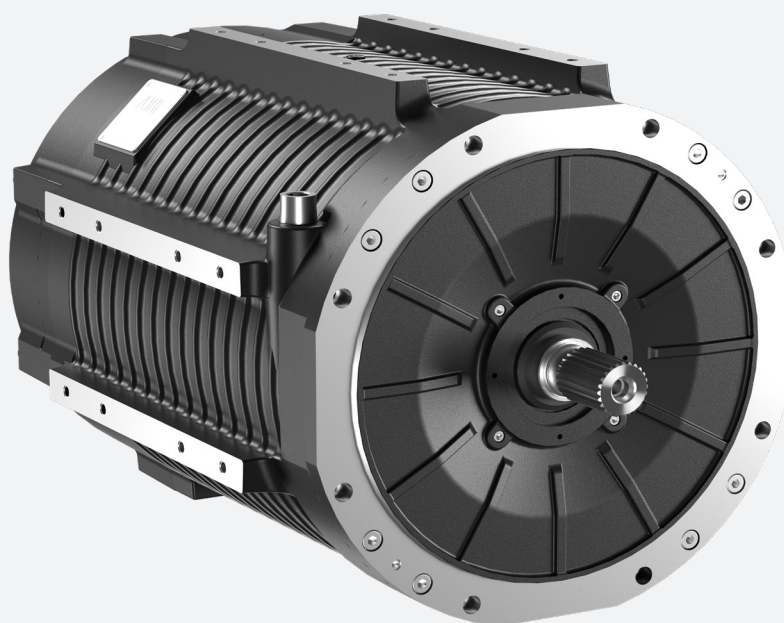


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MANUAL

Motors for heavy electrical vehicles

AMXE250





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1. Introduction

1.1. General

The purpose of this document is to describe general guidelines for installation, maintenance and disposal of the AMXE250 motor.

- Actions shown in this manual are only to be performed by trained personnel authorized by ABB or trained and skilled personnel authorized by the end user.

The actual appearance of the traction motor may vary from the illustrations in this manual, depending on optional features of the product.

Abbreviations and nomenclature used in this manual:

- D-end or DE: that end of the machine which accommodates the shaft end. IEC 411-43-36.
- ND-end or NDE: that end of the machine opposite to the drive end. IEC 411-43-37.
- WARNING: signal word used to indicate a potentially hazardous situation which, if not avoided, could result in death or serious injury.

Symbols used in this manual:



Warning; Electricity, to warn of electricity. Hazard of electric shock.



General warning sign, to signify a general warning. Potential personal injury hazard.



Warning; Magnetic field, to warn of a magnetic field. Hazard for strong magnetic field.



Warning; Hot surface, to warn of a hot surface. Hazard of hot surface(s).



No access for people with active implanted cardiac devices, to prohibit people with active implanted cardiac devices from entering a designated area. Hazard of interference to the operation of or damage to active implanted cardiac devices from equipment generating strong electromagnetic fields.

1.2. Intended application

The motor is primarily intended to be used for heavy electrical vehicle applications, as a traction motor, generator or auxiliary motor. It also fits as propulsion or auxiliary unit in Marine segment. Due to the nature of their electrical and mechanical operating conditions, improper installation or operation, as well as insufficient maintenance, could introduce hazards which could lead to severe bodily injuries or damages to property.

These instructions only consider those measures which must be observed when the motor is being operated in its operative range and in its intended application. The applicable national, local and plant regulations must also be taken into consideration.

1.3. Warranty

The warranty period is 12 months after commissioning but no later than 18 months from the date of notification of being ready for shipment. An extended warranty can be offered on request.

1.4. Information on electromagnetic compatibility

The user must take the following precautions during installation and operation in order not to impair the electromagnetic compatibility.

If it is necessary to replace any anti-interference components, filters or screened cables, the new parts must be identical to the originals.

1.5. Required qualifications for personnel who handle the motor

Installation, operation, maintenance and repair work may only be carried out by mechanically and electrically skilled personnel qualified and properly trained for this work. These persons must be conversant with the motor, that is, they must have completely read and fully understand the relevant chapters of these operating instructions.

1.6. Manual and related documents

- Data sheet, 8AMF500032
- Outline drawing, 3BSM625000-4
- Circuit diagram, 3BSM625000-10

1.7. Safety

The motor is manufactured and intended for use only as prescribed by this manual. Modification, alteration, or lack of maintenance procedures as described in the service manual may adversely affect the safety and efficiency of this device. The manufacturer is not responsible for malfunctions that comprise safety as a result of alteration, use of non ABB replacements parts, neglect or misuse.

Should pre-owned ABB equipment be purchased and reconditioned, the equipment should not be used until testing and analysis demonstrate that the equipment meets the original or upgraded specifications.

The use of solvents as cleaning agents and the use of lubricants can involve health and/or safety hazards. The recommended precautions and procedures stated by manufacturers should be followed.

Non-authorized modifications as well as the use of tools, components and auxiliary components not corresponding to the installation or maintenance instructions exclude any liability of the motor manufacturer.

The traction motor has rotating parts and parts which may be moving even at rest, and possibly hot surfaces.

1.8. Contraindications

The motor is not designed, sold or intended for any use except as indicated above. Furthermore, it is not intended to be used outside of the motor specifications or limitations. The motor must be in good working order without damages caused by improper handling or lack of maintenance according to instructions in this document. .

If technical modifications are considered, they shall always be approved by ABB and be carried out by qualified personnel.

2. Product description

The motor is an AC six (6) pole motor of synchronous type.

The motor features a tailored design, optimized for high energy efficiency and a competitive performance/weight ratio.

The motor is actively cooled by a separate liquid cooling system which is connected to its integrated cooling pipe via inlet and outlet connectors placed on the frame.

Special efforts have been made to decrease harmonic losses, noise and torque pulsations. The insulation system contains corona resistant materials, has low water absorption properties and complies with temperature class H.

Standard features (options are available)

- 3-phase permanent magnet synchronous motor
- Inverter adapted design of active material
- Class H insulation system
- Temperature sensors inside the stator winding
- Rotor balance grade G2.5 according to ISO 21940-11
- Operating ambient temperature between -20°C and +40°C
- Liquid cooled design
- Protection class for the motor, IP66
- Surface treatment, C3-M according to ISO12944-6
- RAL 9005
- Hazardous Voltage Interlock Loop (HVIL) function

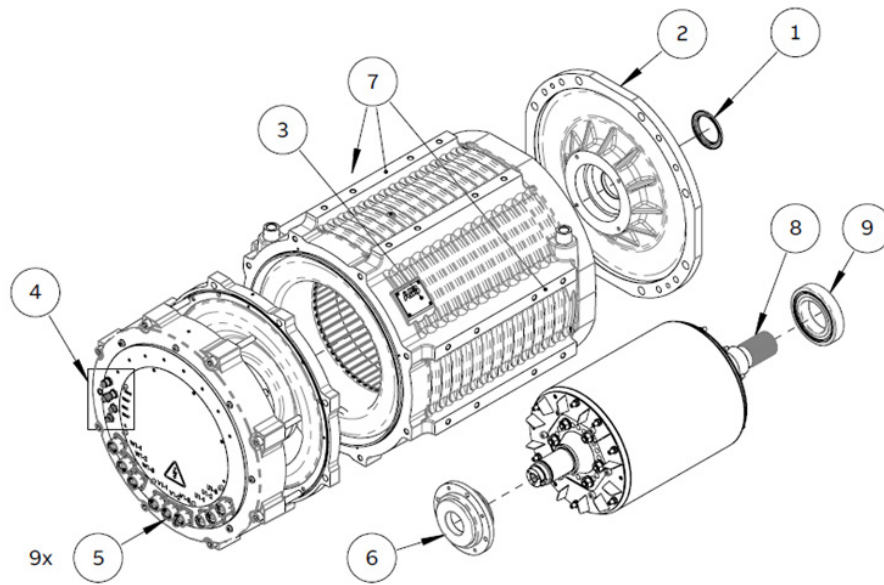


Figure 1. Exploded view of the motor.

Item no.	Designation
1	External shaft seal
2	Flange D-end shield
3	Nameplate
4	Auxiliary connectors
5	Power supply connectors
6	N-end bearing
7	Side mounts
8	Shaft splines
9	D-end bearing

Table 1. Legend to exploded view, Figure 1.

2.1. Technical data

The exact type designation and identification data are shown on the rating plate located on the motor, see Figure 1. An example of a name plate can be seen in Figure 2.

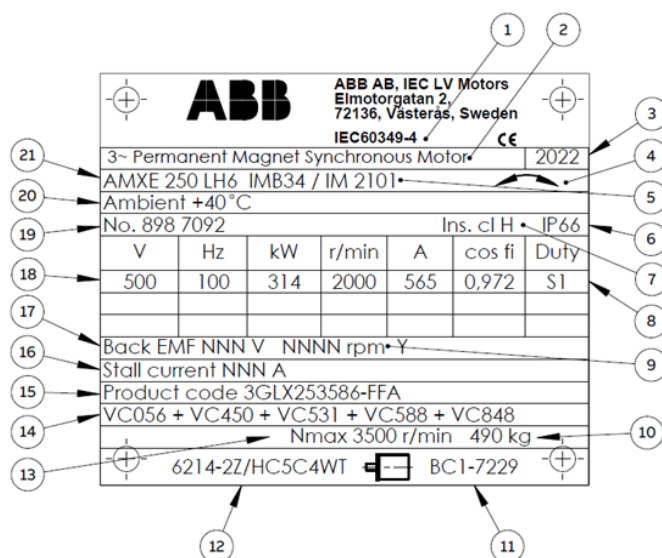


Figure 2. Rating plate example, not to scale.

Position	Explanation
1	Applicable standard
2	Type of motor
3	Year of manufacture
4	Direction of rotation
5	Mounting code according to IEC60034-7
6	Degree of protection according to IEC60034-5
7	Temperature class of insulation system for the motor according to IEC60034-1
8	Defined duty according to IEC60034-1
9	Connection
10	Motor weight
11	N-end bearing
12	D-end bearing
13	Maximum rotational speed
14	Variant codes (options)
15	Product code
16	Stall current ¹
17	Back EMF @20°C and rated speed
18	Rated point
19	Serial number
20	Maximum ambient temperature
21	Type code

Table 2. Explanation of data on rating plate.

2.2. Expected lifetime

The expected lifetime is very dependent on the motor winding and bearing temperatures. The lower the temperature the longer expected lifetime. The insulation system for the motor is class H, which means that the winding temperature should not exceed 180°C. If the winding temperature is kept below this limit, the expected lifetime of the insulation system is at least 20 000 hours. The electrical performance data on the nameplate, see Figure 2, is the continuous operation point (S1). Operating in this point will not compromise the expected lifetime.

In a duty cycle, the rated torque and power on the rating plate could be exceeded short term (peak torque and peak power) as long as the winding temperature does not exceed 180°C.

As mentioned in the product description, the motor is equipped with temperature sensors in the stator winding. In most inverters, it is possible to set a warning limit and a shutdown limit for based on the winding temperature. To not compromise the expected lifetime of the winding, the values in Table 3 are recommended.

Temperature measured by Pt100	Action	Comment
180°C	Warning	Warning and/or derating of motor.
200°C	Shutdown	

Table 3. Recommended temperature limits.

NOTE: The warning and shut down limits are only valid for short term operation. Prolonged operation at high stator winding temperatures will significantly impact the bearing grease lifetime.

The expected lifetime for bearings and external seals is not solely temperature dependent and needs to be evaluated based on the duty cycle. Please contact your local ABB sales office for technical support.

3. Transportation and Storage

3.1. Transportation

3.1.1. Delivery to customer

The traction motor is transported fastened to a pallet. Leave the traction motor on the pallet until it is time to place it in its working place i.e., chassis.

During short term storage, place the traction motor so that it is out of the way of any other goods handling and on a flat, vibration-free surface.

NOTE: When the motor is delivered, the shaft is fixed and secured by a rotor locking device at the D-end of the shaft. The rotor locking device should not be removed as long as the motor remains in storage. Remove the rotor locking device prior to installation of the motor.

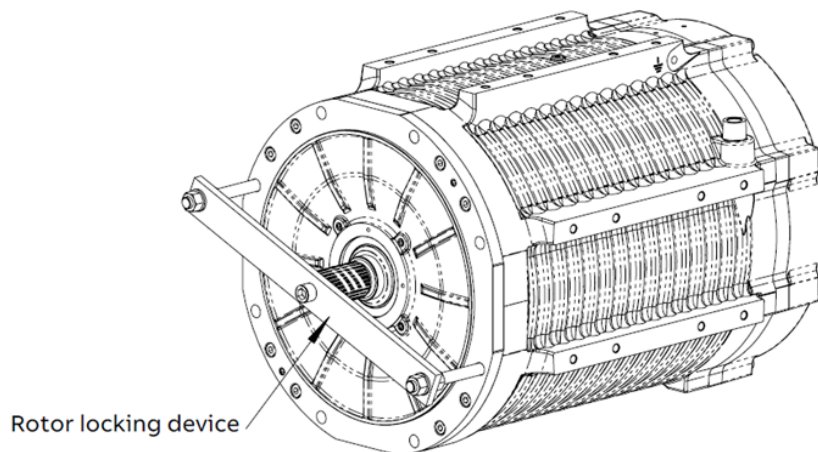


Figure 3. Rotor shaft locking during transportation and storage.

3.1.2. Inspection of delivery

Unpacking should be done carefully in order to avoid damage. The delivery should be checked against the packing list.

NOTE: When the traction motor arrives at its destination, make sure to check the traction motor in order to determine possible transport damage as quickly as possible. Any damage during delivery or deviations from packing list should be entered in a report and the transport company contacted.

If the traction motor has suffered damage during transport or installation, this must be rectified before commissioning.

3.1.3. Lifting of motor

**Warning - Heavy Components**

Risk of personal injury when lifting the motor. The total motor weight is approximately 490 kg. Only skilled and trained personnel should carry out dismantling.

NOTE: The lifting eye bolt are not included in delivery. These lifting components must be dimensioned to handle the motor weight.

NOTE: Check that the used equipment for lifting and lifting hole in the motor are undamaged before lifting. Damaged components must be replaced before lifting.

Lifting must be performed with great care and using appropriate equipment. When lifting the motor, it is important to lift it in a way that does not affect any critical part such as bearings, shaft or connection box.

There are two holes for each allowed lifting setup where the lifting eye bolts should be attached. The positions are shown in Figure 4 below. Always use these holes when lifting the traction motor. See outline drawing for further details.

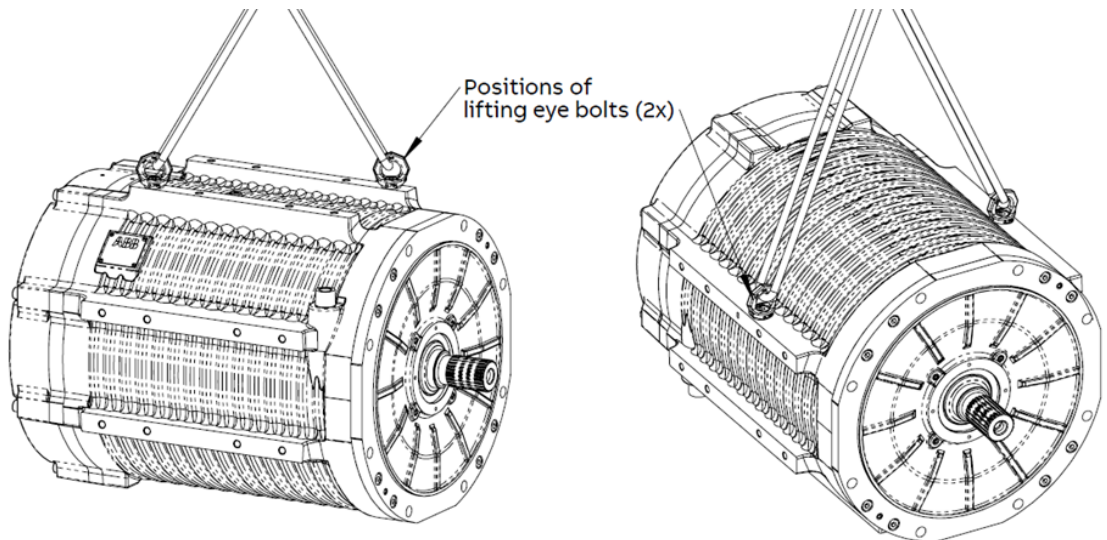


Figure 4. Position of lifting eye bolts.

The angle between the lifting chains shall be maximum 60°, see Figure 5.

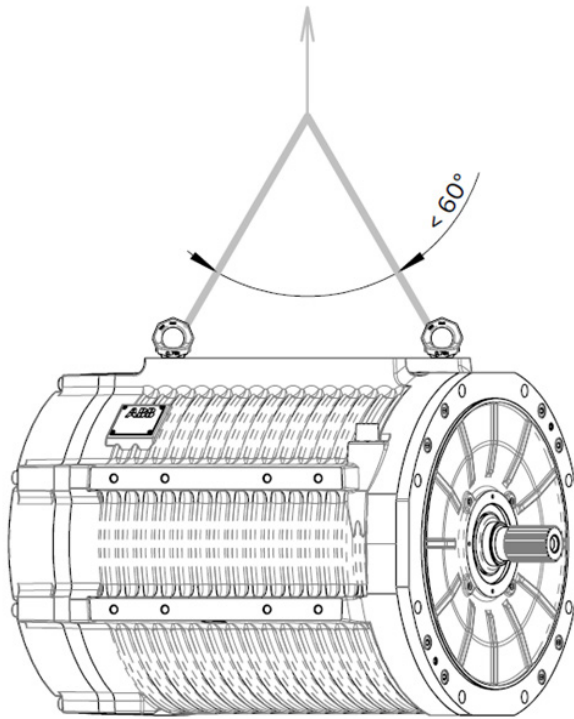


Figure 5. Lifting of the motor.

3.2. Storage

Measures to be taken by the customer or other part:

- The traction motor should be left on the pallet.
- The pallet with the traction motor should preferably be stored indoors and shall be placed on a vibration-free, flat and well-drained surface.
- The pallet with the traction motor should be kept dry, dust-free and protected from rain and moisture.
- The rotor locking device should not be removed as long as the traction motor remains in storage.
- All traction motors leave the factory with an anti-corrosion coating such as Tectyl 506 on the shaft extension and mounting surfaces. The coating should be inspected by the customer and re-applied if necessary.

3.3. Removal of corrosion protection before commissioning

The corrosion protection coating, such as Tectyl 506, must be removed before commissioning. Ensure that corrosion protection coating is removed for mating surfaces, e.g., shaft and flange surfaces. Tectyl 506 can be removed with Tectyl Biocleaner, Tectyl HPS solvent borne thinner, vapor degreasing, a hot alkaline wash or low-pressure steam.

3.4. Insulation resistance check

Measure insulation resistance before commissioning, after long periods of standstill or storage when winding dampness may be suspected.

Insulation resistance should be used as a trend indicator to determine changes in the insulation system. In new motors, the insulation resistance is usually thousands of MΩ and thus following the change of insulation resistance is important to know the condition of the insulation system. Typically, the insulation resistance should not be below 10 MΩ (measured with 500 V DC and corrected to 25°C). If the reference resistance value is not attained, the stator winding is too damp and must be oven dried. Please contact your local ABB sales office for technical support.

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

4. Motor installation

4.1. Preparation and lifting

Remove the rotor locking devices (52, 16, 58, 59, 40) from the ends of the shaft, see Figure 6.

Remove the corrosion protective coating as per chapter 3.3.

Always use the holes for the lifting eye bolts when lifting the traction motor, see chapter 3.1.3 for further details about lifting.

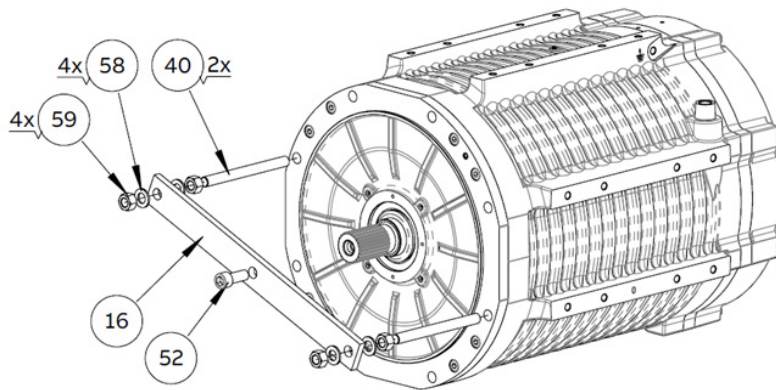


Figure 6. Removing the rotor shaft locking device.

4.2. Installation of coupling

To ensure low noise and vibration levels, the alignment between the motor shaft and the mating coupling must be accurate. The higher the motor operating speed the higher accuracy is needed.

For side support mounting. Some type of flexible coupling shall be used, and the geometrical tolerance demands can differ between type and supplier. See manual from the coupling supplier.

For dimensions involving the motor shaft, flange, and side mounts, see the outline drawing. The product code is visible on the nameplate, see Figure 2.

NOTE: In applications with severe vibrations, only flange mounting is not recommended. Additional side support may be needed. Please contact your local ABB sales office for technical support.

NOTE: Lubricate the splines with a suitable molybdenum disulfide grease prior assembly.

4.3. Installation of motor

The motor is intended to only be installed in horizontal direction. For dimensions involving the motor flange and side mount interfaces, see the outline drawing. Threaded holes are provided with thread inserts to increase the mechanical properties. The motor can either be mounted by flange or using the side mount interfaces.

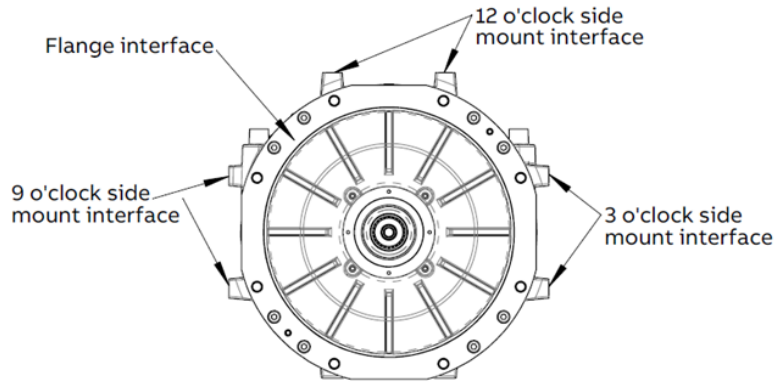


Figure 7. Available installation interfaces seen from D-end.

NOTE: Please contact ABB sales office for technical support if any doubts regarding the installation of the motor.

NOTE: It is advisable to apply thread locking (Loctite 243 or similar) when installing the motor.

4.3.1. Flange mount

The motor can be installed by using the flange provided at D-end. Threaded holes have insert Helicoil plus free running 4130 016 0032 (M16). See outline drawing for further details.

4.3.2. Side mounts

For side mount interfaces, see Figure 7. There are threaded M12 holes along the sides of the motor at 3, 12 and 9 o'clock. The threaded holes have insert Helicoil plus free running 4130 012 0024 (M12). See outline drawing for further details.

The alignment between the side support and the mating surfaces must be accurate in order to not damage the structure of the motor and enable the screw joint for the mating to function as intended.

To ensure that the structure of the motor is not damaged and that screw joints is to function as intended, the alignment between the side support and the mating surfaces must be accurate. Max allowed gap between D-end and N-end for one side support is 0,1mm. Suitable shims can be applied to achieve max allowed gap.

4.3.2.1. Side mounted

Both 3 o'clock and 9 o'clock side mount interfaces of the motor must be used if the motor is to be hung by using side mounts.

4.3.2.2. Bottom mounted

The motor may be turned and mounted with the 12 o'clock side mount interface facing downward.

4.4. Liquid cooling system installation

Remove the protective covers from the cooling inlet and outlet threads (internal ISO 228 - G 1/2") and install the mating cooling connectors, see Figure 8. To prevent leakage, it is advisable to use a mating cooling connector equipped with an O-ring seal and apply thread sealant (Loctite 577 or similar) in the internal thread.

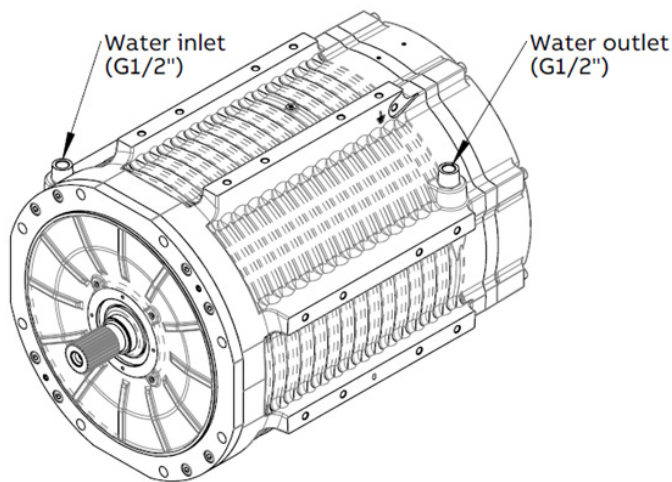


Figure 8. Position of liquid cooling inlet and outlet.

Recommended coolants are ethylene glycol based such as Antifrogen® N from Clariant or propylene glycol based mixed with water. The motor design is intended for a mixture of 50% / 50%. Max allowed pressure is 4 bar at inlet connection.

NOTE: Coolants might be a toxic compound. Use correct personal safety equipment and avoid exposure to the coolant.

NOTE: Ensure that the specified data on the separate rating plate, see Figure 3, is fulfilled before operating the motor.

4.5. Electrical installation



Warning – High Voltage

Touching a live motor connection causes serious injuries or death.

The motor needs an inverter to operate. The inverter must be able to supply 3 phase AC current and be capable of controlling the motor. The motor has been tested and optimized together with the ABB HES880 inverter. An inverter with a different control strategy, switching frequency and pulse pattern might have an impact on the motor performance. For more information about the HES880 inverter, please contact your local ABB sales office.

The motor is equipped with connectors. Types and quantities of the connectors is depending on applicable options of the motor. Figure 9 shows an overview of the electrical connection interfaces and additional details in Table 5. Please see circuit diagram 3BSM625000-10 for full details.

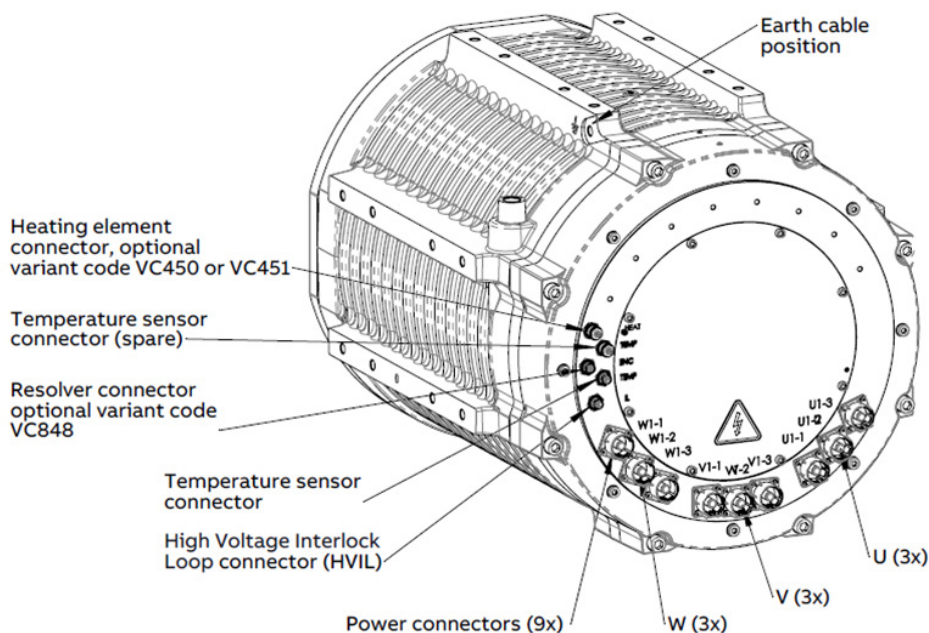


Figure 9. Motor electrical connection interfaces.

Connector description	Type of connector	Comment
Temperature sensor	M12 male, 4-pole, B-coded	
Temperature sensor (spare)	M12 male, 4-pole, B-coded	
Heater	M12 male, 2-pole, B-coded	Optional variant code
Resolver	M12 male, 8-pole, A-coded	VC450 or VC451
High Voltage Interlock Loop (HVIL)	M12 male, 4-pole, B-coded	Optional variant code VC848
Power connectors (3x), phase U	PLOOU-301-90M8	
Power connectors (3x), phase V	PLOOV-301-90M8	
Power connectors (3x), phase W	PLOOX-301-90M8	
Earth point	Threaded hole M12, depth 18	

Table 4. Electrical connectors.

4.5.1. Connection of power supply

Make sure that the traction motor is disconnected from power supply prior to connection or disconnecting the power supply connectors. Installing power voltage at U-V-W will rotate traction motor clockwise, facing traction motor shaft from D-end.

Make sure that all cable connections are installed in appropriate way and suitable for high frequency currents. There are three power connectors for each phase (U, V, W). All nine power connectors must be connected to power cables when setting the power supply to ON. See “Power connectors”, “U”, “V” and “W” in Figure 9.

NOTE: Ensure that the motor is disconnected from power supply prior to connecting or disconnecting the high voltage power connectors.

NOTE: The power supply connectors within a phase are not unique and can be connected to any matching phase on the inverter.

The type of mating power connectors can be straight or right-angled (90°), see Figure 10. It is recommended that the power supply cables are supported by cable cleats or similar in order to reduce the stress at the connectors.

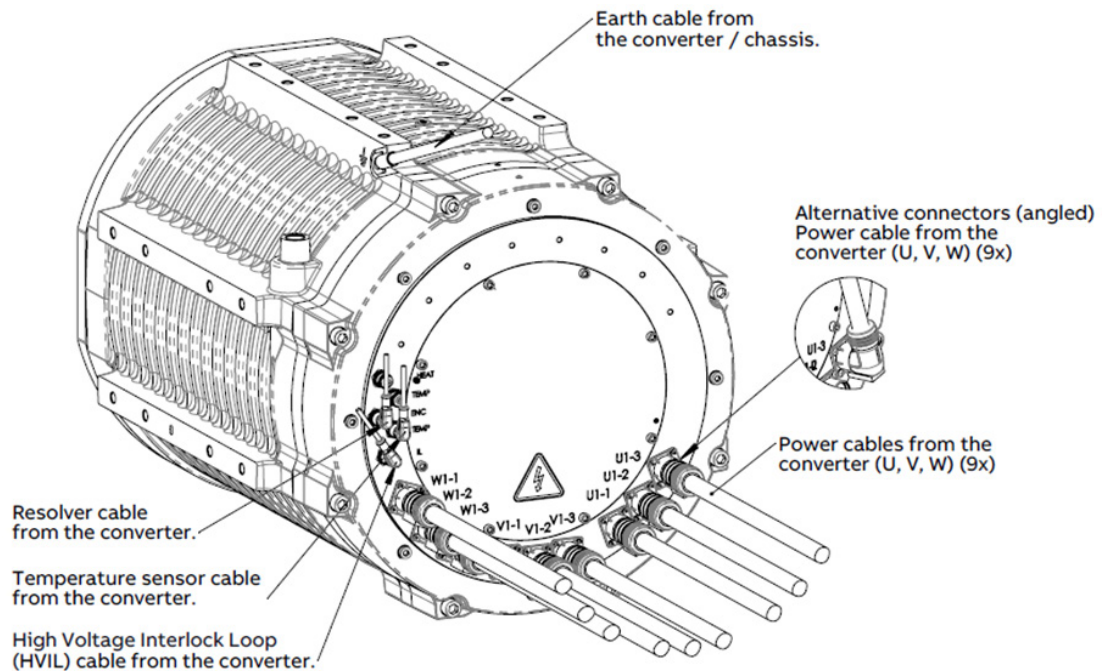


Figure 10. Example of typical cable arrangement.

Typical way of connecting the mating power connectors is as following.

1. Open its latch by pushing the color-coded plastic part forward and down
2. Gently push it into the connector on the terminal box
3. Close the latch
4. See supplier instructions for further details.

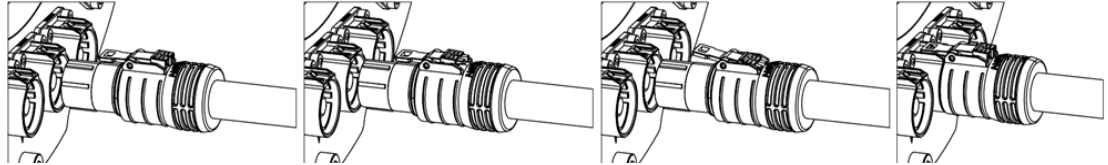


Figure 11. Connecting the mating power connectors to the motor.

NOTE: The mating power connectors are also available as an over-molded option.

NOTE: Ensure that all cable connections are installed in an appropriate way and are suitable for high frequency currents.

4.5.2. Earth point

A dedicated earth point is located on the motor, see Figure 9.

The earth cable from the inverter or vehicle chassis must be installed in an appropriate way and be suitable for high frequency currents.

NOTE: Ensure that the dedicated surface on the earth point is free from paint and dirt to ensure a good connection

4.5.3. Auxiliary connection

The motor is equipped with a number of auxiliary M12 connectors. Number and type as per applied options to the motor. See Figure 12 for positions of the connectors and Table 5. Please see circuit diagram 3BSM625000-10 for full details of type and pin configurations.

NOTE: Ensure that M12 connectors are connected with a mating connector or with the M12 protection caps. Otherwise, the motor IP class will be compromised.

NOTE: Ensure that the protection class of the selected mating low voltage connector is equal to or better than the motor protection class.

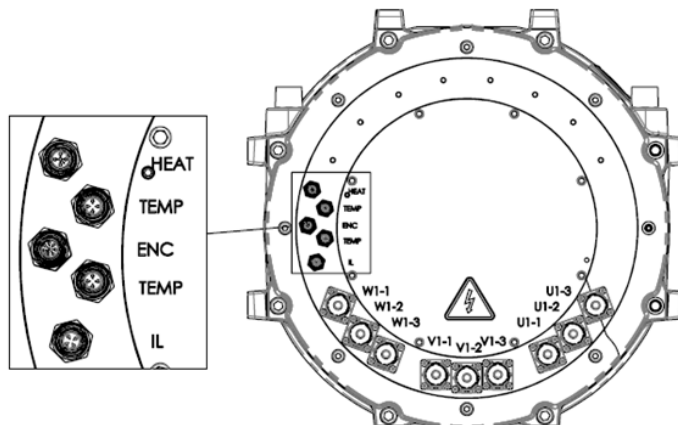


Figure 12. Auxiliary connectors, motor seen from N-end.

5. Operation

The motor is designed for the following ambient conditions:

- Operating ambient temperature between -20°C and +40°C
- Maximum altitude 1000 m above sea level without derating
- Maximum relative humidity 95%
- Shock loads +/-10g in XYZ direction
- Vibration loads +/- 1,5g in XYZ direction

The motor can only be used in applications for which it is intended. The electrical performance data are shown on the nameplate, see example in Figure 2, and are only valid if the requirements of the liquid cooling system, given in 4.4, are fulfilled. In addition, all requirements of this manual and related instructions and standards must be followed.

If these limits are exceeded, electrical performance data and mechanical integrity must be verified. Please contact ABB for further information.

NOTE: If the motor is equipped with heating elements in the winding, ensure they are electrically connected and powered to prevent possible condensation during standstill.

5.1. Failure mode operation

Although not recommended, the motor may operate for a short term in failure mode operation if this is unavoidable or in an emergency as long as the sensors monitoring the stator winding temperature are still functional and the limits in Table 3 are not exceeded. A typical failure mode operation is if the liquid cooling system fails temporarily. Operating in failure mode operation may lead to permanent damage to the motor. However, it is not advisable to tow the vehicle without first disconnecting the motor from the wheels. When connected to the wheels, voltage can be generated which can be harmful to the motor and other components in the system, this is valid even if the motor is suspected to be damaged or defective.

If the temperature sensors are not functional, please contact ABB before proceeding.

6. Inspection and maintenance

Carefully planned and carried out service and maintenance of the motor helps to maintain high reliability of the motor and avoid consequential damages. The use of recommended parts and tools is essential to warrant the correct servicing of the motor. Special tools, devices, liquids and lubricating media are necessary.



Warning – High Voltage

Touching a live motor connection causes serious injuries or death. Put the vehicle to earth properly.



Warning - hot surfaces

Risk of burns caused by hot components.

Wait for hot components to cool down before starting the work.



Warning - pressure

The liquid cooling system may be pressurized.



Warning-Magnetic field.

Hazard for strong magnetic field.



Prohibition – limited access

No access for people with active implanted cardiac devices (pacemaker).

NOTE: Only skilled and trained personnel should carry out maintenance.

When carrying out any work on electrical conductors the local rules and regulations are to be observed. Non-observance of these could result in severest bodily injury or to loss of life.

Prior to maintenance the following points are to be conscientiously carried out:

1. Switch off all circuits feeding the traction motor such as the main power supply.
2. Ensure all power is secured against unauthorized reconnection.

6.1. Inspection and maintenance intervals

NOTE: The need for maintenance can vary depending on local conditions.

It is important to follow the recommendations to ensure a fully working motor.

Action	Interval	Chapter
Visual inspection	Weekly	
Detailed visual inspection	1500 h in operation or every 6 months *	
Bearings	3000 h in operation or every 12 months *	
External shaft seal	3000 h in operation or every 12 months *	
Shaft spline	3000 h in operation or every 12 months *	
External cleaning	3000 h in operation or every 12 months *	

*Whichever comes first.

Table 5. Inspection and maintenance intervals

6.2. Inspection and maintenance actions

6.2.1. Visual inspection

The purpose of the visual inspection is to do a quick check to see whether problems are beginning to develop before they can cause failures and unscheduled maintenance breaks.

The visual inspection shall include the following areas:

1. Listen for any abnormal noise or increased vibrations
2. Verify that the liquid cooling system connections for inlet and outlet are free from dust or any parts that block the flow. If required, clean the inlet and outlet areas.

Check that there are no fluid leakages. The pressure drop may not exceed 1 bar.

3. Verify that the temperature sensors in the stator winding are functioning properly

NOTE: If there is a potential safety risk, inform management and take necessary emergency measures.

6.2.2. Detailed visual inspection

The purpose of the detailed visual inspection is to do a check to see whether problems are beginning to develop before they can cause failures and unscheduled maintenance breaks.

The detailed visual inspection shall include the following areas:

1. The points described in 6.2.1.

2. Look for any visual damage to the structure of the motor such as cracks in the structure and corrosion in screw joints, etc. If external damage to the motor is observed and to such an extent that it prevents operation or represents a safety risk, replace the motor as soon as possible.
3. Verify that the earth connection is correct, re-assemble if necessary
4. Check the condition of low and high voltage connectors, replace if necessary

NOTE: If there is a potential safety risk, inform management and take necessary emergency measures.

6.2.3. Bearings

The bearings, see Figure 1, are lifetime lubricated and require no maintenance. Listen for any abnormal noise or increased vibration from the bearings and contact your local ABB sales office if such exist. The expected lifetime of the grease inside the bearing is dependent on the motor duty cycle and external loads. The lower the bearing temperature and operational speed and torque, the longer the expected grease and bearing life.

6.2.4. External shaft seal

The motor is equipped with an external shaft seal on the D-end, see Figure 1. The expected lifetime of the seal is dependent on the motor duty cycle and the external environment. Check for wear and replace if necessary. A damaged external shaft seal might compromise the IP class of the motor.

NOTE: The external shaft seal should never run dry, lubricate if necessary.

6.2.5. Shaft spline

Inspect the shaft splines, see Figure 1, to ensure no excessive wear has occurred, and apply a suitable molybdenum disulfide grease to the splines. See 4.2 for further information.

6.2.6. External cleaning

External cleaning can be carried out when necessary when mounted in vehicle and at revisions.

As a basic rule, a mechanical process (scraper, compressed air) should be carried out first and when necessary.

NOTE: External cleaning when the motor is mounted in vehicle, when necessary, is to be carried out with dielectric fluid, like FAST-ECO (manufacturer: Smyth Morris). (Cleaning with water may introduce a risk of rust and damage to the interior of the motor).

NOTE: It is recommended that external cleaning during revisions is carried out with water and a detergent like NEUTRA-PON (manufacturer: Henkel) or similar alkaline detergent. When using alkaline detergents, it is very important to rinse off all detergent thoroughly.

**Warning - pressure**

May introduce a risk of particles entering the eyes or skin. Use protective glasses and gloves. Follow the instructions from the manufacturer.

**Warning – chemicals**

May cause serious damage to the lungs if consumed. Dries out the skin. Use protective glasses and gloves.

The pressure must not exceed 600-800 kPa.

NOTE: Do not aim the nozzle toward your skin or toward any other person.

NOTE: Do not hold the nozzle too close to the surface, a minimum of 80 cm from the surface of the motor.

Caution must be taken during cleaning so that liquid is not forced inside the motor. Do not direct the nozzle directly toward the following areas of the motor:

- The external shaft seal.
- Connectors, connection box and edges around connection box cover.

6.2.7. Touch-up painting

The motor is painted with corrosion resistant paint, color RAL 9005. Temabond ST300 is recommended if touch-up painting is necessary. Touch-up painting procedure as below:

- Remove loose, flaking or cracked paint layers by appropriate means. The surface must be clean, dry and free of greases and oils.
- Cover all non/painted areas with tape or other means.
- Apply with an airless spray.

7. Spare parts and consumables

Spare parts and consumables must be stored in a vibration-free, dry, moisture and dirt-free storage. The spare parts must be stored in a heated room where the temperature variations are small.

7.1. Spart parts

Spare parts must meet the requirements defined by ABB. The warranty is only valid if recommended spare parts are used.

For information on price and delivery times, please contact your local ABB sales office

7.2. Consumables

Following consumables are foreseen to be needed.

Type	Description	ABB Part number
Tectyl 506	Corrosion preventive compound	12410011-108
Temabond ST300	Fast drying single coat alkyd paint	
FAST-ECO	Dielectrical fluid for cleaning	
NEUTRA-PON	Alkaline detergent for cleaning	
Loctite 243	Fastener Locking Liquid	12690014-429
Loctite 577	Thread sealant	

Table 6. List of foreseen consumables.

8. Trouble shooting

Instructions to determine the cause of abnormal behavior or failure conditions and proposed corrective measures.

Should abnormal behavior arise when starting or operating the motor, the cause should be determined and eliminated immediately, whereby prompt action can often avoid serious damage. In case of phenomena which cannot be satisfactorily explained, please contact your local ABB sales office for further clarification.

Use the guidelines below for trouble shooting.

Mechanical failures		
Failure	Possible cause of failure	Corrective action
Motor is vibrating and generating abnormal noise.	Damage bearing.	Please contact ABB for further instructions.
Motor starts with scraping noise.	Foreign particles in the air gap.	Please contact ABB for further instructions.
Motor starts with abnormal permanent scraping noise.	Rotor and stator touch each other in the air gap.	Please contact ABB for further instructions.
Motor is abnormally hot also at no load.	Liquid cooling system is out of order.	Check liquid cooling system's functionality.
High vibrations at run out.	Too high residual unbalance.	Please contact ABB for further instructions.
Bearing failure during normal operation.	Misaligned total driving axle system.	Check the alignment, make corrections, and contact ABB for further instructions.
Motor does not start at load, normal magnetic noise.	Load torque too high.	Uncouple the motor and test it separately at no load, compare the results with other motors tested at no load.
Shaft torque disappear.	Coupling or shaft failure.	Take the motor out of them chassis. Investigate the shaft and coupling. Replace defect component.

Table 7. Mechanical failures.

Electrical Failures		
Failure	Possible cause of failure	Corrective action
Motor does not start, no current, no noise.	Interruption on at least two phases. (Open circuit)	Measure the resistance between the phases to investigate if the stator is damaged. If the stator is damaged, please contact ABB for further instructions.
Motor starts with a continuous hum.	Interruption on one phase. (Open circuit)	Check the incoming cables. Measure the resistance for each phase. If the stator is damaged, please contact ABB for further instructions.
Motor starts with the wrong direction of rotation.	Wrong phase sequence on the incoming cables.	Check the phase sequence for the incoming cables.
Motor generates an abnormally high noise level.	Can be caused by mechanical or electrical interference.	Switch off the electrical feed. If the noise remains, it is a mechanical fault. If not, it is an electrical fault.
Motor current is abnormally high.	Fault in the stator winding.	Measure the winding resistance between the stator terminals.
Motor has different phase currents and gets high temperatures.	Asymmetrical feeding.	Check the similarity of the phase voltage on the incoming cables.
Motor gets an abnormally high phase current and high temperature, also at no load.	Wrong incoming voltage level.	Correct the incoming voltage levels.
Smoke appears from the motor.	Fire after flash-over or short circuit in a part of the stator winding.	Disconnect the motor, remove it. Rewinding is most likely necessary, please contact ABB for further instructions.
Motor current is abnormally high.	Demagnetized rotor magnets.	It's possible to continue the operation with reduced performance. The rotor should be replaced to obtain full performance, please contact ABB for further instructions.
Insulation resistance below 10 M Ω .	The stator winding is too damp.	Check for any defect components (covers, seal etc.). The stator winding must be oven dried, please contact ABB for further instructions.

Table 8. Electrical failures.

9. Waste disposal and recycling

In most countries the permanent magnets are not considered as hazardous waste and thus the motor can usually be disposed in the same manner as an induction motor. Please check the local laws and regulation and contact your local ABB sales office for more information.



10. Final comment

If you have any questions regarding environmental matters not taken up in this instruction, please contact the ABB after sales.

Appendix Installation check list

Installation date	Motor serial number

	YES	NA
General		
Has the manual been read and understood?	<input type="checkbox"/>	<input type="checkbox"/>
Has the motor been stored according to what is described in the manual?	<input type="checkbox"/>	<input type="checkbox"/>
Are suitable and correct personal safety equipment available?	<input type="checkbox"/>	<input type="checkbox"/>
Are appropriate lifting eye bolts available?	<input type="checkbox"/>	<input type="checkbox"/>
Mechanical installation		
Have the vibration levels in the application been considered when selecting a mechanical installation?	<input type="checkbox"/>	<input type="checkbox"/>
Are the concentricity and perpendicular tolerances for the mating shaft and flange fulfilled?	<input type="checkbox"/>	<input type="checkbox"/>
Are the requirements for the mating surfaces for side support mounting fulfilled?	<input type="checkbox"/>	<input type="checkbox"/>
Have all bolts been tightened with the correct tighten torque?	<input type="checkbox"/>	<input type="checkbox"/>
Has thread locking been applied to the bolts?	<input type="checkbox"/>	<input type="checkbox"/>
Has the spline been lubricated with a suitable molybdenum disulfide grease?	<input type="checkbox"/>	<input type="checkbox"/>
Liquid cooling system installation		
Are recommended mating cooling connectors used?	<input type="checkbox"/>	<input type="checkbox"/>
Is a recommended coolant used?	<input type="checkbox"/>	<input type="checkbox"/>
Are the requirements of the liquid cooling system according to the separate rating plate fulfilled?	<input type="checkbox"/>	<input type="checkbox"/>
Electrical installation		
Are the mating HV power connectors the correct type?	<input type="checkbox"/>	<input type="checkbox"/>
Is the motor properly grounded?	<input type="checkbox"/>	<input type="checkbox"/>
Are all cable connections installed in an appropriate way and suitable for high frequency currents?	<input type="checkbox"/>	<input type="checkbox"/>
Are the mating LV connectors the correct type?	<input type="checkbox"/>	<input type="checkbox"/>
Motor protection		
Are correct temperature warning limits implemented in the inverter?	<input type="checkbox"/>	<input type="checkbox"/>
Are correct overspeed limits implemented in the inverter?	<input type="checkbox"/>	<input type="checkbox"/>
Are performance derating strategies implemented due to high temperature?	<input type="checkbox"/>	<input type="checkbox"/>
Are peak current limitations included in the inverter?	<input type="checkbox"/>	<input type="checkbox"/>



For more information and contact details:

www.abb.com/motors&generators