INSTRUCTIONS

FOR

THREE PHASE

INDUCTION MOTORS

WUXI TECO ELECTRIC &MACHINERY CO.,LTD.

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1. INTRODUCTION

This and the following instructions address the more common situations encountered in motor installation, operation and maintenance. For the TECO motor warranty to be and to remain in effect, the motor must be installed and operated in strict accordance with the outline drawing, motor nameplates and these instructions and must not be altered or modified in any unauthorized manner.

During these installations and operation of motors in heavy industrial applications there is a danger of live electrical parts and rotating parts. Therefore to prevent injury and/or damage the basic planning work for installation, transport, assembly, operation, etc.… needs to be done and checked by authorized and competent personnel only.

Following indications should be observed when reading these instructions.

Safety instructions are marked as follows：

Warning of electric hazards for personnel.

Warning of dangers for personnel.

ATTENTION !
Warning of damage for the motor or installation.

2. ACCEPTING, INSPECTION, STORAGE, TRANSPORTATION

2.1 Inspection upon receipt

Check the following points upon receipt：

- Are the nameplate ratings identical with what you ordered ?
- Are dimensions and color in compliance with your specifications ?
- Are the nameplate ratings for heater, thermal protector, temperature detector, etc. identical with what you ordered ?
- Is there any damage ?
- Are all accessories and accompanying instruction manuals in good order ?
- Please ensure that the arrowhead indicator really indicates direction of revolution.
- If there are any specific requirements, please ensure they are in conformity with your specification.

2.2 Storage

When motors are not in operation, the following precautionary measures should be undertaken to assure best performance.

2.2.1 Place

(a) High and dry, well-ventilated without direct sun、dust or corrosive gas.
(b) Not located near to a boiler or freezer.
(c) Entirely free from vibration and easy for movements.
(d) Motors should be put on pallets to prevent moisture.

2.2.2 Well protection

Motors should be well shielded from dust, but under well-ventilated circumstances.

2.2.3 Moisture prevention

Since moisture can be very detrimental to electrical components, the motor temperature should be maintained about 3℃above the dew point temperature by providing either external or internal heat. If the motor is equipped with space heaters, they should be energized at the voltage shown by the space heater nameplate attached to the motor.

2.2.4 Insulation resistance test

Even during storage, the insulation resistance should be kept above the specified values.

(a) For measurement of insulation resistance and acceptable standard values, please refer to measures stated in 4.1.2 "Measurement of insulation resistance".
(b) Insulation resistance test should be performed once every three months.

2.2.5 Long period storage

After the motor is installed (or after a period of time), it will be shut down for more than a week (except for 2.2.3 or 2.2.4).

In addition to the treatment, the test run is required every three months.

2.2.6 Bearing protection

If the motor center high above 200 has been provided with a shaft shipping brace to prevent shaft movement during transit, it must be removed before operating the motor. It is very important that this brace be reinstalled exactly as it was originally, before the motor is moved from storage or any time when the motor is being transported. This prevents axial rotor movement that might damage the bearings.

2.2.7 Prevent rusting

ATTENTION！

Cares should be taken to keep parts such as fitting surface, key, shaft extension and axial central hole from any collision with foreign matters. Grease should also be generously applied to prevent rusting.

2.3 Transportation

ATTENTION！

To keep the rotating parts of motors from moving, thus preventing damage and scratching during transportation, the frame number above 200 is designed with shaft end plate. Remove all transit clamps before operating the motor. It is very important that this device be reinstalled exactly as it was originally, before the motor is moved from storage or any time when the motor is being transported. The vertical mounting type motors should be transported in the vertical position.

When the motor and load machine are handled together, the above precautions shall also be observed, but the protection design shall be modified.

Do not use the hoisting hook/eyebolts to lift more that the motor itself. They are designed to support the motor only.

Make sure the hoisting hook is correctly attached to the eyebolt(s) or lug(s) of the motor and that the eyebolt(s)/lug(s) are fully screwed in before hoisting. Also note such parts as fan cover, ventilation box, bracket, slip-ring, etc. may have their own hoisting lugs which can only carry their own weight. Nothing extra should be attached while hoisting.

Do not twist the steel wires and make sure the eyebolts have been firmly screwed and the sling angle is correct.

3. INSTALLATION

3.1 Site and environment for motor installation

3.1.1 Confirm that the orientation of the frame conforms to the design of the original motor, for example, the original B3 (horizontal shaft installation) design, which may not be suitable for V5 (vertical shaft installation) without modification, because the position of the drain hole may not be correct, additional support and fixation may be required to prevent the shaft from sliding in the bearing and different bearings may have to be replaced to bear the thrust.
If the location is different from that specified in the original order, you can consult TECO if it can be used safely.

3.1.2 If the motor is used in places with high vibration (such as vibrating screen), high humidity (over 95%), abnormal temperature (not - 20 ~ + 45 ℃) or high altitude (over 1000m), please confirm the applicability of the motor specification.

3.1.3 When installing the motor, please make sure that all mounting holes are firmly locked with steel bolts and nuts; for places prone to corrosion, stainless steel bolts should be used, and shockproof washer should be installed for high vibration fields.

3.1.4 When the drain hole is open, ensure that there is protection against contact, and then send the power to the motor winding.

3.1.5 When coupling directly, make sure that the motor and load shaft are aligned accurately and flexible coupling is used; the fixed bolt must be locked carefully to prevent the alignment from changing. After all locking, recheck the alignment to ensure it is correct.

3.1.6 When side coupling load (such as pulley or gear drive), please make sure that the side tension at the shaft end is perpendicular to the shaft, so as not to cause damage to the motor. If you have any questions, please contact TECO.

3.2 Coupling installation

3.2.1 General notes

ATTENTION！

If the accuracy of the concentricity of the two shafts is poor, the shaft and the bearing will be damaged easily, causing serious damage adverse consequences. Therefore, it must be confirmed that the two shafts are concentric in the same straight line during installation.

3.2.2 Installation

When installing the coupling on the motor shaft, the installation procedure specified by the coupling manufacturer must be followed. When coupling, the shaft end shall not be subject to overheating or super cooling temperature.

3.2.3 Installation precautions

ATTENTION！

When the coupling is sleeved into the shaft end, the coupling shall be gently pushed into the shaft by heating, and shall not be hammered hard to avoid damage to the bearing.

3.2.4 Thermal growth

In aligning the motor (and rotor) axially with the driven equipment, consideration should be given not only to the end-play indicator position but also to axial shaft expansion and increase in shaft centerline height due to thermal effects. In general, the axial shaft growth for motors can be disregarded since neither bearing is fixed and any shaft growth due to temperature increase will produce an elongation away from the coupling.

Shaft height growth (change in shaft centerline elevation) for TEFC machines can be calculated as follows：

$$\triangle = (0.0005) \times (\text{motor foot to shaft centerline dimension})$$

For non-TEFC machines, divide this number by 2.

3.2.5Alignment

It is desirable, in normal operation, that the motor operate on its magnetic center, so that no axial force is exerted on the coupling.
The motor shaft and the driven shaft should be aligned within the following tolerances in both angular and parallel alignment：

Unit：mm

TIR	Range of rotating speed	Solid coupling	Flexible coupling
C	2500rpm and above	0.03	0.03
	Below 2500rpm	0.04	0.05
A	2500rpm and above	0.03	0.03
	Below 2500rpm	0.03	0.04

TIR = Total indicator reading (by dial indicator)

Angular misalignment is the amount by which the centerlines of driver and driven shaft are skewed. It can be measured using a dial indicator set up as shown in Fig.1. The couplings are rotated together through 360 degrees so that the indicator does not measure run out of the coupling hub face. The shafts should be forced against either the in or out extreme of their end float while being rotated.

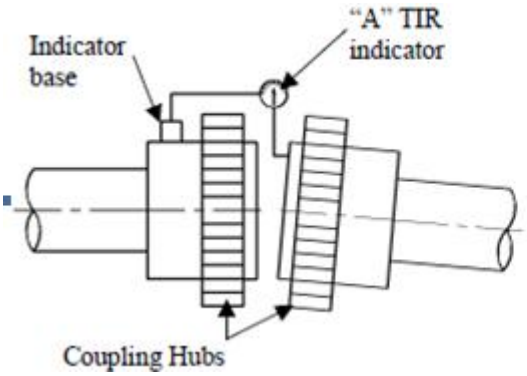

Fig. 1

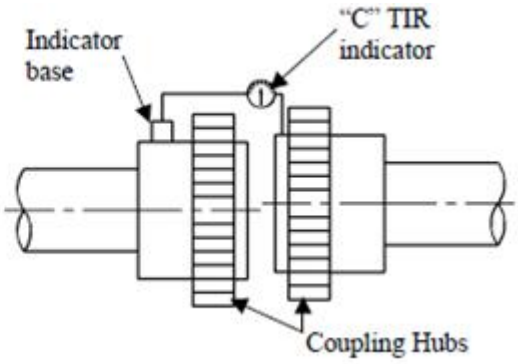

Fig. 2

Parallel misalignment is the amount by which the centerlines of the driver and driven shafts are out of parallel. It can be measured using a dial indicator set up as shown in Fig.2. Again, the couplings are rotated together through 360 degrees so that the indicator does not measure runout of the coupling hub outside diameter.

3.2.6 Dowel

After the motor has been properly aligned with the driven equipment and the hold-down bolts have been installed and tightened, for motors with fabricated frame, at least two dowel pins should be installed in two diagonally opposite motor feet.

3.2.7 Removal of redundant shaft key

When the length of coupling hub is different from the length of shaft key, the motor may have a high vibration level due to this unbalance condition. The removal of redundant shaft key is necessary, shown as Fig.3.

Method (1)： After installing the coupling, use a grinding wheel to remove the redundant key (hatch area).

Method (2)： Before installing the coupling, calculate the different length between coupling hub and shaft key, then cut the half of this different value (hatch area) to achieve approximate-balance condition.

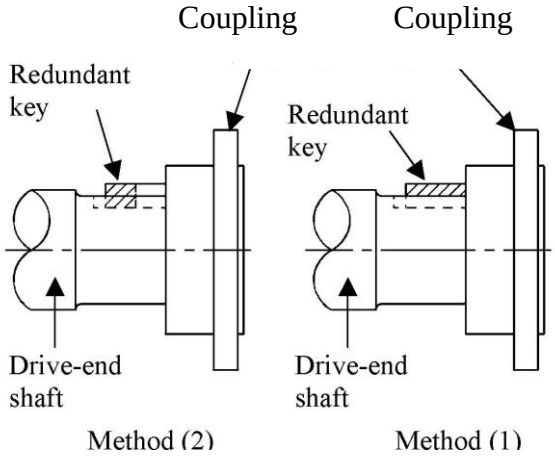

Fig. 3

3.3 Installation for belt drive

In general, power transmission through direct flexible coupling is appropriate for large motors. Such motors are not suitable for belt, chain or gear connection unless specially designed for such service. However, for small and medium motors of which outputs within the ranges shown on table below, it is acceptable to use belt transmission as indicated. Beyond these ranges, do not apply belt sheaves unless specially designed.

3.3.1 Diameter of sheaves

The diameter ratio between conveyance sheaves should not be greater than 5 to 1 for flat belts, and 8 to 1 for V-belt. It is also advisable to limit the belt velocity to under 35 m/sec to limit belt abrasion and vibration. The smaller the outer diameter of the V-belt sheave, the greater the shaft bending stress will be. If the bending stress is in excess of the shaft fatigue stress, the shaft may break. Therefore, please inform us when you have decided the size of the sheaves and the length
of the belts upon ordering.

ATTENTION !

Place the sheave and belt as close as possible to the motor body (it is advisable to make x as shown in Fig.4 equal to 0) to reduce the bending moment and improve shaft life.

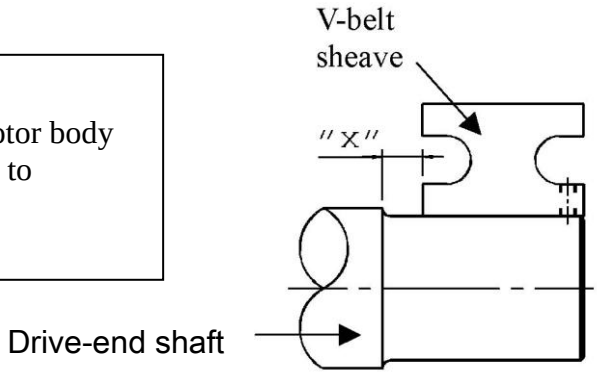

Fig.4

3.3.2 Table of belt-sheave application for general electric motors

Output (kW)			V-Belt Sheave							
			Conventional V-Belt				Narrow V-Belt			
4P	6P	8P	V-Belt Type	Number of Belts	Min. PCD (mm)	Max. Width (mm)	V-Belt Type	Number of Belts	Min. PCD (mm)	Max. Width (mm)
11	--	--	B	4	160	82	3V	4	125	48
--	11	--	B	5	170	101	3V	5	140	59
--	--	11	B	5	190	101	3V	6	160	69
15	--	--	B	5	170	101	3V	6	125	69
--	15	--	B	5	224	101	3V	6	160	69
--	--	15	C	4	224	111	5V	3	180	60
18.5	--	--	B	5	200	101	3V	6	140	69
--	18.5	--	C	4	224	111	5V	3	180	60
--	--	18.5	C	5	224	136	5V	4	180	78
22	--	--	B	5	224	101	3V	6	160	69
--	22	--	C	5	224	136	5V	4	180	78
--	--	22	C	5	250	136	5V	4	200	78
30	--	--	C	5	224	136	5V	4	180	78
--	30	--	C	5	265	136	5V	4	224	78
--	--	30	C	6	265	162	5V	5	224	95
37	--	--	C	6	224	162	5V	4	200	78
--	37	--	C	6	265	162	5V	4	224	78
--	--	37	C	7	280	187	5V	5	250	95
45	--	--	C	6	265	162	5V	4	224	78
--	45	--	C	7	280	187	5V	5	224	95
--	--	45	C	7	315	187	5V	6	250	113
55	--	--	C	7	265	187	5V	5	224	95
--	55	--	C	8	300	213	5V	6	250	113
--	--	55	D	5	355	196	5V	6	280	113
75	--	--	C	8	315	213	5V	6	250	113
--	75	--	D	6	355	233	5V	6	315	113
--	--	75	D	6	400	233	5V	6	355	113
--	90	--	D	6	400	233	5V	6	355	113
--	--	90	D	6	425	233	8V	4	355	124
--	110	--	D	7	400	270	8V	4	355	124
--	132	110	D	7	450	270	8V	4	400	124
--	160	132	D	9	450	344	8V	4	450	124

3.4 Conveyance with chain or gear

3.4.1 Loading capacity

Make sure the loading capacity of shaft and bearings is appropriate for the size and installation position (overhung) of chain and gear. If necessary, please contact us to ensure the shaft and bearings will meet your requirements.

3.4.2 Pay close attention to ensure the parallelism of shafts.

3.4.3 The teeth of couplings should be correctly and precisely matched; the force conveyance centers should lie on the same line.

3.4.4 There should be no skip, jumping, vibration or unusual noises.

ATTENTION！

Do not hammer the conveyance devices such as couplings, belt sheaves, chain wheels, gears etc. onto the shaft. Those shaft fitments should be fitted and removed only by means of suitable devices. Heat shrinking may be a better alternative to avoid damaging bearings and other components.

The exposed rotating parts should be covered to prevent accidents.

3.5 Electrical connections

All control and grounding power wiring must strictly comply with the national electrical standards and local regional regulations. For the wiring, please refer to the wiring nameplate attached to the motor.

3.5.1 Power

The rated conditions of operation for the motor are as shown on the nameplate. Within the limits, given below, of voltage and frequency variation from the nameplate values, the motor will continue to operate but with performance characteristics that may differ from those at the rated conditions：

+/- 10% of rated voltage

+/- 5% of rated frequency

+/- 10% combined voltage and frequency variation so long as frequency variation is no more than +/- 5% of rated Operating the motor at voltages and frequencies outside of the above limits can result in both unsatisfactory motor performance and damage to or failure of the motor.

3.5.2 Main lead box

The main lead box furnished with the motor has been sized to provide adequate space for the make-up of the connections between the motor lead cables and the incoming power cables.

The bolted joints between the motor lead and the power cables must be made and insulated in a workman-like manner following the best trade practices.

3.5.3 Grounding

Either fabricated motors or fan cooled cast frame motors are all provided with grounding pads or bolts.

The motor must be grounded by a proper connection to the electrical system ground.

3.5.4 Rotation direction

The rotation direction of the motor will be as shown by either a nameplate on the motor or the outline drawing. The required phase rotation of the incoming power for this motor rotation may also be stated. If either is unknown, the correct sequence can be determined in the following manner： While the motor is uncoupled from the load, start the motor and observe the direction of rotation. Allow the motor to achieve full speed before disconnecting it from the power source. Refer to the operation section of these instructions for information concerning initial start-up. If resulting rotation is incorrect, it can be reversed by interchanging any two (2) incoming cables.

3.5.5 Auxiliary devices

Please refer to other auxiliary drawings for terminal code and accessory wiring method.
If the motor is provided with internal space heaters, the incoming voltage supplied to them must be exactly as shown by either a nameplate on the motor or the outline drawing for proper heater operation.

Caution must be exercised anytime contact is made with the incoming space heater circuit as space heater voltage is often automatically applied when the motor is shutdown.

4. OPERATION

4.1 Examination before start

4.1.1 Wiring check

When motors are installed in good manner, ensure the wiring is according to the diagram. Also, the following points should be noted：

(a) Make sure all wiring is correct.
(b) Ensure the sizes of cable wires are appropriate and all connections are well made for the currents they will carry.
(c) All contacts except the connecting seat shall be wrapped and insulated.
(d) Ensure the capacity of fuse, switches, magnetic switches and thermo relays etc. are appropriate and the contactors are in good condition.
(e) Make sure that frame and terminal box are grounded.
(f) Make sure that the starting method is correct.
(g) Make sure switches and starters are set at their right positions.
(h) Motor heaters must be switched off when the motor is running.

4.1.2 Measurement of insulation resistance

During and immediately after measuring, the terminals must not be touched as they may carry residual dangerous voltages. Furthermore, if power cables are connected, make sure that the power supplies are clearly disconnected and there are no moving parts.

(a) For rated voltage below 1000V, measured with a 500VDC megger.
For rated voltage above 1000V, measured with a 1000VDC megger.
(b) In accordance with IEEE 43, clause 9.3, the following formula should be applied：

$$R \geq \frac{\text{Rated voltage (v)}}{1000} + 1 \quad (M\Omega)$$

(c) On a new winding, where the contaminant causing low insulation resistance is generally moisture, drying the winding through the proper application of heat will normally increase the insulation resistance to an acceptable level. The following are several accepted methods for applying heat to a winding：

(1) If the motor is equipped with space heaters, they can be energized to heat the winding.

(2) Direct current (as from a welder) can be passed through the winding. The total current should not exceed approximately 20% of rated full load current. If the motor has only three leads, two must be connected together to form one circuit through the winding. In this case, one phase will carry the full applied current and each of the others, one-half each. If the motor has six leads (3 mains and 3 neutrals), the three phased should be connected into one series circuit.

Ensure there is adequate guarding so live parts cannot be touched.

(d) Should the resistance fail to attain the specified value even after drying, careful examination should be undertaken to eliminate all other possible causes, if any.

4.1.3 Power source

(a) Ensure the capacity of the power source is sufficient.

(b) Ensure the supply voltage and frequency ratings are identical to those on the nameplate.

(c) Voltage variation should be confined to within ±10% of the rated value and the phase to phase voltages should be balanced.

4.1.4 Bearing lubrication

Please pay special attention to ensure the initial bearing oil filling

(1) The bearings have been well greased at factory before delivery. However, regreasing is required if a significant period has elapsed between manufacture and use or in storage. Fill new grease until it overflows and the old grease is entirely replaced.

(2) If the motor is in storage for over three months ,refilling of some new oil should be undertaken before operation to prevent bearing damage due to dry friction .The oil level should be kept at the center of the oil gauge .If necessary ,drain some oil after refilling.

(3) Unless otherwise specified, MULTEMP SRL or CALTEX SRI-2 is the standard applied to TECO motors.

ATTENTION ！

Do not mix different kinds of grease.

The mixing of different thickeners may damage the chemical composition or physical properties of the oil. Even if the same thickener is mixed with the same oil, it may have serious adverse effects due to different additives.

4.1.5 Remove all locks

ATTENTION !
Make sure all locks which fasten the movable parts of the motors during transportation are dismantled and the shaft can rotate freely.

4.1.6 Clean before starting

ATTENTION !
Ensure there are no foreign matters or tools inside the motors before starting motors.

4.1.7 Transmission system check

Make sure the transmission system, including belts、screws、bolts、nuts and set pins are in good condition.

The keys fitted to the shaft extensions are held by plastic tape only to prevent them falling out during transportation or handling. The shaft key shall be removed to avoid flying out, when the motor is operated prior to the couplings etc. being fitted to the shaft extension.

4.1.8 Test run

Make sure the items above are examined. Test the motor running with or without load. Record and check according to "Maintenance" at 15 minutes intervals during the first three hours of operation. Then regular examinations should take place at longer intervals. If all goes well the motor can be classified as "in good order".

4.2 Starting operation

4.2.1 Starting load

Initially run the motor unloaded prior to coupling to other machines. Unless otherwise specified, a motor usually starts with light load which is then gradually increased proportional to the square of speed and at last reach 100% load at full load speed.

4.2.2 Starting

Too frequent starts can harm the motors. The following restrictions should be observed：

(a) Motor can be restarted should the initial start fail. Two starts are generally permissible when the motor is cold.

(b) Motor can be started only once when it is at normal running temperature.

(c) Should additional starts be necessary beyond the conditions stated above, the following restrictions should be noted：

(1) Let the motor cool down for 60 minutes before restarting, fully loaded.

(2) Let the motor cool down for 30 minutes before restarting, unloaded.

(3) Two inching starts can be regarded as one normal start.

ATTENTION !

If the motor rotor fails to start turning within one or two seconds, shut off the power supply immediately.

Investigate thoroughly and take corrective action before attempting a restart.

(d) Possible reasons for not starting are：

(1) Too low a voltage at the motor terminals.
(2) The load is too much for the rotor to accelerate.
(3) The load is frozen up mechanically.
(4) All electrical connections have not been made.
(5) Single phase power has been applied.
(6) Any combination of the above.

4.2.3 Rotating direction

(a) Most TECO motors are bi-directional. However, when some special types, such as high speed 2P, certain large capacity motors, those with a non-reverse ratchet etc. should rotate in one direction, please ensure the rotation is in conformity with the directional arrow-mark shown on the attached nameplate.

(b) To reverse a bi-directional motor, cut the power and wait until the motor stops. Then interchange any two of the three phases.

4.2.4 Power source, Voltage, Current

(a) Ensure the voltage and frequency of the power source are identical to the ratings shown on the nameplate.

(b) Voltage variation should be confined to within ±10% of the rating and the three phase voltages should be in full balanced.

(c) Ensure the motor phase currents, when without load, are within ±5% of the average values.

4.2.5 Frequency

Frequency variation should be confined to within ±5% of the rating. The aggregate variation of voltage and frequency should be confined to within ±10% of the absolute value of the ratings.

4.2.6 Starting time and unusual noises

ATTENTION !

Starting time is longer for the motors with large inertia. However, if starting time is longer than usual or if there is difficulty in starting, or there is abnormal noise, do not run the motor and refer to TECO.

4.2.7 Bearing temperature rise

Following the initial start-up, the bearing temperatures should be closely monitored. The rate of rise in bearing temperature is more indicative of impending trouble than is the actual temperature.

ATTENTION！

If the rate of rise in temperature is excessive or if the motor exhibits excessive vibration or noise, it should be shut down immediately and a thorough investigation made as to the cause before it is operated again.

If the bearing temperature rise and motor operation appear to be normal, operation should continue until the bearing temperatures stabilize.

Recommended limits on bearing temperature are as follows：

Rolling Bearings.

	Alarm temperature.	Trip temperature
・By permanently installed detector	95℃	100℃

4.2.8 Noise and Vibration

ATTENTION！

Any abnormal noise or vibration should be immediately investigated and corrected. Increased vibration can be indicative of a change in balance due to mechanical failure of a rotor part, a stator winding problem or a change in motor alignment.

5. MAINTENANCE

5.1 Major points in regular inspection and maintenance

For safety, maintenance and repairs must only be carried out by properly trained personnel.

Some testing, such as insulation resistance, usually requires the motor to be stopped and isolated from power supplie(s).
Routine inspection and maintenance are usually performed by looking, listening, smelling and simple meters.

High temperature may arise under operating conditions on the motor surfaces, so that touching should be prevented or avoided. Keep away from moving and live parts. Unless deemed necessary, do not remove guards whilst assessing the motor.

Timely replacement of worn parts can assure longevity and prevent breakdown.
Routine inspection and regular inspection and maintenance are important in preventing breakdown and lengthening service life.
Owing to the varied time and circumstances, motors are used, it is difficult to set the items and periods for regular inspection and maintenance. However, as a guide it is recommended to be performed periodically according to factory maintenance program. Generally, the inspection scope determined by the following factors：

(a) Ambient temperature.
(b) Starting and stopping frequency.
(c) Troublesome parts usually affecting motor functions.
(d) Easily abraded parts.
(e) The important position of motor in the operational system of a factory should be duly recognized. Therefore, its health and wellbeing should be fully protected, especially when it is operating in severe conditions.

5.2 Motor windings

(a) Measurement of insulation resistance and standards to determine quality of insulation resistance, please refer to measures stated in 4.1.2 "Measurement of insulation resistance".
(b) Inspection of coil-ends：
(1) Grease and dust accumulated on coils may cause insulation deterioration and poor cooling effect.
(2) Moisture must not accumulate. Keep coils warm when motor is not in use if moisture can be seen.
(3) Discoloring. This is mainly caused by overheat.
(c) Ensure no untoward change of wedges from original position.

5.3 Clean the interior of the motor

(a) After a motor is in operation for some time, accumulation of dust, carbon powder and grease etc., on the inside is unavoidable, and may cause damage. Regular cleaning and examination is necessary to assure top performance.
(b) Points to note during cleaning：
(1) If using compressed air or a blower：

a) Compressed air should be free of moisture.

b) Maintain air pressure at 4 kg/cm^2, since high pressure can cause damage to coils.

(2) Vacuum
Vacuum cleaning can be used, both before and after other methods of cleaning, to remove loose dirt and debris. It is a very effective way to remove loose surface contamination from the winding without scattering. Vacuum cleaning tools should be non-metallic to avoid any damage to the winding insulation.
(3) Wiping
Surface contamination on the winding can be removed by wiping using a soft, lint-free wiping material. If the contamination is oily, the wiping material can be moistened (not dripping wet) with a safety type petroleum solvent.

In hazardous locations, a solvent such as inhibited methyl chloroform may be used, but must be used sparingly and immediately removed. While this solvent is non-flammable

under ordinary conditions, it is toxic and proper health and safety precautions should be followed while using it.

ATTENTION !

Solvents of any type should never be used on windings provided with abrasion protection. Abrasion protection is a gray, rubber-like coating applied to the winding end-turns.

Adequate ventilation must always be provided in any area where solvents are being used to avoid the danger of fire, explosion or health hazards. In confined areas (such as pits) each operator should be provided with an air line respirator, a hose mask or a self-contained breathing apparatus. Operators should wear goggles, aprons and suitable gloves. Solvents and their vapors should never be exposed to open flames or sparks and should always be stored in approved safety containers.

(4) Keep core ducts completely clean. The difference in temperature rise could be around 10℃ before and after cleaning.

5.4 Clean the exterior of the motor

(a) On open ventilated motors, screens and louvers over the inlet air openings should not be allowed to accumulate any build-up of dirt, lint, etc. that could restrict free air movement.

ATTENTION !

Screens and louvers should never be cleaned or disturbed while the motor is in operation because any dislodged dirt or debris can be drawn directly into the motor.

(b) If the motor is equipped with air filters, they should be replaced (disposable type) or cleaned and reconditioned (permanent type) at a frequency that is dictated by conditions. It is better to replace or recondition filters too often than not often enough.
(c) Totally enclosed air-to-air cooled and totally enclosed fan cooled motors require special cleaning considerations. The external fan must be cleaned thoroughly since any dirt build-up not removed can lead to unbalance and vibration. All of the tubes of the air-to-air heat exchanger should be cleaned using a suitable tube brush having synthetic fiber bristles (not wire of any type).

5.5 Maintenance of anti-friction bearing

5.5.1 Frequency of relubrication

The motor adopting double cover bearing (bearing model suffix is "ZZ") is of pre oiling type, and no oiling is needed.

The larger frame number (usually frame number 200 and above) and the specific one will have oil feeding device. These motors have been noted at the time of shipment Oil, and need to change the grease regularly; the period depends on the size and use of the motor. The following table is the recommendations for the filling period value, excessive or frequent oiling may damage the motor.

For motors with ball bearings, if there is any sound like rustling or rustling at the bearing, please try to add a small amount of grease first, If the sound disappears immediately after adding grease, this is a normal phenomenon. As long as the temperature rise of the bearing is normal, it can continue on safe.

Rated output Kw	Pole	Lubrication cycle		
		Standard conditions	Severe conditions	Extreme conditions
30-75	4P and above	60day	55day	30day
90-110	4P and above	70day	30day	15day
132-315	4P and above	90day	30day	15day
30-75	2P	60day	55day	30day
90-110	2P	70day	30day	15day
132-315	2P	90day	30day	15day

As the product series designs are not the same, the above expression is for reference only. The amount of grease and the cycle of lubrication of the bearing should be based on the actual instructions on the relubrication nameplate.

Definition:

Standard condition: under clean and low vibration environment, operate at rated or light load for 8 hours every day.

Severe condition: operate at rated or light load for 24 hours a day, or in dirty / dusty environment, or the motor bears Vibration / light shock load.

Extreme conditions: heavy shock load or high vibration, or very dirty / dusty environment.

ATTENTION!

If the lubricating grease is replenished during the operation of the motor, make sure that it is carried out by properly trained personnel, charged and rotated. The Department has complete protection.

Confirm that the oil outlet nozzle has been opened and the oil filling head is clean, connect the low pressure oil gun to the oil outlet head, and inject the grease until the oil outlet nozzle ,until the grease flows out.

Remove the oil gun, and operate the motor for 10-30 minutes under the complete protection of electrified and rotating parts to confirm that the excess grease is suitable. After the degree is eliminated, install the oil outlet plug.

Grease styling:

Make sure the grease is correctly shaped. Incompatible grease with bearing insiders will greatly reduce bearing life, if not confirmed. Please contact TECO for the model.

The grease used for TECO standard oil fed motor is MULTEMP SRL or Caltex sri-2, etc. Please follow the principle of motor carry out oil feeding operation on the upper oil feeding nameplate.

5.5.2 Supply of Grease

The amount of grease replenishment varies with the type and size of the bearing and the structure of the bearing housing, and the amount of oil replenishment for each bearing is large

Bearing No.		Amount of replenishment
62XX 72XX NU2XX 222XX	6210	30g
	6212	40
	6213	50
	6214	50
	6215	60
	6216	60
	6217	80
	6218	80
	6220	100
	6222	120
	6224	120
	6226	140
	6228	160
	6230	180
	6232	200
	6234	250
	6236	300
	6238	350
	6240	400
	6244	450
	6248	500

Bearing No.		Amount of replenishment
63XX 73XX NU3XX 223XX	6310	40g
	6312	60
	6313	80
	6314	80
	6315	100
	6316	100
	6317	120
	6318	120
	6320	160
	6322	220
	6324	270
	6326	300
	6328	400
	6330	450
	6332	500
	6334	600
	6336	700
	6338	800
	6340	900
	6344	900
	6348	900

As the product series designs are not the same, the above expression is for reference only. The amount of grease and the cycle of lubrication of the bearing should be based on the actual instructions on the relubrication nameplate.

* Fill new grease until it overflows and the old grease is entirely replaced.

5.5.3 Re-greasing

If relubrication is to be performed when the motor is running, stay clear of rotating parts.

It is advisable to re-grease when the motor is running to allow the new grease to be evenly distributed inside the bearing.

Before re-greasing, the inlet fitting should be thoroughly cleaned to prevent any accumulated dirt from being carried into the bearing with the new grease. The outlet of grease drainage should be opened to allow the proper venting of old grease.

Use a grease gun to pump grease through grease nipple into bearings. After re-greasing, operate the motor for 10-30 minutes to allow any excess grease to vent out.

5.5.4 Cleaning and installation of bearings

(a) Apply the proper amount of grease to disassembled parts of the bearing after they have been thoroughly cleaned with high quality cleaning oil. Then protect them from contamination before and during assembly.

(b) Bearing installation

Since the bearing is a high precision component, it is important to avoid ingression of dust and foreign matter, and hammering during cleaning and installation. Use extreme care and ensure clean conditions during installation and assembly.

ATTENTION！

Before installing the bearings, make sure that the shaft mounted parts inside the bearings are in place before installation.

ATTENTION！

The best way for bearing installation is heat shrinking. Knocking and hammering during installation should be avoided absolutely.

The bearing should be heated in a bath of clean oil at temperature of approx. 80℃. After warming, slide the bearings in place quickly and nimbly so that it has not shrunk before being fully in position.

Grease the bearing after the temperature returns to normal, and then reassemble the motor.

6.FAULT FINDING AND RECOGNITION

Kinds of Breakdown	Symptoms	Possible causes	Remedies
Fail to start without load	Motionless and soundless	Power-off	Consult power company
		Switch-off	Switch-on
		No fuse	Install fuse
		Broken wiring	Check wiring and repair
		Broken lead	Check wiring and repair
		Broken windings	Check windings and repair
	Fuse blowing. (Automatic switch trips off, slow start with electromagnetic noise)	Short circuit of circuit switches	Check circuit switches and replace
		Incorrect wiring	Check wiring according to nameplate
		Poor contact at terminals	Lock tightly
		Windings grounded	Factory repair
		Broken windings	Factory repair
		Poor contact of circuit switches	Check and repair
		Broken wiring	Check and repair
		Poor contact of starting switches	Check and repair
		Short circuit of starting switches	Check and repair
		Incorrect connections of starting switches	Connect according to nameplate
Loading after start	Fuse blowing. Fail to restart due to trip-off of automatic switch	Insufficient capacity of fuse	Replace fuse if wiring permits
		Overload	Lighten load
		High load at low voltage	Check circuit capacity and reduce load
	Overheating motor	Overload or intermittent overload	Lighten load
		Under-voltage	Check circuit capacity and power source
		Over-voltage	Check power source
		Ventilation duct clogged	Remove the foreign matter in the duct
		Ambient temperature exceeds 40˚C	Correct insulation class to B or F, or lower ambient temperature.
		Friction between rotor and stator	Factory repair
		Fuse blown (Single-phase rotating)	Install the specified fuse
		Poor contact of circuit switches	Check and repair
		Poor contact of circuit starting switches	Check and repair
		Unbalanced three-phase voltage	Check circuit or consult power company

Kinds of Breakdown	Symptoms	Possible causes	Remedies
Loading after start	Speed falls sharply	Voltage drop	Check circuit and power source
		Sudden overload	Check machine
		Single-phase rotating	Check circuit and repair
	Switch overheat	Insufficient capacity of switch	Replace switch
		High load	Lighten load
	Bearing overheating	High belt tension	Adjust belt tension
		Slack belt tension	Adjust belt tension
		Misalignment between motor and machine shafts	Re-align
		Over speed of bearing outer-ring	Adjust bracket
		High bearing noise	Replace the damaged bearing
Noise	Electromagnetic noise induced by electricity	Occurrence from its first operation	May be normal
		Sudden sharp noise and smoking	Short circuit of windings Should be repaired at factory
	Bearing noise	Noise of low shishi or Thru-Thru	May be normal
		Kala-Kala as result of poor lubrication	Grease
		Kulo-Kulo as a result of deteriorated grease	Clean bearing and grease
		Sa-Sa or larger noise	Replace the damaged bearing
	Mechanical noise caused by machinery	Loose belt sheave	Adjust key and lock the screw
		Loose coupling or skip	Adjust the position of couplings, lock key and screw
		Loose screw on fan cover	Lock fan cover screw tightly
		Fan rubbing	Adjust fan position
		Rubbing as a result of ingression of foreign matters	Clean motor interior and ventilation ducts
		Wind noise	Noise induced by air flowing through ventilation ducts
		Induced by conveyance machine	Repair machine
Vibration	Electromagnetic vibration	Short circuit of windings	Factory repair
		Open circuit of rotor	Factory repair
	Mechanical vibration	Unbalanced rotor	Factory repair
		Unbalanced fan	Factory repair
		Broken fan blade	Replace fan
		Unsymmetrical centers between belt sheaves	Align central points
		Central points of couplings do not lie on the same level	Adjust the central points of couplings to the same level
		Improper mounting installation	Lock the mounting screws
		Motor mounting bed is not strong enough	Reinforce mounting bed
		Mounting bed vibration caused by near machines	Eliminate the vibration source near motor

Remarks: (1) (2) Circuit switches: These include knife switches, electromagnetic switches, fuse and other connection switch etc. Starting switches: These include Delta-Star starters, compensate starters, reactance starters, resistor starters, starting controllers etc.

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