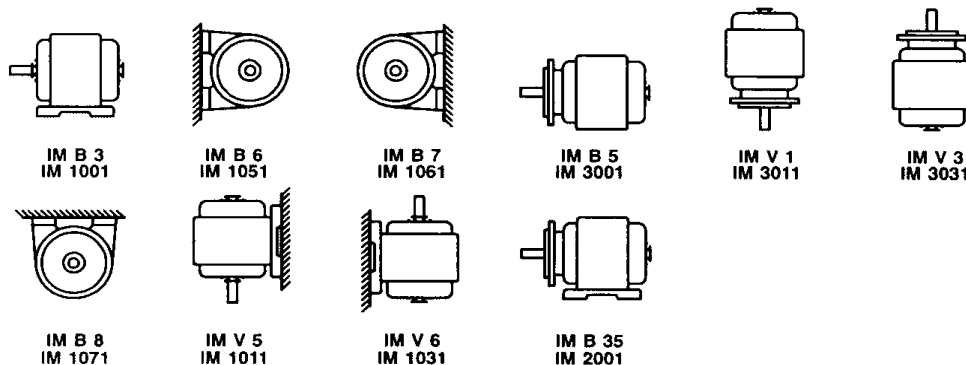


# INSTALLATION OPERATION & MAINTENANCE INSTRUCTIONS

## For THREE-PHASE INDUCTION MOTORS TYPE HJN / HJA

**Fig.1** Types of mounting



### GENERAL INFORMATION

This manual concerns standard three-phase TEFC induction motors, supplied in cast iron or aluminium frame and provided with ball bearings or roller bearings, lubricated with grease.

#### General Note

The aim of these instructions is to inform the operators of the required information to install, maintain and check the motors in use to such an extent that not only the deterioration of the product features and proper function should be avoided, but also resulting damages on both persons' health and property must be prevented. These instructions cannot include all possible types of installation, operation or maintenance. Therefore it is expected that the qualification, professionalism and experience of authorised personnel should determine the regulations which must be used and adhered to.

## 1 Description

### 1.1 Application

#### Normal use of the standard motors:

The motors may operate at an ambient temperature from -20°C up to +40°C, and up to a site altitude of 1000 m. The motors are designed to comply with the degree of protection IP55 - **the endshield/flange must not form part of oil filled casing, as it is not designed to prevent ingress of oil**. When oil tightness is required an execution with oil tight flange (or endshield) must be specified in the order.

The motors are suitable for installation in dusty and/or damp environments. The insulation is tropicalised. If properly stored or installed outdoors, these motors usually do not require any special measures against weather influences. They must, however, be protected against intensive sunlight, e.g. by means of a canopy. Each installation must be assessed by authorised personnel to establish the required degree of protection.

### 1.2 Motor Frame Material

**Motor types:** HJA - aluminium frame  
HJN - cast iron frame

## 2 Operation

**Before starting any work on the motor be sure to isolate it from the power supply.**

### 2.1 Transport, storage

Upon the delivery check the motor to see whether transport damage has not occurred. You should be able to rotate the shaft easily and smoothly by hand.

Check the details on the nameplate.



The motors should always be lifted utilising all lifting eyes (if provided) when being transported. For transportation of the motor/driven equipment assembly (gearboxes, fan units, etc.) always use the lifting eyes or lifting lugs provided! Pay attention to the lifting capacity of the aforementioned lifting features! If, after delivery, the motors have been stored for more than 4 years under correct conditions (kept in a dry place free from dust and vibration) prior to commissioning the rolling-contact bearings should be replaced.

Under severe storage conditions, this period becomes considerably shorter. If necessary, any unprotected, machined surfaces (flange surface, shaft end, etc.) should be treated with an anti-corrosion agent.

If necessary, the insulation resistance of the winding should be checked. See Section 2.5.

After installation, the screwed lifting eyes should be either tightened or removed!

### 2.2 Installation

The motor must be fixed on a stable, clean and flat foundation with good fitting foundation bolts, using washers. Do not mount a motor manufactured for a horizontal mounting on a surface with an angle of more than 15 degrees without consulting the supplier.

Under no circumstances the cooling air inlet, may be obstructed. This will cause motor overheating. Special attention is required where motors will be located in small-enclosed rooms.

The ambient cooling temperature must not exceed 40°C, unless otherwise agreed upon at the time of ordering.

In case of vertically installed motors, additional measures must be taken to ensure that no water would penetrate inside the motor alongside the shaft.

**Quiet running:** Exact alignment of the coupling and a well-balanced transmission element (coupling, pulley, fan, etc.) is essential for quiet vibration-free running. If necessary, the whole motor and transmission element should be balanced.

The terminal box can be turned by 4 x 90°.

### 2.3 Balancing, transmission elements

A suitable device should always be used to fit and remove the transmission elements (couplings, pulleys, pinions, etc.) (**Fig. 4**). As standard, the rotors are dynamically balanced with the complete shaft key inserted.

The type of balance has been marked either on the drive end of the shaft (shaft end face) or on the rating plate:

(F = balanced with full key)

(H = balanced with half-key)

When fitting the transmission elements, keep the type of balance in mind. The transmission elements have to be balanced in accordance with ISO 1940.

Preventative measures must be taken to avoid physical contact of the personnel with rotating parts.

### 2.4 Electrical connection

**NOTE:** The supply mains voltage and frequency must agree with the data given on the rating plate. Voltage or frequency deviations of  $\pm 5\%$  and  $\pm 2\%$  respectively from the rated voltage and frequency values are permitted without need of reducing the output. The connection and terminal board arrangement (connection links) must agree with the diagram provided inside the terminal box and in accordance with the connection (Y or  $\Delta$ ) stated on the motor nameplate. Connect the earthing conductor to the terminal with the earthing mark.

Please refer to **Fig. 2** for the tightening torque's for the screwed electrical connections - terminal board connections (except for terminal strips).

The anti-condensation heater (if fitted) must not be switched on during operation.

## 2.5 Checking the insulation resistance

The insulation resistance of the winding should be tested prior to the initial start-up of the motor after long periods of storage or standstill (approx. 6 months).

While the measurements being taken, and immediately afterwards, some of the terminals may carry dangerous voltages so physical contact must be prevented.

### Insulation resistance

- the minimum insulation resistance of new, cleaned or operated windings against earth must be 10 MΩ.
- The critical insulation resistance  $R_{crit}$  is calculated first by multiplying the rated voltage  $U_N$ , e.g. 0.69 kV AC, with the constant factor (0.5 MΩ/kV):

$$R_{crit} = 0.69 \text{ kV} * 0.5 \text{ M}\Omega/\text{kV} = 0.345 \text{ M}\Omega$$

### Testing

The minimum insulation resistance of the windings against earth must be tested at 500 Volts DC tester.

The winding temperature should be  $25^{\circ}\text{C} \pm 15^{\circ}\text{C}$ .

The critical insulation resistance should be tested with 500 Volts DC tester at operating temperature.

If the insulation resistance of a new motor or used motor, which has been stored or inactive for a prolonged period of time is less than 10 MΩ, this may be due to humidity. The winding must then be dried.

After long periods of operation, the minimum operation resistance may drop to the critical insulation resistance.

As long as the measured value does not fall below the calculated value of the critical insulation resistance, the motor may continue to operate. Otherwise the motor must be removed from operation immediately and the cause of the failure must be determined. The windings or its sections must be renewed, cleaned or dried as necessary.

## 2.6 Electrical Protection

The motor must be protected against short-circuit and overload. The recommended protection should be provided by a circuit breaker. The circuit breaker with a delayed overcurrent characteristic is suitable, which also protects against overload, while cut-out fuses protect the line and the motor against short-circuit effects. For three-phase motors, a circuit breaker of a corresponding nominal value is recommended. If cut-out fuses are used for protection against short-circuit, the overcurrent relay and contactor must be used to protect the motor against overload. The motor starting is carried out directly by means of a switch or contactor. In case of three-phase motors with power output above 3 kW, being connected to the public power network, a star-delta switch is recommended. The network voltage must then correspond with the motor voltage in the delta connection. The starting rate with the S1 duty cycle has been determined in uniform intervals of 6 times per hour. If a higher starting rate is required consultation with the manufacturer is necessary.

## 2.7 Commissioning

### NOTE: Electromagnetic compatibility



Emitted interference: Where the torque is very uneven (the drive of a piston-type compressor, for example), the inevitable result is a non-sinusoidal motor current, whose harmonics can lead to excessive system perturbation and thus excessive emitted interference. In the case of inverter controlled motors, interference is emitted to a greater or lesser degree, depending on the inverter version concerned (type, interference suppression measures, manufacturer).

The instructions of the inverter manufacturer regarding electromagnetic compatibility must be observed at all times. The use of a screened motor cable is recommended, the screen will have the best effect if it is conductively connected over a large area on the metal terminal box of the motor (with a screwed metal conduit thread). Noise voltages may be induced on the sensor leads of motors with integrated sensors (e.g. PTC thermistors) as a result of the inverter operation.

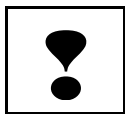
**Noise immunity:** If the motor features an integrated sensor (e.g. a PTC thermistor), the owner is responsible for ensuring adequate noise immunity by choosing a suitable sensor signal lead (possibly with shielding, connected like the motor supply lead) and an evaluator.

The data and recommendations specified in all the instructions supplied („Information on Safety and Commissioning“) and in all other related instructions, must always be observed prior to commissioning!

After motor installation, the brake, encoder, force ventilation unit, if fitted, should be checked for correct functioning!

### 3 Maintenance

#### Safety precautions



Before starting any work on the motor or other equipment, particularly before opening covers over live parts; the motor must be properly isolated from the power supply. Besides the main circuits, any additional or auxiliary circuits that may be present must also be isolated.

The usual "5 Safety Rules" (as per DIN VDE 0105) are:

- isolate the equipment
- take effective measures to prevent reconnection
- verify equipment is isolated
- earth and short-circuit the isolated equipment
- cover or fence off adjacent live parts

The precautions listed above should remain in force until all maintenance work is finished and the motor has been fully assembled.

#### NOTE:

Where motors are fitted with water condensation holes enclosed, these should be opened from time to time to allow any accumulated condensation water to be discharged.

Condensation water openings should always be positioned at the lowest point of the motor!

#### Fitting new bearings, type of grease

Under normal operating conditions, with horizontally mounted motors and the following coolant temperatures and motor speeds, the bearings should be replaced at the intervals [h] specified below:

	25°C	40°C
≤ 1800 r.p.m.	approx. 40,000 h	approx. 20,000 h
3600 r.p.m.	approx. 20,000 h	approx. 10,000 h

For list of bearings see **Table 1 & 2**.

Irrespective of the number of operating hours, the rolling-contact bearings should be replaced every 5 years due of grease ageing. In the case of motors operating under special conditions, such as the vertical motor position, heavy vibrations, sudden load changes, frequent reversing operation, etc., the bearing should be replaced at considerably more frequent intervals than the operating hours stated above.

Type of grease for standard motors: Chevron SRI 2 grease; substitute greases must conform to DIN 51825-K3N.

To change bearings, dismantle the motor. Pull of the rolling-contact bearings with a suitable device (see **Fig. 3**). Heat the rolling-contact bearing evenly to approx. 80-100°C and press on the shaft all the way to the shoulder. The use of a hammer should be avoided. Any worn sealing elements (such as the shaft sealing ring, etc.) should also be replaced.

#### Re-greasing facility

In motors are equipped with re-greasing facility, take note of the information given on the rating plate or the lubrication instruction plate. The bearings should be re-lubricated while the motor is running!

When dismantling the motor, follow the points below:

- a) remove the shaft key from the keyway on the free shaft end
- b) unscrew the fastening bolts and remove the fan cover
- c) unscrew and remove the endshield bolts
- d) remove the endshield, drive end
- e) remove the endshield, non-drive end, together with the rotor and the fan, from the stator

The motor re-assembly should be carried out in reverse order

For detailed re-lubrication intervals see **Table 2**.

**Note**

The specified maintenance, checking and overhauls must be carried out regularly by qualified personnel in order to prevent any damage or defects.

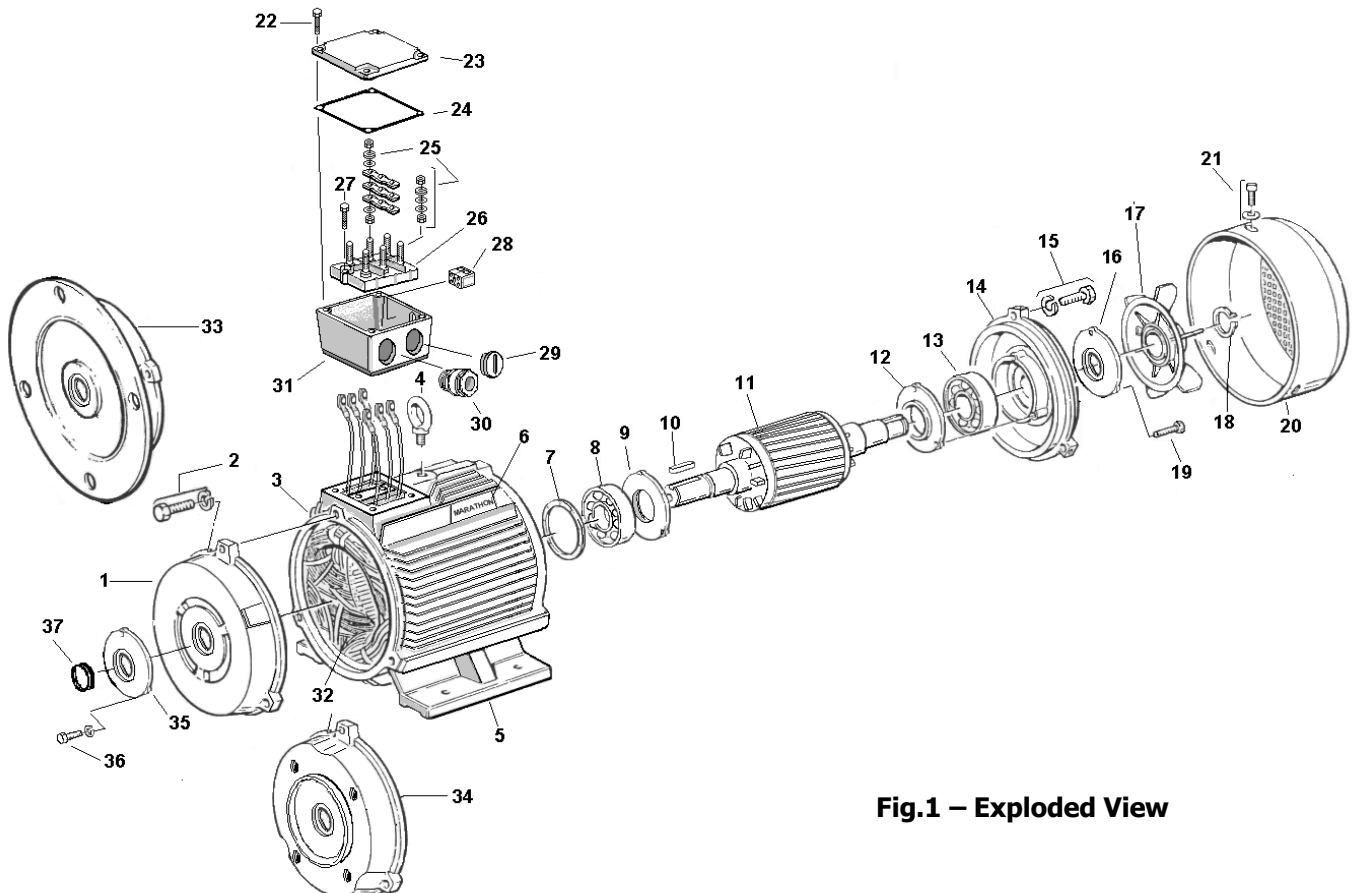
Deviations from the normal operation (higher power input, higher temperatures or vibrations, unusual sounds or smells, monitoring device signalling, etc.) mean that the motor condition has deteriorated. To prevent defects that may, directly or indirectly, cause serious damage to property or cause personnel injuries, the responsible person in charge of maintenance must be informed without delay.

**When in doubt switch off the motor immediately!**

**LIST OF SPARE PARTS**


**Three-phase motor with squirrel-cage rotor**

- |  |                               |
|--|-------------------------------|
| 1 Shield B3 DE                         | 19 Bolt bearing cap NDE       |
| 2 Fixing bolt shield DE                | 20 Fan cover                  |
| 3 Stator frame                         | 21 Fan cover screw            |
| 4 Eye bolt                             | 22 Terminal box screw         |
| 5 Feet                                 | 23 Terminal box cover         |
| 6 Nameplate                            | 24 Terminal box gasket        |
| 7 Spring washer                        | 25 Connection fixation nuts   |
| 8 BearingDE                            | 26 Terminal board             |
| 9 Inner Bearing cap DE from size 180   | 27 Terminal board holder bolt |
| 10 Key                                 | 28 Terminal block PTC         |
| 11 Rotor core                          | 29 Blinder                    |
| 12 Inner bearing cap NDE from size 180 | 30 Cable gland (not standard) |
| 13 Bearing NDE                         | 31 Terminal box house         |
| 14 Shield NDE                          | 32 Windings                   |
| 15 Fixing bolt shield NDE              | 33 Flange B5                  |
| 16 Outer bearing cap NDE from size 180 | 34 Flange B14                 |
| 17 Fan                                 | 35 Bearing cap DE outside     |



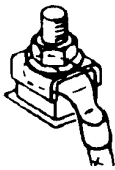
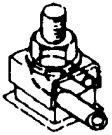
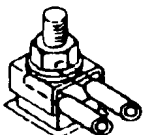
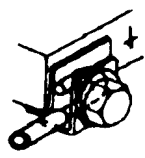
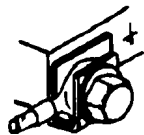
**Fig.1 – Exploded View**

**Fig.2– Cable Termination on the Terminal Board**

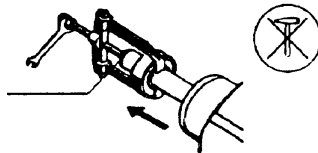
	Thread		M4	M5	M6	M8	M10	M12	M16
	Tightening Torque [Nm]	min	max	0.8	1.8	2.7	5.5	9	14
			1.2	2.5	4	8	13	20	40

The above stated tightening torque values are valid unless alternative values are given.

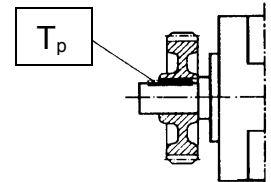
Tightening torque's for screwed electrical connections - terminal box connections (except terminal strips)

25 mm <sup>2</sup>	10 mm <sup>2</sup>	25 mm <sup>2</sup>	10 mm <sup>2</sup>	25 mm <sup>2</sup>
				
When connections are made with DIN cable lugs, bend the cable lugs downwards.	Connecting a single conductor with a terminal clip	Connecting two conductors of almost equal thickness with a terminal clip.	Connecting a single conductor under the outer earthing angle.	When connections are made with DIN cable lugs, under the outer earthing angle.

Spacer washer (to protect the centre hole in the shaft end)



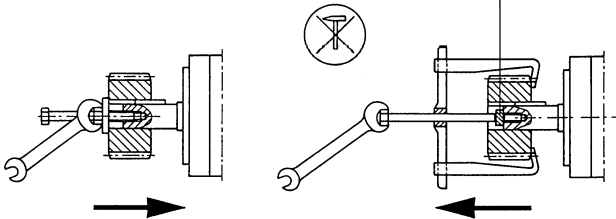
**Fig.3 Bearing Replacement**



**Fig.4 Balancing with the half-key**

**Fig.5 Pressing-on and pulling-off of the transmission elements**

Spacer washer (to protect centering bore in shaft end)



Use the tapped hole provided in the drive end shaft for fitting drive components such as couplings, gearwheels, belt pulleys, etc., and if possible, warm up the components as necessary. Use a suitable puller tool to remove the components. Do not strike the components, e.g. with a hammer or similar tool when fitting or removing them and do not exert more than the maximum value of radial or axial forces - according to the catalogue - transmitted to the motor bearings.

**Table 1 – Types of Bearings**

Motor Type	poles	DE	NDE
HJA-56	2, 4, 6	6201 ZZ C3	6201 ZZ C3
HJA-63	2, 4, 6	6202 ZZ C3	6201 ZZ C3
HJA-71	2, 4, 6	6203 ZZ C3	6202 ZZ C3
HJN/HJA-80	2, 4, 6, 8	6204 ZZ C3	6203 ZZ C3
HJN/HJA-100	2, 4, 6, 8	6206 ZZ C3	6206 ZZ C3
HJN/HJA-112	2, 4, 6, 8	6306 ZZ C3	6306 ZZ C3
HJN/HJA-132	2, 4, 6, 8	6308 ZZ C3	6308 ZZ C3
HJN-160	2, 4, 6, 8	6309 ZZ C3	6309 ZZ C3
HJN-180	2, 4, 6, 8	6311 ZZ C3	6311 ZZ C3
HJN-200	2, 4, 6, 8	6312 ZZ C3	6312 ZZ C3
HJN-225	2, 4, 6, 8	6313 ZZ C3	6313 ZZ C3
HJN-250	2, 4, 6, 8	6314 ZZ C3	6314 ZZ C3

**Table 2 - Types of Bearings with re-lubrication intervals**

Motor Type	poles	DE	NDE	Interval (h)	Quantity (gr)
HJN-280	2	6314 C3	6314 C3	2000	35
HJN-280	4,6,8	6317 C3	6317 C3	4000	50
HJN-315	2	6317 C3	6317 C3	2000	50
HJN-315	4,6,8	6319 C3	6319 C3	4000	55
HJN-355	2	6317 C3	6317 C3	2000	50
HJN-355	4,6,8	6322 C3	6320 C3	4000	65 / 60
HJN-400	4,6,8	6326 C3	6326 C3	4000	85
HJN-450	2	6319 C3	6319 C3	2000	55
HJN-450	4,6,8	6328 C3	6328 C3	4000	95
HJN-500	4,6,8	6330 C3	6330 C3	2000	120
HJN-560	4,6,8	6330 C3	6330 C3	2000	120

## Safety information for electrical equipment for use in heavy current installations

This information sheet with its warning is in addition to the operating instructions for the individual products and for safety reasons its contents must be adhered to.

### Danger



Electric machines are intended for use in industrial environment at high current installations. During operation this equipment has parts exposed which are live and dangerous and may also have moving or rotating parts. For this reason, unauthorised removal of the necessary covers, improper use, incorrect operation or insufficient maintenance could lead to severe personal injuries or property damage.

Those responsible for the safety of electrical equipment must therefore ensure that

- ◆ only qualified personnel are entrusted to work on the machines or equipment,
- ◆ these persons always have at their disposal the operating instructions and other product documentation supplied when they carry out such work, and that they undertake to follow consistently any such instructions,
- ◆ Non-qualified personnel are not permitted to work on or near the machines or equipment.

**Qualified personnel** - are persons who, on account of their training, experience and instruction, their knowledge of relevant standards, specifications, accident prevention regulations and operating conditions, have been authorised by those responsible for the safety of the plant to carry out the necessary work, and who can recognise and avoid possible dangers. The qualified personnel must adhere to valid national regulations securing the safety of electric motor operation. The international directions concerning the above mentioned problems are given in IEC 364.

A knowledge of first aid is also required, as is information about local rescue facilities.

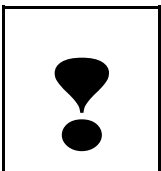
### Note

It is expected that only qualified personnel may carry out and/or inspect the basic planning work for installations and all the work connected with transport, assembly, supervision, maintenance and repairs.

Particular note must be taken of the following:

- the technical data and information on permissible use (assembly conditions, connection conditions, ambient and operating conditions) which are contained in the catalogue, order documents, operating instructions, rating plate and other product documentation;
- the general erection and safety regulations;
- the local plant-specific specifications and requirements;
- the proper use of tools, lifting gear and transport devices;
- the use of personal protective equipment;
- installation instructions for equipment that may be supplied to IP 00 modification (without covers). In operation this equipment must have the necessary shock protection fitted or access must be prevented which could result in dangerous conditions.

These instructions do not cover or describe all risks or details of possible equipment variations, nor in particular can they provide for every possible example of installation, operation or maintenance. This means that the instructions for machines or equipment for industrial applications normally include only the directions to be followed by qualified personnel (see above) where the equipment is used for its defined purpose.



**If, in special cases, it is intended to use the machines or equipment in non-industrial areas and therefore requirements may be more strict, e.g. protection against contact by children fingers, etc., compliance with such requirements must be assured during installation by providing additional protective measures on site.**

When there are any uncertainties in this respect, particularly in the event of missing product-related information, clarification must be obtained via the appropriate sales office. Please indicate the machine or equipment type and serial number.