



# INSTALLATION AND MAINTENANCE MANUAL

**Motorelli Electric Motors**  
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## Topics

- Safety warning
- Acceptance inspection
- Pre-commissioning
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- Belt drives
- Commissioning
- Bearings
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## **Safety warning**

MOTORELLI three phase induction motors are manufactured in accordance with strict quality control procedures, have excellent functional and performance characteristics, and are of robust construction.

MOTORELLI MOTORS are designed for the operation in industrial applications and in normal service where there is possible danger from rotating parts and/or live terminals. It is essential that these motors are only installed and serviced by qualified personnel to avoid injury or death and/or damage to equipment or buildings.

**IF THERE ARE ANY DOUBTS ABOUT SAFETY  
DO NOT INSTALL THE MOTOR AND DO NOT  
ATTEMPT TO OPERATE IT.**

## Acceptance inspection

When receiving MOTORELLI MOTORS please carry out the following:

Check that the description on the delivery note agrees with your Order specification.

Check that the rating, speed, etc., are in accordance with your requirements.

Check for any damage, rust, dirt, foreign substances, etc. All motors should be received with a plastic shaft cover to protect the shaft during the transportation and storage.

Check that the direction of rotation, if specified, is correct. If the motors have a low noise fan a direction arrow is fitted to the motor.

All motors 160 frame and above should be received with a shaft clamp. After removing the clamp, if applicable, manually turn the shaft and check for smooth quiet operation.

If the motor is to be transported again, either alone, or with the driven equipment, the rotor and shaft must be clamped again to prevent brinelling of the bearings. Transportation can cause brinelling of the bearings.

If any defect is found, please contact your MOTORELLI office immediately and provide the following information:

- Full name plate details - including serial number
- Details of your order number and delivery note
- Full description of the defect and the photo's if possible

## Pre-commissioning

Satisfactory operation of an electric motor depends on its location. Please ensure that the following factors have been taken into consideration:

- Ambient temperature - The ambient temperature range in which a standard motor will operate without any problems is  $-15^{\circ}\text{C}$  to  $+40^{\circ}\text{C}$ . If the motors are required to operate outside this temperature range and were not specifically ordered and supplied for such conditions, please contact your MOTORELLI representative for advice before proceeding.
- Ventilation - Please ensure that the motor is installed in a suitably ventilated area. Ensure that there is a free area in front of the air intake to allow enough airflow into the motor. The exhausted air must not be re-circulated back over the motor as this will reduce the effectiveness of the cooling system.

- Dust - If the air contains a high concentration of dust which is permitted to accumulate on the external surface of the motor, it may result in the motor overheating. If the dust is a problem, it may warrant the use of a special motors.
- Hazardous area - Ensure that the motor is certified for the use in the operation. Hazardous areas require specially certified motors.
- Vibrations - Ensure that the motor is installed on a solid floor, foundation, or rigid base, free from any external vibrations.
- Mounting - The motors are designed for horizontal mounting and frames 160 and above are provided with suitably positioned condensation and draining holes. All motors in frames up to and including 280 are mechanically suitable for mounting in any position subject to the drain holes being suitably positioned. Where it is required to mount larger frame sizes other than horizontal, please contact your nearest MOTORELLI office.

- Enclosure - All motors are Totally Enclosed Fan Cooled and have an enclosure rating of IP55 as a minimum. Motors with higher protection are available, but we recommend that IP56 and IP66 motors are supplied and used with the space heaters to prevent water condensation.



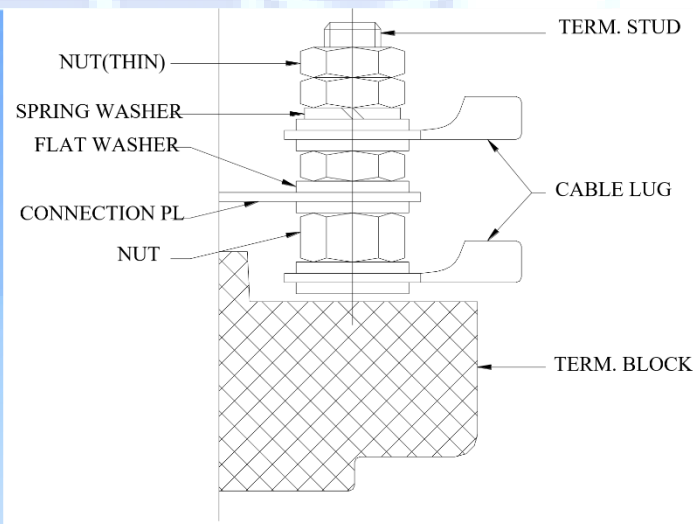
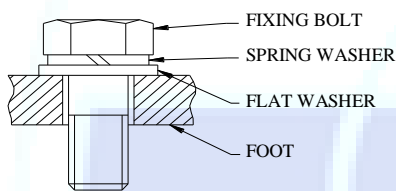
## **Fitting couplings and alignment**

Extreme care must be paid to the lining up of couplings as miss-alignment can be detrimental to the shaft and bearings. For direct drives we recommend flexible couplings to be used. Please ensure that the coupling manufacturer instructions are followed.

We recommend that couplings and pulleys are bored out with an H7 tolerance. Do not at any time use force in the fitting of couplings, pulleys etc. All motors are provided with a threaded hole in the drive end shaft to assist fitting and removal. A bolt should be used in this hole and a nut with a large washer used to press the coupling or pulley against the shoulder of the shaft.

Care must be taken to ensure that the motor bearings are not subject to end thrust caused by the two halves of the coupling being squeezed too tightly together. Please ensure that all couplings, belts, pulleys etc. are properly and permanently guarded against accidental contact while the motor is running. Care must be taken to ensure fixing bolts are correctly tightened.

It is recommended that a flat washer and a spring washer are used to prevent too much stress on the foot or flange of the motor, and to prevent fixing bolts from getting loose. Normal hand tools should be used, and bolts only be tightened until the spring washer is fully compressed between the flat washer and the bolt head.



**Recommended tightening torques for electrical terminals in Nm.**

Stud-0	M5	M6	M8	M10	M12	M16
Min	1.8	3.0	8.0	10	20	60
Max	2.5	4.0	9.0	17	30	73

## **Belt drive**

Please ensure that all used V- Belts are of the same manufacturer and have the same dimensions. Also ensure that the belts are correctly tensioned in accordance with the manufacturer's recommendations. If the V-Belts are not tensioned correctly it can cause belt and pulley wear and/or shaft and bearing damage. When replacing belts, it is recommended that all belts are replaced at the same time. It is not generally recommended to use 2 pole motors for belt drive applications. Please refer such requirements to your MOTORELLI office.

## Commissioning

Before starting the motor please ensure that the following checks have been carried out:

- **Safety/Lifting** - All motors 100 frame and above are fitted with lifting eyebolts as standard. These eyebolts are only intended for lifting the motor, not equipment attached to the motor such as gearboxes, pumps, etc.
- **Wiring** - Please refer to the motor nameplate for the method of connection. All motors are supplied with a connection diagram on the inside of the terminal box lid or on the motor nameplate. Ensure the motor is connected in the correct manner for the starter. All standard motors 3kW and below are supplied for dual Voltage operation, e.g. 400V Volts-Star, 230 Volts-Delta. This is to allow the motor to be used in conjunction with a 230V, 3 Phase, variable frequency supply. These motors cannot be started with Star-Delta starter. All motors 4kW and above are supplied with a delta connection and six leads. These motors can be started with Star-Delta starter.

- Connection - All motors are provided with a spacious terminal box. They are mounted on top of the motor for all frames. All terminal boxes can be rotated in 90-degree steps.
- Earth Connection - All motors are provided with two earth points, ensuring a reliable and permanent connection of the motor to the earth with the protective conductor. The internal connection is located adjacent to the motor supply terminals inside the terminal box. The external connection is mounted on the stator frames for all frame sizes.
- Insulation resistance - Check the insulation resistance between phase and earth, and between phases with a 500V or 1000V megger for 60 seconds. The reading must not be less than 5 mega ohms. After a long period of storage or standing idle in a moist environment, it is recommended that the motors are dried out or run on no load at approximately 20% of the rated Voltage to ensure that any internal moisture is dried out.

- **Starting** - When a motor is operated for the first time it is recommended that it is run uncoupled from the load to ensure that the direction or rotation is correct and that there is no undue noise or vibration. Before running the motor make sure that any loose items such as shaft keys are removed or fixed so that they cannot fly off when the motor is switched on. All motors are balanced in the factory with a half key. Motors can be run without the key fitted, or with the full key fitted, however this may cause a small amount of vibrations.
- **Reversing** - To reverse the direction of the rotation interchange any two of three supply leads. In the case of incorrect rotation of a motor fitted with a unidirectional fan please contact your MOTORELLI office.

- Frequency of starting - Standard motors are capable of 2 starts in succession, with a 3 seconds duration between each start, with the motor at normal running temperature. Standard motors are also suitable for 6 evenly spaced starts per hour. If starting frequency is more than the above, it is required to contact your MOTORELLI office.
- Thermistors - Motors 160 frame and above are supplied with the thermistors as standard. The thermistors are terminated in the main terminal box unless separate terminal boxes are specified. Please note that if the thermistors are to be checked for continuity the maximum Voltage applied must not exceed 2.5 V D.C. (an ohmmeter can be used, but a megger not).

If the thermistors and/or PT100's are fitted it is recommended that they are connected to a suitable relay and set correctly. When connected they provide reliable protection for the motor. Their use is essential to ensure the validity of the warrantee.

## *SET-UP of PT100's*

Where PT100's are fitted to the motor they are required to be connected for the validity of the warranty. Below is a picture of how they can be fitted.

The relay settings are as follows:

Windings: Alarm @ 135 deg C /Cut-off @ 140 deg C

Bearings: Alarm @ 75 deg C /Cut-off @ 85 deg C





## Bearings

The bearings in MOTORELLI motors are lubricated with lithium-based grease. Motors running in high or low ambient temperatures may require special bearings and almost certainly special grease. As standard the motors are supplied with the following bearings:

- Frames 160-355 - These motors have open bearings with a C3 internal clearance.
- Grease nipples are fitted, and the bearings are re-greaseable as standard. These motors are fitted with a grease relief plug which must be removed to allow the old grease to purge during re greasing. It is recommended that the motor should be run for 2 hours with the plug removed when the new grease is added.
- These motors have open bearings with a C3 internal clearance and automatic grease relief as standard. We recommend that these motors are checked every 3 months and re-greased if necessary. We recommend to re-grease these motors whilst running.

It is essential that the grease nipples are always cleaned before the lubrication to ensure the dirt does not enter the bearings.

- Recommended greases for normal application are lithium-based types BP LS3, SHELL ALVANIA R3.
- **Mixing different greases is not recommended** as not all greases are compatible with each other. If the motor is subject to any axial thrust, please contact your nearest agent as special thrust bearings may be necessary.
- For motors running in **high humidity** environments the bearings need to be serviced every 12 months. We suggest that they be replaced with new 2RS bearings which are fitted to the motor. Special moisture resistant grease is recommended for these bearings. It is important that regular monitoring of the bearings take place.

- For motors running without grease relief facilities the old grease must be cleaned out from time to time by removing the bearing cap and / or end shield.

The bearing and housing must then be repacked with the grease and reassembled. Do not overfill the bearing housing – it should not be more than a quarter full of grease after reassembly.

<b>BEARING GREASE</b>					
<b>Frame</b>	<b>Bearing</b>	<b>Bearing grease</b>	<b>Bearing</b>	<b>Bearing grease</b>	<b>Re-greasing periods</b>
	<b>DE</b>	<b>(g)</b>	<b>NDE</b>	<b>(g)</b>	<b>hours</b>
180-2	6211C3	21	6211C3	21	4000
180-4/6/8	6311C3	30	6211C3	21	10000
200-2	6212C3	23	6212C3	30	3500
200-4/6/8	6312C3	40	6212C3	30	8500
225-2	6312C3	40	6312C3	40	3000
225-4/6/8	6313C3	50	6312C3	40	6000
250-2	6313C3	50	6313C3	50	2000
250-4/6/8	6314C3	55	6313C3	50	5000
280-2	6314C3	55	6314C3	55	1200
280-4/6/8	6317C3	85	6314C3	55	4000
315-2	6317C3	85	6317C3	85	1200
315-4/6/8/10	6319C3	110	6317C3	85	2000
355-2	6319C3	110	6319C3	110	1200
355-4/6/8/10	NU322C3	125	6319C3	110	1400

## Maintenance

We recommend that if a motor is used continuously that it is removed for the inspection and dismantled every 5 years. Items that should be checked and recorded are:

- Insulation resistance and temperature at which it is measured (expect the insulation level to be low if the motor is hot)
- Inspection of the bearings and check for discoloration of the grease.
- Tightness of V Belts and alignment of couplings.
- Ensure that the holding down bolts are tight, and the base plate or foundations are rigid.
- Cleanliness inside and outside motor.

## FAULT FINDING

PROBLEM	POSSIBLE CAUSE	TESTS	SOLUTION
Motor will not start.	1.Fault with supply. 2.Motor or load locked up. 3.Wrong connections in control circuit.	1.Check for correct voltage at motor terminals. 2.Make sure motor and load are free to turn. 3.Check to ensure contactors operate.	1.Fit new fuses, reset circuit breakers, etc. 2.Remove clamp, locks, et. 3.Sort out control circuit.
Supply or starter trips out at start.	1.Wrong or loose connections. 2.Motor overloaded. 3.Inertia of load too high. 4.Low voltage due to volt drop in cables. 5.Overload or circuit breaker incorrectly set or sized.	1.Check all lugs are properly crimped or soldered, and connections are tight. 2,3, Check load performance data against motor performance data. 4.Measure voltage at motor terminals while motor starting. 5.Check settings of overload and circuit breaker and allow for starting current.	1.Fix up connections. 2,3, Change motor for correct size. 4.Change cables for correct size. 5.Correct setting of overload or breaker or change.



PROBLEM	POSSIBLE CAUSE	TESTS	SOLUTION
<p>Motor starts but has no torque.</p> <p>Motor does not reach full speed or takes a long time to accelerate.</p>	<ol style="list-style-type: none"> <li>1. Incorrect connection.</li> <li>2. Delta wound motor connected in star.</li> <li>3. Star/Delta starter staying in star.</li> <li>4. Inertia of load too high.</li> <li>5. Motor overloaded.</li> <li>6. Low voltage due to volt drop in cables.</li> </ol>	<ol style="list-style-type: none"> <li>1.2, Check connection diagram and nameplate data.</li> <li>3. Measure voltage at motor terminals while motor starting.</li> <li>4.5, Check load performance data against motor performance data.</li> <li>6. Measure voltage at motor terminals while motor starting.</li> </ol>	<ol style="list-style-type: none"> <li>1.2, Sort out and correct connections at motor terminals.</li> <li>3. Check timer and starter control circuit.</li> <li>4.5, Change motor for correct size.</li> <li>6. Change cables for correct size.</li> </ol>
<p>Motor is overheating</p>	<ol style="list-style-type: none"> <li>1. Motor overloaded.</li> <li>2. Ineffective cooling.</li> <li>3. Excessive ambient.</li> <li>4. Wrong connection.</li> <li>5. Delta wound motor in star</li> <li>6. Motor “single-Phase”.</li> <li>7. Wrong voltage or frequency.</li> <li>8. Supply voltage unbalanced.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check load and performance data.</li> <li>2.3, check fan and air flow and temperature of air. Look for build-up of dirt.</li> <li>4.5, check connection diagram and nameplate data.</li> <li>6. Check volts and amps in all Three phases.</li> <li>7. Check nameplate.</li> <li>8. Measure phase to phase voltage accurately.</li> </ol>	<ol style="list-style-type: none"> <li>1. Fix problem with load or fit larger motor.</li> <li>2.3, Clean motor. Sort out cooling air temp. and flow.</li> <li>4.5, Sort out connections.</li> <li>6. Restore supply to all phases.</li> <li>7. Correct voltage or frequency.</li> <li>8. Balance supply or accept unbalance</li> </ol>

PROBLEM	POSSIBLE CAUSE	TESTS	SOLUTION
No load amps more than full load amps.	<ol style="list-style-type: none"> <li>1. Incorrect connection.</li> <li>2. Star wound motor connected in Delta.</li> <li>3. Voltage more than nameplate.</li> <li>4. Motor supplied for different voltage or frequency.</li> </ol>	<ol style="list-style-type: none"> <li>1.2, check connection diagram and nameplate data.</li> <li>3. Measure voltage at motor terminals.</li> <li>4. Compare supply voltage and frequency to nameplate.</li> </ol>	<ol style="list-style-type: none"> <li>1.2, Sort out and correct connections at motor terminals.</li> <li>3. Correct supply voltage.</li> <li>4. Change motor for correct voltage and frequency</li> </ol>
Mechanical noise or Vibration. Noisy bearings. Bearing's overheating.	<ol style="list-style-type: none"> <li>1. Thrust from load or misalignment.</li> <li>2. Damaged bearings, too much grease, no grease, or foreign matter in grease.</li> <li>3. Rotor poling or foreign matter in air gap.</li> <li>4. Out of balance load, coupling or pulley.</li> <li>5. Excessive belt pull.</li> <li>6. Motor foundations not rigid.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check gap between coupling halves &amp; alignment.</li> <li>2.3, turn shaft slowly by hand &amp; feel for roughness or stiffness. Check for bent shaft or fan rubbing.</li> <li>4. Run motor disconnected from load &amp; then with pulley or coupling removed.</li> <li>5. Run motor without belts.</li> <li>6. Check design and construction of foundations.</li> </ol>	<ol style="list-style-type: none"> <li>1. Re-align coupling.</li> <li>2.3, Clean bearing housing, change bearings, and repack with fresh grease.</li> <li>4. Fix up out of balance items.</li> <li>5. Loosen belt tension.</li> <li>6. Increase strength of foundations.</li> </ol>



PROBLEM	POSSIBLE CAUSE	TESTS	SOLUTION
<p>Motor amps more than nameplate full load amps on load.</p>	<ol style="list-style-type: none"> <li>1.Motor overloaded.</li> <li>2.Low supply voltage.</li> <li>3.Wrong voltage or frequency.</li> <li>4.Wrong connections</li> <li>5.Motor “single-phase”</li> <li>6.Supply voltage unbalanced.</li> <li>7.Motor speed not matched to load.</li> </ol>	<ol style="list-style-type: none"> <li>1.check load and performance data.</li> <li>2.Measure voltage at motor terminals.</li> <li>3.Check nameplate.</li> <li>4. Check connection diagram and nameplate data.</li> <li>5.6, check volts and amps in all three phases.</li> <li>7.Measure motor speed &amp;check load speed requirements.</li> </ol>	<ol style="list-style-type: none"> <li>1.Fix problem with load or fit larger motor.</li> <li>2.Fix problem, maybe with larger cables.</li> <li>3.Correct voltage or frequency.</li> <li>4.Sort out and correct.</li> <li>5.6, Restore balanced supply to all three phases.</li> </ol>
<p>Excessive electrical noise.</p>	<ol style="list-style-type: none"> <li>1.Wrong connections.</li> <li>2.Wrong voltage.</li> <li>3.Motor “single-phase”</li> </ol>	<ol style="list-style-type: none"> <li>1.Check connections.</li> <li>2.Check voltage with nameplate.</li> <li>3.Check volts with amps in all three phases.</li> </ol>	<ol style="list-style-type: none"> <li>1.Fix up connections.</li> <li>2.Correct voltage.</li> <li>3.Restore supply to all three phases.</li> </ol>

PROBLEM	POSSIBLE CAUSE	TESTS	SOLUTION
Unbalanced amps in different phases.	1.unbalanced supply.	1.Measure phase to phase voltage accurately.	1.Balance supply or accept unbalance
Motor runs wrong direction.	1.wrong connections.	1.Watch shaft rotation	1.Swap any two phases of supply.

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