shaft extension, suitable for coupled application. Either straight or tapered shaft can be selected by the purchaser.

Poor alignment will course vibration problem and early bearing failure. It is essential to be accurate when doing alignment of motor to driven equipment.

Mounting the motor on the mounting plate, install mounting bolts but do not tighten. Checking angular alignment by using a gap gauge between coupling hubs at four points, 90 degrees apart. Position motor to obtain best possible alignment and correct coupling hub separation (This can be obtained from supplier of the coupling). Maximum allowable angular misalignment is 0.05 mm (0.002”).

Checking the offset alignment between two shafts. The indicator movement does not exceed 0.05 mm (0.002”). Transfer indicator to opposite hub and recheck again. Connecting the couplings and tighten the motor and mounting plate bolts. Recheck the alignment again to make sure all done properly.

Connecting the motor:

Motor and control wiring, overload protection and grounding should be in accordance with the local electrical code and consistent with sound local practices. Neglect these precautions may result in damage to the equipment, injury to personnel or both.

Be sure the motor is connected as shown on the nameplate diagram and the power supply (voltage, frequency and number of phases) corresponds with the nameplate data. Install wiring, fusing and grounding in accordance with the local electrical code and site requirements.

Apply power momentarily to observe the direction of rotation for which the leads are connected. Motor damage may occur if power is applied for more than ten seconds while rotation is locked against the non-reverse ratchet. The motor should be uncoupled from the driven equipment during this procedure to assure driven equipment will not damaged by wrong direction.

Do not attempt to start or operate motor without fan cover and drain cover in place. Exposure to rotating parts with the machine could result in property damage, serious injury or death.

Carefully identify motor auxiliary devices before connecting. These might be space heaters, winding thermostats, thermocouples, thermistors or other temperature sensors. Be sure they are connected only in circuits for which they are designed and the connections are carefully insulated from the motor power cables. Connect the power supply through a suitable switch and overload protection. To change the direction of rotation on a three phase vertical motor, interchange any two line leads.

The motor with non-reverse ratchet, just allow single direction, and can not change rotation direction arbitrarily.

IV. OPERATION

Before energizing the motor for the first time or after an extended shut down, it is advisable to check insulation resistance, power supply and mechanical freedom of the motor.

Before start the motor:

1. Check insulation resistance, in accordance with established standards, the recommended minimum insulation resistance for the stator winding is as follows:

$$RS = \frac{Vs}{1000} + 1$$

Where RS is the recommended minimum insulation resistance in megohms at 40°C of the entire stator winding obtained by applying direct potential to the entire winding for one minute, and VS is rated machine voltage.

See IEEE Recommended Practice for Testing Insulation Resistance of Rotating Machines, Publication No. 43, for more complete information.

Disconnect all external accessories or equipment that have leads connected to the winding and connect them to a common ground. Connect all other accessories that are in contact with the winding to a common ground.

The recommended minimum value for the 1minute insulation resistance reading corrected to 40°C is:

Rated Motor Voltage	Minimum Insulation Resistance
Up to 999 (inclusive)	5 Megohms
1000 and up	100 Megohms

2. Check bearing oil reservoirs to be sure they have been filled to the proper level with fresh oil and that grease lubricated bearings are properly greased.

3. Whenever possible, examine the interior of the machine for loose objects or debris which may have accumulated and remove any foreign material.

4. If possible, turn the rotor by hand to be sure it rotates freely.

5. Check all connections with the connection diagram. Check all accessible factory-made connections for tightness to make sure none has become loose during shipment.

6. If possible, leave motor uncoupled (or uncouple it) for initial operation so motor vibration, noise, current and bearings can be checked uncoupled before they are masked by the pump. To run a VHS motor uncoupled, it is recommended the pump headshaft be removed. If this cannot be done, remove the coupling and be sure the pump shaft is well centered in the motor shaft so it will not rub. IF THIS IS DONE, ROTATE THE MOTOR BY HAND TO BE SURE THERE IS NO INTERFERENCE BETWEEN SHAFTS. Do not try to run the motor uncoupled by just removing the gib key.

7. When the driven machine is likely to be damaged by the wrong direction of rotation, it is imperative to uncouple the motor from its load during the initial start and make certain it rotates in the correct direction. For VHS motor, do this before installing the pump head-shaft and coupling. Some motors are designed for signal direction. Rotation of these motors must be in accordance with the rotation indicated on the nameplate furnished with the equipment. unusual noise, remove all power and disconnect the machine from the load and check the mounting and alignment.

Initial Start the motor:

Do not attempt to start or operate motor without fan cover and drain cover in place. Exposure to rotating parts with machine could result in property damage, serious injury or death.

1. After inspecting the machine carefully as outlined above, make the initial start by following the regular sequence of starting operations in the control instructions.

2. Run the motor uncoupled initially, if possible. Checking for abnormal noise, vibration or bearing temperatures and for current and voltage balance.

3. Start motor at lowest possible load and monitor to be sure that no unusual condition develops.

4. In the event of excessive vibration or unusual noise, remove all power and disconnect the machine from the load and check the mounting and alignment.

5. Check line voltage on all three phases to be sure it is balanced and within 10% of motor rated voltage with motor drawing load current.

6. Check the operating current against the nameplate value. Do not exceed the value of nameplate amperes x service factor (if any) under steady continuous load. Also verify the current in all three lines is balanced.

7. Ensure that all protective devices are connected and operating properly, and that all outlet accessory, and access covers have been in place.

8. Space heaters (Optional) should be disconnected during motor operation.

Jogging the motor:

Repeated starts and/or jogs of induction motors greatly reduce the life of the winding insulation. The heat produced by each acceleration or jog is much more than that dissipated by the motor at full load. If it is necessary to repeatedly start or jog a motor, it is advisable to check the application with Tatung Electric Co.

Check motor heating by using the temperature detectors furnished in the motor (e.g., RTD's or thermocouples), or use a thermometer. If there is any doubt about the safe operating temperature, please contact with Tatung Electric Co. Give full details, including all nameplate information. Overheating of the motor may be caused by improper ventilation, excessive ambient temperature, dirty conditions, excessive current due to overload, unbalanced a-c voltage or (if a variable speed controller is used) harmonics in power supplied to the motor.

V. MAINTENANCE

Regular, routine maintenance is the best assurance of trouble-free, long-life motor operation. It prevents costly shutdown and repairs.

Do not attempt to start or operate motor without fan cover and drain cover in place. Exposure to rotating parts with machine could result in property damage, serious injury or death.

Before maintenance procedures, disconnect all power sources to the motor and accessories. For machines equipped with surge capacitors do not handle the capacitor until it is discharged by a conductor simultaneously touching all terminals and leads, including ground. This discharge conductor should be insulated for handling. Replace all normal grounding connections prior to operating. People may be injury or death in neglect.

Some important history:

Some important records have shown below. Keeping them for trace back in case of motor failure.

1. When (year, month, day and hour) and what weather the test is conducted. Note relative humidity.
2. Voltage and frequency of power supply; load current.
3. Ambient temperature and temperature rise of frame and windings.
4. Temperature rise of air exhaust.
5. Vibration and noise.

General maintenance:

Inspect the motor at regular intervals, as determined by service conditions. In addition to a daily observation of the overall condition, it is recommended that a regular inspection routine be set up to periodically check the following items.

1. General cleanliness

   Wipe off dirt, dust, oil, water, or other liquids from external surfaces of motor. These materials may reduce cooling efficiency of motor.

2. Bearing lubrication

   To replace oil/grease regularly is must important for maintenance job.

3. Bolt tightness

   Make sure every bolts were tight properly, Especially for coupling.

Knock-down Examination:

Motor running continuously, 24 hours a day, a complete knock-down inspection should be made every two years. Motor running for shorter periods 8 to 12 hours/day, knock-down inspection should be made every 3 to 4 years, depending upon the environment.

1. Clean the motor, inside and out

   - Wipe off dirt, dust, oil (or grease), water or other liquids from exterior surfaces of motor. These materials may reduce cooling efficiency of motor.
   - Remove dirt, dust or other debris from ventilating air inlets and exhaust ports. Never operate a motor with air passage clogged or blocked, the motor will be severely overheated.
   - If windings are generally coated with oil, grease or other contamination, disassemble the motor and clean thoroughly with solvents. Use solvents with high flash naphtha or mineral spirits. Wipe the motor with solvent-dampened cloth or use soft bristle brush to clean windings. Never soak the motor directly with solvent. Before reassemble, the windings must be heated and thoroughly dried by electric oven or other means. After cleaning and drying the motor, recheck the insulation resistance. If readings are below safe operating levels a re-treatment may be required. Consult the nearest Tatung authorized service center.

2. Inspect the insulation material and winding for discoloration and possible overheating.

   - Inspect the binding of rotor windings for discoloration or loosening.
   - Inspect all bearings for signs of excessive wear corrosion or overheating. Replace if necessary.

Some useful information regarding operation and maintenance

1. Variations from rated voltage and rated frequency Motors shall operate satisfactorily under running conditions at rated load with a variation in the voltage or the frequency up to the following limits:

   - Plus or minus 10 percent of rated voltage, with rated frequency.
   - Plus or minus 5 Percent of rated frequency, with rated voltage.
   - A combined variation in voltage and frequency of plus or minus 10 percent (sum of absolute values) of the rated values, provided the frequency variation does not exceed plus or minus 5 percent of rated frequency.

Performance within these voltage and frequency variations will not necessarily be in accordance with the standards established for operation at rated voltage and frequency.
Table 1 shows the general effect of voltage and frequency variation on induction-motor performance characteristics.

TABLE 1. General Effect of Voltage and Frequency Variation on Induction

Characteristic	AC induction Motor			
	Voltage		Frequency	
	110%	90%	105%	95%
Torque, Starting and max running	Increase 21%	Decrease 19%	Decrease 10 %	Increase 11%
Speed:				
Synchronous…	No change	No change	Increase 5%	Decrease 5%
Full load...	Increase 1%	Decrease 1.5%	Increase 5%	Decrease 5%
Slip…	Decrease 17%	Increase 23%	Little change	Little change
Efficiency:				
Full load …	Increase 0.5 to 1 Point	Decrease 2 points	Slight increase	Slight decrease
3/4 load …	Little change decrease 1 to	Little change	Slight increase	Slight decrease
1/2 load …	2 points	Increase 1 to 2 points	Slight increase	Slight decrease
Power Factor:				
Full load…	Decrease 3 points	Increase 1 point	Slight increase	Slight decrease
3/4 load …	Decrease 4 points	Increase 2 to 3 points	Slight increase	Slight decrease
1/2 load …	Decrease 5 to 6 points	Increase 4 to 5 points	Slight increase	Slight decrease
Current:				
Starting….	Increase 10 to 12%	Decrease 10 to 12%	Decrease 5 to 6%	Increase 5 to 6%
Full load …	Decrease 7%	Increase 11%	Slight decrease	Slight increase
Temp. rise …	Decrease 3 to 4°C	Increase 6 to 7°C	Slight decrease	Slight increase
Max. overload Capacity….	Increase 21 %	Decrease 19%	Slight decrease	Slight increase
Magnetic noise…	Slight increase	Slight decrease	Slight decrease	Slight increase

REMARK:

- The starting and maximum running torque of ac induction motors will vary as the square of the voltage.
- The speed of ac induction motors will vary directly with the frequency.
- This table shows general effects, which will vary somewhat for specific ratings.

2. Effects of unbalanced voltage

When line voltages applied to a polyphase induction motor are not equal, unbalanced currents in the stator winding will result. A small percentage voltage unbalance will result in a much larger percentage current unbalance. Consequently, the temperature rise of the motor operating at a particular load and voltage unbalance will be much greater than for the motor operating under the same conditions with balanced voltages. Should voltages be unbalanced, the rated horsepower of the motor should be derogated by the factor shown in figure 1 to reduce the possibility of damage to the motor. Operation of he motor above a 5 percent voltage unbalance condition is not recommended.

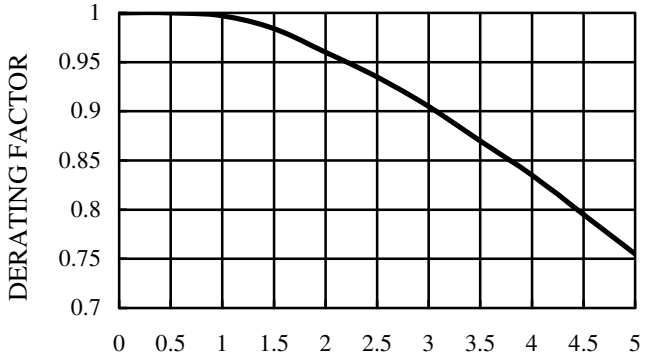


Fig1. Integral Horsepower Motors Derating Factor Due to Unbalanced Voltage

The voltage unbalance is defined as follows:

$$\text{Voltage unbalance}(\%) = 100 * \frac{\text{Max. voltage deviation from average voltage}}{\text{Average voltage}}$$

3. Temperature rise

The observable temperature rise under rated load conditions of each of the various parts of the induction motor, above the temperature of the cooling air, shall not exceed the values given in table2 shown as below:

Table 2. Limits of temperature rise for induction motors

INSULATION CLASS	E	B	F	H
STATOR WINDING	75	80	100	125

REMARK:

- By RESISTANCE method
- Based on a max. ambient temperature of 40℃

4. Vibration

Severe vibration may adversely affect the windings, bearings and coupling mechanism and other mechanical parts of the motor, thereby causing them to breakdown. When motor is running under load, the values of vibration must be not more than those listed below. If the values of vibration are beyond the desired values, remedial measures must be adopted.

- Allowable vibration values of motors with load.
  0.025mm (0.001") for 2 pole motors
  0.050mm (0.002") for 4 pole motors
  0.064mm (0.0025") for 6 and more pole motors
  (Max. amplitude, peak to peak displacement)

- Possible causes for abnormal vibrations.
  - Misalignment of coupling.
  - Poor connection of couplings or balance of coupling.
  - Weak foundation construction.
  - Accumulation of dirt on fan or rotor.
  - Rotor out of balance.
  - Shaft bent or flange face run out excessive.
  - System natural frequency (resonance).

- Analysis of vibration causes
  - Disconnect the load, and let the motor run alone, to identify if the vibration results from motor side or driven machine side.
  - If after disconnecting the load the motor vibration is still unacceptable, please proceed as follows:
    * Tighten the foundation bolts.
    * Check if base or motor mounting plate vibrates.
    * Check vibration with coupling or belt/pulley removed.
    * Inspect bearing for excessive wear.
  - If vibration level increase after connection with the load, please investigate the following items:
    * Investigate the variation of vibration levels from start-up to several hours later.
    * Determine if vibration changes with load.
    * Determine the variation of vibration with power source switched off as motor coasts to complete stop.
    * Check the balance of the driven machine.
  - After making all the corrective measures stated above, if vibration levels are still excessive, a vibration frequency analyzer is needed to make a more advanced analysis. Please contact with Tatung Electric Co. for details.

5. Noise
   - Analysis of noise cause
     - If noise level increase after coupling with the load, please investigate the following items:
       * Whether the noise level changes with load fluctuation.
       * Investigate the noise level variation during the duration from start up to several hours later.
       * Switch off the power supply as motor coasts to complete stop to verify the noise orientation.
       * Disconnect the load machine to check the motor's noise levels to discrete the noise source.
     - After making all the corrective measures stated above, if noise level still excessive, a noise frequency analyzer is needed to make a more advanced analysis. Please contact with Tatung Electric Co. for details.

VI. LUBRICATION

Oil Lubricated Bearing:

320T frame size and larger have oil lubricated upper bearing. The following instructions apply to that bearing.
Motor has been tested with oil in factory, and leaked out for shipment. A small amount of residual oil and rust inhibitor will remain in the oil sump. It is not necessary to drain this residual oil when adding new oil for operation. With the motor at standstill, fill the top bearing reservoir with a good grade of lubricating oil having a viscosity equivalent to S.A.E. #10W; 150 SUS (ISO 32) @ 100°F for ball bearing. Change oil once or twice per year with normal service conditions. Frequent starting and stopping, damp or dusty environment, extreme temperature, or any other severe service conditions may require more frequent changes. Avoid operating motor with oxidized oil. If there is any question, please contact with Tatung Electric Co. for recommended oil change intervals regarding your particular situation. Maintain proper lubrication by checking the oil level periodically and adding oil when necessary. Because of the clearing action of the bearing as the motor accelerates up to speed, and the expansion of the oil as it comes up to operating temperature, the oil level will be higher after the motor has been in operation for a while than it is with the motor at standstill. The normal level, with the motor stopped and the oil cold, is marked STANDSTILL LEVEL on the sight gage.

Overfilling should be avoided not only because of the possibility that expansion may force the oil over the oil sleeve and into the motor, also because operating with the oil level too high may cause extra loss, high temperatures and oxidized oil. If during operation, the oil level goes above the maximum shown on the sight gage, drain enough oil to lower the oil level within the operating range. To drain the oil, remove the drain plug below the sight gage. Do not permit the operating oil level to fall below the minimum shown on the gage. Should it ever become necessary to add excessive amounts of make-up oil, investigate for all oil leaks.

Use only best grade, oxidation and corrosion inhibited turbine oil produced by reputable oil companies. The viscosity of the oil to be used depends upon the type and size of the bearing, its load and speed, the ambient temperature. The lubrication nameplate or instruction with each motor specifies the viscosity range of oil suitable for average conditions. Operation in ambient temperatures that are near or below freezing may require preheating the oil or special oil.

1. Disadvantage due to too heavy oil:

- Higher operating temperature due to increasing fluid friction. Higher temperatures will cause the oil to oxidize or break down at an accelerated rate.
- Heavy oil tends to churn or foam more than a lighter weight oil.
- Bearings may run warmer because of reduced oil circulation through and around the bearing.

2. Disadvantage due to too light oil:

Too light oil may allow the oil film to wipe or break down. For standard applications, the oil viscosity on the lubricate nameplate should be used. Do not use E.P. oil.

Grease Lubricated Bearing:

Shield guide bearing for lower side is standard. It is unnecessary to any further maintenance. Regreasable structure of lower guide bearing is available. Please contact with local supplier, if necessary.

Different type of grease might be used for special application. Please refer to grease information shown on motor. Making sure all the grease have been clean out, if different type of grease must be used.

Table 1 below suggests lubrication interval for motor under normal, steady condition, and in a relatively clean atmosphere at 40°C ambient (104°F) temperature or less.

Table 1 : Regreasing and Lubrication Interval Table for Standard

Frame Size	Upper Thrust Brg	Number of Pumps		Lubrication Intervals (days)		
		16 Oz. Gun (500ml)	24 Oz. Gun (680ml)	2 Pole	4 Pole	6 Pole and above
213/5	7309	25	17	120	180	180
254/6	7311	25	17	120	180	180
284/6	7311	25	17	120	180	180

Table 2 below suggests lubrication interval for regreasable motor under normal, steady condition, and in a relatively clean atmosphere at 40°C ambient (104°F) temperature or less.

Table 2 : Regreasing and Lubrication Interval Table for Regreasable

Frame Size	Upper Thrust Brg	Number of Pumps		Lower GuideBrg	Number of Pumps		Lubrication Intervals (days)		
		16 Oz. Gun (500ml)	24 Oz. Gun (680ml)		16 Oz. Gun (500ml)	24 Oz. Gun (680ml)	2 Pole	4 Pole	6 Pole and above
213/5	7309	25	17	6209	25	17	120	180	180
254/6	7311	25	17	6309	25	17	120	180	180
284/6	7311	25	17	6311	25	17	120	180	180
324/6	7219	N/A	N/A	6312	44	29	120	180	180
364/5	7319	N/A	N/A	6314	44	29	120	180	180
404/5	7222DT	N/A	N/A	6314	44	29	N/A	180	180
444/5	7224DT	N/A	N/A	6218	44	29	N/A	180	180
447/9	29330	N/A	N/A	6218	44	29	N/A	180	180

NOTE :

A standard 10,000psi (68.95MPa) 16oz (500ml) grease gun delivers 0.04oz (1.2ml) of grease with each pump.

A standard 10,000psi (68.95MPa) 24oz (700ml) grease gun delivers 0.06oz (1.8ml) of grease with each pump.

VII. TROUBLE SHOOTING

Listed below are typical Problems with their corresponding causes and recommended countermeasures;

Problem	Cause of Problem	Countermeasures
Failure to start	Over current trips relay	This may result from overload; wait until temperature of motor cools down to room temperature; if still unable restart, check the following
	Power source unconnected	Check circuits and contactors connecting motor and power source through motor controller.
	Fuse blown	Check the fuses in motor controller and primary panel.
	Controller misconnect	Check and compare actual connections with wiring diagram.
	Power cable terminals loosened	Tighten all terminals of lead wires.
	Driven machine locked or jammed	Disconnect load from motor. If motor can be started independently, then check the driven machine.
	Stator and/or rotor coils broken-open circuit	Check coils for open circuit.
	Coil grounded	Check windings for grounded condition
	Bearing fit excessively tight	Dismantle and inspect bearings.
	Controller malfunction	Check controller.
	Terminal voltage too low	Check terminal applied voltage.

Problem	Cause of Problem	Countermeasures
Abnormal noise and/or vibration	Single phase running	Stop running and restart. If motor can't be restarted, probable cause is single phase. Check for one phase of power source to motor to be open circuit.
	Unbalance of electrical supply	Check for power supply voltage unbalance.
	End-play of shaft	Check coupling and pulley alignment; check belt. If pedestal type bearing, check rotor shaft center and endplay.
	Vibration	Could be due to driven machine. Disconnect load from motor, if motor vibrates, may require balance of rotor.
	Non uniform air gap	Align rotor to center of stator; change bearings if necessary.
	Core lamination loosened, loose fit between rotor core and shaft	Tighten all set screws. Tighten all clamping bolts.
	Contact or rubbing between rotor and stator	Align center of stator and rotor. Change bearings if necessary.
	Foreign materials between fan and fan cover	Dismantle, remove and clean.
	Motor loosely bolted to the base	Tighten mounting screws, note any deviation resulting from this action.
	Loose coupling	Check coupling, realign if necessary, tighten set screws.
	Overload	Check load. Check current, reduce load if it is in excess of rating.

Problem	Cause of Problem	Countermeasures
Excessive temperature rise and/or smoke	Unbalance of electrical supply	Check for voltage unbalance or single -Phasing
	Power fuse blown, breakdown of controller, etc.	Check power source, adjust controller as required.
	Block of cooling air passage	Clean air passage and winding coils.
	Wrong voltage or frequency.	Check power source against nameplate data, for terminal voltage and frequency.
	Stall condition results from too tight of driven machine or bearing	Immediately cut off power. Check for locked or jammed condition in motor bearings and driven equipment.
	Stator coils short-circuited or grounded	Contact Tatung Electric for solutions.
Excessive temperature rise in bearings	Bearing bracket loosened or inaccurately positioned	Check for perpendicular fit between bearing and bracket and properly fastened bolts.
	Bending of shaft between rotor and stator	Straighten shaft; if unable to repair consult the nearest Tatung authorized service center.
	Incorrect oil, or oil level too high or too low.	Refill with proper oil. Verify oil level is correct.
	Excessive thrust.	Reduce thrust from driven machine.
	Bearing over-greased.	Relieve bearing cavity of grease to level specified in lubrication section.
	Motor overloaded	Measure load and compare to nameplate rating. Check for excessive friction in motor or in complete drive. Reduce load or replace motor with greater capacity motor.

APPENDIX A

A : Proper torque table

All bolts on the motor were be tightened accordingly. Table values are upon dry assembly.

Standard torque for imperial unit bolt		
Bolt size	Grade	Torque (lb-ft)
1/4 20UNC	SAE Grade 5	10
5/16 18UNC		19
3/8 16UNC		33
7/16 14UNC		54
1/2 13UNC		78
9/16 12UNC		114
5/8 11UNC		154
3/4 10UNC		257
7/8 9UNC		382
1 8UNC		587
1-1/8 7UNC		794
1-1/4 7UNC		1105
1-3/8 6UNC		1500
1-1/2 6UNC		1775
1-5/8 5.5UNC		2425
1-3/4 5UNC		3150
1-7/8 5UNC		4200
2 4.5UNC		4550

Standard torque for metric unit bolt		
Bolt size	Grade	Torque (kgf-cm)
M3	ISO Grade 8.8	10
M4		23
M5		47
M6		80
M8		195
M10		386
M12		674
M14		1070
M16		1670
M18		2370
M20		3360
M22		4580
M24		5820

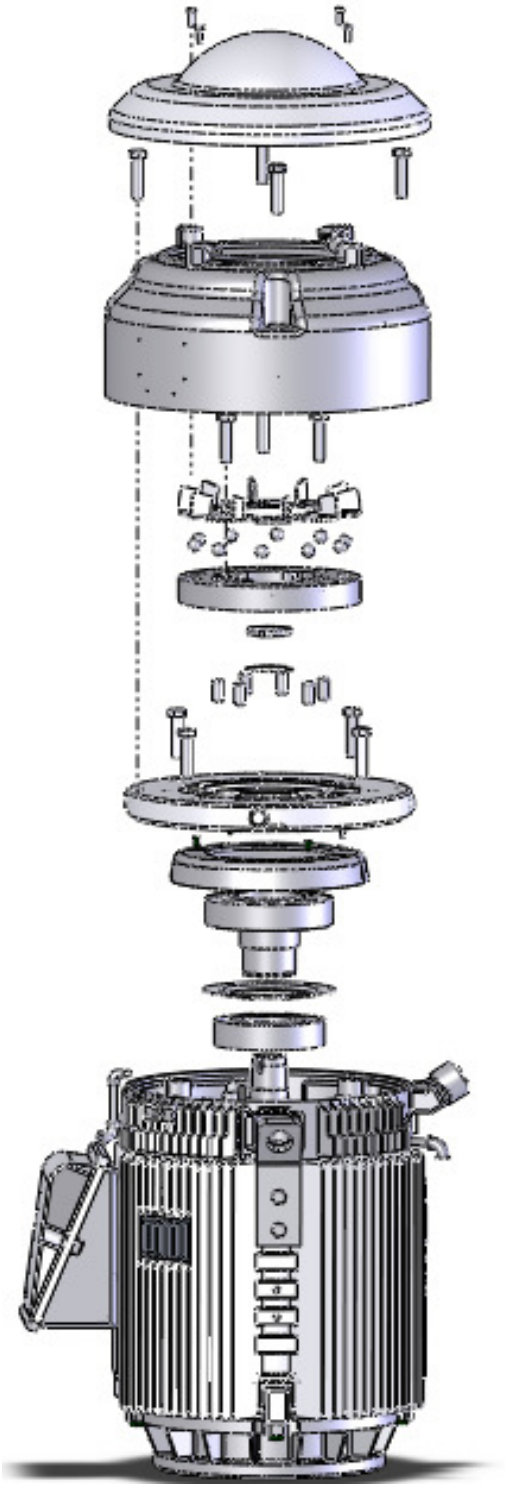
1 foot = 30.48 centimeter; 1 pound = 0.45 kilogram

APPENDIX B :

Bearing change instruction

Prevent from any possible of damage or injured. Before you start to change bearing, beware to disconnect all power. And leak out all oil (320T and above). Process this work at complete safe place.

Tighten bolts with proper torque is very important. Please refer to “proper torque table” in the manual.

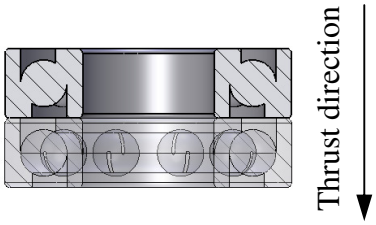


For oil lubrication structure

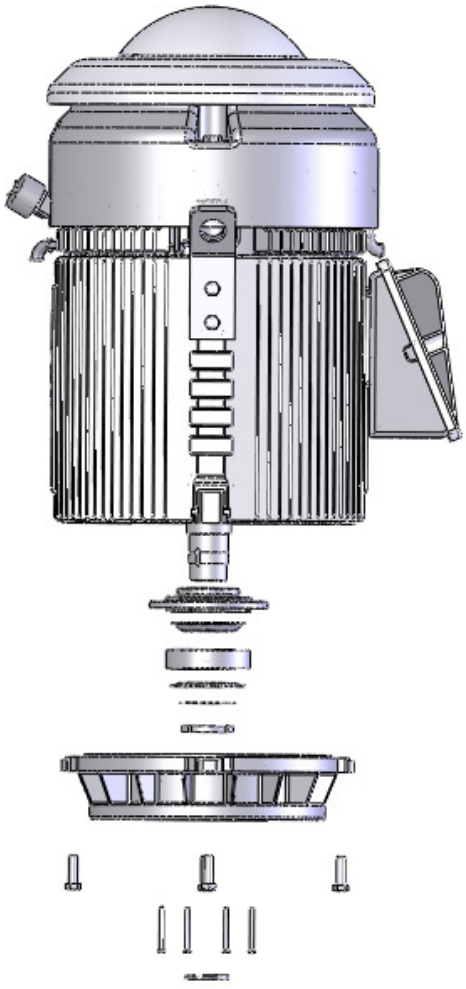
A. Remove the upper bearing

1. Remove the drain cover and the fan cover.
2. Remove the fan.
3. Remove the stop ring. Be sure that the steel balls (x10) were being collected properly.
4. Remove the drive pin (3 pcs for 320T and below ; 6 pcs for 360T and above).
5. Remove the ratchet plate.
6. Remover the oil cover.
7. Remove the shaft nut and shaft washer.
8. Remove the runner from bracket (upper bearing will be taken off with runner).
9. Remove the bearing nut (or bearing clip) and bearing washer.
10. Remove the bearing.

B. Assemble the upper bearing



1. Clean all parts to prevent bearing space from contaminate due to dust, particle or any other uncertainty.
2. Place the outer bearing flinger into the runner.
3. Heat the new bearing with proper equipment.
4. Place the new bearing into the runner. Be sure that the bearing has been sat with correct direction.
5. Place the bearing washer and screw on the bearing nut. Be sure that the lip of bearing washer must be snapped into the pit of bearing nut.
6. Place the bearing set into bearing housing.
7. Place the oil cover.
8. Place the ratchet plate.
9. Place the drive pin.
10. Place the stop ring.
11. Put the steel balls into the stop ring.
12. Place the fan, and screw the bolts properly.
13. Tighten the shaft nut and washer.
14. Readjust the shaft end play.
15. Place the fan cover and the drain cover.



C. Remove the lower bearing

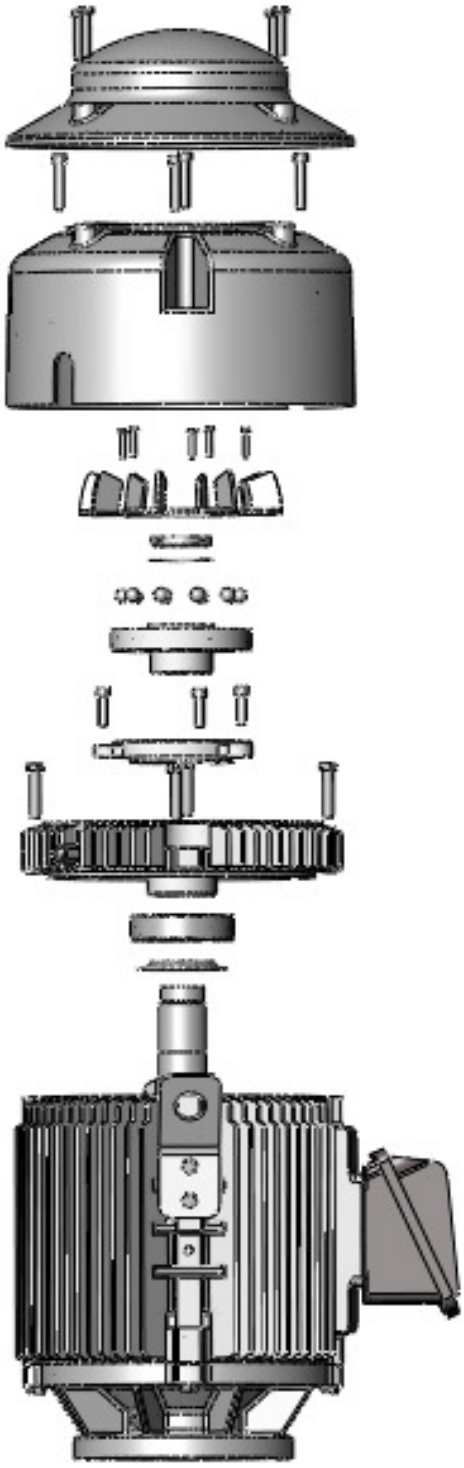
1. Put the motor horizontal.
2. Remove the flinger (and the steady bush).
3. Remove the bolts between flange and frame.
4. Remove the bolts between flange and bearing cap
5. Remove the flange from the motor.
6. Remove the bearing nut and bearing washer or retainer ring.
7. Remove the bearing flinger if any.
8. Remove the bearing with bearing puller.
9. Remove the bearing cap, if necessary.

D. Assemble the lower bearing

1. Clean all parts to prevent bearing space from contaminate due to dust, particle or any other uncertainty.
2. Please jump to next step, if the motor with bearing flinger.
   Apply proper grease and fill with about 2/3 interior of bearing cap, but not too much to prevent overheating.
3. Place the bearing cap, and screw two longer headless screws (guide screws) in any tow of threads for positioning.
4. Place the inner bearing flinger, if any.
5. Heat the new bearing with proper equipment.
6. Place the new bearing into the shaft.
7. Please jump to next step, if the motor without bearing flinger.
   Apply proper grease onto the bearing, if the motor have bearing flinger.
8. Place the outer bearing flinger, if any.
9. Place the bearing washer and screw on the bearing nut. Be sure that the lip of bearing washer must be snapped into the pit of bearing nut.
10. Place the flange through the guide screws.
11. Rotate the flange to the right angel.
12. Screw on the bolts between flange and frame with lock washer.
13. Remove the guide screws, and screw on the bolts between flange and bearing cap.
14. Put the flinger (and the steady bush, if any) back in place.
15. Adjust the shaft end play.

For grease lubrication structure

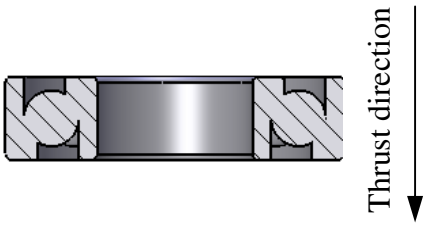
A. Remove the upper bearing



1. Remove the drain cover and the fan cover.
2. Remove the coupling.
3. Remove the fan.
4. Remove the shaft nut and shaft washer.
5. Remove the runner. Be sure that the steel balls (x10) were being collected properly .
6. Remove the ratchet plate.
7. Remove the bracket and upper bearing (and bearing flinger, if any) will be taken off with the bracket.

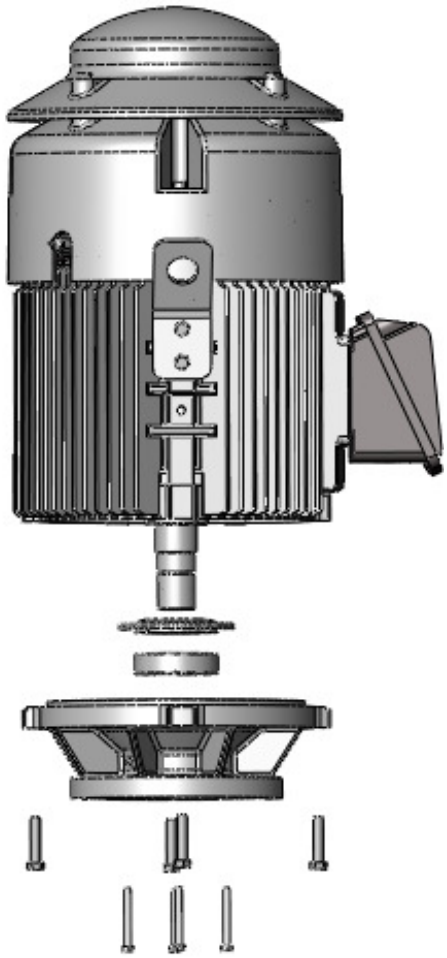
B. Assemble the upper bearing

1. Clean all parts to prevent bearing space from contaminate due to dust, particle or any other uncertainty.
2. Place the bracket, and rotate to the correct position.
3. Heat the new bearing with proper equipment.
4. Place the new bearing into the shaft. Be sure that the bearing has been sat with correct direction.



5. Place the ratchet plate.
6. Place the runner.
7. Put the steel balls into the runner.
8. Place the fan, and screw the bolts properly.
9. Readjust the shaft end play.
10. Place the fan cover and the drain cover.

C. Remove the lower bearing



1. Put the motor horizontal.
2. Remove the flinger and the steady bush, if any.
3. Remove the bolts between flange and bearing cap
4. Remove the bolts between flange and frame.
5. Remove the flange from the motor.
6. Remove the retainer ring.
7. Remove the bearing .
8. Remove the bearing cap, if necessary.

D. Assemble the lower bearing

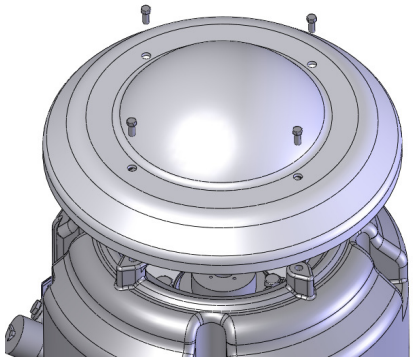
1. Clean all parts to prevent bearing space from contaminate due to dust, particle or any other uncertainty.
2. Apply proper grease and fill with about 2/3 interior of bearing cap, but not too much to prevent overheating.
3. Place the bearing cap, and screw two longer headless screws (guide screws) in any tow of threads for positioning.
4. Heat the new bearing with proper equipment.
5. Place the new bearing into the shaft.
6. Place the bearing retainer ring.
7. Place the flange through the guide screws.
8. Rotate the flange to the right angle.
9. Screw on the bolts between flange and frame with lock washer.
10. Remove the guide screws, and screw on the bolts between flange and bearing cap.
11. Put the flinger (and the steady bush, if any) back in place.
12. Adjust the shaft end play.

To ensure the motor is in the best, adjust end play after disassemble the motor for any reason.

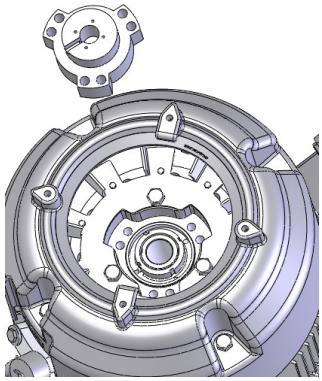
APPENDIX C :

Coupling mount instruction

Coupling mount is piece of cake by yourself. Only you have to do is follow the steps bellow.



Step 1:
Loosen the bolts on top of drain cover and take off the drain cover.



Step 2:
Put the coupling on the runner.
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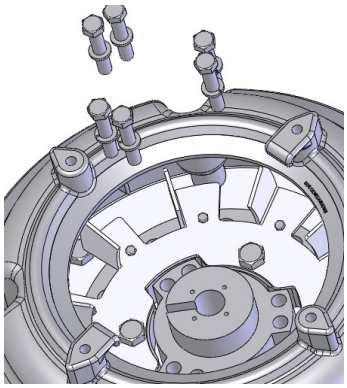
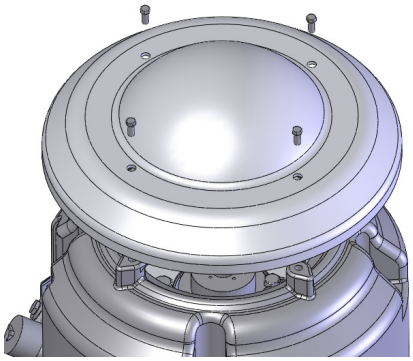
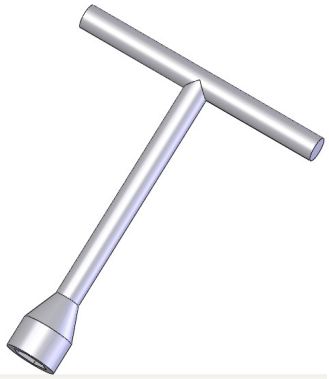


Step 3:
Lock coupling bolts with lock washer.



Step4:
Put back the drain cover and lock the bolts.

T-wench will make your work easy.
Tighten bolts with proper torque is very important. Please refer to “proper torque table” in the manual.



APPENDIX D :

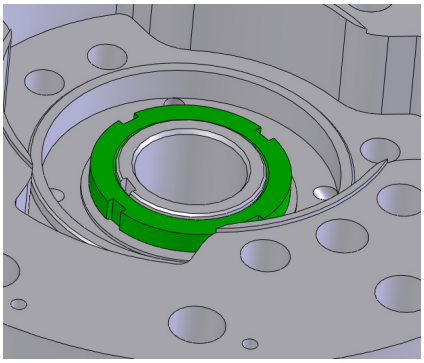
Endplay adjust instruction

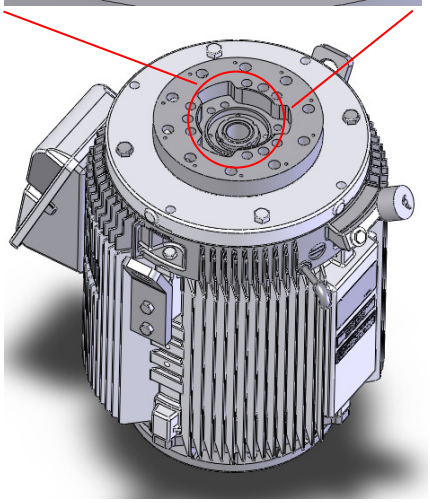
To ensure the motor is in the best, adjust end play after disassemble the motor for any reason. Too loose endplay may cause bearing separate and broken when momentary up thrust. Too tight endplay may course bearing broken due to overload.

Prevent from any possible of damage or injured. Before you start to adjust endplay, beware to disconnect all power. And leak out all oil (320T and above). Process this work at complete safe place.

Excessive and insufficient endplay both are not good setting for thrust bearing. Appropriate range for angular contact bearing is between 0.127mm (0.005”) and 0.508mm (0.020”). Follow the step below to keep endplay in proper range.

Step 1: Leave the locknut holding the runner on the shaft loose.
Step 2: Tighten the lower bearing cap bolts.
Step 3: Tighten down on the shaft locknut until the bearings are just starting to preload. When slight preloading is experienced, there is no endplay and the rotor will not turn as freely by hand.
Step 4: After slightly preloading the bearings, back off the locknut approximately 1/4 turn (0.005” (0.1mm) ~ 0.008” (0.2mm)) for angular contact bearing motors.
Step 5: If the equipment is available, it is desirable for the shaft endplay be checked using a dial indicator to measure movement as the rotor and shaft are raised and lowered.

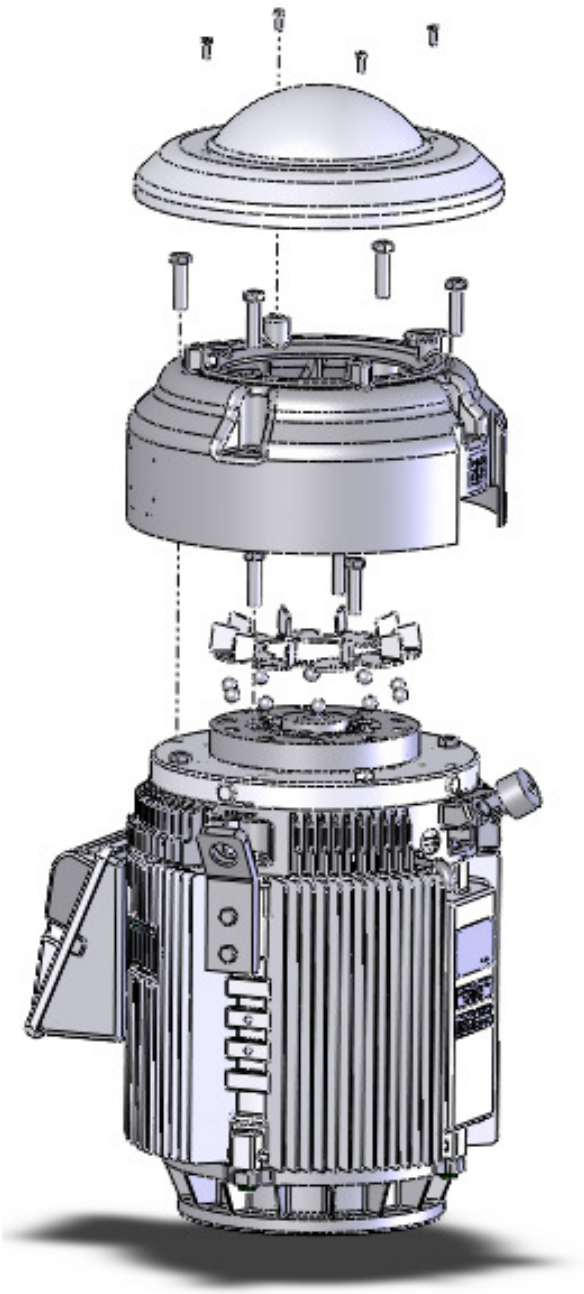




APPENDIX E :

Remove NRR instruction

All motors with NRR(non-reverse ratchet) mechanism from factory. You can remove this function easy, if you don't need it. Just simply remove the steel balls from the stop ring.



Prevent from any possible of damage or injured. Before you start to remove NRR function, beware to disconnect all power.

Remove steel balls from the stop ring:

Step 1: Remove drain cover with four bolts.
Step 2: Remove fan cover with four bolts.
Step 3: Remove fan with three bolts.
Step 4: Remove steel ball (x 10).

Prepare a magnetic bar, and you can remove the steel balls easy.

Reassemble the motor:

Step 1: Assemble fan with three bolts.
Step 2: Assemble fan cover with four bolts.
Step 3: Assemble drain cover with four bolts.

Tighten bolts with proper torque is very important. Please refer to "proper torque table" in the manual.

Motor and control wiring, overload protection and grounding should be in accordance with the Local Electrical Code and consistent with sound local practices. Neglect these precautions may result in damage to the equipment, injury to personnel or both.

NAMEPLATE INFORMATION & INSTALLATION HISTORY

EQUIPMENT NAME… ……...…. _____
LOCATION……..……... _____
TAG NUMBER…… ……. _____
PURCHASED DATE…… ……. _____
P.O. NUMBER…… _____
PURCHASED FROM …… _____
INSTALLED DATE ……... _____
SERIAL NUMBER ……..... _____
HORSEPOWER/POLE/RPM …... _____
VOLTAGE/FREQUENCY ……. _____
CURRENT ……. _____
INSULATION CODE …… _____
BEARING TYPE DE/ODE……... _____
GREASE/OIL TYPE …….. _____
INDEX OF PROTECTION……... _____

DATA	EVENT	ACTION