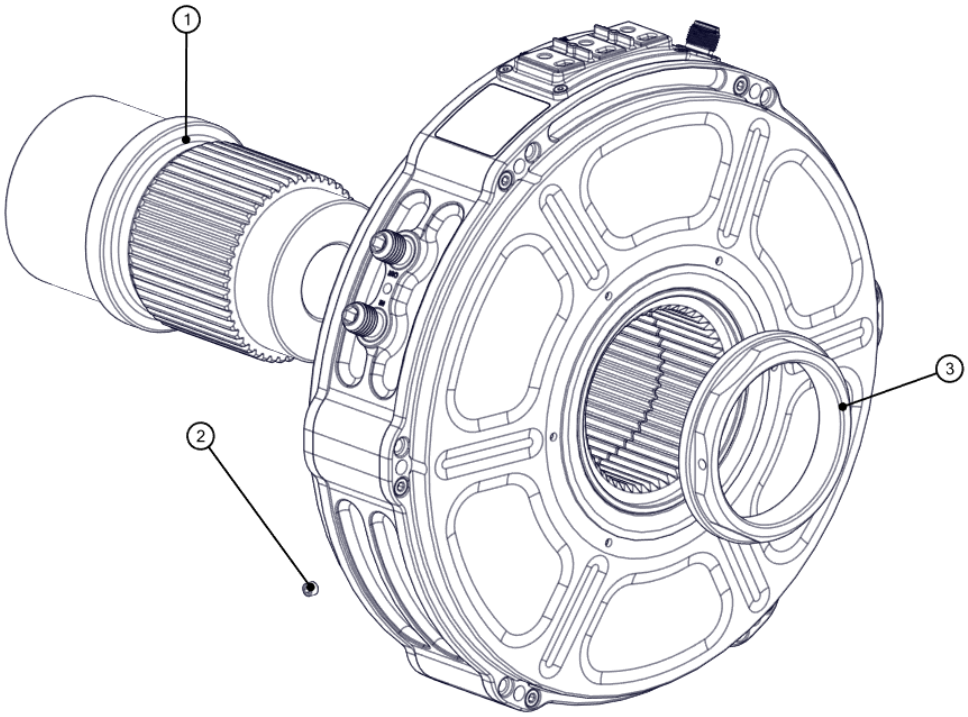
NSRUK

Motor Installation and Maintenance Manual



All data found in this manual is subject to change without notice.

Notes:

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1. Contents

2. General information

2.1. How to properly use this manual

This installation and maintenance manual has been written to assist the user with proper procedures when handling, installing, operating, and maintaining the equipment. All the safety warnings and instructions in this book must be followed to prevent injury to personnel.
This manual must be kept for future reference during installation, operation, and maintenance.

2.2. Safe motor operation information


WARNINGS: High voltage and rotating parts can cause serious or fatal injuries. Qualified personnel should perform installation, operation, and maintenance of electrical machinery. For equipment covered by this instruction book, it is important to observe safety precautions to protect personnel from possible injury. Be sure to keep the installation and maintenance information for future reference. All warning and cautions must be followed.

Installation
• Avoid contact with energized circuits and rotating parts.
• Avoid bypassing or rendering any inoperative safeguards or protective devices.
• Avoid use of automatic-reset thermal protection where unexpected starting of equipment might be hazardous to personnel.
• Avoid contact with capacitors until safe discharge procedures have been followed.
• Be sure the motor shaft key is captive before the motor is energized.
• Avoid long exposure near machinery with high noise levels.
• When the motor is coupled to equipment, ensure that system vibrations are within acceptable limits (per ISO 10816-1) to avoid failure of the motor.
• Use proper protective gear, care, and procedures when handling, lifting, installing, operating and maintaining the motor.
• If eyebolts are used for lifting motors, they must be securely tightened, and the direction of the lift must not exceed a 15° angle from the shank of the eyebolt.
• Do not use the motor shaft as a means for lifting.
• Do not lift both the motor and driven equipment with the motor lifting means.
• Do not stand on or place objects on the motor.

Maintenance
Safe maintenance practices performed by qualified personnel are imperative. Before starting maintenance procedures, be positive that:
• Equipment connected to the shaft will not cause mechanical rotation.
• Main motor windings and all accessory devices associated with the work area are disconnected from electrical power sources.
• The motor has been given time to cool.

Failure to properly ground the frame of the motor can cause serious injury to personnel. Grounding should be in accordance with National and local Standards and consistent with sound practice.

These instructions do not purport to cover all the details in motors nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired, or should problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to ASRUK directly.

2.3. Intended use

Electrical motor will convert electrical energy into mechanical rotating energy or vice versa. Its primary usage is found in automotive, but not limited to. The motors can also be used for other traction application, aviation, energy recuperation, … If your intended use differs from standard applications seen on company website, please contact ASRUK support about its appropriate usage.

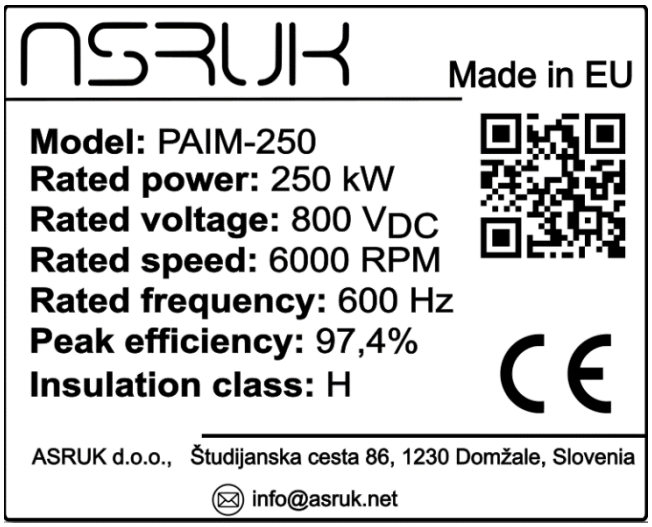
2.4. Operating ceiling

The electric motor can operate in ambient temperatures between -40 to +60^{o}C. The maximum motor temperature allowed as recorded by internal temperature sensor is 120^{o}C.

The maximum service ceiling is 6,500 m (21,300 ft).

2.5. Description of nameplate

Motor rating and identification data are furnished on labels and nameplates. Packing nameplates provide a permanent record of motor characteristics, plant identification and date of manufacture. Below is an example of a label that is attached to the shipping package:



2.6. Serial number

Every motor that is manufactured by ASRUK has a model and a serial number, which are permanently marked on the motor nameplate. When contacting ASRUK please provide the serial number and configuration of the motor.

2.7. Delivery

Prior to shipment, all motors are factory-tested and balanced. They are wrapped in protecting wrap and packed in boxes or bolted to a wooden base. Upon receipt, we recommend careful handling and a psychical examination for damage which may have occurred during the transportation.

In the event of damage and to guaranty insurance coverage, notify the sales office or support email with picture evidence, without delay.

2.8. Storage

When motors are not immediately installed, they should be stored in their upright position in a dry, temperature-controlled place, free of dust, gasses, and corrosive atmospheres. Other objects should not be place on or against them. Motors stored over long periods are subject to loss of insulation resistance and oxidation of the bearings.

Bearings deserve special attention during prolonged periods of storage. Depending on the length and conditions of storage it may be necessary to change rusted bearings. The weight of the rotor in an inactive motor tends to expel grease from between the bearing surfaces thereby removing the protective film that impedes metal-to-metal contact. As a preventive measure against the formation of corrosion by contact, motors should not be stored near machines which cause vibrations, and every 3 month their shafts should be rotated manually. Check the motor for smoothness of operation before first stars, if necessary, contact ASRUK support.

Insulation resistance fluctuates widely with temperature and humidity variations and the cleanliness of components. When a motor is not immediately put into service it should be protected against moist, high temperatures and impurities, thus avoiding damage to insulation resistance.
If the motor has been in storage more than six months or has been subjected to adverse moisture conditions, it is best to check the insulation resistance of the stator winding with an insulation tester. If the resistance is lower than 1 Giga-ohm the windings should be dried in one of the two following ways:

1) Bake in oven at temperatures not exceeding 90 ^{o}C until insulation resistance becomes constant.
2) With rotor locked, apply low voltage, and gradually increase current through windings until temperature measured with thermometer reaches 90 ^{o}C. Do not exceed this temperature.

If the motor is stored for an extensive period, the rotor must be periodically rotated. In case the ambient conditions are very humid, periodical inspection is recommended during storage.

2.9. Handling

Raising and moving of the motors should be steady and jointless, otherwise bearings may be harmed.
Motor connectors, moving parts or cables, should not be used to lift the motor. The motor should be lifted by a sling around the rotor, or via an X-bracket attached to it. Take care, not to damage the sensors or connectors during manipulation.

In case of unbalanced loads (such as couplings or other attachments), additional slings or other effective means should be used to prevent tipping.

3. Motor installation

3.1. General space requirements

Electric machines should be installed to allow an easy access for inspection and maintenance. Should the surrounding atmosphere be humid, corrosive or contain flammable substances or particles, it is essential to ensure an adequate degree of protection. The installation of motors in environments where there are vapours, gases or dusts, flammable, or combustible materials, subject to fire or explosion, should be undertaken according to appropriate and governing codes, such as NEC Art. 500 (National Electrical Code) and UL-674 (Underwriters Laboratories, Inc.) Standards.

Under no circumstances can motors be enclosed in boxes or covered with materials which may impede or reduce the free circulation of ventilating air. Machines fitted with external ventilation should be at least 100 mm from the wall to permit the passage of air.

The opening for the entry and exit of air flow should never be obstructed or reduced by conductors, pipes, or other objects. The place of installation should allow for air renewal at a rate of **8 cubic meters** per minute for each 50 kw of motor capacity (please ensure that the ambient temperature of surrounding air remains stable during motor operation).

See cooling details under section 2.4. Motor cooling.

3.2. Mounting the motor

Motors should be mounted on a firm, flat base using a minimum of four (4) evenly distributed bolts.

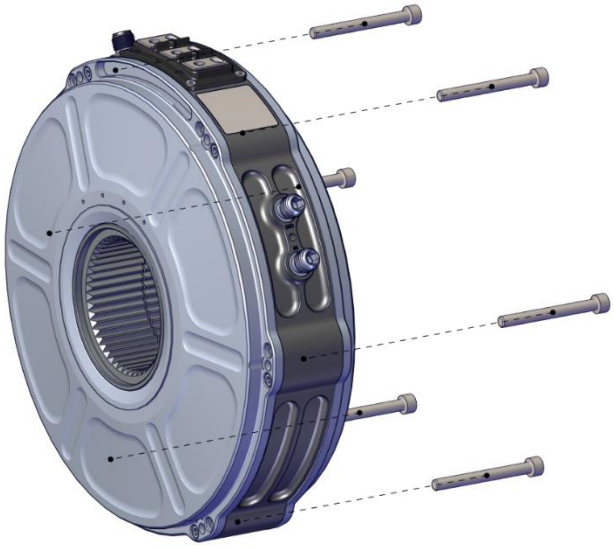


Figure 1: Motor mounting

The outer diameter of the rotor housing is intended to function as a centering diameter when mounting the motor. Please refer to the motor datasheet for its position and tolerance specifications.

Use the bellow prescribed torques when bolting the motor:

Bolt size	Recommended Torque [Nm]		
	Property class based on ISO 898/1		
	8.8	**10.9**	**12.9**
M6x1	11	16	19

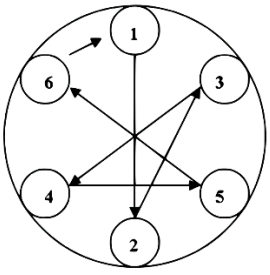


Figure 2: Bolt tightening pattern

Bolt tightening should follow the pattern shown in the above picture. It is recommended to use a thread-locking adhesive (such as LOCTITE 243 or a similar product) or to secure the bolts with a safety wire or washer.

A minimum of 4 bolts, evenly spaced around the flange should be used. The bolts must be of quality 8.8 or higher.

When stacking multiple motor together, please ensure, that the motor mouting flanges are supported on both ends of stacked motor confifuration.

3.3. Stacking the motors

Multiple motors can be stacked to create a configuration with multiple motors, as illustrated in the picture below.

Figure 3: Stacked motors (twin)

There is no limit to the number of motors that can be stacked. Since power is transmitted from each motor to the output shaft, the customer must ensure that the output shaft is correctly dimensioned to handle the expected loads.

The required motors, to assemble a stacked configuration, can be purchased separately.
ASRUK offers the needed components, to assemble a stacked configuration, along with the output shafts, for the twin and triple configuration.

Figure 4: Required mounting parts

Description	Note	ID	QTY.
Motor	/	1	/
Stacking bracket	*Dimensioned to motor type*	2	/
Stud bolt	*Dimensioned to motor type*	3	6

To assemble a stacked motor configuration:

1. Position a stacking bracket (2) on one of the motors (1) and align the holes
2. Place stud bolts, trough all the holes and position them, so they are slightly protruding trough the stacking bracket (2)
3. Position the other motor (1) to the stud bolts (3) and slide it into position

When mounting a stacked motor configuration, please ensure, that the motor stack is supported on both ends, via a motor mounting flange.

It is recommended to use a thread-locking adhesive (such as LOCTITE 243 or a similar product) or to secure the bolts with a safety wire or washer.

Please refer to Chapter 3.2 for the appropriate torque specifications for bolting the motors.

3.4. Motor output

The motor can transmit its torque via its internal splines, as shown in the picture below.

Figure 5: Motor output

Customers can build their own output shaft according to their specifications, provided they adhere to our mounting specifications.
If custom shaft is used, it should be designed to align with the inner bore of the motor flange. The tolerance of the shaft where in contact with the bore should be g6.

ASRUK also offers a blank shaft, which can be purchased additionally with the motor and post-machined to meet the customer's specifications.

Figure 6: Blank shaft

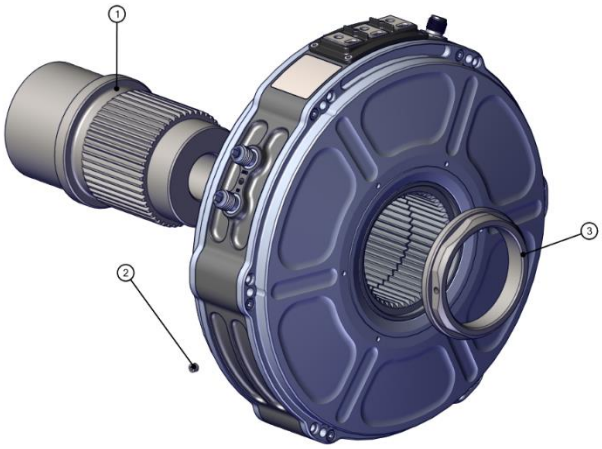


Figure 7: Required mounting parts

Description	Note	ID	QTY.
Blank shaft	/	1	1
Shaft lock nut	/	2	1
Set screw	*DIN 914*	3	1

To assemble a shaft to the motor:

1. Slide a blank shaft (1) inside the motor.
2. Tighten the shaft lock nut (2), to the blank shaft. Appropriate torque is found in the table below.
3. Tighten the set screw (3), to the shaft lock nut (2). The tightening torque is 3 Nm.

Motor size	Recommended Torque [Nm]
AIM-250	25

It is recommended to use a thread-locking adhesive (LOCTITE 243 or a similar product) to secure the bolts.

The electric motor should be accurately aligned with the driven machine, particularly in cases of direct coupling. An incorrect alignment can cause bearing failure vibrations and even shaft rupture.

The best way to ensure correct alignment is to use dial gauges placed on each coupling half:

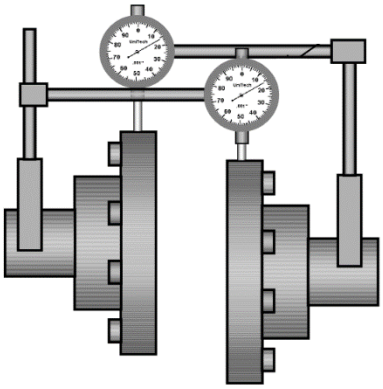


Figure 8: Alignment measurement

The space between coupling hubs should be maintained as recommended by the coupling manufacturer. Shaft offset should not exceed 0.03 mm. Angular misalignment should be less than that recommended by the coupling manufacturer.

Hammers should be avoided during the fitting of shaft flanges or pulleys to the motor. The fitting with the aid of hammers leaves blemishes on the bearing races. These initially small flaws increase with usage and can develop to a stage that completely impairs the bearing.

3.5. Motor cooling

Coolant needs to be supplied to the motor at rates given in the bellow table, according to their designation:

Designation	Min. flow rate	Pressure drop (8 l/min)	Coolant volume (l)
AIM-250	8 l/min	0.12 bar	0.34

Water inlet temperature should not exceed 60°C.

Maximum inlet pressure should not exceed 2 bar(g). No particles greater than 50 µm are permitted.

For connecting the coolant inlet and outlet, please refer to the markings found on the motor.

It's important to deaerate the motor when connecting to coolant supply. The preferred way is using a vacuum on the outlet.

Demineralized water or glycol mixture are the preferred coolant options. Do not expose the motor directly to salt water, as internal damage may occur.

Under no circumstances can motors be enclosed in boxes or covered with materials which may impede or reduce the free circulation of ventilating air. Machines fitted with external ventilation should be at least 150 mm from the wall to permit the passage of air.

The motors can be used in ambient temperatures and flow rates different from those specified in the motor datasheet; however, expect the continuous duty cycle of the motors to be lower. For advice regarding your specific application, please contact ASRUK support.

Please be advised that motors are subject to (metal) particle ingress. Take caution when handling and transporting the motors.

Motor temperature shouldn't at any moment exceed 120°C, as recorded by motor temperature sensor.

It is advised that when firstly dealing with the motor, the current derating point is set at 100°C.

3.6. Coolant fittings replacement

The coolant fittings are of AN6 design. Connections purchased from external suppliers can be used to connect the motor to the coolant system.

Sealing is done with O-rings. The standard O-rings are VMQ70 11x1

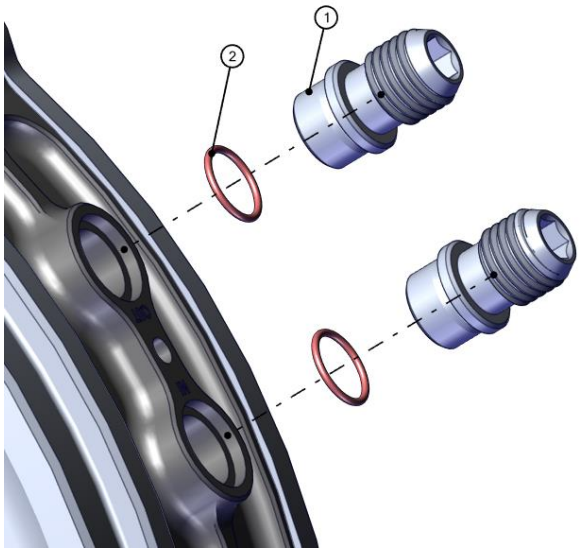


Figure 9: Required mounting parts

To install the fittings to the motor:

4. Grease and install the O-ring onto the coolant fitting
5. Use an Allen key to bolt the coolant fitting to the motor. The required torque for tightening is 6Nm.

3.7. Temperature sensor connection

The default temperature sensor built into the motor is type Pt1000. The connection for motor sensor is on the top of the motor via an M8 sensor connector.

Figure 10: Temperature sensor connector

Connect the sensor using the supplied female M8 sensor connecting adapter. It is recommended to use a shielded (LiYCY) 2-pole wire of 0.75 mm^2.

Temperature sensor wires can be orientated either way.

3.8. Position sensor connection

There are several selections on motor position sensor depending on your motor controller choice. Please turn to their respectful manufacturers to get the required info on wiring, shielding and colour codes.

3.9. Power supply and connections

Turn to motor manual according to motor nameplate, to find suitable data on the voltage and current required by the electric drive.

The power cables must comply with established practice and standards and be properly insulated and rated for the current draw; the connection cabling and cable cross sections must comply with EN60204.

The recommended power cable cross section is found in the table below:

Designation	Recom. cable cross section [mm^2]
AIM-250	70

When dealing with electrical connections, ensure that the system is not under voltage.

Check that the motor's wires are properly tightened down to the cable shoes with positive locking (DIN 980, locking washers or similar).

Power cables must be supported at a maximum distance of 200 mm from the connection. Resting the weight of the cable on the motor connections can result in their dynamic failure.

It is recommended to use electro-insulating gloves when handling high voltage electrical connections. Additionally, using an IMD (insulation monitoring device) in the system for voltages higher than 48V is advisable.

Ensure insulation on motor connections by using heat shrinks or similar. For watertight connection we recommend using adhesive lined heat shrink tubing.

Motor mounting point should be shielded to the main ground of the system.

4. Steps prior to starting

4.1. Steps prior to starting


WARNING:
If the motor has been in a damp location, dry it out thoroughly before operating. Before energizing the motor for the first time or after an extended shut down, it is advisable to check the insulation resistance, power supply and mechanical freedom of the motor.

4.2. Initial start


WARNING:
Do not touch or reach into moving parts, while the motor is operating!

Whenever possible, examine the interior of the motor for loose objects or debris which may have accumulated and remove any foreign material.

If possible, turn the rotor by hand to be sure, that it rotates freely.

Check all connections with the connection diagram. Check all accessible factory made connections for tightness to make sure none has become loose during shipment.

When the driven load is likely to be damaged by the wrong direction of rotation, it is best to uncouple the motor from its load during the initial start and make certain it rotates in the correct direction.

After inspecting the motor carefully, make the initial start by following the regular sequence of starting operations as prescribed by motor controller manufacturer.

In the event of excessive vibration or unusual noise disconnects the motor from the load and check the mounting and alignment. If the issue is not resolved, please contact ASRUK support for further instructions.

5. Maintenance

5.1. General

When the motor is in operation, examine the motor at regular intervals depending on the service. Check the following items:

- Make sure the ventilation openings are clear and unobstructed.
- General cleanliness.
- Check the condition of shaft seals and replace if necessary.
- Check the condition of connections and mounting and assembly bolts.
- Check the bearing condition by listening for any unusual noise, vibration measurement, bearing temperature, inspection of spent grease or SPM bearing monitoring.

5.2. General cleanliness

Motors should be kept clean, free of dust, debris, and oil. Soft brushes or clean cotton rags should be used for cleaning. A jet of compressed air should be used to remove non-abrasive dust and any accumulated grime. Oil or damp impregnated impurities can be removed with rags soaked in a suitable solvent.

5.3. Vacuum and compressed air cleaning

Compressed air or suction should be used to remove loose dirt and dust from air and coolant passages.

Care must be taken to make sure the air is dry and that the pressure of not more than 2 bar(g) is used.

5.4. Cleaning with water and detergent

Water-solvent mixture is a very effective way in cleaning coolant channels against accumulated dirt.
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Care must be taken to make sure that the pressure of not more than 2 bar(g) is used, and that the temperature never exceeds 90 ^{o}C.

5.5. Bearings

Bearings are assembled and pretensioned in factory and are greased for its entire life cycle. Their appropriate life cycle is to be determined by a customer using their boundary conditions. In case of bearing failure, please contact ASRUK representative or contact ASRUK support directly for inspection or possible replacement.

5.6. Failure

WARNING:
An extreme overload or electrical failure may result in heating or arcing which can cause the insulation to give off noxious fumes. All power should be removed from the motor circuit as a precaution even though the circuit has overload protection. Personnel should not approach the motor until adequate ventilation of the area has purged the air of fumes. When covers of a motor are removed after a failure, care should be observed to avoid breathing fumes from inside the motor. Preferably, time should be allowed for the motor to cool before attempting any examination.

WARNING:
Water should not be applied to any electrically energized equipment because electric shock could result in serious or fatal injury. In case of fire, disconnect all power and use a carbon dioxide extinguisher to quench the flame. Before operating any motor after a suspected failure, it should be inspected for damage.

5.7. Repair

If suspecting motor failure, please contact a representative or contact ASRUK support directly for further instructions regarding the motor repair. The following must be sent to ASRUK to process a motor repair:

- Original nameplate from the failed motor.
- Copy of the original invoice or invoice # for the failed motor.
- Brief description of the failure for quality control purposes.
- Please send request no later than 30 days after failure.

Any unauthorized attempts in disassembling the motor will result in warranty void, and further damage to the motor may occur.

5.8. Warranty

ASRUK provides a limited warranty on our products against defects in materials and workmanship for a period of twelve (12) months, from the date of delivery.

During the warranty period, ASRUK will repair or replace, at no charge, products or parts of a product that proves defective because of improper material or workmanship, under normal use and maintenance. Repaired or replaced product will have a warranty extended for a period of twelve (12) months from the date of delivery.

The warranty shall be void and of no effect if the following are performed & found on the motor:

(1) The motor has been subjected to improper installation, storage, or handling; as well as any abuse unsuitable for the motor;
(2) The motor was subjected to an unauthorized repair.
(3) The motor was subject to any water damage;
(4) The motor was engaged above its rated load;
(5) The motor lacked reasonable & necessary maintenance.
(6) The motor usage was not according to its installation manual
(7) Improper packaging for return.

ASRUK does not cover the cost of installation, removal, or re-testing of the new or repaired products.

ASRUK will not be liable for any costs or damage incurred by its customers in the removal or replacement of defective products from units in which the products have been assembled.

When processing a warranty claim, please contact ASRUK support and provide the following:

- Original nameplate from the failed motor.
- Copy of the original invoice or invoice # for the failed motor.
- Brief description of the warranty claim.
- Please send request no later than 30 days after failure.

Document Revision history:

Revision	Date	Author	Description
A00	18/07/2024	U.K.	Initial version