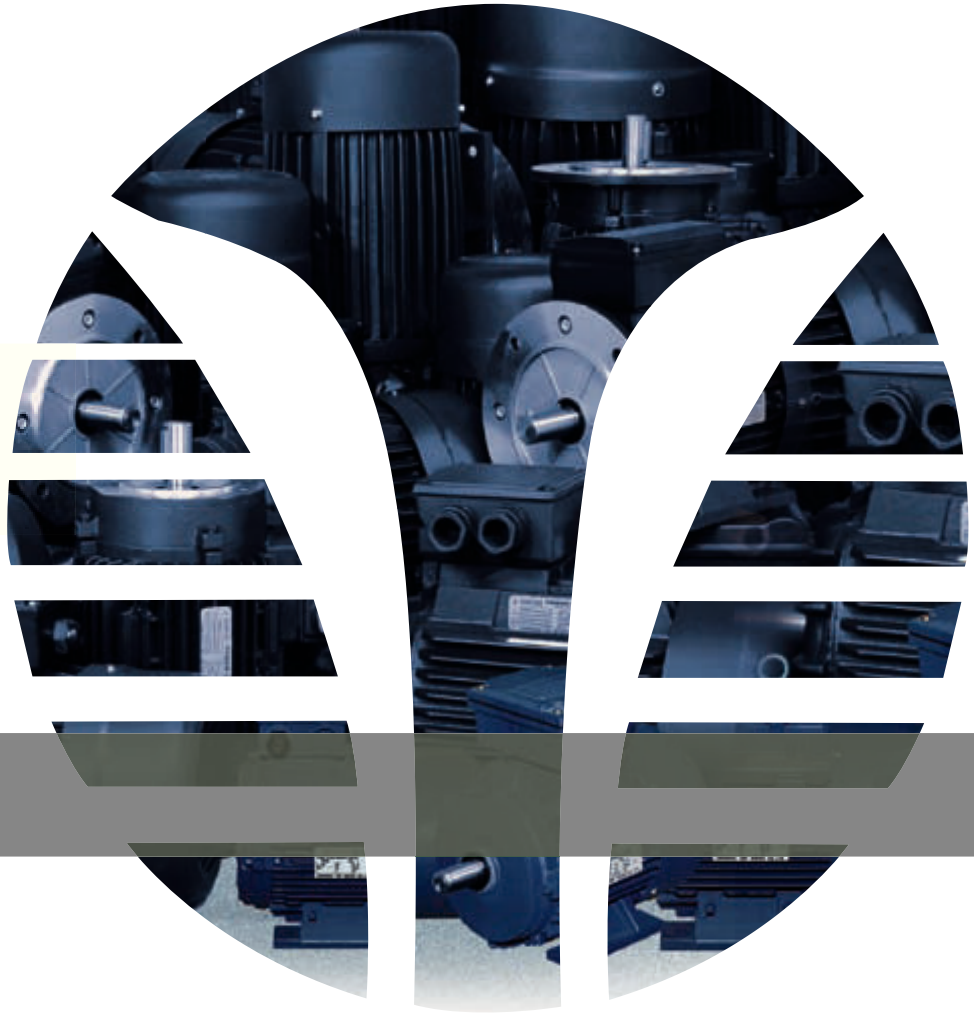


Operation and Maintenance Manual

1. Introduction

NOTE!

These instructions must be followed to ensure safe and proper installation, operation and maintenance of the machine. They should be brought to the attention of anyone who installs, operates or maintains the machine or associated equipment. The machine is intended for installation and use by qualified personnel, familiar with health and safety requirements and national legislation. Ignoring these instructions may invalidate all applicable warranties.

1.1 Declaration of Conformity

Declarations of Conformity with respect to the Low voltage Directive 73/23/EEC amended by Directive 93/68 EEC are issued separately with individual machines.
The Declaration of Conformity also satisfies the requirements of a Declaration of Incorporation with respect to the Machinery Directive 98/37/EEC, Art 4.2 Annex II, sub B

1.2 Validity

The instructions are valid for the operation of the following types of TEC electrical machine.
Series: MS1/MS2 (TM), MSB, MSD, MSC/MYC, MSV (TMV), MYV
Series: MY/MYT, ML, MC
Series: Y/Y2 (TM), YC, T1C/ T1A (TM), T2C / T2A(TM/TCF), T3C/ T3A(TCF), TCI/TCP, TG
in frame sizes 56--355

2. Handling

2.1 Reception check

Immediately upon receipt check the motor for external damage (e.g. shaft-ends and flanges and painted surfaces) and if found, inform the forwarding agent without delay.
Check all rating plate data, especially voltage and winding connection (star or delta). The type of bearing is specified in the catalogue.

2.2 Transportation and storage

The motor should always be stored indoors (above –20°C), in dry, vibration free and dust free conditions. During transportation, shocks, falls and humidity should be avoided. In other conditions, please contact TEC.
Unprotected machined surfaces (shaft-ends and flanges) should be treated against corrosion.
It is recommended that shafts are rotated periodically by hand to prevent grease migration.
Anti-condensation heaters, if fitted, are recommended to be used to avoid water condensing in the motor.
The motor must not be subject to any external vibrations at standstill so as to avoid causing damage to the bearings.
Motors fitted with cylindrical-roller and/or angular contact bearings must be fitted with locking devices during transport.

2.3 Lifting

All TEC motors above 25 kg are equipped with lifting lugs or eyebolts.
Only the main lifting lugs or eyebolts of the motor should be used for lifting the motor. They must not be used to lift the motor when it is attached to other equipment.
Lifting lugs for auxiliaries (e.g. brakes, separate cooling fans) or terminal boxes must not be used for lifting the motor.
Motors with the same frame may have a different center of gravity because of different output, mounting arrangements and auxiliary equipment. Damaged lifting lugs must not be used. Check that eyebolts or integrated lifting lugs are undamaged before lifting.
Lifting eyebolts must be tightened before lifting. If needed, the position of the eyebolt can be adjusted using suitable washers as spacers.
Ensure that proper lifting equipment is used and that the sizes of the hooks are suitable for the lifting lugs.
Care must be taken not to damage auxiliary equipment and cables connected to the motor.

2.4 Machine weight

The total machine weight can vary within the same frame size (center height) depending on different output, mounting arrangement and auxiliaries.
The following table shows estimated maximum weights for machines in their basic versions as a function of frame material.
The actual weight of all TEC 's motors is shown in the catalogue.

Frame size	Aluminum Frame Weight (kg)	Cast Iron Frame Weight (kg)	Extra Brake Weight (kg)
56	4	-	1
63	5	-	1
71	7	-	1.5
80	11.2	19	1.9
90	17.6	27	3.4
100	27.3	38	5
112	35.7	50	7
132	64	84	11.5
160	97.5	147	13
180	128	195	29
200	158	270	45
225	-	320	55
250	-	427	-
280	-	667	-
315	-	1270	-
355	-	1850	-

3. Installation and commissioning

WARNING

Disconnect and lock ***off the electrical supply*** *before working on the motor or the driven equipment.*

3.1 General

All rating plate values must be carefully checked to ensure that the motor protection and connection will be carried out proficiently and to the necessary standards.

WARNING

In case of motors mounted with the shaft upwards , water or liquid ***can travel*** *down along the shaft,The user must take* ***this*** *into account* ***and*** *mount some means* ***of prevention.***

Remove transport locking if employed. Turn shaft by hand to check free rotation if possible.

Motors equipped with roller bearings:

Running the motor with no radial force applied to the shaft may damage the roller bearing.

Motors equipped with angular contact bearing:

Running the motor with no axial force applied in the right direction in relation to the shaft may damage the angular contact bearing.

WARNING

For machines with angular contact bearings the axial force must not by any means change direction.

Motors equipped with regreasing nipples:

When starting the motor for the first time, or after long storage, apply the specified quantity of grease.
For details, see section “5.2.2 Motors with regreasable bearings”.

3.2 Insulation resistance check

Measure insulation resistance before commissioning and when winding dampness is suspected.

WARNING

Disconnect and lock ***off the electrical supply*** *before working on the motor or the driven equipment.*
Insulation resistance, corrected to 25°C, must exceed the reference value, i.e. 100 MΩ (measured with 500 or 1000 V DC). The insulation resistance value is halved for each 20°C rise in ambient temperature.

WARNING

The motor frame must be grounded and the windings should be discharged against the frame immediately after each measurement to avoid risk of electrical shock.

If the reference resistance value is not attained, the winding is too damp and must be oven dried. The oven temperature should be 90°C for 12-16 hours followed by 105°C for 6-8 hours.

Drain hole plugs, if fitted, must be removed. Valves, if fitted, must be opened during heating. After heating, make sure the plugs are refitted. Even if the drain plugs are fitted, it is recommended to disassemble the end shields and terminal box covers for the drying process.

3.3 Foundation

The end user has full responsibility for preparation of the foundation.

Foundations must be even, and sufficiently rigid to withstand possible short circuit forces. They must be designed and dimensioned to avoid the transfer of vibration to the motor and vibration caused by resonance.

3.4 Balancing and fitting coupling halves and pulleys

As standard, balancing of the motor has been carried out using half key.

Coupling halves or pulleys must be balanced after machining the keyways. Balancing must be done in accordance with the standard balancing method specified for the motor.

Coupling halves and pulleys must be fitted on the shaft by using suitable equipment and tools which do not damage the bearings and seals.

Never fit a coupling half or pulley by hammering or by removing it using a lever pressed against the body of the motor.

3.5 Mounting and alignment of the motor

Ensure that there is enough space for free airflow around the motor. Minimum requirements for free space behind the motor fan cover should be achieved.

Correct alignment is essential to avoid bearing, vibration and possible shaft failures.

Mount the motor on the foundation using the appropriate bolts or studs and place shim plates between the foundation and the feet.

Align the motor using appropriate methods.

If applicable, drill locating holes and fix the locating pins into position.

Re-check the alignment after final tightening of the bolts or studs.

3.6 Slide rails and belt drives

Fasten the motor to the slide rails.

Place the slide rails horizontally on the same level.

Check that the motor shaft is parallel with the drive shaft. Belts must be tensioned according to the instructions of the supplier of the driven equipment.

WARNING

Excessive belt tension/belt mis-alignment, will damage bearings and can cause shaft damage.

3.7 Cabling and electrical connections

The terminal box on standard single speed motors normally contains six winding terminals and at least one earth terminal.
In addition to the main winding and earthing terminals, the terminal box can also contain connections for thermistors, heating elements or other auxiliary devices.
Suitable cable lugs must be used for the connection of all main cables. Cables for auxiliaries can be connected into their terminal blocks as such.
Machines are intended for fixed installation only. If not otherwise specified, cable entry threads are metric. The IP-class of the cable gland must be at least the same as those of the terminal boxes.
Unused cable entries must be closed with blanking elements according to the IP class of the terminal box.
The degree of protection and diameter are specified in the documents relating to the cable gland.

WARNING

Use appropriate cable glands and seals in the cable entries according to the type and diameter of the cable.
Earthing must be carried out according to local regulations before the machine is connected to the supply voltage.
Ensure that the motor protection corresponds to the environment and weather conditions; for example, make sure that water cannot enter the motor or the terminal boxes.
The seals of terminal boxes must be placed correctly in the slots provided, to ensure the correct IP class.

3.7.1 Connections for different starting methods

The terminal box on standard single speed motors normally contains six winding terminals and at least one earth terminal. This enables the use of DOL- or Y/D–starting.
For two-speed and special motors, the supply connection must follow the instructions inside the terminal box or in the motor manual.
The voltage and connection are stamped on the terminal box cover.

Direct-on-line starting (DOL):

Y or D winding connections may be used.
For example, 690 VY, 400 VD indicates Y-connection for 690 V and D-connection for 400 V.

Star/Delta starting (Y/D):

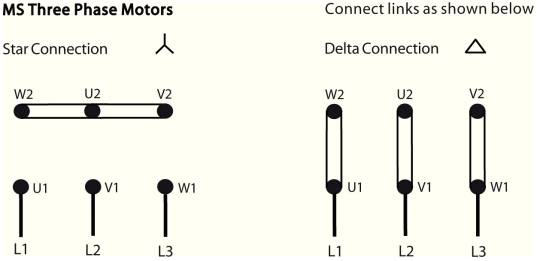
The supply voltage must be equal to the rated voltage of the motor when using a D-connection.
Remove all connection links from the terminal block.

3.7.2 Connections of auxiliaries

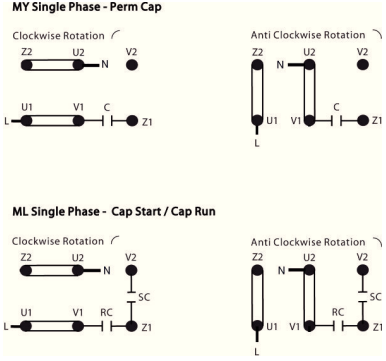
If a motor is equipped with thermistors or other RTDs (Pt100, thermal relays, etc.) and auxiliary devices, it is recommended they be used and connected by appropriate means.
Maximum measuring voltage for the thermistors is 2.5 V. Maximum measuring current for Pt100 is 5 mA. Using a higher measuring voltage or current may cause errors in readings or damage the system.

3.8 Wiring

Three phase motors should be wired in STAR or DELTA depending on supply and motor size. Motors 4.0kw and above can also be wired in STAR/DELTA by removing all of the links and supplying with 6 individual cables from the STAR/DELTA starter.
Motors 3.0kw and below should be wired in STAR for 400/3/50 supply. Motors 4.0kw and above should be wired in DELTA for 400/3/50.
To change the direction of rotation, swap to of the incoming supply phases over when wired DOL.



1ph motors are wired differently to 3ph motors and rotation is changed by different positions of the linking bars and supply cables. The wiring for different rotations is as below:



4. Operation

4.1 Use

The motors are designed for the following conditions unless otherwise stated on the rating plate.
- Normal ambient temperature limits are -20°C to +40°C.
- Maximum altitude 1000 m above sea level.
- Tolerance for supply voltage is ±5% and for frequency ±2% according to EN / IEC 60034-1 (2004).

WARNING

Ignoring any of given instructions or maintenance of the apparatus may jeopardize the safety and thus prevents the use of the machine.

4.2 Cooling

Check that the motor has sufficient airflow. Ensure that no nearby objects or direct sunshine radiate additional heat to the motor.
For flange mounted motors (e.g. B5, B35, V1), make sure that the construction allows sufficient air flow on the outer surface of the flange.

4.3 Safety considerations

The machine is intended for installation and use by qualified personnel, familiar with health and safety requirements and national legislation.
Safety equipment necessary for the prevention of accidents at the installation and operating site must be provided in accordance with local regulations.

WARNING

Do not carry out work on motor, connection cables or accessories such as frequency converters, starters, brakes, thermistor cables or heating elements when voltage is applied.

Points to observe

1. Do not step on the motor.
2. The temperature of the outer casing of the motor may be too hot to touch during normal operation and especially after shut-down.
3. Some special motor applications require special instructions (e.g. using frequency converter supplies).
4. Be aware of rotating parts of the motor.
5. Do not open terminal boxes while energized.

5. Maintenance

WARNING

Voltage may be connected at standstill inside the terminal box for heating elements or direct winding heating.
The capacitor in single-phase motors can retain a charge that appears across the motor terminals, even when the motor has reached standstill.
A motor with frequency converter supply may energize even if the motor is at standstill.

5.1 General inspection

1. Inspect the motor at regular intervals, at least once a year. The frequency of checks depends on, for example, the humidity level of the ambient air and on the local weather conditions. This can initially be determined experimentally and must then be strictly adhered to.
2. Keep the motor clean and ensure free ventilation airflow. If the motor is used in a dusty environment, the ventilation system must be regularly checked and cleaned.
3. Check the condition of shaft seals (e.g. V-ring or radial seal) and replace if necessary.
4. Check the condition of connections and mounting and assembly bolts.
5. Check the bearing condition by listening for any unusual noise, vibration measurement, bearing temperature, inspection of spent grease or bearing monitor. Pay special attention to bearings when their calculated rated life time is coming to an end.

When signs of wear are noticed, dismantle the motor, check the parts and replace if necessary. When bearings are changed, replacement bearings must be of the same type as those originally fitted. The shaft seals have to be replaced with seals of the same quality and characteristics as the originals when changing bearings.
In the case of the IP 55 motor and when the motor has been delivered with a plug closed, it is advisable to periodically open the drain plugs in order to ensure that the way out for condensation is not blocked and allows condensation to escape from the motor. This operation must be done when the motor is at a standstill and has been made safe to work on.

5.2 Lubrication

WARNING
Beware of all rotating parts!

Grease can cause skin irritation and eye inflammation. Follow all safety precautions specified by the manufacturer.

Bearing types are specified in the respective product catalogues;
Reliability is a vital issue for bearing lubrication intervals. TEC uses mainly the L1-principle (i.e. that 99% of the motors are certain to make the life time) for lubrication.

5.2.1 Machines with permanently greased bearings

Bearings are usually permanently greased bearings of 1Z, 2Z, 2RS or equivalent types.
As a guide, adequate lubrication for sizes up to 200 can be achieved for the following duration, according to L10.
Duty hours for permanently greased bearings at ambient temperatures of 25 and 40° C are:

Lubrication intervals according to L10 principle			
Frame Size	**Poles**	**Duty hours at 25° C**	**Duty hours at 40° C**
56-63	2-8	40000	40000
71	2-8	40000	40000
80-90	2-8	40000	40000
100-112	2	40000	32000
100-112	4-8	40000	40000
132	2	40000	27000
132	4-8	40000	40000
160	2	40000	36000
160	4-8	40000	40000
180	2	38000	38000
180	4-8	40000	40000
200	2	27000	27000
200	4-8	40000	40000
*Data valid at 50 Hz, for 60 Hz reduce values for 20 %.			

These values are valid for permitted load values given in the product catalogues. Depending on application and load conditions, see the applicable product catalogues or contact TEC .
Operation hours for vertical motors are half of the above values.

5.2.2 Motors with regreasable bearings

During the first start or after a bearing lubrication a temporary temperature rise may appear, approximately 10 to 20 hours.

A. Manual lubrication

Regreasing while the motor is running

– Remove grease outlet plug.
– Be sure that the lubrication channel is open
– Inject the specified amount of grease into the bearing.
– Let the motor run for 1-2 hours to ensure that all excess grease is forced out of the bearing. Close the grease outlet plug.

Regreasing while the motor is at a standstill

If it is not possible to regrease the bearings while the motors are running, lubrication can be carried out while the machine is at a standstill.
– In this case use only half the quantity of grease and then run the motor for a few minutes at full speed.
– When the motor has stopped, apply the rest of the specified amount of grease to the bearing.
– After 1-2 running hours close the grease outlet plug.

B. Automatic lubrication

The grease outlet plug must be removed permanently with automatic lubrication.
TEC recommends only the use of electromechanical systems.
The amount of grease per lubrication interval stated in the table should be multiplied by four if an automatic regreasing system is used.
When 2-pole motors are automatically regreased, the note concerning lubricant recommendations for 2-pole motors in the Lubricants chapter should be followed.

5.2.3 Lubrication intervals and amounts

As a guide, adequate lubrication for motors with regreasable bearings can be achieved for the following duration, according to L1. For duties with higher ambient temperatures please contact TEC . The formula to change the L1 values roughly to L10 values: L10 = 2.7 x L1.
Lubrication intervals for vertical machines are half of the values shown in the table below.
The lubrication intervals are based on an ambient temperature +25°C. An increase in the ambient temperature raises the temperature of the bearings correspondingly. The values should be halved for a 15°C increase and may be doubled for a 15°C decrease.

WARNING

The maximum operating temperature of the grease and bearings, +110°C, must not be exceeded. The designed maximum speed of the motor must not be exceeded.

Lubrication intervals according to L1 principle

Frame size	Amount of grease g/bearing	kW	3000 rpm	kW	1500 rpm	kW	1000 rpm	kW	500-900 rpm
	Ball bearings -- Lubrication intervals in duty hours								
112	10	all	13000	all	21000	all	25000	all	28000
132	15	all	11000	all	19000	all	23000	all	26500
160	25	≤18.5	12000	≤15	21500	≤11	24000	all	24000
160	25	>18.5	10000	>15	18000	>11	22500	all	24000
180	30	≤22	9000	≤22	18500	≤15	24000	all	24000
180	30	>22	8500	>22	17000	>15	21000	all	24000
200	40	≤37	8000	≤30	17500	≤22	23000	all	24000
200	40	>37	5500	>30	12000	>22	16000	all	20000
225	50	≤45	6500	≤45	16500	≤30	22000	all	24000
225	50	>45	2500	>45	6000	>30	8000	all	10000
250	60	≤55	4000	≤55	11500	≤37	15000	all	18000
250	60	>55	1500	>55	4500	>37	6000	all	7000
280	60	all	3500	-	-	-	-	-	-
280	60	-	-	all	10500	all	14000	all	17000
280	35	all	3200	-	-	-	-	-	-
280	40	-	-	all	9600	all	13900	all	15000
315	35	all	3200	-	-	-	-	-	-
315	55	-	-	all	7600	all	11800	all	12900
355	35	all	3200	-	-	-	-	-	-
355	70	-	-	all	5600	all	9600	all	10700

Frame size	Amount of grease g/bearing	kW	3000 rpm	kW	1500 rpm	kW	1000 rpm	kW	500-900 rpm
	Roller bearings -- Lubrication intervals in duty hours								
160	25	≤18.5	6000	≤15	10500	≤11	12000	all	12000
160	25	>18.5	5000	>15	9000	>11	11000	all	12000
180	30	≤22	4500	≤22	9000	≤15	12000	all	12000
180	30	>22	4000	>22	8500	>15	10500	all	12000
200	40	≤37	4000	≤30	8500	≤22	11500	all	12000
200	40	>37	2500	>30	6000	>22	8000	all	10000
225	50	≤45	3000	≤45	8000	≤30	11000	all	12000
225	50	>45	1250	>45	3000	>30	4000	all	5000
250	60	≤55	2000	≤55	5500	≤37	7500	all	9000
250	60	>55	750	>55	2000	>37	3000	all	3500
280	60	all	1750	-	-	-	-	-	-
280	60	-	-	all	5250	all	7000	all	8500
280	35	all	1600	-	-	-	-	-	-
280	40	-	-	all	5300	all	7000	all	8500
315	35	all	1600	-	-	-	-	-	-
315	55	-	-	all	3800	all	5900	all	6500
355	35	all	1600	-	-	-	-	-	-
355	70	-	-	all	2800	all	4800	all	5400

5.2.4 Lubricants

WARNING

Do not mix different types of grease.
Incompatible lubricants may cause bearing damage.

When regreasing, use only special ball bearing grease with the following properties:

– good quality grease with lithium complex soap and with mineral- or PAO-oil
– base oil viscosity 100-160 cST at 40°C
– consistency NLGI grade 1.5 - 3*
– temperature range -30°C - +120°C, continuously.
**) For vertical mounted motors or in hot conditions a stiffer end of scale is recommended.*
The above mentioned grease specification is valid if the ambient temperature is above -30°C or below +55°C, and the bearing temperature is below 110°C.
Grease with the correct properties is available from all the major lubricant manufacturers.
Admixtures are recommended, but a written guarantee must be obtained from the lubricant manufacturer, especially concerning EP admixtures, that admixtures do not damage bearings or the properties of lubricants at the operating temperature range.

WARNING

Lubricants containing EP admixtures are not recommended in high bearing temperatures in frame sizes 280 to 450.

The following high performance greases can be used:

- Esso Unirex N2 or N3 (lithium complex base)
- Mobil Mobilith SHC 100 (lithium complex base)
- Shell Albida EMS 2 (lithium complex base)
- Klüber Klüberplex BEM 41-132 (special lithium base)
- FAG Arcanol TEMP110 (lithium complex base)
- Lubcon Turmogrease L 802 EP PLUS
- Total Multiplex S 2 A (lithium complex base)

NOTE!

Always use high speed grease for high speed 2-pole machines where the speed factor is higher than 480,000 (calculated as Dm x n where Dm = average bearing diameter, mm; n = rotational speed, r/min).

The following greases can be used for high speed cast iron motors but not mixed with lithium complex greases:

- Klüber Klüber Quiet BQH 72-102 (polyurea base)
- Lubcon Turmogrease PU703 (polyurea base)

If other lubricants are used:

Check with the manufacturer that the qualities correspond to those of the above mentioned lubricants.

6. After Sales Support

6.1 Spare parts

When ordering spare parts, the motor serial number, full type designation and product code, as stated on the rating plate, must be specified.

6.2 Rewinding

Rewinding should always be carried out by qualified repair shops.

6.3 Bearings

Special care should be taken with the bearings. These must be removed using pullers and fitted by heating or using special tools for the purpose.

7. Environmental requirements

7.1 Noise levels

The majority of TEC 's motors have a sound pressure level not exceeding 82 dB(A) at 50 Hz .
Values for specific machines can be found in the relevant product catalogues. At 60 Hz sinusoidal supply the values are approximately 4 dB(A) higher compared to 50 Hz values in product catalogues.

8. Troubleshooting

These instructions do not cover all details or variations in equipment nor provide for every possible condition to be met in connection with installation, operation or maintenance.

Motor troubleshooting chart

Your motor service and any troubleshooting must be handled by qualified and approved persons who have proper tools and equipment.

TROUBLE	CAUSE	SOLUTION
Motor None Start	Blown fuses	Replace fuses with proper type and rating.
	Overload trips	Check and reset overload in starter.
	Improper power supply	Check to see that power supplied agrees with motor rating plate and load factor.
	Improper line connections	Check connections against diagram supplied with motor.
	Open circuit in winding or control switch	Indicated by humming sound when switch is closed. Check for loose wiring connections. Also ensure that all control contacts are closing.
	Mechanical failure	Check to see if motor and drive turn freely. Check bearings and lubrication.
	Short circuited stator	Indicated by blown fuses. Motor must be rewound.
	Poor stator coil connection	Remove end shields, locate fault.
	Rotor defective	Look for broken bars or end rings.
	Motor may be overloaded	Reduce load and check for winding damage.
Motor stalls	One phase may be open	Check lines for open phase.
	Wrong application	Change type or size. Consult equipment supplier.
	Overload	Reduce load.
	Low voltage	Ensure the rating plate voltage is maintained. Check connection.
	Open circuit	Fuses blown, check overload relay, stator and push buttons.
Motor runs and then dies down	Power failure	Check for loose connections to line, to fuses and to control.

Motor does not come up to nominal speed	Not applied correctly;	Consult equipment supplier for correct type.
	Voltage too low at motor terminals because of line drop	Use higher voltage or transformer terminals or reduce load. Check connections. Check conductors for proper size.
	Starting load too high	Check the start load of the motor.
	Broken rotor bars or loose rotor	Look for cracks near the rings. A new rotor may be required, as repairs are usually temporary.
	Open primary circuit	Locate fault with testing device and repair.
Motor takes too long to accelerate and/or draws high current	Excessive load	Reduce load.
	Low voltage during start	Check for high resistance. Make sure that adequate cable size is used.
	Defective squirrel cage rotor	Replace with new rotor.
	Applied voltage too low	Correct power supply.
Wrong rotation direction	Wrong sequence of phases	Reverse connections at motor or at switchboard.
Motor overheats while running	Overload	Reduce load and check windings.
	Frame or ventilation openings may be full of dirt and prevent proper ventilation of motor	Open vent holes and check for a continuous stream of air from the motor.
Motor overheats while running	Motor may have one phase open	Check to make sure that all leads are well connected.
	Grounded coil	Motor must be rewound.
	Unbalanced terminal voltage	Check for faulty leads, connections and transformers.
Motor vibrates	Motor misaligned	Realign.
	Weak support	Strengthen base.
	Coupling out of balance	Balance coupling.
	Driven equipment unbalanced	Balance driven equipment.
	Defective bearings	Replace bearings.
	Bearings not in line	Repair motor.
	Balancing weights shifted	Rebalance motor.
	Contradiction between balancing of rotor and coupling (half key-full key)	Rebalance coupling or motor.
	Polyphase motor running single phase	Check for open circuit.
	Excessive end play	Adjust bearing or add shim.

Scraping noise	Fan rubbing end shield of fan cover	Correct fan mounting.
	Loose on bedplate	Tighten holding bolts.
Noisy operation	Air gap not uniform	Check and correct end shield fits or bearing fits.
	Rotor unbalance	Rebalance rotor.
Hot bearings	Bent or sprung shaft	Straighten or replace shaft.
	Excessive belt pull	Decrease belt tension.
	Pulleys too far away from shaft shoulder	Move pulley closer to motor bearing.
	Pulley diameter too small	Use larger pulleys.
	Misalignment	Correct by realighment of the drive.
	Insufficient grease	Maintain proper quality and amount of grease in bearing.
	Deterioration of grease or lubricant contaminated	Remove old grease, wash bearings thoroughly in kerosene and replace with new grease.
	Excess lubricant	Reduce quantity of grease, bearing should not be more than half full.
	Overload bearing	Check alignment, side and end thrust.
	Broken ball or rough races	Replace bearing, clean housing thoroughly first.

Total Engineering Commitment

T.E.C Electric Motors Limited
Unit 1, Building 341
Rushock Trading Estate, Rushock
Droitwich
Worcestershire
WR9 0NR
VAT Reg No: 861 4883 00

01299 252990 01299 253597

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WWW.TECMOTORS.CO.UK

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