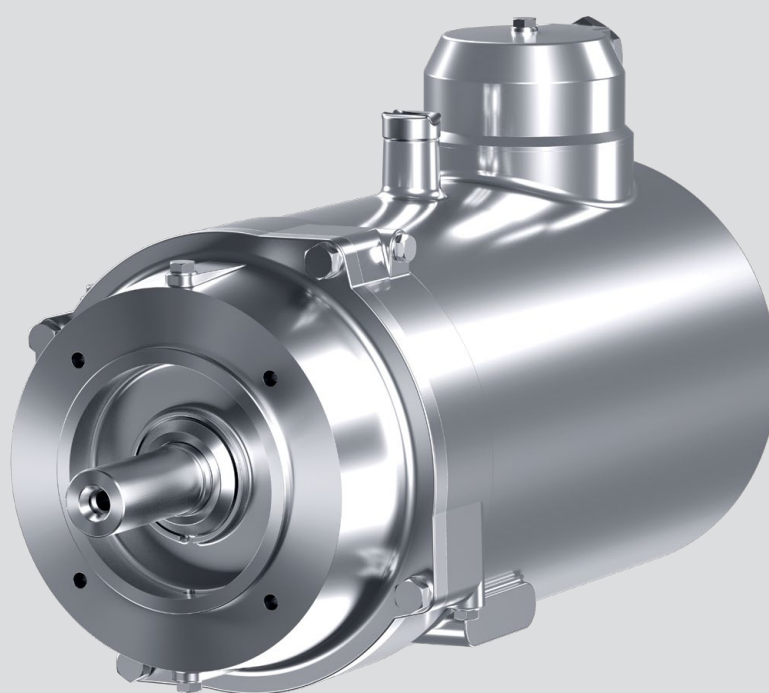

MANUAL | FEBRUARY 2019

IEC Food safe stainless steel motors

Installation, operation, maintenance and
safety manual



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1. Introduction

NOTE!

These instructions must be followed to ensure safe and proper installation, operation and maintenance of the motor. They should be brought to the attention of anyone who installs, operates or maintains the motor or associated equipment.

The motor 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

The conformity of the end product according to Directive 2006/42/EC (Machinery) has to be established by the commissioning party when the motor is fitted to the machinery.

1.2 Validity

These instructions are valid for the following ABB electrical machine types, in both motor and generator operation:

- series M3MA
- in frame sizes 71 – 132

i.e. motors for washdown duty for Food & Beverage with stainless steel frame and components, and windings encapsulated in epoxy resin.

2. Safety considerations

WARNING!

Emergency stop controls must be equipped with restart lockouts. After an emergency stop, a new start command can take effect only after the restart lockout has been intentionally reset.

The motor 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.

Points to be observed:

- Do not step on the motor.
- The temperature of the outer casing of the motor may be hot to the touch during normal operation and especially after shut-down.
- Some special motor applications may require additional instructions (e.g. when supplied with a frequency converter).
- Be aware of the rotating parts of the motor.
- Do not open the terminal boxes while the motor is energized.

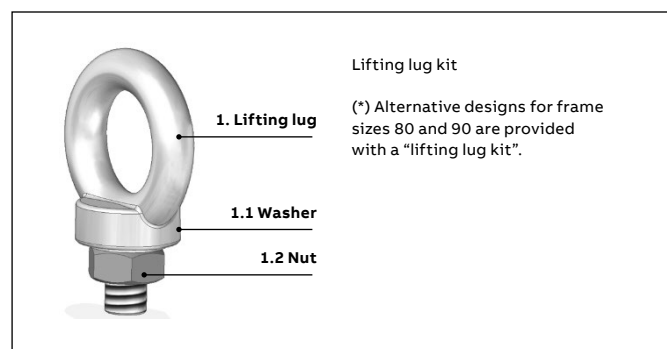
3. Handling

3.1 Reception

Immediately upon receipt, check the motor for external damage (e.g. shaft-ends, flanges and finished surfaces) and, if any damage is found, inform the forwarding agent without delay.

Check all rating plate data, in particular voltage and winding connections (star or delta). The type of bearing used is specified on the rating plate of all motors.

In the case of a variable speed drive application, check the maximum loadability allowed according to frequency.

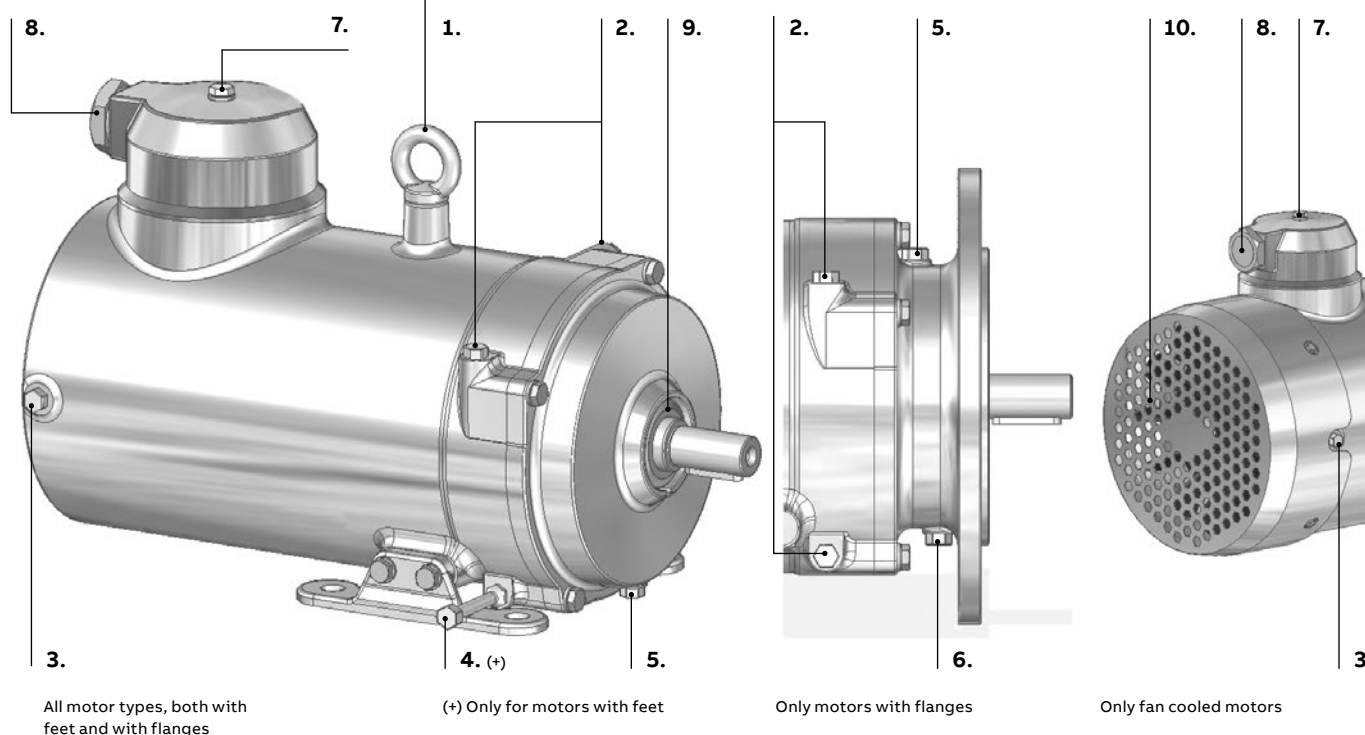


3.2 Motor description

The following parts are visible on the motor when received:

1. Lifting lug (an alternative design for frame sizes 80 and 90 that does not have pre-installed lifting lugs) (*)
2. Drain plugs available on four sides (only the two on top of the motor are shown in the picture) (+)
3. Drain plug for use when motors are mounted vertically, with the shaft upside (in the alternative design for frame sizes 80 and 90, it is on the non-drive end face of the motor)
4. Long drain plug, only for motors equipped with feet, due to difficulties in the tightening/removal of the standard plug with this type of mounting
5. Drain plug for use when motors are mounted vertically, with shaft downside (not available in alternative design)
6. Drain plug for use when the motor is coupled to a gearbox to remove possible condensed water between motor and gearbox (not available in alternative design)
7. Fixing screw for the terminal box cover
8. Threaded hole for cable gland, closed with a plastic plug
9. Gamma ring seal on DE flange
10. Fan cover (only frame sizes 100 and above)

(+) All motors in general use M6 drain plugs: alternative designs for frame sizes 80 and 90 may use M10 drain plugs or a mix of M10 and M6.



3.3 Transportation and storage

The motor should always be stored indoors (above $-40\text{ }^{\circ}\text{C}$), in dry, vibration-free and dust-free conditions. During transportation, shocks, falls, and humidity should be avoided. For advice on what to do in other conditions, please contact ABB.

We recommend that shafts are rotated periodically (one time per quarter) by hand to prevent grease migration.

The motor must not be subject to any external vibrations at standstill so as to avoid causing damage to the bearings.

3.4 Lifting

All ABB M3MA motors are equipped with lifting lugs or eyebolts.

Only the lifting lug kits 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.

Because of different outputs, mounting arrangements and auxiliary equipment, motors with the same frame may have a different center of gravity.

Damaged lifting lug kits or eyebolts must not be used. Check that they are undamaged before lifting.

Lifting lug kits and eyebolts must be tightened before lifting.

Ensure that proper lifting equipment is used and that the hooks are the correct size for the lifting lugs and eyebolts.

Care must be taken not to damage auxiliary equipment and cables connected to the motor.

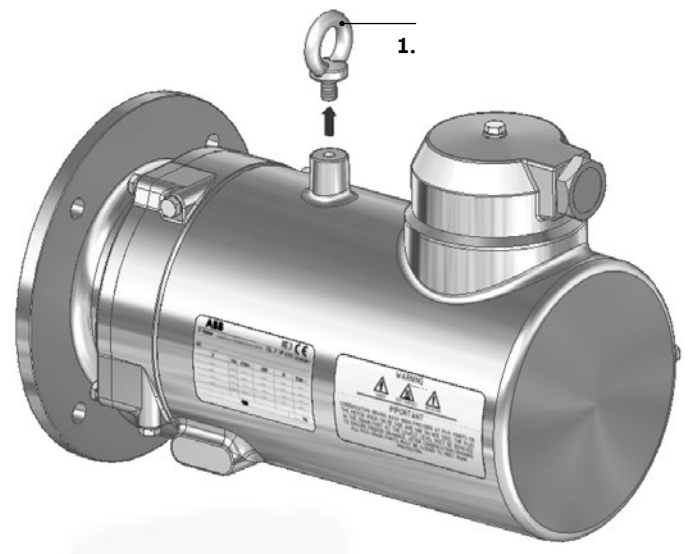
Remove any transport jigs fixing the motor to the pallet.

WARNING!

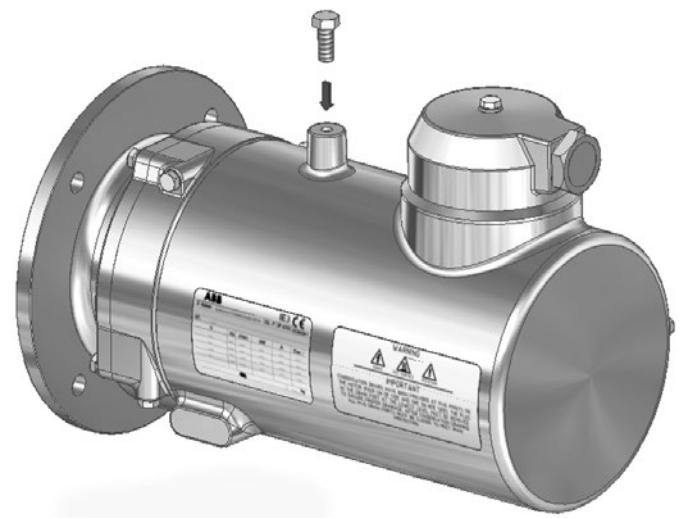
During lifting, mounting or maintenance work, ensure all necessary safety precautions have been taken and make certain that no-one is under the lifted load at any time.

Lifting instructions for all frame sizes (71 to 132):

- A. Motors come with a preinstalled central eyebolt. Once the motor has been installed, remove 1



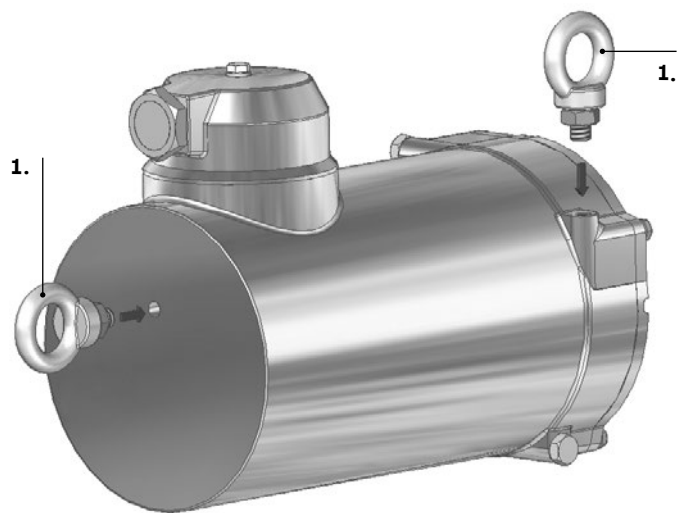
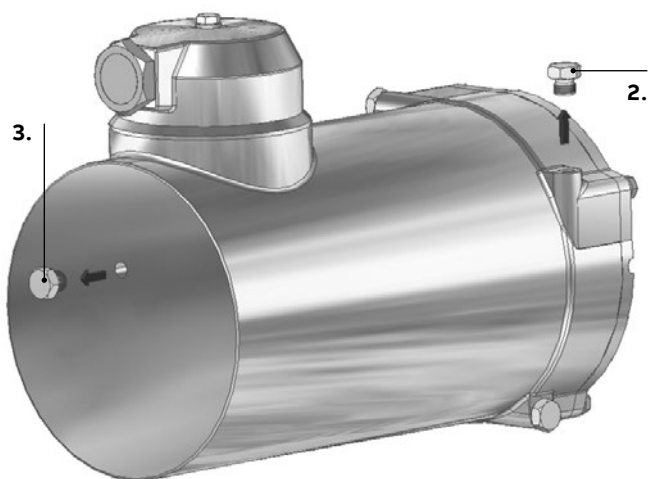
- B. Screw in the stainless steel bolt available in the packaging. A washer maybe also be included, depending on the motor frame size



Lifting instructions for alternative designs, frame sizes 80 and 90 only:

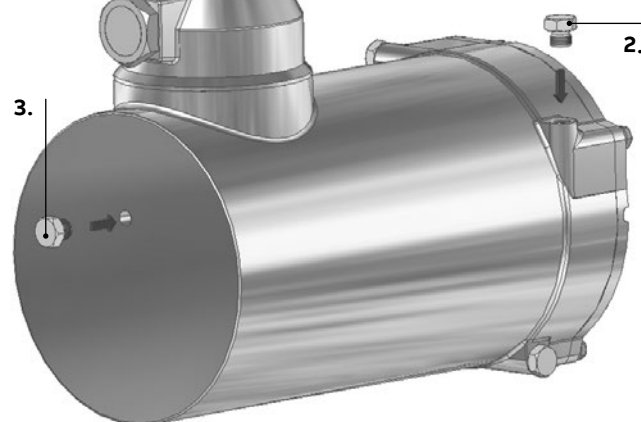
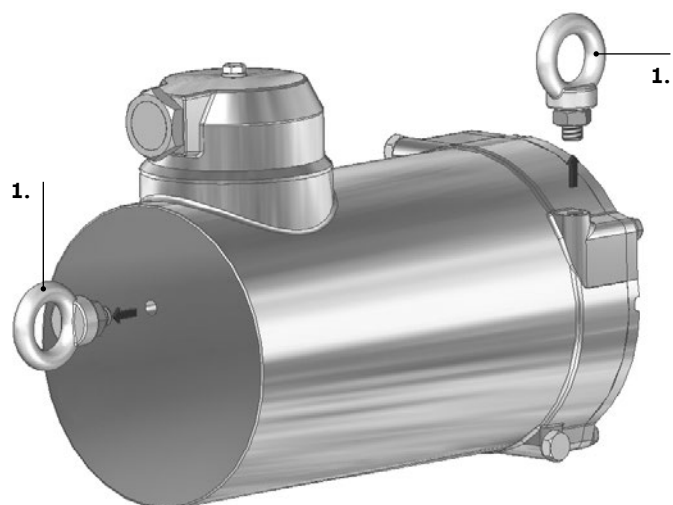
A. Remove drain plugs 2 and 3

B. Screw in the "lifting lug kit" 1



C. Once the motor has been installed, remove 1

D. Screw in drain plugs 2 and 3 in the same place



3.5 Drain plugs for condensation

Motors have several drain plugs for removing any condensed water from inside the motor. To remove such water, the bottommost plug must be unplugged.

For motors that are equipped with flanges only and have no feet, there is one drain plug for each of the four possible orientation sides of the motor, i.e. with the terminal box oriented upside, left, right or downside.

There is also one drain plug on the NDE side of the motor in case of vertical mounting with the shaft upside and one drain plug on the DE end shield or flange for motors that are mounted with the shaft downwards.

Finally, for motors equipped with flanges, designed for a sealed connection to a gearbox, there is an additional drain plug to remove possible condensed water from the area between the motor and the gearbox itself. Please note: for motors mounted horizontally, this plug will be in the bottommost part of the motor only when the motor is mounted with the terminal box on top of the motor. In case the motor is mounted with the terminal box in a horizontal position (left or right), this plug becomes unusable unless the flange is dismantled and rotated accordingly (this is an operation that can only be done by authorized personnel or at the factory: it should be requested as Variant Code, either available as VC for Production and for Stock Modification).

3.6 Motor weight

The total weight of the motor can vary within the same frame size, depending on different power outputs, mounting arrangements and auxiliaries.

Consequently, also the position of the center of mass varies.

As a further consequence, motors with a single hanging point on the frame will not be lifted horizontally in most cases.

The following table shows the estimated maximum weights for machines in their basic versions as a function of frame size.

The actual weight of a motor is shown on the rating plate.

Frame size	Weight kg
71	20
80	25
90	45
100	62
112	64
132	118

If the motor is equipped with any accessories, contact ABB for the weight, if not available on the nameplate.

4. Installation and commissioning

WARNING!

Disconnect and lock out before working on the motor or the driven equipment.

4.1 General

All rating plate values must be carefully checked to ensure that the motor protection and connection will be properly done.

When starting the motor for the first time or after it has been in storage more than six months, manually rotate the shaft for some turns in both directions.

4.2 Insulation resistance check

Measure insulation resistance (IR) before commissioning, or after long periods of standstill or storage if there is a risk of winding dampness. IR shall be measured directly on the motor terminals with the supply cables disconnected in order to avoid them affecting the result.

Insulation resistance should be used as a trend indicator to determine changes in the insulation system. In new machines, the IR is usually thousands of Mohms and therefore it is important to following changes in IR so as to know the condition of the insulation system. Typically, the IR should not be below 10 MΩ and in no case should it be below 1 MΩ (measured with 500 or 1000 VDC and corrected to 25 °C). The insulation resistance value is halved for each 20 °C increase in temperature.

Figure 1, in chapter 11, can be used for the insulation correction to the desired temperature.

WARNING!

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

If the reference resistance value is not attained, the winding may be damaged and the motor has to be inspected.

4.3 Foundation

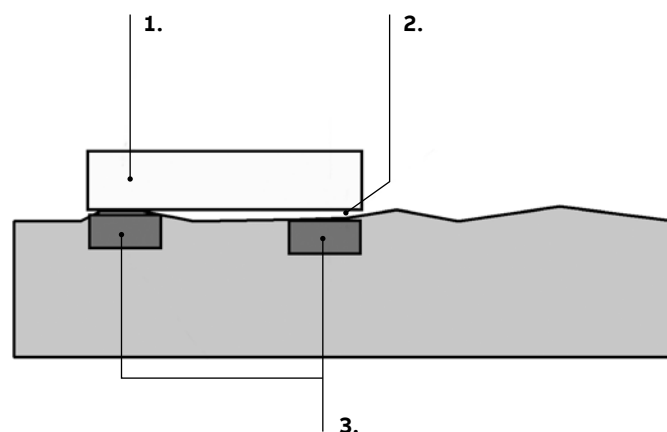
The end user is fully responsible for preparing the foundation.

Metal foundations should be made from stainless steel to avoid corrosion.

The 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. See figure.

1. Ruler
2. Note! Height difference shall not exceed $\pm 0,1\text{mm}$ in relation to any other motor
3. Foot location



4.4 Balancing and fitting coupling halves and pulleys

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

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

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

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

4.5 Mounting and alignment of the motor

Ensure that there is enough space for free airflow around the motor. For motors equipped with a fan, we recommend that a clearance between the fan cover and the wall etc. of at least $\frac{1}{2}$ of the air intake of the fan cover. Additional information may be found from the dimension drawings available on our web pages: www.abb.com/motors&generators.

Correct alignment is essential to avoid bearing damage, 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. To be compliant with hygienic design, only hexagonal head bolts are allowed, preferably in stainless steel.

Align the motor using the appropriate methods.

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

Mounting accuracy of coupling half: check that clearance b is less than 0.05 mm and that the difference a1 to a2 is also less than 0.05 mm. See figure 2.

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

Do not exceed permissible loading values for bearings as stated in the product catalogs.

Check that the motor has sufficient airflow.

Ensure that no nearby objects or direct sunshine radiate additional heat on the motor.

For flange mounted motors (e.g. B14, B5, B35, V1), make sure that the construction allows sufficient air flow on the outer surface of the flange. To be compliant with Hygienic Design, only hexagonal head bolts are allowed, preferably in stainless steel.

4.6 Radial forces and belt drives

Belts must be tightened according to the instructions of the supplier of the driven equipment.

WARNING!

Excessive belt tension will damage bearings and can cause shaft damage.

4.7 Drain plugs for condensation

During operation, all drain holes can be either closed or opened; the only condition when drain plugs must be tightly closed is during washing operations, to ensure IP69 protection.

In any case, to remove possible condensed water from inside the motor, at least the bottommost plug must be unplugged.

4. Installation and commissioning

4.8 Cabling and electrical connections

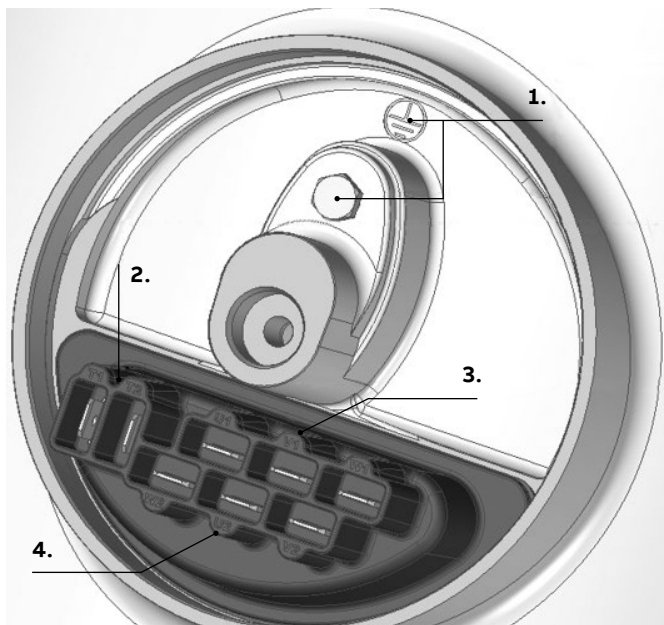
To cable the motor, remove the terminal box cover by untightening its central screw.

The terminal box cover can be oriented 360 degrees and is tightened in the desired position using its central screw. Two O-rings, one on the external diameter and one on the central pin, secure IP69 protection class for the terminal box cover.

Once cabling is completed, reassemble the terminal box cover on the motor with the desired orientation and tighten its central screw.

The terminal box has a terminal block inside equipped with:

1. One earth terminal (M4 stainless steel or brass screw), with ground marking on the frame
2. Two thermal sensor terminals (T1 T2)
3. Three winding terminals (U1-V1-W1) for power line supply
4. Three winding terminals (U2-V2-W2) to be used to create both star and delta connections



WARNING!

Before reassembling the terminal box cover, ensure that the O-rings are correctly positioned, are not damaged and are properly greased with H1 food grade grease: grease is needed to avoid damage to the O-rings during reassembly.

Once the central screw is tightened, the cover cannot be turned freely anymore. If you want to orient it in a different position, the entire process described above has to be followed. We recommend replacing the O-rings after one or two times.

The terminal block has male faston tabs $6.45 \times 7.9 \times 0.8$ mm, for both power connection and for thermal sensors. Cables must be provided with suitable female faston receptacle connectors (ABB uses the following code from TE for an internal connection not accessible by Customers: 60650-2, or equivalent).

The terminal box has only one cable entry suitable for an M25 cable gland. Due to this, the power cables must have at least six conductors:

- Three conductors for L1, L2, L3 power supply phases
- One conductor for PE
- Two conductors for the thermal sensor

We recommend using cables of up to a maximum 16 mm and compatible with the following IP69 cable glands (or equivalent):

- ABB FSCG-M251 M25X1.5 D12-17 mm (FNB CG M25 12.0-17.0 SS – EAN 5415022418255)
- Lapp SKINTOP INOX M25X1.5 D9X17 (53806743)
- Harting Han CGM-P M25X1.5 D.13-18 mm black (19000005192)
- Hummel HSK-INOX-Ex-d / Metr. M25X1.5 D9-16 mm (1.632.2500.51)

Motors are intended for fixed installation only. Unless otherwise specified, cable entry threads are metric. The IP class of the cable gland must be the same as the motor, i.e. IP69.

WARNING!

For consistency with the motor IP69 protection level, only IP69 cable glands can be considered as appropriate. Cable glands shall be selected according to the type and diameter of the cable.

Earthing must be carried out according to local regulations before the motor is connected to the supply voltage. The earth terminal on the frame is always inside the terminal box and has to be connected to PE (protective earth) with a cable as shown, e.g. in Figure 24 of IEC 60034-25

Minimum cross-sectional area of protective conductors

Cross-sectional area of phase conductors of the installation S [mm ²]	Cross-sectional area of the corresponding protective conductor S [mm ²]
4	4
6	6

In addition, earthing or bonding connection facilities on the outside of electrical apparatus must provide the effective connection of a conductor with a cross-sectional area of at least 4 mm².

The cable connection between the network and motor terminals must meet the requirements stated in the national standards for installation or in the standard IEC/EN 60204-1 according to the rated current indicated on the rating plate.

NOTE!

When the ambient temperature exceeds +50 °C, cables with a permissible operating temperature of +90 °C as a minimum shall be used. Also, all other conversion factors depending on the installation conditions shall be taken into account while sizing the cables.

After connection, make sure that water cannot enter the terminal box: the O-ring must be in place in the terminal box cover slot and greased to avoid pinching during mounting. The cables must enter the terminal box cover through an IP69 cable gland. A leak could lead to the penetration of dust or water, creating a risk of flashover to live elements

4.8.1 Connections for different starting methods

The terminal box contains six winding terminals and at least one earth terminal. This enables the use of DOL or Y/D starting.

The voltage and connection are stamped on the rating plate.

Direct-on-line starting (DOL):

Y or D winding connections may be used.

For example, 400 VY, 230 VD indicates Y-connection for 400 V and D-connection for 230 V.

Star/Delta (Wye/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.

Other starting methods and severe starting conditions:

In cases where other starting methods, e.g. converters or soft starters are used in the duty types of S1 and S2, it is considered that the device is “isolated from the power system when the electrical machine is running” as in standard IEC 60079-0 and thermal protection is optional.

Each motor comes with eight (8) female faston receptacles in an envelope inside the terminal box to facilitate this operation.

Connection diagrams (Y-D) can be found inside the terminal box.

4. Installation and commissioning

To make the star center three wires with crimped fastons need to be connected together and inserted in the U2, V2, W2 terminals; connection of the wires may be soldered together, but in this case the welded terminal must be isolated (use a heat shrinking sleeve).

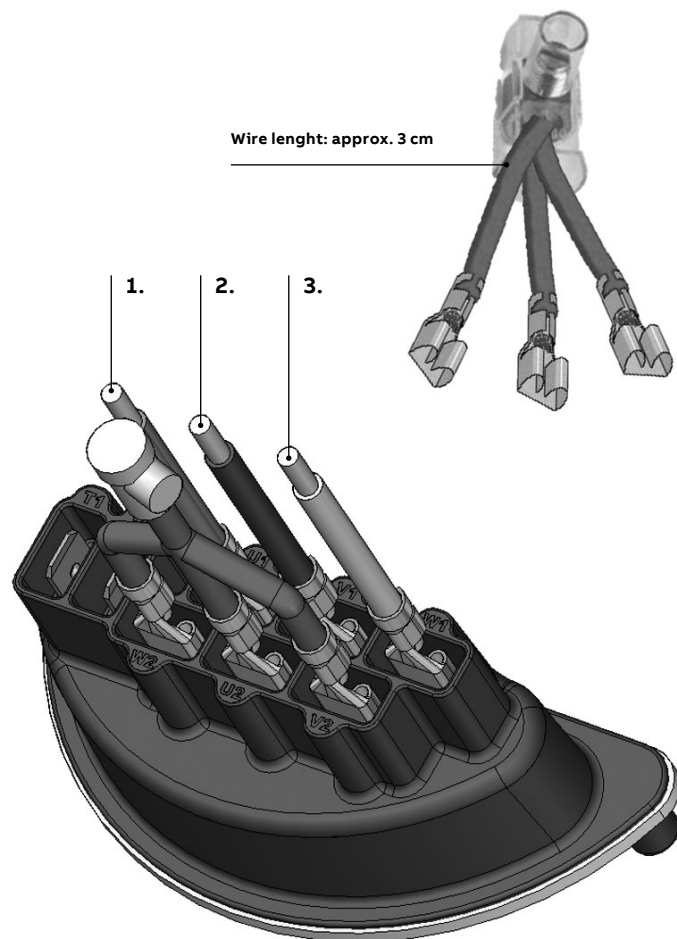
NOTE!

ABB provides only the fastons.

Color code shown for cables is according to IEC 60445 (2010) but it is not mandatory:

1. L1 = U1 = Brown
2. L2 = V1 = Black
3. L3 = W1 = Grey

To supply the motor at 400 VY, create the star center as shown in the figure.



To make the Delta connection three wires with crimped fastons need to be connected together and inserted in the U2, V2, W2 terminals as shown in the figure; connection of the wires maybe done by a one clamp for each phase or they may be soldered together, but in this case the welding must be isolated (use a heat shrinking sleeve).

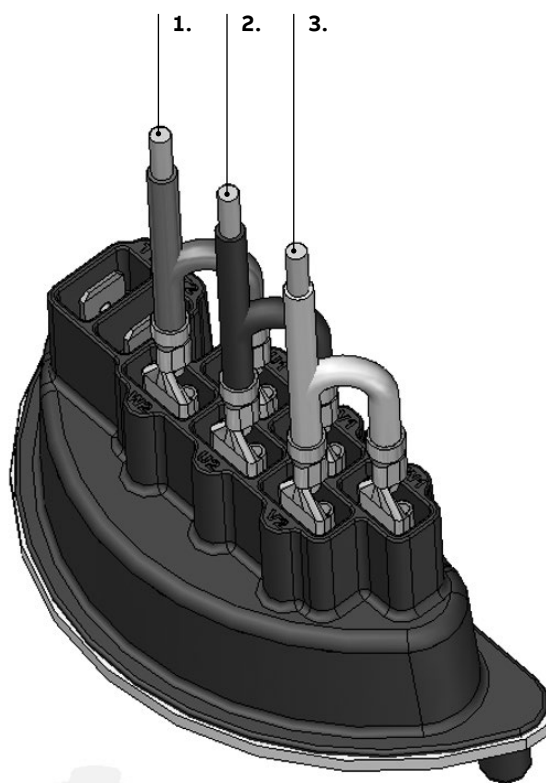
NOTE!

ABB provides only the fastons.

Color code shown for cables is according to IEC 60445 (2010) but it is not mandatory:

1. L1 = U1 = Brown
2. L2 = V1 = Black
3. L3 = W1 = Grey

To supply motors with 230 VΔ connect the cables as shown in figure.



4.8.2 Connections of auxiliaries

All motors are, by default, equipped with 3 PTC thermistors connected in series, which are encapsulated into the stator winding to monitor the motor temperature and provide a signal in case the maximum temperature is exceeded.

The threshold value of the PTC thermistors varies depending on the motor shaft height and cooling method:

- Frame sizes 71 to 90 have threshold value of 150 °C due to IC410 cooling
- Frame sizes 100 to 132 have a threshold value of 130 °C due to IC411 cooling

These thermistors do not cut power supply to the motor, i.e. they are not connected in series with the windings.

It is up to the user whether to connect and use those thermistors or not; however ABB recommends their use and connection by the appropriate means: ABB provides eight (8) female faston receptacles in the terminal box, two of which can be used to connect the thermistors.

The maximum measuring voltage for the thermistors is 2.5 V. Using a higher measuring voltage or current may cause errors in readings or damage the temperature detector.

The insulation of thermal sensors fulfills the requirements of basic insulation.

4.9 Terminals and direction of rotation

The shaft rotates clockwise when viewing the shaft face at the motor drive end, and the line phase sequence - L1, L2, L3 - is connected to the terminals as shown in figure 3.

To alter the direction of rotation, interchange any two connections on the supply cables.

5. Operation

5.1 General

Unless otherwise stated on the rating plate, the motors are designed for the following conditions:

- Motors are to be installed in fixed installations only.
- Storage temperature and startup should not be below -40 °C.
- Normal ambient working temperature range is from -40 °C to +40 °C, provided that a pre-heating cycle as described above has been carried out.
- Maximum altitude is 1000 m above sea level.
- The variation of the supply voltage and frequency may not exceed the limits mentioned in relevant standards. Tolerance for supply voltage is $\pm 5\%$, and for frequency $\pm 2\%$ according to the figure 4 (EN / IEC 60034-1, paragraph 7.3, Zone A). Both extreme values are not supposed to occur at the same time.

The motor can only be used in applications for which it is intended. The rated nominal values and operation conditions are shown on the motor rating plates. In addition, all requirements of this manual and other related instructions and standards must be followed.

If these limits are exceeded, motor data and construction data must be checked. Please contact ABB for further information.

WARNING!

Ignoring any instructions or maintenance of the apparatus may jeopardize safety and thus prevent the use of the motor.

6. Low voltage motors in variable speed operation

6.1 Introduction

This part of the manual provides additional instructions for motors used in frequency converter supplies. The motor is intended to operate from a single frequency converter supply and not motors running in parallel from one frequency converter. The instructions given by the converter manufacturer shall be followed.

Additional information may be required by ABB to decide on the suitability of the motor in special applications or with special design modifications.

6.2 Winding insulation

Variable speed drives create higher voltage stresses than the sinusoidal supply on the winding of the motor. Therefore, when needed, the filter at the converter output must be dimensioned according to the following instructions.

6.2.1 Selection of filters for ABB converters

In the case of, e.g. ABB AC_8_-series and AC_5_-series single drives with a diode supply unit (uncontrolled DC voltage), the selection of filters can be made according to table 6.1.

6.2.2 Selection of filters with all other converters

The voltage stresses must be limited to below the accepted limits. Please contact the system supplier to ensure the safety of the application. The influence of possible filters must be taken into account when dimensioning the motor.

6.3 Thermal protection

The M3MA motors covered by this manual are, by default, equipped with 3 PTC thermistors, which are connected in series and encapsulated into the stator winding to monitor the motor temperature and provide a signal in case the maximum temperature is exceeded.

The threshold value of the PTC thermistors varies depending on the motor shaft height and cooling method:

- Frame sizes 71 to 90 have a threshold value of 150 °C due to IC410 cooling
- Frame sizes 100 to 132 have a threshold value 130 °C due to IC411 cooling

We highly recommend connecting them to the frequency converter. Read more in chapter 4.8.

6.4 Bearing currents

Common mode filters and suitable cabling and grounding methods must be used according to the following instructions and using table 6.1.

6.4.1 Elimination of bearing currents with ABB converters

In case of ABB frequency converters, e.g. AC_8_- and AC_5_-series with a diode supply unit, the methods according to table 6.1 must be used to avoid harmful bearing currents in motors.

$P_N < 100 \text{ kW}$	
$U_N \leq 500 \text{ V}$	Standard motor
$500 \text{ V} < U_N \leq 690 \text{ V}$ (any cable length)	Standard motor + dU/dt –filter (reactor)

Table 6.1 Selection of filters for ABB converters

Please contact ABB for more information on resistor braking and converters with controlled supply units.

NOTE!

Insulated bearings that have aluminum oxide coated inner and/or outer bores or ceramic rolling elements are not suitable for M3MA motors. Changing the bearing type or insulation method without ABB's permission is prohibited.

6.4.2 Elimination of bearing currents with all other converters

The user is responsible for protecting the motor and driven equipment from harmful bearing currents. Instructions described in chapter 6.4.1 can be used as guideline, but their effectiveness cannot be guaranteed in all cases.

6.5 Cabling, grounding and EMC

Although not mandatory, symmetrical and shielded cables are still highly recommended. Make the 360° grounding arrangement at all the cable entries as described in the instructions for the glands. Twist the cable shields into bundles and connect to the nearest ground terminal/bus bar inside the terminal box, converter cabinet, etc.

6. Low voltage motors in variable speed operation

NOTE!

In addition to the IP69 protection characteristics, proper cable glands providing 360° bonding must be used at all termination points such as motor, converter, possible safety switch, etc.

More information regarding grounding and cabling of variable speed drives can be found in the manual “Grounding and cabling of the drive system” (Code: 3AFY 61201998).

6.6 Operating speed

For speeds higher than the nominal speed stated on the motor's rating plate or in the respective product catalog, ensure that either the highest permissible rotational speed of the motor or the critical speed of the whole application is not exceeded. For 2 pole motors, the maximum speed is 6000 r/min; for 4 pole motors, the maximum speed is 4000 r/min.

6.7 Motors in variable speed applications

6.7.1 General

With ABB's frequency converters, the motors can be dimensioned using ABB's DriveSize dimensioning program. The tool can be downloaded from the ABB website (www.abb.com/motors&generators).

For applications supplied with other converters, the motors must be dimensioned manually. For more information, please contact ABB.

The loadability curves (or load capacity curves) are based on nominal supply voltage. Operation in under or over voltage conditions may affect the performance of the application.

6.7.2 Motor loadability with AC_8__ – series of converters with DTC control

The loadability curves presented in Figures 5a – 5d are valid for ABB AC_8_-series converters with uncontrolled DC-voltage and DTC-control. The figures show the approximate maximum continuous output torque of the motors as a function of supply frequency. The output torque is given as a percentage of the nominal torque of the motor. The values are indicative and exact values are available on request.

NOTE!

The maximum speed of the motor and application may not be exceeded!

6.7.3 Motor loadability with AC_5__ – series of converter

The loadability curves presented in Figures 6a – 6b are valid for AC_5_-series converters. The figures show the approximate maximum continuous output torque of the motors as a function of supply frequency. The output torque is given as a percentage of the nominal torque of the motor. The values are indicative and exact values are available on request.

NOTE!

The maximum speed of the motor and application may not be exceeded!

6.7.4 Motor loadability with other voltage source PWM-type converters

For other converters, with uncontrolled DC voltage and minimum switching frequency of 3 kHz (200...500 V), the dimensioning instructions as mentioned in chapter 6.7.3 can be used as guidelines. However, please note that the actual thermal loadability can also be lower. Please contact the manufacturer of the converter or the system supplier.

NOTE!

The actual thermal loadability of a motor may be lower than that shown by guideline curves.

6.7.5 Short time overloads

ABB motors can usually be temporarily overloaded as well as used in intermittent duties. The most convenient method to dimension such applications is to use the DriveSize tool.

6.8 Rating plates

The usage of ABB's motors in variable speed applications does not usually require additional rating plates. The parameters required for commissioning the converter can be found from the main rating plate.

6.9 Commissioning the variable speed application

The commissioning of the variable speed application must be done according to the instructions of the frequency converter and local laws and regulations. The requirements and limitations set by the application must also be taken into account.

All parameters needed for setting the converter must be taken from the motor rating plates. The most often needed parameters are:

- nominal voltage
- nominal current
- nominal frequency
- nominal speed
- nominal power

NOTE!

In case of missing or inaccurate information, do not operate the motor before ensuring the settings are correct!

ABB recommends using all the suitable protective features provided by the converter to improve the safety of the application. Converters usually provide features such as (names and availability of features depend on the manufacturer and model of the converter):

- minimum speed
- maximum speed
- acceleration and deceleration times
- maximum current
- maximum torque
- stall protection

7. Maintenance

WARNING!

Voltage may be connected at standstill inside the terminal box for heating elements or direct winding heating.

7.1 General inspection

1. Inspect the motor at regular intervals, at least twice a year. The frequency of checks depends on, for example, the amount of washing cycles per day and their toughness, the type of food in contact with the motors etc. This can initially be determined experimentally and must then be strictly adhered to.
2. Keep the motor clean and ensure free ventilation airflow (for fan cooled motors). If the motor is used in a dusty or very dirty environment with a lot of food debris, the ventilation system must be regularly checked and cleaned.
3. Remove condensed water frequently by unplugging the bottommost drain plug of the motor.
4. Check the condition of shaft seals (the external V-ring) and replace if necessary.
5. Check the condition of connections (by opening the terminal box cover and inspecting the faston connectors) and mounting and assembly bolts. Once opened, check the status of the O-ring seal and in case of damage, replace it. Before closing the cover, apply grease to the O-ring – food grade grease approved by the USFDA must be used.
6. Check bearing condition by checking for any unusual noises, vibration measurements, bearing temperatures, leakages of grease, etc. 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 (H1 food grade grease). The shaft seals have to be replaced with seals of the same quality and characteristics as the originals when changing bearings (food grade rubber seals).

We recommend periodically opening the drain plugs in order to ensure that the way out for condensation is not blocked and condensation is able 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. To do so, first remove the bottom plug and then possibly also the top one for a better evacuation of the condensed water. Check the condition of the O-rings of the removed drain plugs and in case of damage or wear, replace them. Once finished, drain plugs must be tightened ensuring that their O-rings are properly installed in their seats.

7.1.1 Standby motors

If the motor is in standby for a longer period of time on a ship or another vibrating environment, the following measures have to be taken:

1. The shaft must be rotated regularly every two weeks (to be reported) by means of starting up the system. In case a start-up is not possible, for any reason, at the very least the shaft has to be turned by hand in order to achieve a different position once a week. Vibrations caused by other equipment in the vessel will cause bearing pitting which should be minimized by regular operation/hand turning.
2. All vibration must be avoided to prevent bearings from failing. All instructions in the motor instruction manual for commissioning and maintenance have to be followed. The warranty will not cover damage to the windings and bearings if these instructions have not been followed.

7.2 Lubrication

WARNING!

Beware of all rotating parts!

WARNING!

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

Bearing types are specified on the rating plate of all motors.

Bearings are in stainless steel and are permanently greased with H1 food grade grease and do not need regreasing. Bearings are of the type 2Z, 2RS or equivalent. In case of replacement, it is mandatory to use bearings with this kind of grease.

Duty hours for permanently greased bearings at ambient temperatures of 25 °C and 40 °C are:

Permissible radial forces

			Deep groove ball bearings			
			Mounting arrangement IM B3/B5/B14			
			20,000 h		40,000 h	
Motor size	Poles	Length of shaft extension E (mm)	F_{x0} (N)	F_{xmax} (N)	F_{x0} (N)	F_{xmax} (N)
71	2	30	702	631	553	497
	4	30	879	789	691	621
	6	30	1018	915	803	722
80	2	40	768	679	604	534
	4	40	953	843	747	660
	6	40	1086	960	850	751
90	2	50	1080	956	849	752
	4	50	1343	1189	1052	931
	6	50	1529	1354	1196	1059
100	2	60	1054	905	822	706
	4	60	1313	1128	1021	877
	6	60	1535	1318	1201	1031
112	2	60	1048	900	817	701
	4	60	1283	1102	991	851
	6	60	1527	1312	1193	1025
132	2	80	1629	1382	1278	1084
	4	80	1998	1694	1555	1319
	6	80	2342	1986	1835	1556

Data is valid up to 60 Hz.

NOTE!

An increase in the ambient temperature raises the temperature of the bearings correspondingly. The interval values should be halved for a 15 °C increase in bearing temperature and may be doubled for a 15 °C decrease in bearing temperature.

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.

Higher speed operation, e.g. in frequency converter applications, or lower speed with heavy load will lead to less duty hours.

7. Maintenance

7.2.1 Lubricants

WARNING!

Do not mix different types of grease.

Incompatible lubricants may cause bearing damage.

In case of bearing replacement, bearings with H1 food grade grease with the following properties must be used:

- good quality grease with Aluminum complex soap and PAO-oil
- base oil viscosity 150 cST at 40 °C
- temperature range -40 °C – +120 °C, continuously

The above mentioned grease specification is valid if the ambient temperature is above -40 °C or below +55 °C, and the bearing temperature is below 110 °C; otherwise, consult ABB regarding suitable grease.

The above grease is marked as VT378 by SKF

Grease with the correct properties is available from all major lubricant manufacturers. As an example, the following H1 Food grade greases can be used:

- Bechem Berolub FG-H 2 SL
- Mobil Mobilgrease™ FM Series (101, 222)
- Mobil Mobil SHC Polyrex™ Series (005, 221, 222, 462)
- Shell CASSIDA GREASE GTS 2
- Klüber Klüberfood NH1 94-402
- Total NEVASTANE XMF

If other lubricants are used, check with the manufacturer that the qualities correspond to those of the above-mentioned lubricants (H1 Food Grade greases are mandatory).

8. After Sales Support

8.1 Spare parts

Unless otherwise stated, spare parts must either be original parts or otherwise approved by ABB.

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

8.2 Dismantling, re-assembly and rewinding

Motors cannot be rewound.

8.3 Bearings

Special care should be taken with the bearings.

These must be removed using pullers and fitted by heating or using special tools. When replacing a DE bearing, the external gamma ring and the internal simmering must also be replaced.

Bearing replacement is described in detail in a separate instruction leaflet available from the ABB Sales Office.

Any directions placed on the motor, such as labels, must be followed. The bearing types indicated on the rating plate must not be changed.

NOTE!

Any repair by the end user, unless expressly approved by the manufacturer, releases the manufacturer from responsibility to conformity.

Replacing the bearings only without replacing also the external gamma ring and the internal simmering can cause serious damage and loss of IP69 characteristics of the motors.

9. Environmental requirements

Frame sizes 71 to 90 do not have a fan, so their sound pressure level does not exceed 57 dB. Frame sizes 100 to 132 are equipped with a fan, but their sound pressure level does not exceed 69 dB.

At 60 Hz sinusoidal supply, the values are approximately 4 dB(A) higher compared to 50 Hz values.

For sound pressure levels at frequency converter supplies, please contact ABB.

When motor(s) need to be scrapped or recycled, the appropriate means must be used and local regulations and laws followed.

9.1 EU Directive 2012/19/EU (WEEE)

EU Directive 2012/19/EU (WEEE) gives end-users the necessary information on how to treat and dispose of EEE (Electrical and Electronic Equipment) waste after it has been removed from service and is to be recycled.

9.1.1 Marking of the products

Products that are marked with the crossed-out wheeled bin symbol as below and/or the symbol is included in its documentation shall be handled in the following way:



9.1.2 For private households

The crossed-out wheeled bin symbol on the product(s) and / or accompanying documents means that used electrical and electronic equipment (WEEE) should not be mixed with general household waste. For proper treatment, recovery and recycling, please take this product(s) to the designated collection point where it will be accepted free of charge. Alternatively, in some countries, you may be able to return your products to your local retailer upon purchase of an equivalent new product.

Disposing of this product correctly will help save valuable resources and prevent any potential negative effects on human health and the environment, which might otherwise arise from inappropriate waste handling.

Please contact your local authority for further details of your nearest designated collection point.

Depending on your national legislation, incorrect disposal of this waste may incur a penalty in your country.

9.1.3 For professional users in the European Union

The crossed-out wheeled bin symbol on the product(s) and / or accompanying documents means that used electrical and electronic equipment (WEEE) should not be mixed with general household waste.

If you wish to dispose of electrical and electronic equipment (EEE), please contact your dealer or supplier for further information.

Disposing of this product correctly will help save valuable resources and prevent any potential negative effects on human health and the environment, which could otherwise arise from inappropriate waste handling.

9.1.4 For disposal in countries outside of the European Union

The crossed-out wheeled bin symbol is only valid in the European Union (EU) and means that used electrical and electronic equipment (WEEE) should not be mixed with general household waste.

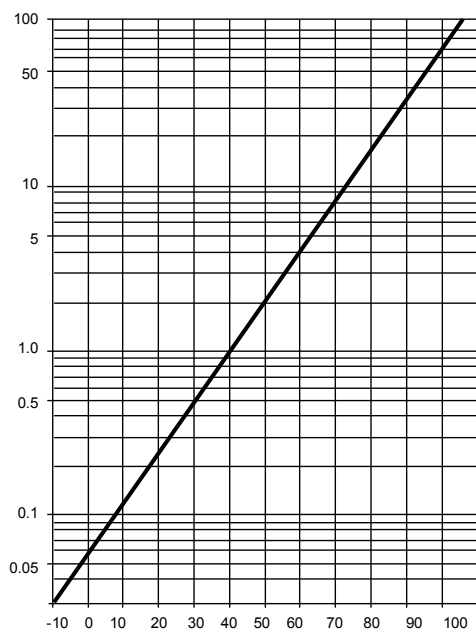
If you wish to dispose of this product, please contact your local authorities or dealer for the correct method of disposal.

Disposing of this product correctly will help save valuable resources and prevent any potential negative effects on human health and the environment, which could otherwise arise from inappropriate waste handling.

10. Figures

Figure 1

Diagram illustrating the insulation resistance dependence from the temperature and how to correct the measured insulation resistance to a temperature of 40 °C.



Key

X-axis: Winding temperature, Celsius Degrees

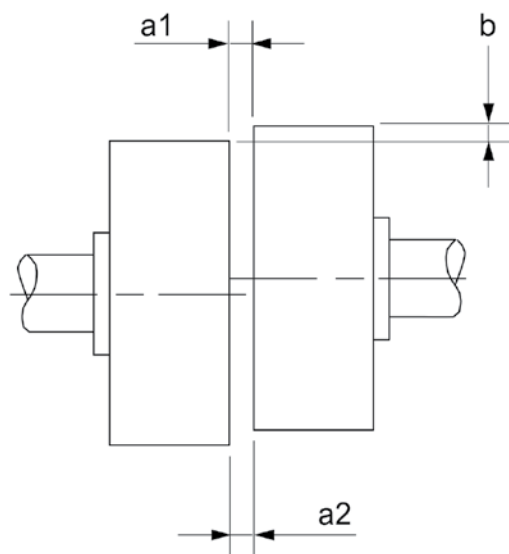
Y-axis: Insulation Resistance Temperature Coefficient, k_{tc}

1) To correct to 40 °C the insulation resistance R_i measured at a given temperature, multiply it by the temperature coefficient k_{tc} at that temperature:

$$R_{i40^{\circ}\text{C}} = R_i * k_{tc}$$

Figure 2

Mounting of half-coupling or pulley



10. Figures

Figure 3

Connection of terminals for main supply

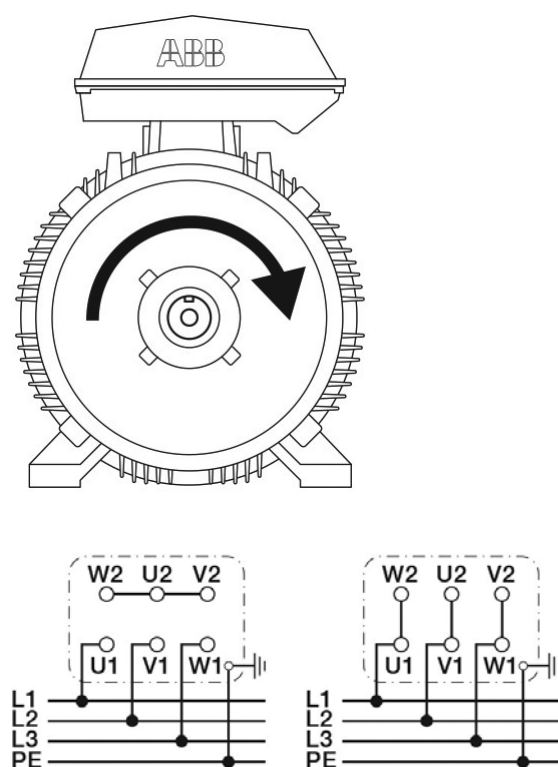
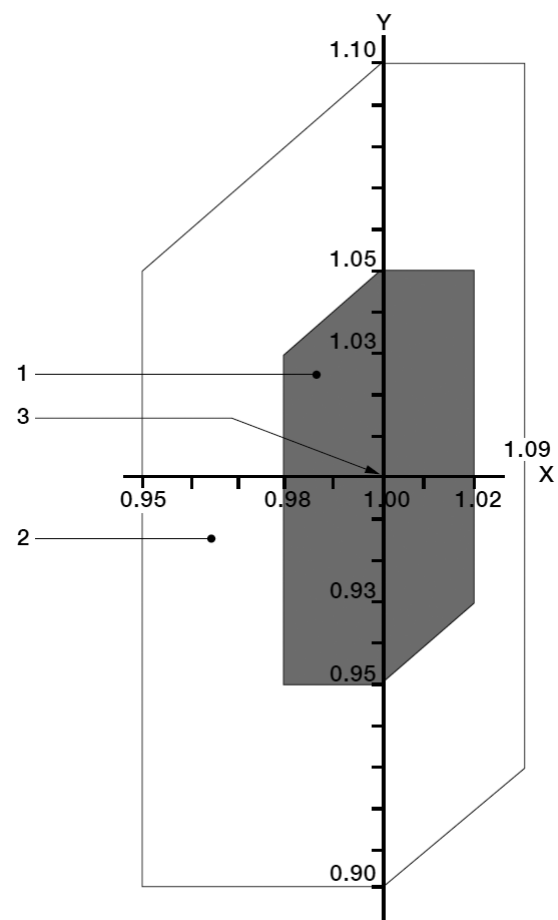


Figure 4

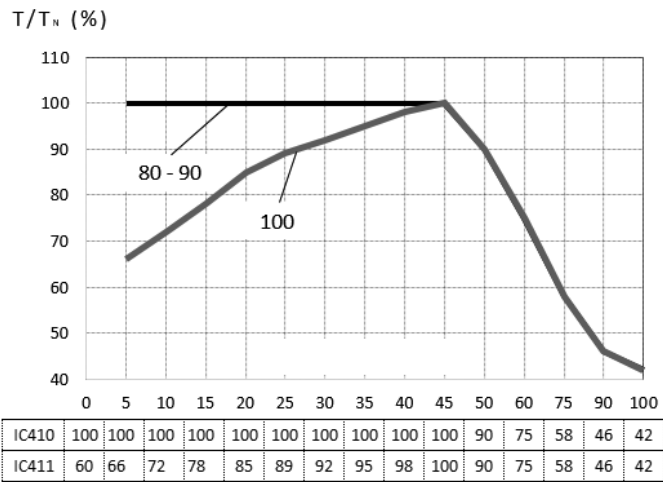
Voltage and frequency deviation in zones A and B



Key

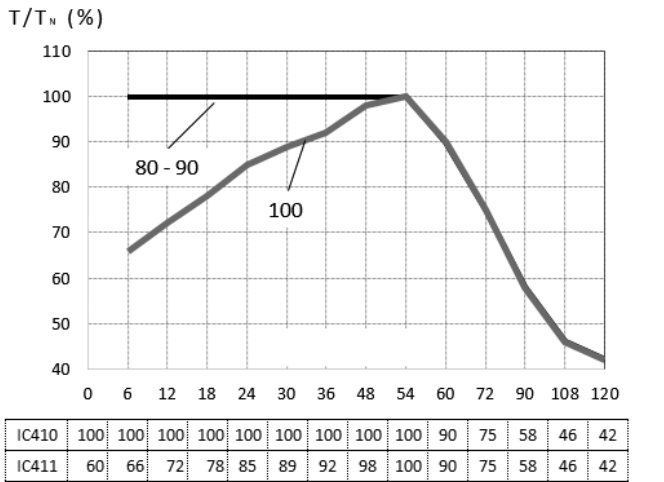
- X axis frequency p.u.
- Y axis voltage p.u.
- 1 zone A
- 2 zone B (outside zone A)
- 3 rating point

Figure 5a
 Converter with DTC control, 50 Hz, temperature rise B
 Guideline loadability curve with converters with DTC control



IC410 Non ventilated natural air flow, IEC frame sizes 80-90
IC411 Self ventilated, IEC frame size 100

Figure 5b
 Converter with DTC control, 60 Hz, temperature rise B
 Guideline loadability curve with converters with DTC control



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For more information and contact details:

www.abb.com/motors&generators