OPERATING AND MAINTENANCE MANUAL

TOTALLY ENCLOSED FAN COOLED CAGE ROTOR ASHYNCHRONOUS MOTORS

(Norm, Slip Ring, Two Speed and Brake Motors)

IEC Frame Sizes : 80 ... 355

USAGE LIFE : 5 YEARS

ELSAN ELEKTRİK SANAYİİ ve TİCARET A.Ş.

CE TSE TÜV CERT DIN EN ISO 9001

CONTENTS

GENERAL

This operating and maintenance manual includes low voltage, totally enclosed, squirrel cage induction motors produced in accordance with IEC Publications.

For convenience, these operating and maintenance instructions may not contain specific information regarding to the special applications and areas having special requirements. In this case, the user himself has to make suitable protection arrangements during installation.

The following subjects should be considered for the information not mentioned in this manual.

1. Technical values given in the catalogue and on the rating plate
2. Information regarding to the place where motor will operate
3. Precautions for protection of motor depending on the operation place.

Our electric motors are covered with a 2 YEAR WARRANTY. Motors, not operated under conditions explained in this manual, catalogue, rating plate, or motors lack of protection systems subject to TS 10316–EN 60204-1, are out of warranty.

OPERATING CONDITIONS

Motors are designed to operate at rated voltage and frequency (380V, 50 Hz), at –20 - +40°C of ambient temperature and at an altitude of maximum 1000 m. In case of different ambient temperatures and altitudes, the output should be reduced.

Motors are totally enclosed, fan cooled and produced to protection class IP55. (Protected against ingress of dust and water jets / IEC 34-5) Slip ring motors are protected with the class of IP44. Open-air operation of motors requires adequate protection against direct atmospheric influences such as rain, snow, ice, dust etc.

HANDLING

NM 112 and bigger type motors are equipped with eye bolts (DIN 580). Eye bolts are intended only for lifting the motors without such additional parts as bed plates, gears, driven machine etc. If eye bolts are removed after installation, the tapped holes should be blanked off using a suitable part.

GENERAL

Do not use the shaft end to lift up the motor. Never transport or store the motor resting on its fan cowl.

STORAGE

Upon receiving the motor, inspection for damage or missing parts should be carried out. There should not be any broken, crushed or missing parts in the motor, and the shaft should be able to rotate freely without any seizing and runout. For long period storage, clean, dry places with no vibration should be selected. The resistance of windings must be measured after a long storage time. If resistance is low, the windings must be dried out.

COOLING AND VENTILATION

Cooling is provided with an aluminum or plastic fan mounted onto the non-driving end of the shaft. Cooling is independent of direction of rotation. In case of motors to be operated in closed places, circulation of cooling air must be prevented. The distance between fan cowl and the wall or other machines should be at least half of the diameter of air entry. For the motors to be operated vertically, it is suggested to use a special bowl (Canopy) in order to prevent the ingress of water and substances. For motors running at low speeds fed by inverters, in case of continuous operation, since cooling may loose effect, it's suggested to use forced cooling.

SECURITY

Our motors are machines working via induction and by connecting to the power supply network. By handling, assembling, and maintaining according to this guide, motors do not harm any living being.
Our motors have earthing connection terminal against static electricity.

INSTALLATION AND OPERATION

Places where the motor operates should be, airy, dust-free and dry. Motors should be mounted on a flat place where no vibration exists. Mounting the motor should be made considering the accessibility to the motor in case of maintenance and repairing.

Temperatures in excess of 100 °C can occur on the motor surface during normal operation. For this reason any contact to the surface must be avoided in accessible areas.

INSTALLATION

Electric motors are industrial products. Thus, installation must be done by licensed personel.

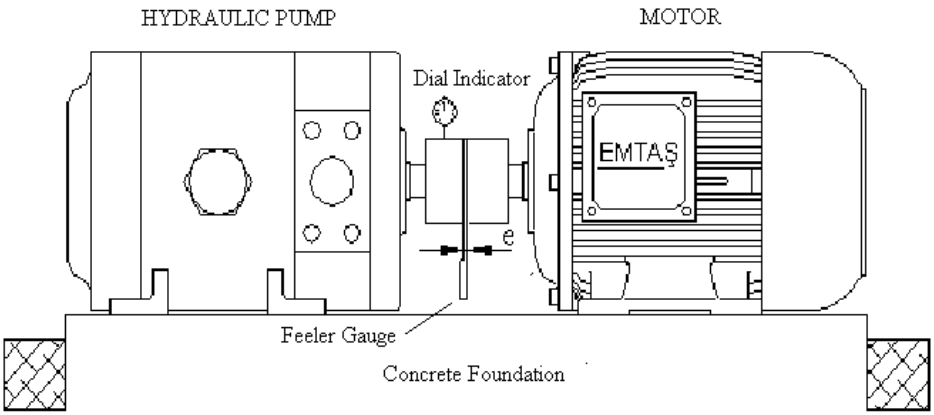


Figure – 1

Direct coupling to the driven machine requires exact alignment with respect to the shafts of both units using a dial indicator and feeler gauge. If necessary, use suitable shims to make the shaft heights of motor and the driven machine match. When shaft height matching is achieved, value of "e" is identical around the coupling. Also when the shaft is rotated, the same values are read on the dial indicator on both two discs. In case of different speeds of motor and the driven machine, gear or belt couplings are used.

INSTALLATION AND OPERATION

In the case of belt coupling, make sure that the belt tension is aligned properly since excessive pull may entail bearing trouble and shaft failures. Shimmying of the pulley should be checked using a comparator. If pulley is still shimmying, necessary corrections should be made on the pulley (See Figure–2). For long-life shafts and bearings, belt must be tight enough and the pulleys must be well-arranged with exactly parallel axes (See Figure-3). Too much belt tension can damage the bearings or break the shaft with time.

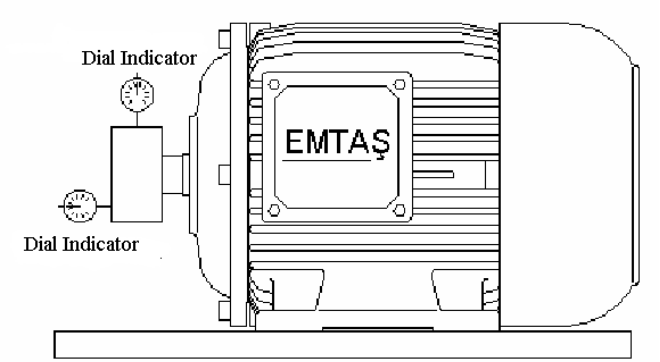


Figure – 2

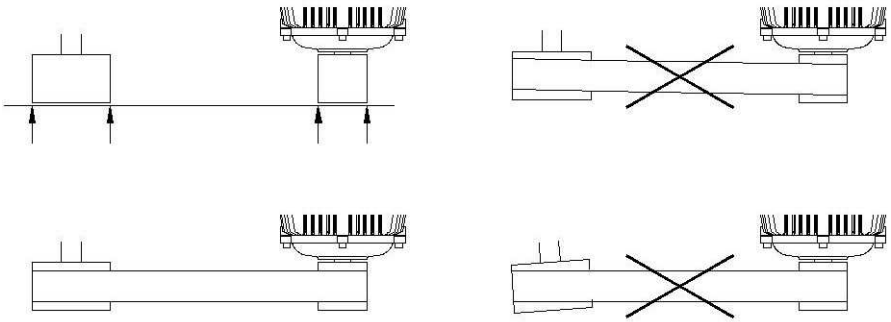


Figure – 3

In case of gear-drive, in order to prevent the noise, unnecessary abrasions and unexpected forces, gear axes must be parallel, tooth faces must be on the same plane, and tooth-top of a gear must not touch to the tooth-base of other gear. It can be examined using a piece of paper illustrated in figure–4. The paper, which moves in the direction of rotation, should not be torn off or crushed.

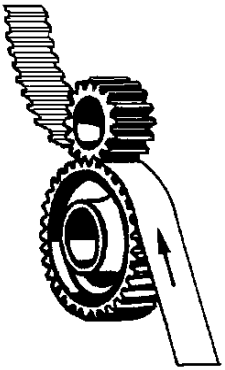


Figure - 4

For a healthy operation life, transmission members (i.e., clutches, pinions or pulleys) should be drawn onto the shaft by warming-up and taken apart by means of a pull-out device. Hammer blows should be avoided not to damage the shaft, bearings and other components of the motor. Statistics show that 60% of motor failures occur due to bearing defects.

INSULATION RESISTANCE

After a long storage period, the insulation resistance of the windings should be measured. In this process, windings are subjected to DC 500V by the insulation resistance measuring device (mega ohmmeter) and the resistance is read after a minute. Insulation resistance, measured at 25ºC of winding temperature, should be more than 10 MOhms for a new motor, and more than 1 MOhms for a motor that has run for a long time. Otherwise, cables and terminals should be cleaned and dried out. If insulation resistance is still low the windings need to be dried up at 80ºC using a heater or a furnace. Also drying–out process is made by applying DC voltage using a transformer to the terminals U1 and V1 with 10% of rated voltage and 20% of rated current.

Insulation resistance should be checked again after motor gets cold. Since dangerous voltages are present, **do not touch** the terminals during and after the measurement.

STARTING

Terminals are marked according to the standards in order to prevent any misconnection. There are diagrams, indicating how to connect the terminals in the terminal box. Appropriateness of the network to the values on the motor label must be checked, and the cables must be selected taking these values into account. In case of a difference in voltage greater than 5%, the windings can be damaged.

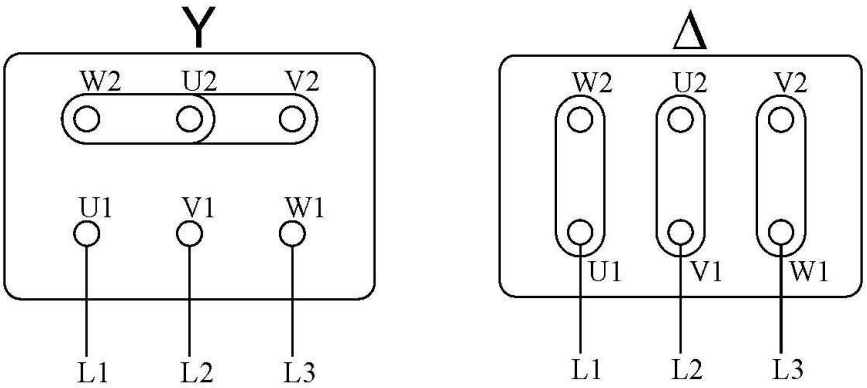
Customer is responsible for the protection of the motor against overloading. The motor should be connected to the power network my means of a thermo-magnetic switch which has protection against excess current. The switch current adjustment should not be higher than 1,05 times the nominal current of the motor. Otherwise the motor becomes out of warranty in case of a failure.

In addition to these, since the protection of motor against overloading is especially dependent on detection of excess heat, which is generated by overloading and other reasons (such as one phase interruption, decrease or loss of cooling, excess environment temperature or altitude, frequent start/stop…), protection can be provided by mounting thermistors inside the windings and connecting their ends to the thermistors relay. PTC thermistors are mounted in motors with power of 55kW and over, as standard. PTC and phase protecting relays are also given for free. For smaller type motors, thermistors are mounted on request for a fee, and their relays are given with them.

The connections of terminals should be made according to the diagrams in the terminal box, and tightness of nuts should be checked. Nuts which are not tightened sufficiently cause motor failure.

Starting With Direct-On-Line

All motors are capable of direct starting when suitable network and other components exist.



Figure–5: Scheme for starting with direct on line

Pole Number	**380-400V Y**	**380-400V Δ**
2 poles (3000 1/min) 4 poles (1500 1/min)	≤ 3 kW	≥ 4 kW
6 poles (1000 1/min)	≤ 2,2 kW	≥ 3 kW
8 poles (750 1/min)	≤ 1,5 kW	≥ 2,2 kW
Way of starting	Direct on line	Direct on line or Y/Δ

Table 1: Starting

Note: The way of starting is written on the rating plate of motor and also the table above can be followed.

Starting With Star-Delta (Y/Δ) Connection

It is preferred to start the motors above 4 kW with star-delta connection in order to use optimum cable, switch and the other installation materials, and also not to make a shock in the network.

When direct-on-line starting is used, starting torque and current are high (2-3 times the rated torque and 4-7 times the rated current), whereas star-delta connection is used, starting torque and current are between 25% and 30% of the values that of when direct-on-line starting method is used. Motor starts with star connection, and switches to delta at the speed of 95% of the rated speed.

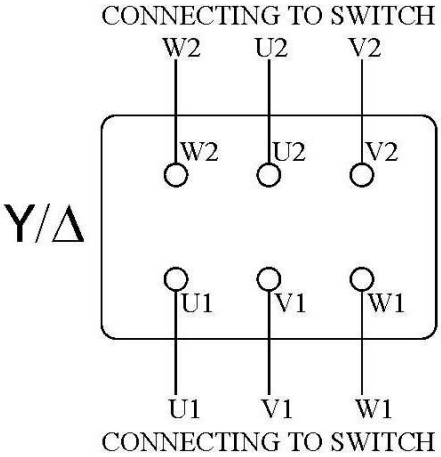


Figure-6: Scheme for starting with star-delta connection

Starting With Soft Starter

Motors are started with soft starter in order to lower the starting current and torque. With these devices, voltage increases step by step until it reaches its nominal value thus the torque fluctuations are prevented. Both starting current and time can be adjusted with soft starters.

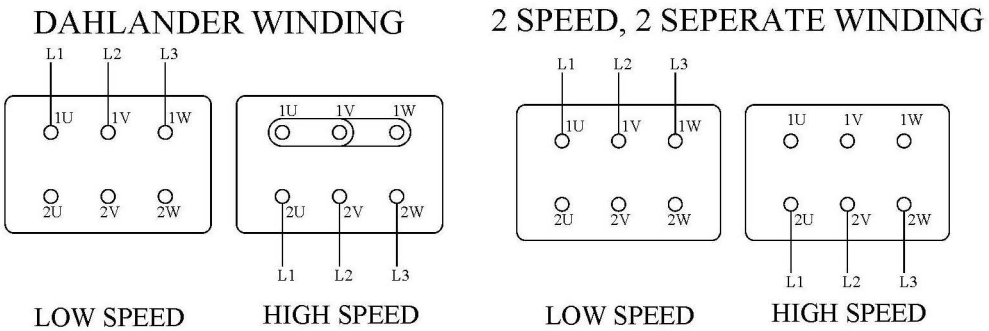


Figure-7: Scheme for two-speed connection

INSTALLATION AND OPERATION

DIRECTION OF ROTATION

Direction of rotation can be changed by interchanging the two ends of network terminals shown in Figure-7. Motors are designed in order to rotate in every direction.

FINAL CONTROL

After mechanical and electrical installations, the following controls should be made before operating:

1. Operating condition must comply with the label of motor (380V ±%5, 50Hz ±%5, three phase A.C etc. / please see page 26)
2. Motor should be installed so that circulation of air would not be prevented.
3. Machine or coupling should be lined up.
4. Motor shaft should be able to rotate by hand freely.
5. The insulation resistance of motors stored for a long time should be sufficient.
6. All mechanical and electrical connections must be tightened.
7. The parts under tension and rotating must be secured against unintentional touch.
8. Direction of rotation must be checked.
9. The noise coming from the bearings and end-shields and the vibration should be checked by operating the motor at no load and rated speed.

MAINTENANCE

Maintenance must be done under safe conditions and it should be ensured that the motor is disconnected from the network and with no voltage. Besides, be sure that, the auxiliary circuits (i.e. brakes, anti-condensation heaters, forced ventilators) are also disconnected from the mains.

BEARINGS

Our motors are equipped with long life bearings which are capable of carrying the axial, radial and combined forces effectively.

Lubrication

In general, the frame sizes NM80-200 have shielded bearings with permanent lubrication. These bearings do not require lubrication during their life times.

Motor sizes of 225 and higher have grease nipples and grease relief plugs. The grease type and the lubrication period is indicated with a plate on the motor.

It is not suggested to mix the different type of greases because they can lose their physical properties and harm the composition. As a result, motor may be damaged.

In order to re-lubricate the bearings;

- Remove the grease relief plug, and clean off the dirty grease in relief channel.
- Clean the grease fitting and the grease gun tip. This will prevent the dirt's entrance into the bearing.
- Pomp the grease into the grease fitting until new grease comes out of the relief channel.
- For the grease to reach every corner in the bearing homogeneously, lubrication should be made while the motor is running.

MAINTENANCE

The re-lubrication intervals for the motors with grease nipples are as follows:

NORM MOTOR / BALL (63 SERIES) BEARINGS				
MOTOR TYPEİ	2 POLES	4 POLES	6 POLES	8 POLES
NM 200	2.400	5.200	6.500	
NM 225		5.000	6.400	7.600
NM 250	2.000	4.900	6.300	7.500
NM 280	1.500	4.500	6.100	7.200
NM 315		4.300	5.900	7.000
NM 355		4.000		

NORM MOTOR / ROLLER (NU) BEARINGS				
MOTOR TYPE	2 POLES	4 POLES	6 POLES	8 POLES
NM 280	800	3.300	4.800	5.900
NM 315		3.100	4.500	5.700
NM 355		2.600		

Table 2: Re-lubrication intervals for electric motors

*NU Type bearings are used in case of customer inquiry.

Replacement

Removing:

Ball bearings should be removed by means of a puller-device after slightly heating the inner ring. Never use a hammer in any way.

The inner ring of *cylindrical roller bearings* should be removed by a puller device after heating the inner ring with a torch. If it does not get off, grind the inner ring by creating a groove and break it off.

To mount, heat the ball bearings or the inner ring of the roller bearings in oil or air up to a temperature of approximately 80°C and slip them onto the shaft.

Avoid the heavy blows. This will damage the bearings and reduce the bearing life.

MAINTENANCE

 Do not take the bearings out of the nylon bags until assembling them.

 Take special care not to damage the windings while disassemble the rotor.

COOLING SYSTEM

Protect the air entry and the ribs on the frame from dust, oil and any kind of dirt in order to prevent the overheating caused by insufficient cooling.

BEARING SEALS

V-ring and oil-seals should be pushed into place by using an appropriate assembly tool. Contact faces of both seals should be slightly greased before fitting. The incorrect axial position of V-rings may cause damage due to excessive friction.

TROUBLESHOOTING

Table-3. Mechanical faults in electric motors

Troubleshooting in Squirrel Cage and Slip-ring Three Phase Induction Motors – Mechanical Faults		
FAULT	**CAUSE**	**REMEDIAL MEASURE**
Vibration exists only when the motor is coupled.	Transmission members or driven machine may be faulty.	Check transmission members and fix the problems.
	Belt tension is too high in belted systems.	Loosen the belt. Check the belt joint. Use the belt tightening pulley.
	Centering fault on coupling of motor and driven machine.	Get the shaft axes of motor and driven machine to be concentric.
	Fault on gear coupling.	Fix the coupling. Make the gears fit to each other as well as possible.
	Insufficient balance of transmission member or driven machine.	Check the balance of these members.
Vibration exists when there is no coupling.	Bearing is corroded.	Check the bearings and replace the bearings if necessary.
	Bolts are loose.	Tighten the bolts such that they won't get loose again.
	There is short circuit on windings.	See the section for electrical faults.
	Unbalance in transmission members.	Re-balance the rotor with coupling or pulley.
Bearing overheats after motor stars or just after re-lubrication.	Too much grease in the bearing.	Remove the excess grease and pay attention not to lubricate too much.

TROUBLESHOOTING

FAULT	CAUSE	REMEDIAL MEASURE
Bearing overheats after a long running period.	No grease in the bearing.	Lubricate the bearing.
	Seals of bearings do not work properly.	Fix or renew the seals of bearing, if necessary renew the bearing itself.
Whistle noise on lubricated bearings.	No grease in the bearing.	Carefully lubricate.
	Fault on bearing cage.	Change the bearing.
Bearing is corroded in a short period.	Overloading of bearing.	Check the belt tension, gear surface pressure, loads due to coupling and the whole system. Eliminate the excessive axial and radial loads if they exist.
Motor overheats at full load.	Rotor touches the stator.	Check the bearings and bearing housings and make required corrections. If necessary renew the bearings.
An area of outer race of bearing gets corroded when motor is not running.	Existing vibration coming from outside.	Insulate the motor against the vibrations coming from outside.
An area of outer race of bearing gets corroded when motor is running.	Electrical current exists on the bearing.	Use insulated bearing or consult with a specialist.

TROUBLESHOOTING

Table-4. Electrical Faults in electric motors

Troubleshooting in Squirrel Cage Three Phase Induction Motors – Electrical Faults		
FAULTS	**CAUSE**	**REMEDIAL MEASURE**
Motor does not run under voltage, no sound coming from motor.	Minimum two phases are interrupted.	Check the switches, cables and related screws and terminals.
		(Switch off the motor during the changing of ruined plugs.)
	Over-current relay or thermistor switched off the motor.	Check the over-current relay and thermistor.
Motor does not run under voltage, excessive magnetic noise comes from motor.	Interruption of a phase. (A manual help by hand results with the rotation of motor to the same direction that shaft is directed to.)	Check the interrupted phase, if necessary renew the fuse.
Motor does not start under full load. (Magnetic noise is normal.)	Counter torque is too high.	Check transmission system and rearrange it, run the motor at no load.
	Low network voltage.	Measure the voltage.

TROUBLESHOOTING

FAULTS	CAUSE	REMEDIAL MEASURE
Motor runs at no load but speed decreases at full load.	Interruption of a phase after motor is started.	Check the network and lines.
	Interruption in the squirrel cage winding. (In this case, ammeter in the stator winding oscillates.)	Check the rotor. If necessary, renew it.
Motor overheats at no load.	Wrong connection. (i.e. "Δ" in case of "Y")	Correct the connection.
	High network voltage.	Measure the current at no load and network voltage.
	Insufficient cooling, air entries blocked.	Clean the air entries.
Motor absorbes excessive current and overheats at full load.	Motor is overloaded.	Check the absorbed current.
	Low or high network voltage.	Check current and voltage.
	Interruption of a phase.	Search the interrupted phase.
	Rotor touches the stator.	Check the air gap.
Rotor warms up, speed decreases, and motor makes noise.	Fault on squirrel cage windings.	Change the rotor.

TROUBLESHOOTING

FAULTS	CAUSE	REMEDIAL MEASURE
Motor stops in a few moments after it starts.	Motor was overloaded.	Get the motor to be loaded as nominal.
	Over-current relay is not adjusted correctly. Thermistor is on.	Adjust over-current relay.
Local warm-ups exist in the stator.	Short circuit may exist in the stator windings.	Renew the stator windings.
	Some windings seem to be roasted.	
Abnormal noise in the motor.	Mechanical or electrical fault may exist.	In electrical faults, noise disappears when the current is cut off. In mechanical faults, noise varies with respect to speed.
		In electrical faults please apply our authorized service. In mechanical faults make required control, if necessary change the bearings.
Wrong speed in pole changeable motors.	Wrong connection.	Check and correct the connection.
The pole changeable motor rotates at only one speed.	Causes are alike as in one-speed motors.	Check the connections for the speed, at which motor does not run, in accordance with the above recommendations.
Too different phase currents.	Different phase voltages.	Check the voltage.
	Interruption of line or windings exists.	Check the line and windings.
	Stator windings touch the chassis.	
	Short circuit in the stator windings.	

TROUBLESHOOTING

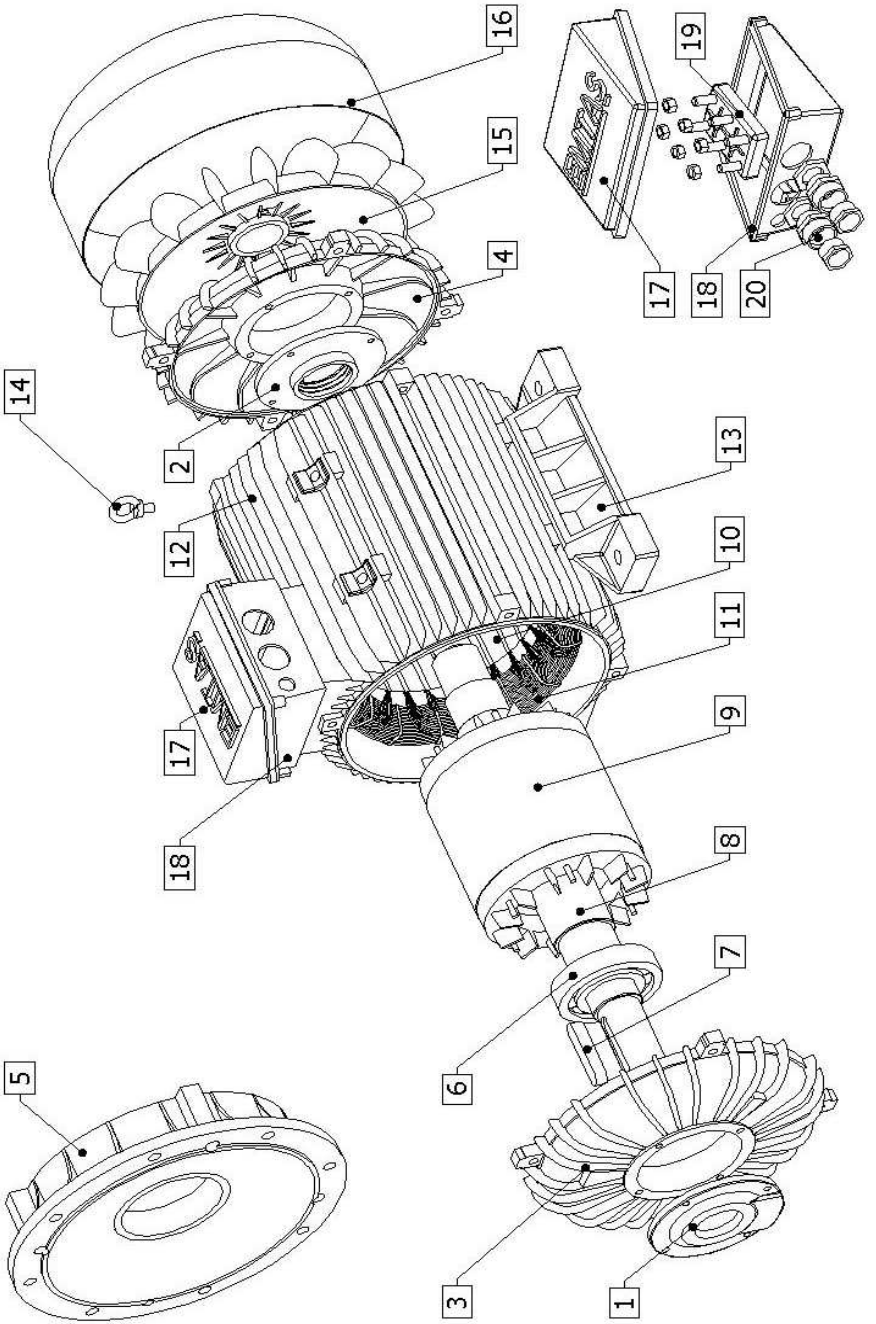
Table-5. Electrical Faults in electric motors (See table-3 and table-4 for the faults which are not given in this table)

Troubleshooting in Slip ring Three Phase Induction Motors – Electrical Faults		
FAULTS	**CAUSE**	**REMEDIAL MEASURE**
Spark occurs in the brushes, and the brushes are corroded quickly.	The location of brushes is bad, brushes do not contact to the ring by whole surface. Brush pressure is low.	Improve the location of brushes and their contact condition. Normal pressure force is 1.8-2 N/ cm².
	Ring has become oval, dirty due to sparking or scratched.	Clean the brushes and rings by polishing with emery paper.
	Wrong brush selection.	Carbone Lorraine CG 651 or CG 665 quality brush is recommended.
Ammeter in the stator winding circuit oscillates up to 6 times per second.	Bad contact in rotor circuit, bad pressure of brushes or bad contact in starter circuit.	Check the brushes, rotor circuit, and starter circuit.
Motor does not run under voltage and excessive magnetic noise exists.	Interruption of phases in the stator or rotor exists.	Check the interrupted phase conductor and related switch. Replace the switch.

TROUBLESHOOTING

FAULTS	CAUSE	REMEDIAL MEASURE
Motor does not run under full load. (Magnetic noise is normal.)	Interruption in rotor circuit. (in rotor or starter circuit)	Check the rotor and starter circuit.
Motor does not run at full load after starting at no load.	Interruption in rotor circuit, connection and contact surfaces of brushes and starters.	Check the brushes, terminals, short circuit switches and starter.
Local warming up exists in rotor.	Short circuit or interruption in rotor windings.	Disassemble and inspect the motor with an authorized person. If necessary send us the stator and/or rotor.
Excessive speed drop exists even in low counter torque.	A part of starter resistance remains switched on.	Check the starter and switch, measure their resistances.

MOTOR PARTS



MOTOR PARTS

PART NUMBER	NAME OF PART
1	OUTER BEARING CAP
2	INNER BEARING CAP
3	DRIVE END SHIELD
4	NON-DRIVE END SHIELD
5	B5-FLANGE
6	BEARING
7	KEY
8	SHAFT
9	ROTOR
10	STATOR
11	WINDINGS
12	FRAME
13	FOOT
14	EYE-BOLT
15	FAN
16	FAN COWL
17	TERMINAL BOX LID
18	TERMINAL BOX
19	TERMINAL BLOCK
20	GLAND

Table-6. Motor Parts

MOTOR RATING PLATE

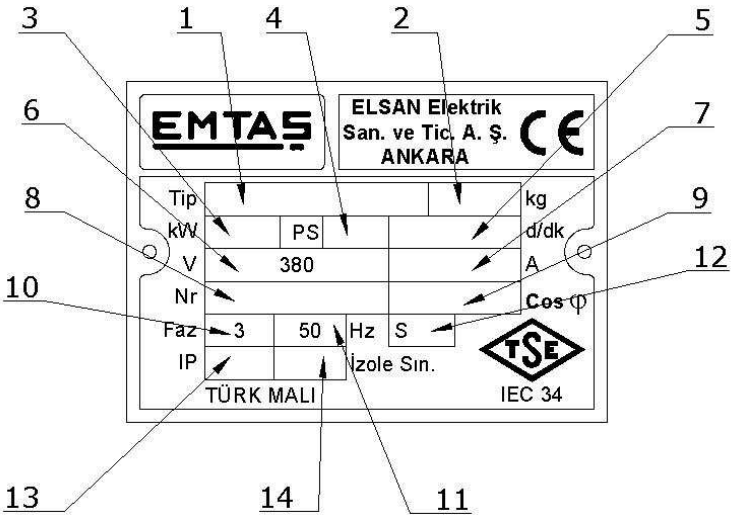


Figure-8. Rating Plate

NUMBER	DEFINITION
1	MOTOR TYPE
2	WEIGHT
3	OUTPUT, kW
4	OUTPUT, PS
5	SPEED
6	VOLTAGE AND CONNECTION TYPE
7	CURRENT
8	SERIAL NUMBER
9	POWER FACTOR
10	PHASE
11	FREQUENCY
12	DUTY TYPE
13	PROTECTION CLASS
14	INSULATION CLASS

Table-7. Rating Plate

NOTE

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