

Operating and maintenance instructions (translation of original instructions)

Motor, pump unit, motor unit, servo unit



Imprint

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Technical changes

We reserve the right to make technical changes in production, processing and appearance of all editions.

Record of changes

Version	Date	Changes
1.0	22/03/2019	New creation
1.1	05/05/2022	Air gap new

Table of contents

1	General information	5
1.1	About these operating instructions	5
1.2	Further product documentation	5
1.3	Motor type-dependent descriptions	6
1.4	Rating plates	7
1.5	Options and attachments	9
1.6	Variant examples	10
2	Safety	12
2.1	General safety instructions	12
2.2	Safety instructions in these operating instructions	12
3	Transport and storage	14
3.1	Transport	14
3.2	Incoming inspection	14
3.3	Storage	15
4	Installing the motor	17
4.1	Tightening torques for fastening elements	17
4.2	Mounting the shaft sealing rings	18
4.3	Installing O-rings	21
4.4	Installing shafts with gearing	21
4.5	Installing a motor without A-bearing plate	23
5	Electrical connection	24
5.1	Overview	24
5.2	Asynchronous motor, synchronous motor, reluctance motor	24
5.3	DC motor	28
6	Installing optional attachments	30
6.1	Incremental encoder	30
6.2	Tachometer	33
6.3	Electromagnetic brake	34
6.4	Pump	38
6.5	Gearing	39
7	Commissioning	44
7.1	Preparation	44
7.2	Checklist	44
7.3	Initial start	45
8	Maintenance	46
8.1	Safety instructions	46
8.2	Regular inspection	46
8.3	Maintenance schedule	48
8.4	Inspection	49

9	Troubleshooting.....	50
10	Customer Service and Support	52
11	Disposal.....	53
11.1	Cleaning agents, auxiliary materials and operating materials.....	53
11.2	Scrapping.....	53
11.3	Electrical and electronic components.....	53
12	Standards	54

1 General information

1.1 About these operating instructions

The information in these operating and maintenance instructions (hereinafter: operating instructions) has been compiled with great care to ensure that it corresponds to the specifications and use of the motor. These operating instructions for Schabmüller GmbH motors are intended to assist persons entrusted with the corresponding tasks in correctly installing, operating and maintaining this electrical machine.

All instructions and standards given in these operating instructions must be strictly observed for reasons of personal and material safety when transporting, assembling, commissioning, servicing or repairing Schabmüller GmbH motors.

The warranty of the products depends on the observance of the operating instructions and the safety instructions.

If these operating instructions are lost, the electronic file is available in PDF format on the website www.schabmueller.de.

A new printed version can also be requested.

If you have any questions, please contact Schabmüller GmbH.

1.2 Further product documentation

These operating instructions refer only to standard motors.

More detailed instructions can be found in the documentation specially prepared for your motor, motor unit or power unit.

If additional information on motors with special designs is required, please contact Schabmüller GmbH.

If specific or extended documents, such as the product documentation, are available, these must be read and taken into account together with these operating instructions prior to installation, operation and maintenance of the motor.

Those responsible for the safety of the installation and/or the vehicle must ensure that the operating instructions and other documents supplied with the product documentation are always available for all relevant work and must oblige their employees to observe these documents consistently.

Particular attention must be paid to the following:

- The technical data and information on the permissible use (assembly, connection, ambient and operating conditions) contained in the order documents and other product documentation, among other things
- Local plant- or vehicle-specific regulations
- The proper use of tools, lifting and transport equipment

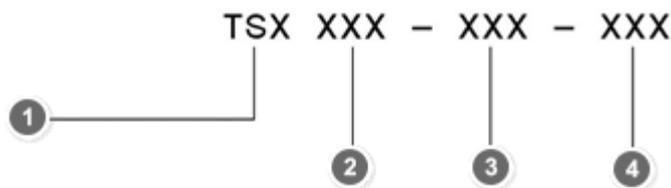
1.3 Motor type-dependent descriptions

These operating instructions apply to all Schabmüller GmbH standard motors.

Note: Electrical connections, attachments, maintenance measures, etc. may differ depending on the type of drive or motor. An overview can be found on page 9.

To better understand these operating instructions, please first identify your motor type using the information on the rating plate (see page 7 and page 8).

The motor type is indicated by the following code:



Item	Designation	Comment
1	Motor type	TSA = asynchronous motor TSL = DC motor TSS = synchronous motor TSR = synchronous reluctance motor
2	Size	Stator diameter/TSL housing diameter
3	Iron length	Stator length or rotor length (this size specification can be omitted for DC motors)
4	Electrical number	Consecutive number of the electrical calculation

Examples:

TSA 200-100-220

1. Asynchronous motor
2. 200 mm stator diameter
3. 100 mm iron length
4. 220 electrical calculation number

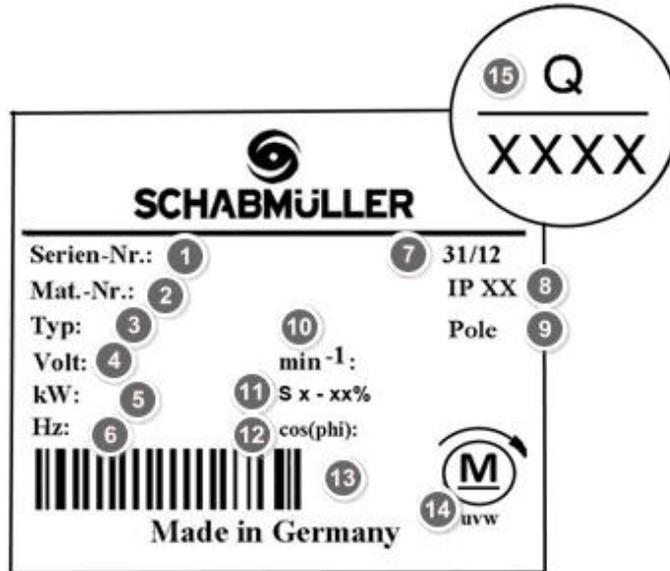
TSL 240-354

1. DC motor
2. 240 mm housing diameter
3. – not applicable –
4. 354 electrical calculation number

1.4 Rating plates

1.4.1 Asynchronous motor / Permanent magnet motor / Synchronous reluctance motor

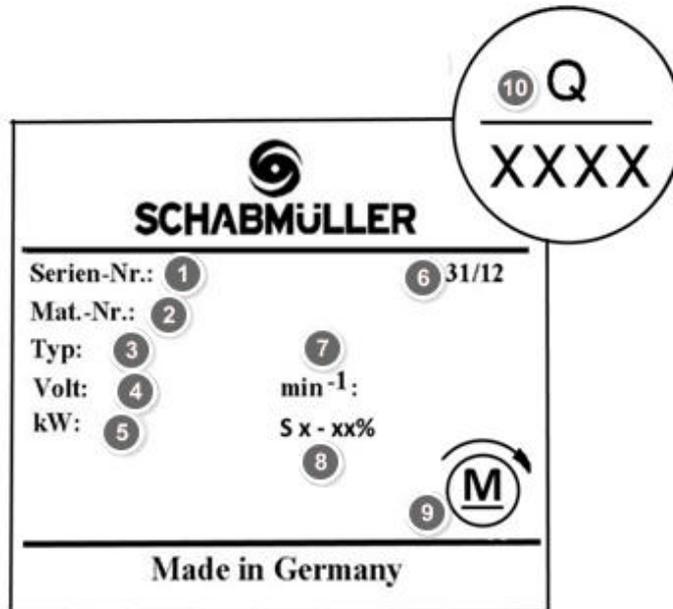
The standard rating plates for asynchronous motors, permanent magnet motors and synchronous reluctance motors contain the following information (customer-specific rating plates may differ):



Item	Designation
1	Serial number
2	Material number
3	Type designation
4	Voltage
5	Output
6	Frequency
7	Production week
8	Degree of protection
9	Number of poles
10	RPM
11	Duty cycle
12	Power factor
13	Bar code
14	Direction of rotation
15	Quality sticker with the number of the final inspector

1.4.2 DC motor

The standard rating plate for DC motors contains the following information (customer-specific rating plates may differ):



Item	Designation
1	Serial number
2	Material number
3	Type designation
4	Voltage
5	Output
6	Production week
7	RPM
8	Duty cycle
9	Direction of rotation
10	Quality sticker with the number of the final inspector

1.5 Options and attachments

Depending on the drive type or motor type (see page 6), the following combinations are possible:

Drive type	Motor type	Sealing elements		Optional attachments					Protection class of terminal board				Carbon	Collector		
		Motor without A-bearing	O-ring	Shaft seal	Tachometer	Encoder	Pump	Brake	Gearing	Motor with gearing	IP6k9k	IP64-67			IP43/54	IP00/20
Drive motor	TSL		x	x	x	x		x	x	x			x	x	x	x
	TSA	x	x	x	x	x		x	x	x		x	x	x		
	TSS	x	x	x	x	x		x	x	x	x	x	x	x		
	TSR	x	x	x	x	x		x	x	x	x	x	x	x		
Pump unit	TSL		x	x			x			x			x	x	x	x
	TSA		x	x			x			x		x	x	x		
	TSS		x	x			x			x	x	x	x	x		
	TSR		x	x			x			x	x	x	x	x		
Motor unit	TSL		x	x	x	x		x	x	x			x	x	x	x
	TSA	x	x	x	x	x		x	x	x		x	x	x		
	TSS	x	x	x	x	x		x	x	x	x	x	x	x		
	TSR	x	x	x	x	x		x	x	x	x	x	x	x		
Servo unit	TSL			x	x	x		x	x	x			x	x	x	x
	TSA			x	x	x		x	x	x		x	x	x		
	TSS			x	x	x		x	x	x	x	x	x	x		
	TSR			x	x	x		x	x	x	x	x	x	x		

TSA = asynchronous motor

TSL = DC motor

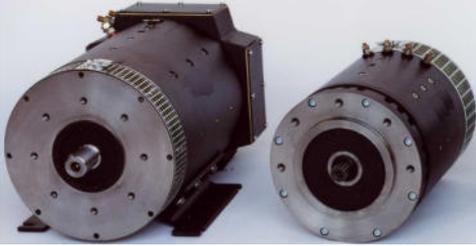
TSS = synchronous motor

TSR = synchronous reluctance motor

x = combination possible

1.6 Variant examples

Schabmüller GmbH produces hundreds of motor variants for a wide variety of applications. Here you will find examples and excerpts of various applications and motor variants:

Application	Figure showing motor	Characteristics
Drive motors		<ul style="list-style-type: none"> • Asynchronous, PM synchronous • Battery voltage: 24 V...80 V • Stator diameter: 120, 135, 170, 200, 240, 270, 300 mm • Output: 5...20 kW • RPM range: 2,000...5,000 rpm • Air-cooled • Integrated speed direction encoder and temperature sensor • Optional brake attachment • Mounting and shaft ends according to customer specification
		<ul style="list-style-type: none"> • DC motor • Battery voltage: 24 V...80 V • Stator diameter: 112, 125, 140, 150, 160, 178, 190, 210, 240, 325 mm • Output: 5...30 kW • RPM range: 1,000...5,000 rpm • Air-cooled • Integrated speed direction encoder and temperature sensor • Optional brake attachment • Mounting and shaft ends according to customer specification
Steering units		<ul style="list-style-type: none"> • Asynchronous, PM synchronous • Battery voltage: 24 V...80 V • Stator diameter: 106, 120, 135, 150 mm • Output: 0.2...2 kW • Gear translation: 18:1...93:1 • Drive rpm: 2...40 rpm • Air-cooled • Integrated speed direction encoder and temperature sensor • Mounting and shaft ends according to customer specification

Application	Figure showing motor	Characteristics
		<ul style="list-style-type: none"> • DC motor • Battery voltage: 24 V...80 V • Housing diameter: 100, 102, 112, 125, 150, 178, mm • Output: 0.5...10 kW • Pump mounting, mounting and shaft ends according to customer specification
Pump units		<ul style="list-style-type: none"> • Asynchronous, PM synchronous • Terminal voltage: 16 V...480 V 3~ • Stator diameter: 150, 170, 200 mm • Output: 5...15 kW • RPM range: 2,000...4,000 rpm • Air-cooled • Integrated speed direction encoder and temperature sensor • Pump mounting according to customer specifications • Mounting and shaft ends according to customer specification
		<ul style="list-style-type: none"> • DC motor • Battery voltage: 24 V...80 V • Housing diameter: 112, 125, 150, 178, 190, 210, 240, 315 mm • Output: 0.5...10 kW • Pump mounting, mounting and shaft ends according to customer specification

2 Safety

2.1 General safety instructions

2.1.1 Obligations of the operating company

Only qualified persons who carry out work on the motors and consistently observe and implement the supplied operating and maintenance instructions as well as the standards and safety instructions mentioned may install, commission and service the motors.

Before any work is carried out on the motors, it is the responsibility of the supervisor to draw the attention of his qualified personnel to the dangers that could occur during this work. Improper use of the motors or improper maintenance by unqualified personnel can lead to serious damage to health and material damage.

2.1.2 Qualified personnel

Qualified personnel are persons who, on the basis of their training, experience and instruction as well as their knowledge of relevant standards, accident prevention regulations and corresponding operating conditions, are authorised to carry out the necessary activities.

2.2 Safety instructions in these operating instructions

The motor corresponds to the state of the art and the recognised safety regulations. Nevertheless, dangers can arise during operation and during maintenance and repair work.

These dangers are pointed out in these operating instructions with safety instructions.

The safety instructions precede the relevant descriptions or work steps.

2.2.1 Structure of the safety instructions

The safety instructions consist of the following elements:

1. Danger signs
2. Signal word
3. Nature and source of the danger
4. Possible consequences of non-observance
5. Measures for the avoidance/avoidance of danger



Danger
sign

SIGNAL WORD

Nature and source of the danger

Possible consequences of non-observance

- Measure for the avoidance/avoidance of danger

2.2.2 Danger signs

Danger symbols are used to draw attention to the danger of personal injury.

Danger signs	Meaning
	<p>General danger sign Failure to observe the warnings may result in death, serious injury or serious damage.</p>
	<p>Suspended loads Failure to observe the warnings may result in death, serious injury or property damage due to falling loads.</p>
	<p>Electricity Failure to observe the warnings may result in death or serious injury from dangerous voltage.</p>

2.2.3 Signal words

Signal words indicate the level of risk and the severity of the possible damage. The following signal words are used in these operating instructions:

Signal word	Meaning
DANGER	Death or serious injury will result
WARNING	Death possible, serious injury foreseeable
CAUTION	Injury or slight injury possible
NOTE	Danger of property damage

3 Transport and storage

NOTICE

Warranty

If any damage is discovered after delivery, report it immediately to the transport company, the insurance company and Schabmüller GmbH.
Failure to report the discovered damage will void the warranty.

The motors are tested and delivered ready for installation. The machined surfaces are protected against rust with a corrosion inhibitor. Immediately after receipt, the packaging and the motor must be inspected for external transport damage.

3.1 Transport

Observe the following safety instructions for each transport:



CAUTION

Danger of injury from falling objects.

- Only lift packaging or our products at the lifting points provided for this purpose
- Take into account the weight indicated on the packaging or on our products and the lifting capacity of the lifting device
- Do not tip the packaging
- Put down the packaging or our products gently (without impact) to avoid storage damage
- Replace the corrosion protection or protective devices that were removed for the incoming inspection immediately after the inspection
- Do not remove any protective devices until shortly before installation

3.2 Incoming inspection

Proceed in the order given:

Step	Procedure
1	Check all parts (also parts in additional packaging).
2	Unpack the motor and inspect it thoroughly for damage.
3	Reprocess any damage to the paint coat or rust protection on machined surfaces.

3.3 Storage

NOTICE**Danger of property damage**

Improper handling during transport and storage can cause damage.

- Avoid vibrations, falls and humidity during transport
- Strictly follow all instructions in these operating and maintenance instructions and document this to maintain the manufacturer's warranty
- If the motor is exposed to external influences such as temperature fluctuations, humidity, aggressive chemicals, etc. during storage, damage can occur inside the motor, in the roller bearings, in the terminal box and in the winding; the components oxidise, the grease ages and the insulation resistance drops to an inadmissible value

3.3.1 Ambient conditions

The motor must be stored in a dry, vibration-free and dust-free location in a building at an ambient temperature above 5 °C. If other conditions apply, please contact Schabmüller GmbH.

3.3.2 Storage location for prolonged storage

The following instructions apply to motors that are stored for long periods of time or are taken out of service for more than two months.

The following points must be taken into account when selecting the storage location:

- The room must be closed and covered
- The room must be protected against moisture, vapours, rodents and insects
- The room must not contain any corrosive gases such as chlorine, sulphur dioxide or acids
- The room must not be subject any heavy continuous or intermittent vibrations
- The ambient temperature must be between 5 °C and 60 °C
- The ambient temperature must not fluctuate suddenly
- The relative humidity must be less than 50%
- The room must be protected against dirt and dust deposits
- The room must be equipped with a fire protection system

If the storage room does not meet one of these requirements, Schabmüller GmbH proposes to provide the packaging with special protective measures during the storage period:

- Closed box or similar packaging
- If there is a risk of fungal attack or formation, the box must be protected at the storage location by spraying or painting with suitable chemical agents
- The packaging must be carried out with great care by qualified persons

3.3.3 Logging during storage time

The motor in storage must be checked at regular intervals. A log should be kept of the findings. The following points must be checked:

- Damage
- Soiling
- Condensation formation

- Condition of the protective coating
- Condition of the paintwork
- Signs of larvae and insects
- Ambient temperature
- Humidity
- Conditions at the storage location (see page 15)
- Instructions in the maintenance schedule (see page 46)

3.3.4 Other motor-dependent storage measures

Motor characteristic	Storage measures
DC motor	<p>If stored for more than two months:</p> <ul style="list-style-type: none"> • Lift off the carbon brushes and remove them from their holders to prevent oxidation at the contact points with the slip rings • Before operation, reinstall the carbon brushes and check that the brush holders run smoothly
Water-cooled motors	<ul style="list-style-type: none"> • Do not allow the ambient temperature to fall below +5 °C • At temperatures below +5 °C, add an antifreeze to the water in the cooling circuit
Separately supplied components	<ul style="list-style-type: none"> • If components are supplied separately (terminal boxes, bearing plates, etc.), these parts must also be packed and protected • If the manufacturer has his own operating instructions, these must be followed • Do not allow the relative humidity in the original packaging to exceed 50%
Machined surfaces	<p>All machined surfaces (shaft ends, flanges, etc.) are supplied ex works with a rust inhibitor.</p> <ul style="list-style-type: none"> • This protective film should be reapplied at least every six months or in case of removal or damage <p>Recommended rust inhibitor: Gunex 2000, Manufacturer: Klever</p>
Grease-lubricated rolling bearings	<p>The rolling bearings are factory lubricated. To avoid bearing damage:</p> <ul style="list-style-type: none"> • During the storage period, turn the rotor/armature by hand every two months • Turn the rotor/armature at a speed of 30 rpm for one minute in order to achieve even grease distribution <p>If stored for three years or longer:</p> <ul style="list-style-type: none"> • Replace the rolling bearings before commissioning

4 Installing the motor

4.1 Tightening torques for fastening elements

NOTICE

Danger of property damage

- For attachments, use the tightening torques specified by the manufacturer
- If no tightening torques are specified by the manufacturer, refer to the drawing or the table below for tightening torques
- The tightening torques indicated on the drawing have priority

Thread	Production class according to DIN 267				Width across flats
	4.8	8.8	10.9	12.9	
	Tightening torques [Nm]				
M 3	0.6	1.4	1.9	2.2	5.5
M 4	1.3-1.5	3-3.6	4.3-5.3	5.1-6.1	7
M 5	2.6-3.1	6-7.1	8.5-10	10.2-12	8
M 6	4.5-5.2	10.3-12	14.7-18	17.6-21	10
M 8	10.8-12.5	25.5-30	35.3-44	42.2-52	13
M 10	21.6-25.8	50-60	70.6-87	85.3-100	15
M 12	38.2-45	87.3-105	122-151	147-177	18
M 16	90-100	200-220	290-320	345-380	24

These tightening torques are standard values for metric standard threads according to DIN 13 and head support dimensions according to DIN 912; 931; 934; 6912; 7994 and 79xx. They result in a 90% utilisation of the bolt yield strength. A coefficient of friction of 0.14 to 0.20 was assumed (new screw, without post-treatment, unlubricated).

4.2 Mounting the shaft sealing rings

NOTICE

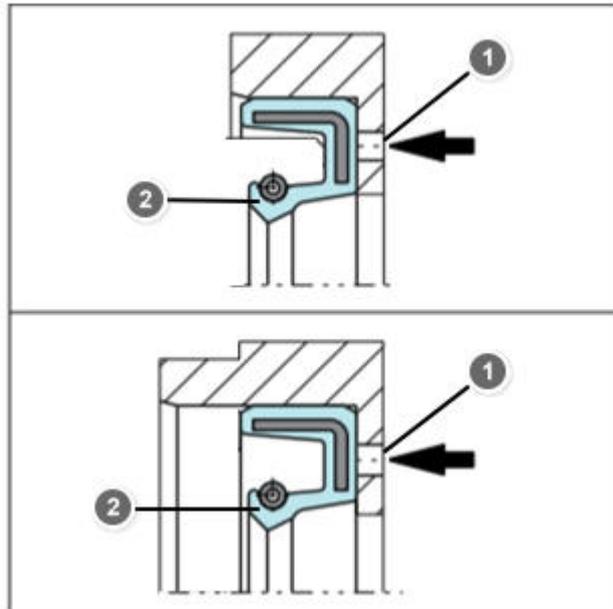
Danger of property damage

- Do not scratch or damage the sealing surfaces during disassembly
- Do not tilt the sealing ring when pressing it in

4.2.1 Removal and replacement

The removal of sealing rings is generally not difficult. Usually a screwdriver or similar is sufficient for disassembly. However, this will damage the sealing ring. After a machine has been repaired or overhauled, new rotary shaft seals must always be installed.

If there is a disassembly hole on the housing, the shaft seal can be pressed out with a pin.



Item	Designation
1	Disassembly hole on housing
2	Shaft seal

4.2.2 Installation

The sealing edge of the new shaft seal should not come into contact with the old raceway.

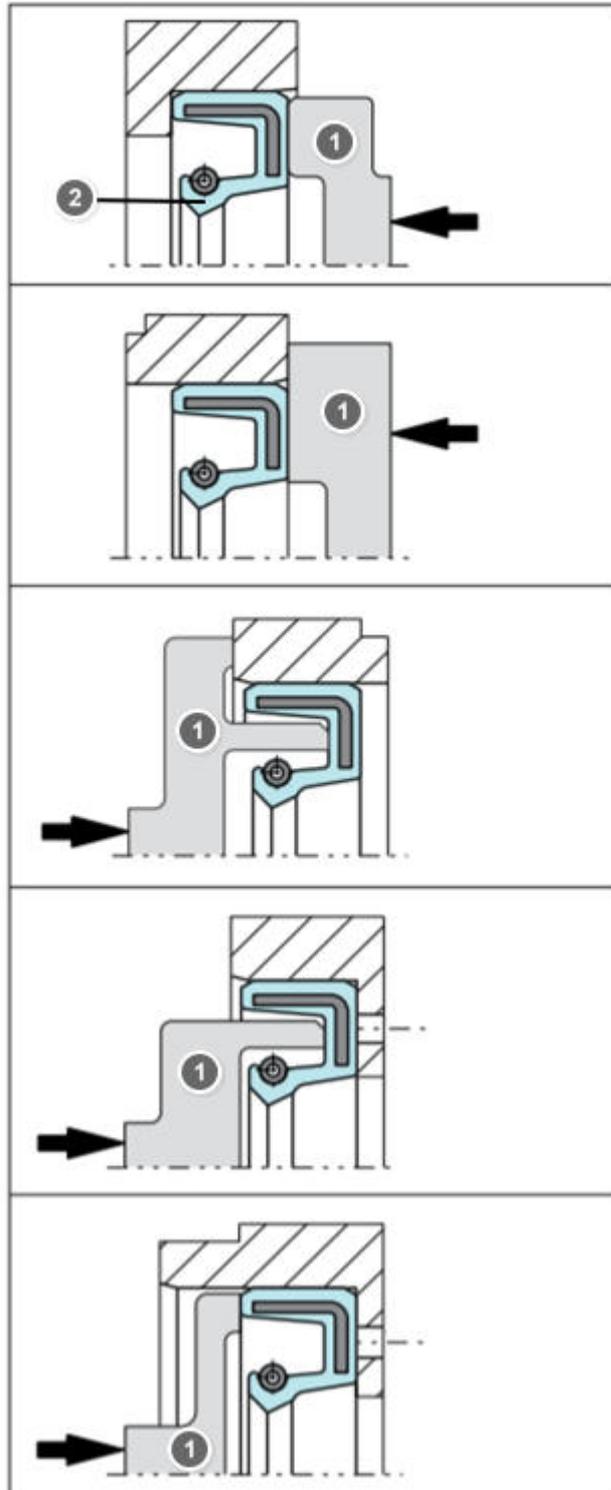
This can be achieved by:

- Pressing into the locating bore at different depths
- Reworking the shaft and assembly of a shaft sleeve

Proceed in the order given:

Step	Procedure
1	Clean installation spaces before assembly.
2	For rubber seals: Grease or oil shafts and seals.
3	For shaft seals that cannot be lubricated by external media: Fill the shaft seal with grease (PETAMO GY193).
4	Cover sharp-edged transitions (e.g. at indentions) with a phase or round or feather key grooves or hub grooves and threads with an adhesive tape, sleeve or similar.
5	Place the sealing ring centrally and perpendicular to the shaft. Apply the press-in force as close as possible to the outer diameter.
6	Push the sealing ring up to the adjusted stop (usually the end face of the receiving bore) or fix the sealing ring with a shoulder or a spacer washer.

Examples of the assembly of shaft seals



Item	Designation
1	Press-in tool
2	Shaft seal

4.3 Installing O-rings

NOTICE

Danger of property damage

- Do not use lubricants with solid additives
- Do not use sharp objects
- Avoid twisting the O-ring
- Do not overstretch the O-ring
- If possible, use assembly aids

Proceed in the order given:

Step	Procedure
1	Check that the insertion chamfer is deburred and rounded. Rework if necessary.
2	Check that internal bores are deburred and rounded. Rework if necessary.
3	Remove machining residues such as chips, dirt and foreign particles.
4	Cover threads and feather key grooves or hub grooves with adhesive tape, a sleeve or similar.
5	Grease or oil the O-ring and components with a suitable lubricant.
6	Install the O-ring.

4.4 Installing shafts with gearing

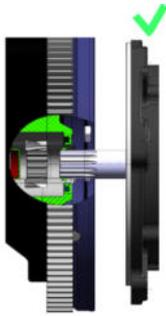
NOTICE

Danger of property damage

- Do not tilt the shafts
- Do not subject the shafts to impacts

The gearing is factory tested and usually provided with gearing protection. Proceed in the order given:

Step	Procedure
1	Remove the gearing protection and check the gearing for contamination.
2	Contact Schabmüller GmbH in case of damage to the gearing.
3	Clean the teeth with a lint-free cloth or blow out/off.

Step	Procedure		
4a	For internal gearing: Fill the gearing up to half with grease (e.g. Klüberplex BEM 34-132) and spread the grease up to the upper edge with a wooden or plastic rod.		
4b	For external gearing: Coat the gearing evenly with grease.		
5	Carefully guide the gearing straight into or over the counterpart with slight back and forth movements and slight pressure.	 <p data-bbox="1034 1478 1129 1505">Correct</p>	 <p data-bbox="1257 1478 1353 1505">Incorrect</p>

4.5 Installing a motor without A-bearing plate



CAUTION

Risk of injury from falling objects (rotor).

- Secure the rotor

NOTICE

Danger of property damage

- Do not subject the motor to impacts

4.5.1 Preparation

For motors without A-bearing plates, carry out the following work **before assembling** the motor or individual parts.

Proceed in the order given:

Step	Procedure
1	If there is no fixed bearing: Secure the rotor/armature against falling out of the motor.
2	Treat the gearing (see page 21).
3	Grease or oil the O-ring or shaft seal (see page 21).
4	Clean the flange surfaces, bearing sleeves or shaft of foreign bodies such as dirt, chips, etc.
5	Check centrings for damage. The centrings must be free of damage.

4.5.2 Installing the motor

Proceed in the order given:

Step	Procedure
1	Place the motor carefully and straight on the gearbox or vehicle.
2	For toothed shafts (see page 21): Insert the rotor/armature into the counterpart with slight back and forth movements.
3	Flange the motor with light pressure.
4	Tighten the fixing screws diagonally (for tightening torques see page 17).

5 Electrical connection

5.1 Overview



DANGER

Danger due to electrical voltage

The electrical connection may only be carried out by a qualified electrician.

NOTICE

Danger of property damage

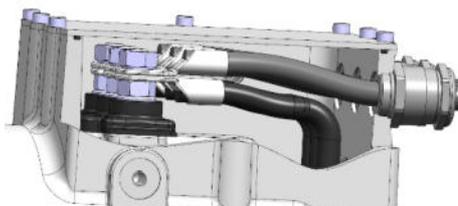
- We recommend that the connection cable cross-section be designed to comply with VDE guidelines
- Connect the motor according to the drawing or according to the desired direction of rotation (if the motor is connected incorrectly, the motor or the connected devices may be defective)
- For open and free-standing connection bolts with a voltage of 50 V/AC or 120 V/DC or higher, provide separate protection against accidental contact
- Note the tightening torques on the drawing; these have priority

Connection examples are shown below. Depending on the protection class, the connections are made via connection bolts, plugs or a terminal board.

IP00 – IP54



IP64 – IP67



IP6K9K



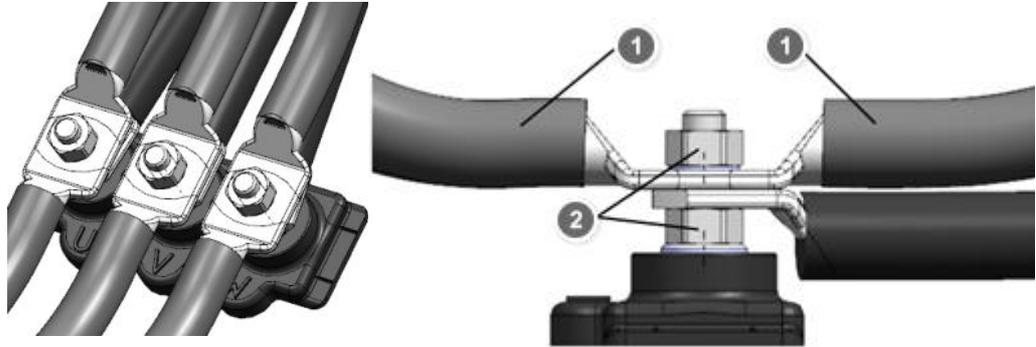
5.2 Asynchronous motor, synchronous motor, reluctance motor

The motors are suitable for clockwise and anticlockwise rotation as standard. If the mains cables are connected with U, V, W, a clockwise rotation results (view of the drive-side shaft end). If two connections are interchanged (e.g. W, V, U), the result is anticlockwise rotation. For machines with only one direction of rotation, the prescribed direction of rotation is indicated by a direction arrow on the machine.

5.2.1 Connection examples to comply with protection class range IP00 – IP54

5.2.1.1 3-pin connection with size M6, M8 or M10 screws

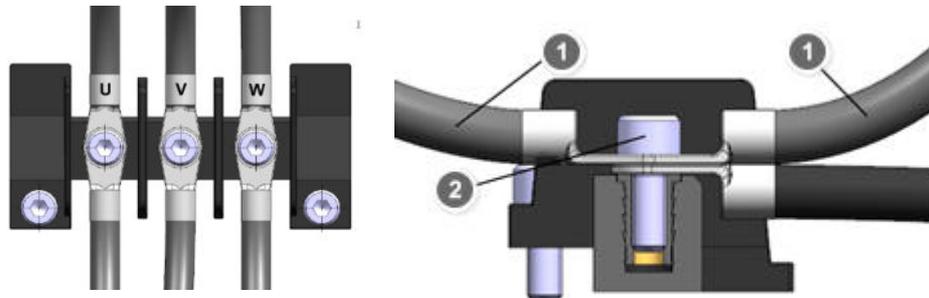
Example



Item	Designation
1	Possible customer connection
2	Counter nuts against each other, tightening torques: M6 max. 3.5 Nm M8 max. 11 Nm M10 max. 15 Nm

5.2.1.2 3-pin connection with size M4 screws

Example

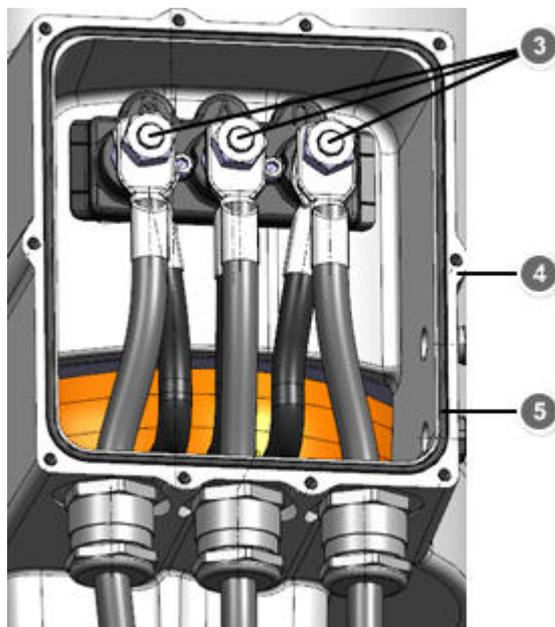
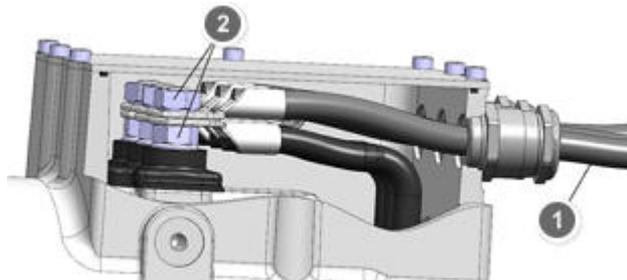


Item	Designation
1	Possible customer connection
2	Screw tightening torque: M4 max. 3.5 Nm

5.2.2 Connection example to comply with protection class range IP64 – IP67

5.2.2.1 Connection via terminal box

Example, view without cover



Item	Designation
1	Customer connection
2	Counter nuts against each other, tightening torques: M6 max. 3.5 Nm M8 max. 11 Nm M10 max. 15 Nm
3	Terminals
4	Sealing surface
5	O-ring

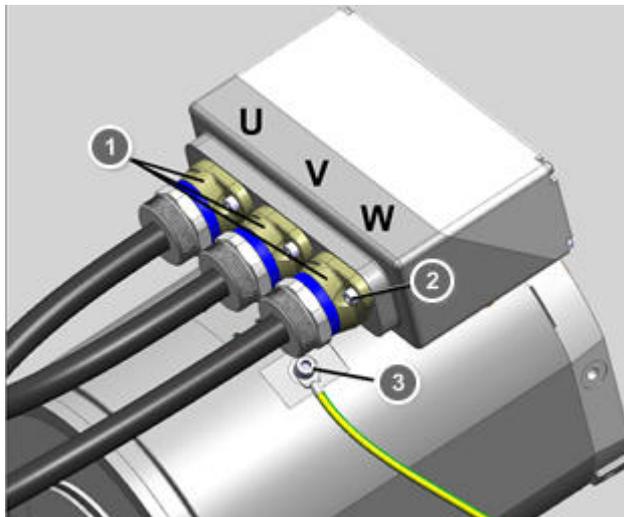
Proceed in the order given:

Step	Procedure
1	Connect the terminals (item 3).
2	Before mounting the cover, clean the sealing surfaces (item 4).
3	Do not twist, damage or bend the silicone seal or the O-ring (item 5) when mounting the cover.

5.2.3 Connection example to comply with protection class IP6K9K

The connections are standard connections.
Details on drawings have priority.

Example

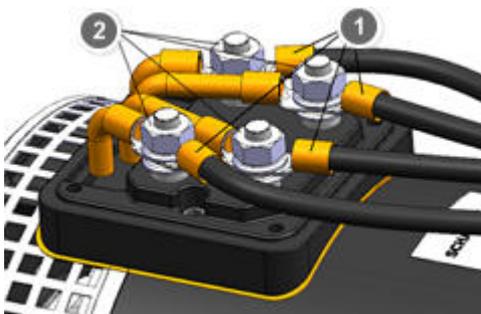
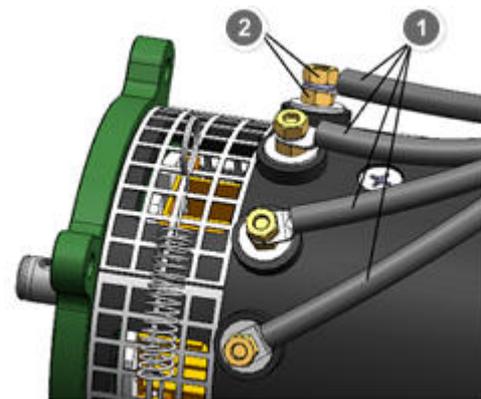
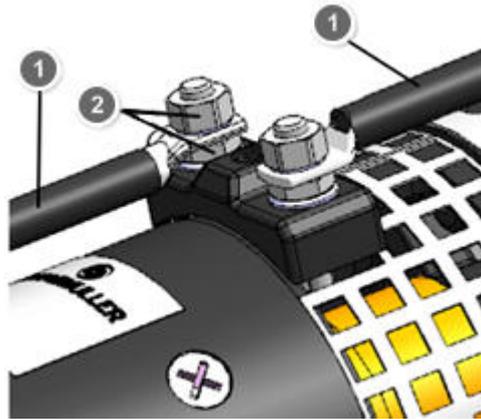


Item	Designation
1	Molex plug
2	Screw tightening torque: M6 max. 13 Nm
3	Potential equalisation screw, tightening torque: M8 max. 21 Nm

5.3 DC motor

5.3.1 Connection examples to comply with protection class range IP00 – IP54

Examples



Item	Designation
1	Possible customer connection
2	Counter nuts against each other, tightening torques: M6 max. 3.5 Nm M8 max. 11 Nm M10 max. 15 Nm

5.3.2 Wiring diagrams

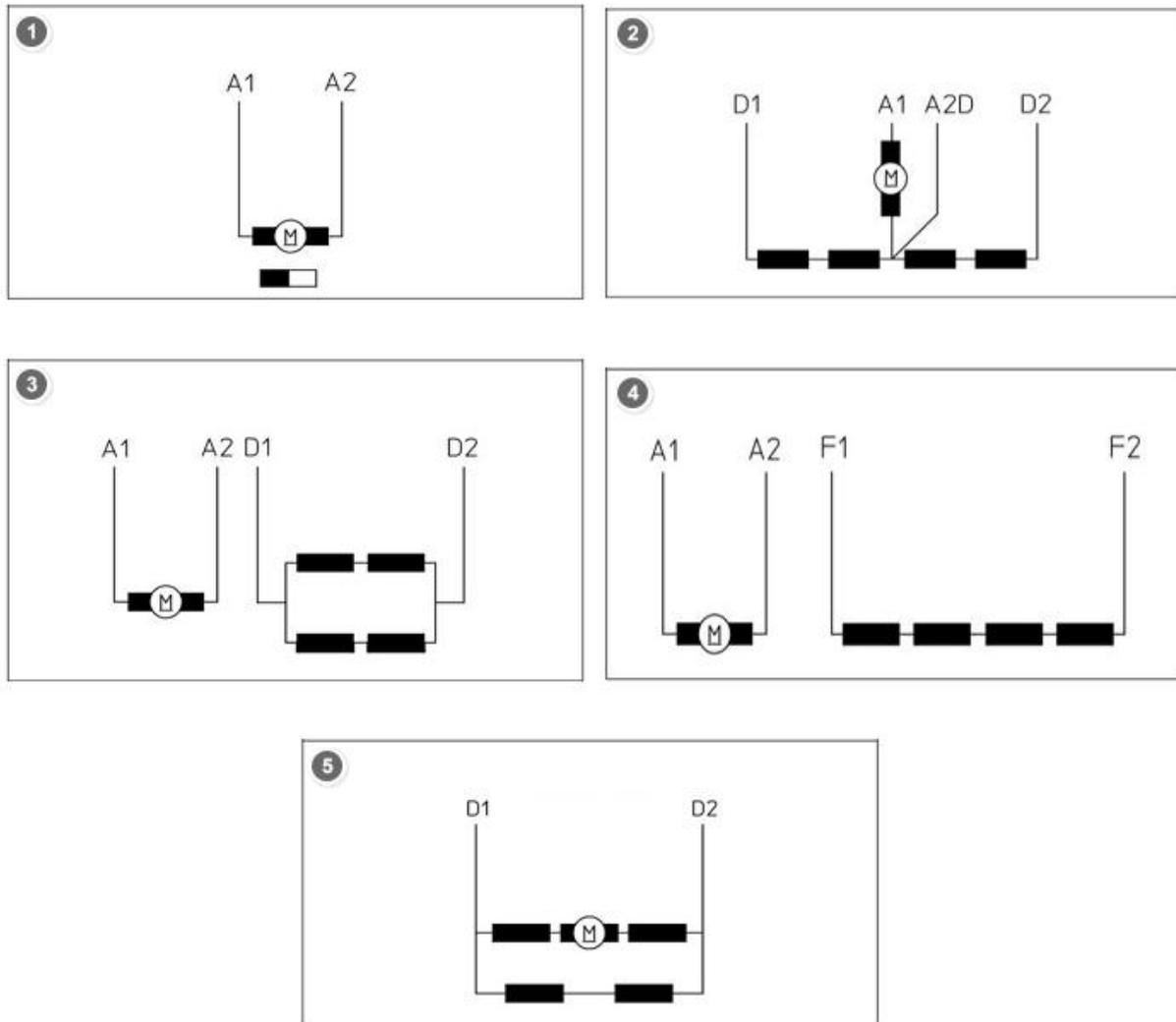


Figure	Connection	Rotation
1	Permanent	Right/left rotation
2	Series, split field	Right/left rotation
3	Series	Right/left rotation
4	Shunt	Right/left rotation
5	Double shunt	Right rotation

6 Installing optional attachments

The installation option for attachments depends on the drive type. The possible combinations can be found in the overview on page 9.

Observe the following instructions for each installation:

NOTICE

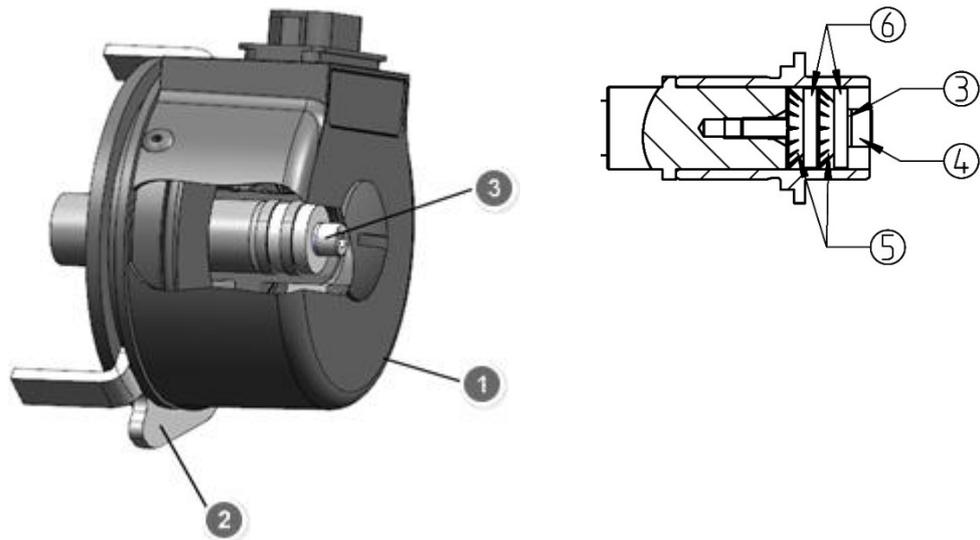
Danger of property damage

- Observe the instructions supplied by our suppliers for the attachments
- Observe the maximum screw-in depth of the fastening screws (see installation drawing); screws that protrude too far into the motor damage the motor
- Do not subject the attached parts (incremental encoder, tachometer, etc.) to axial or radial pressure during assembly

6.1 Incremental encoder

6.1.1 Installation with torque arm

Example



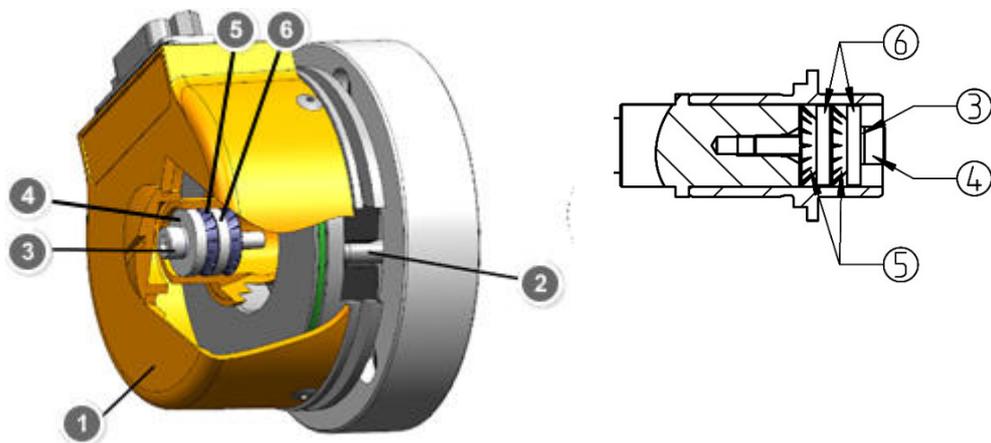
Item	Designation
1	Incremental encoder
2	Torque arm
3	Screw M3 (DIN 912 quality 8.8)
4	Locking washer
5	Serrated lock washer (DIN 6798 Form V)
6	Spring washer

Proceed in the order given:

Step	Procedure
1	Remove the cap.
2	Push the torque arm (item 2) onto the incremental encoder (item 1).
3	Push the incremental encoder with the support onto the shaft. Maintain an air gap of min. 0.9 mm and max. 1.0 mm between the incremental encoder and counterpart.
4	Mount the fastening elements with the screw (item 3) with screw lock medium tight (e.g. Three Bond 1344) and with a tightening torque of 1 Nm.
5	Attach the cap.

6.1.2 Mounting on counterpart

Example



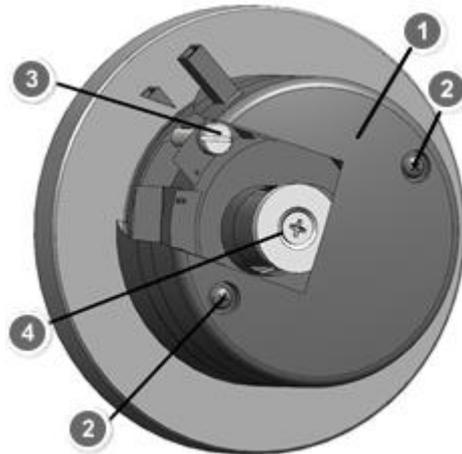
Item	Designation
1	Incremental encoder
2	Cylinder pin
3	Cap screw M3x16 8.8 (DIN 912 quality 8.8), tightening torque: 1 Nm
4	Locking washer
5	Serrated lock washer (DIN 6798 Form V)
6	Spring washer

Proceed in the order given:

Step	Procedure
1	Remove the cap.
2	Push the incremental encoder (item 1) onto the shaft.
3	Insert the cylinder pin (item 2) correctly into the rubber part; maintain an air gap of min. 0.9 mm and max. 1.0 mm between the incremental encoder and flange.
4	Mount the fastening elements with the cylinder screw (item 3) with screw lock medium tight (e.g. Three Bond 1344) and with a tightening torque of 1 Nm.

6.2 Tachometer

Example



Item	Designation
1	Cover
2	Cover screw
3	Cap screw M3 (quality 4.8)
4	Fixing screw M3 (quality 4.8)

6.2.1 Disassembly

Proceed in the order given:

Step	Procedure
1	Loosen the two screws (item 2) and remove the cover (item 1).
2	Loosen and remove the two screws (item 3) with the locking element.
3	Remove the tachometer housing without the armature.
4	Loosen and remove the fixing screw (item 4).
5	Remove the armature from the shaft.
6	Check for abrasion of the carbon brushes (interval like motor carbon brushes, see page 48).

6.2.2 Installation

Proceed in the order given:

Step	Procedure
1	Place the armature on the shaft.
2	Tighten the fixing screw (item 4) with a tightening torque of 1 Nm and secure with medium strength adhesive (Three Bond 1344).
3	Put on the tachometer housing.
4	Tighten the two screws (item 3) with safety element.
5	Replace the cover (item 1) and tighten the two screws (item 2).

6.3 Electromagnetic brake

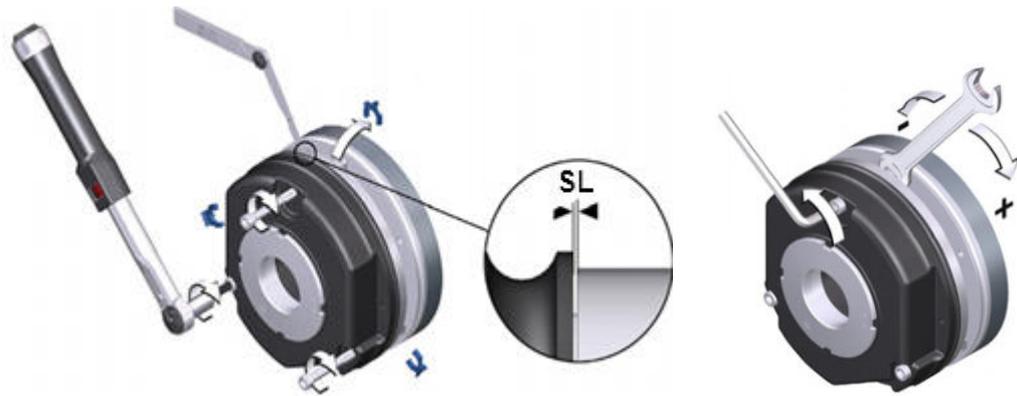
NOTICE

Danger of property damage

- Keep the brake surface free of oil and grease

6.3.1 Brake manufacturer: Intorq/Warner ERD 10/20/KEB

Example



Proceed in the order given:

Step	Procedure
1	Insert the feather key into the groove provided for this purpose.
2	Press the hub onto the shaft with a little force.
3	Secure the hub against axial displacement with the circlip.
4	Push the rotor onto the hub.
5	Check that the rotor can be moved by hand.
6	Push the magnetic part onto the hub.
7	Screw the magnetic part completely onto the bearing plate. For this purpose, use the supplied screw set and a torque wrench (for tightening torques see page 17).
8	Check the air gap SL (see table below) near the screws with a feeler gauge.
9	Reset the dimension if the measured value "SL" is outside the tolerance. To do this, loosen the cap screws a little and adjust the air gap with a wrench over the sleeve screws.
10	Tighten the screws with a torque wrench.

INTORQ KEB Size	SL _N +0.1 mm -0.05 mm [mm]	SL _{max.} Service brake [mm]	Torque [Nm]	Brake torque adjustment (factory-set to nominal torque as standard)
06	0,2	0,5	4	Braking torque adjustable on the central adjustment ring
08			8	
10			16	
12	0,3	0,75	32	
14			60	
16			80	

The friction lining is dimensioned so that the brake can be readjusted at least five times.

WARNER ERD10 and ERD20	010	020
Nominal torque [Nm]	10	20
Nominal air gap SL _N +0.1 -0.005 [mm]	0.2	
Max. gap [mm]	0.65	0.55

6.3.2 Brake manufacturer: Mayr ROBA-stop

NOTICE

Danger of property damage

- An uneven adjustment dimension on the manual release can disrupt the functioning of the brake

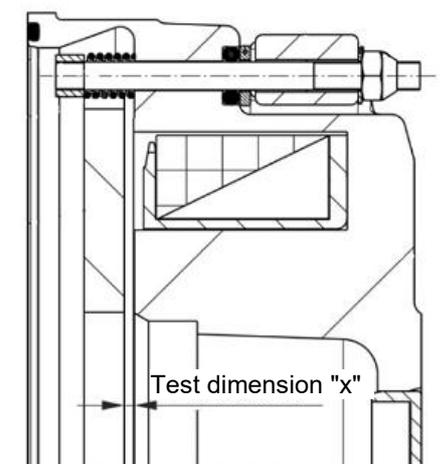
Proceed in the order given:

Step	Procedure
1	If necessary, screw on the flange.
2	Insert the feather key into the motor shaft.
3	Push the hub onto the shaft and secure with the circlip.
4	Check the nominal rotor thickness according to the table below and slide it onto the hub.
5	Tighten the magnetic part with three screws (for tightening torques, see page 17).

The air gap of the brake cannot be adjusted due to the design of the magnetic part. If wear occurs, the rotor may be replaceable, see the following table:

ROBA-stop-M	4	8	16	32
Nominal air gap +0.1/-0.005 [mm]	0.15	0.2		
Max. gap [mm]	0.4	0.45	0.7	

The test dimension "x" (air gap) is only used to adjust the manual release when dismantled.



6.3.3 Brake manufacturer: Precima FDS

Proceed in the order given:

Step	Procedure
1	If necessary, screw on the flange.
2	Insert the feather key into the motor shaft.
3	Push the hub onto the shaft and secure with the circlip.
4	Check the rotor thickness according to the table below and slide it onto the hub.
5	Tighten the magnetic part with three screws (for tightening torques, see page 17).

The air gap of the brake cannot be adjusted due to the design of the magnetic part. If wear occurs, the rotor may be replaceable, see the following table:

Type	Nominal torque [Nm]	Max. rpm	Nominal air gap a +0.2 mm [mm]	Rotor thickness new condition S -0.1 [mm]	Min. rotor thickness [mm]
FDS 08	7.5*	6000	0.2	5	4.8
	5				4.5
	4				4.5
	3				4.3
FDS 10	15*	6000	0.2	6	5.8
	10				5.6
	7.5				5.5
	6				5.4
FDS 13	30*	6000	0.3	6	5.8
	20				5.5
	17				5.5
	14				5.4

* Holding brakes with emergency stop characteristics

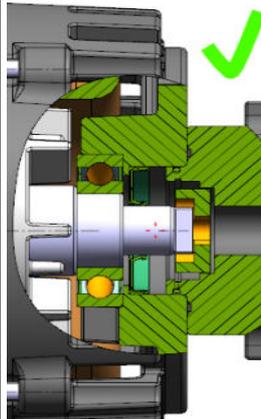
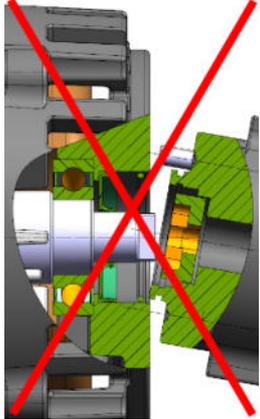
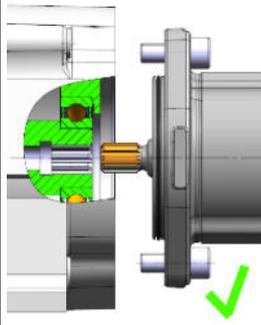
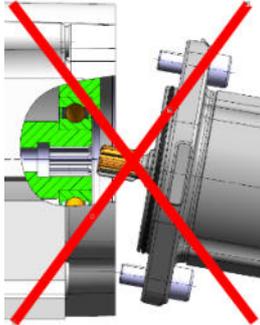
6.4 Pump

NOTICE

Danger of property damage

- Check the pump support for flatness and avoid tensions
- Check the piping for correct installation and avoid tensions due to piping
- Ensure that the directions of rotation of the drive and pump match (indicated by an arrow on the housing or on the rating plate); a left-turning motor, for example, requires a right-turning pump
- Do not tilt the pump shaft and the motor shaft
- Do not assemble the coupling parts by hammering or pressing
- Observe the permissible tightening torques of the fixing screws (see page 17)

Proceed in the order given:

Step	Procedure		
1	Clean the sealing surfaces and check for damage.		
2	For hollow shaft connections: Grease the gearing (see page 21).		
3	For O-ring sealing: Grease the O-ring.		
4	Mount the pump on the motor shaft.	 <p>Correct</p>	 <p>Incorrect</p>
	Hollow shaft gearing	 <p>Correct</p>	 <p>Incorrect</p>
5	Before start-up, fill the pump with oil from the suction side.		

6.5 Gearing

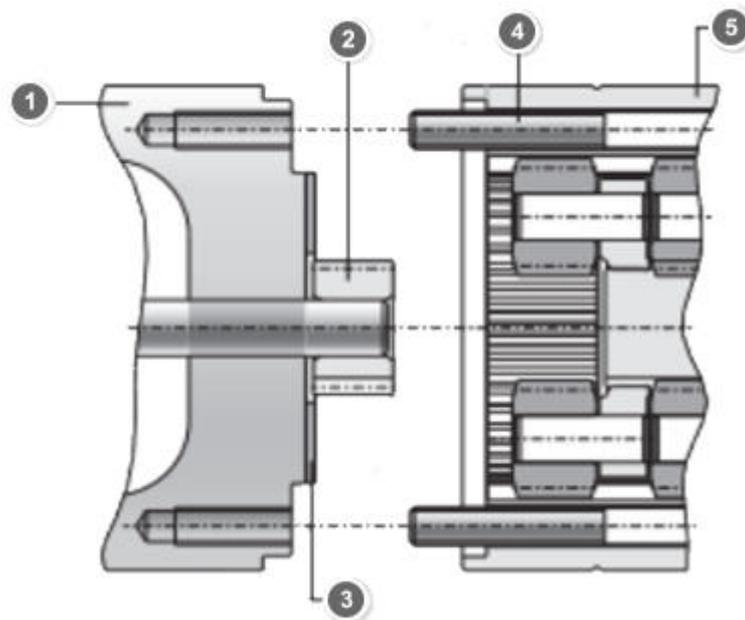
6.5.1 Gear manufacturer: IMS/SPN

NOTICE

Danger of property damage

- Do not disassemble the gear unit
- Prevent dirt particles from entering the gear unit during installation

Example



Item	Designation
1	Motor
2	Motor pinion
3	Thrust washer
4	Fixing screw
5	Gearing

Proceed in the order given:

Step	Procedure
1	Check all components for impurities, impact points or other damage.
2	Clean the flange and sealing surfaces.
3	Grease the gearing (see page 21).
4	Carefully assemble the motor (item 1) and gear unit (item 2). Do not tilt the motor pinion (item 5) or toothed shafts. Insert the gear unit into the counterpart with slight rotary movements.
5	Tighten the motor flange bolts crosswise (see drawing or tightening torques on page 17).
6	Secure screw connections against loosening.

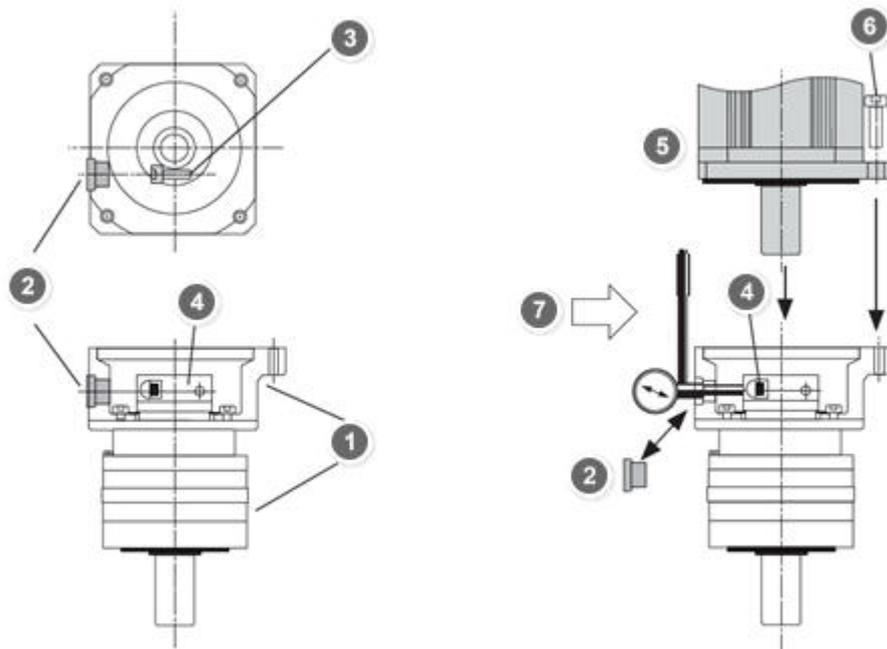
6.5.2 Gear manufacturer: SUMITOMO/SPN 00E2

NOTICE

Danger of property damage

- Do not disassemble the gear unit
- Prevent dirt particles from entering the gear unit during installation
- Keep the motor shaft and the clamping bore free of oil and grease

Example



Item	Designation
1	Gearing
2	Mounting opening cover
3	Fixing screw for clamping ring or coupling
4	Clamping ring or coupling
5	Motor
6	Fixing screw for motor
7	Torque wrench.

6.6.1.1 Motor attachment

Proceed in the order given:

Step	Procedure
1	Check all components for impurities, impact points or other damage.
2	Clean the flange and sealing surfaces.
3	Turn the clamping ring or coupling (item 4) so that the fixing screw (item 3) is under the mounting opening.
4	Insert the motor shaft into the clamping ring bore or into the coupling bore, push in vertically and insert the motor flange into the gear flange centring. After mounting with clamping ring, the slots of the clamping ring and shaft must lie on top of each other.
5	Fasten the motor (item 5) to the gear unit (item 1) with screws (item 6).
6	Tighten the fixing screw of the clamping ring or coupling (Item 3) through the bore of the gear unit using a torque wrench (for tightening torques, see page 17).
7	Insert the cover (item 2) into the mounting opening.

6.6.1.2 Tightening torque SUMITOMO

Gearbox size	Clamping ring for motor shaft diameter	Clamping screw DIN 6912	Tightening torque [Nm]
045 1-stage	Ø 8 - Ø 14	M5-8.8	5.5
045 2-stage	Ø 16 - Ø 19	M6-8.8	9.6
080 2-stage	Ø 22 - Ø 28	M8-8.8	23
250 2-stage	Ø 32	M10-8.8	46
080 1-stage	Ø 8 - Ø 24	M6-12.9	16.5
250 1-stage	Ø 8 - Ø 14	M6-12.9	16.5
450 1-stage 450 2-stage	Ø 16 - Ø 32	M8-8.8	23

6.6.1.3 Tightening torque SPN E2X

Fixing screws	
DIN 912-10.9	Tightening torque [Nm]
M4	2.4
M5	4.9
M6	8
M8	20
M10	40
M12	69

Clamping screws			
Motor shaft	DIN 912-10.9	SW	Nm
5-8	M4	3	4 ±0.3
9-11	M5	4	8.5 ±1
12-19	M6	4	14 ±1
20-32	M8	6	34 ±2
33-38	M10	8	69 ±2

7 Commissioning

7.1 Preparation

NOTICE

Danger of property damage

The following checklist is not comprehensive.

- If necessary, refer to the separate product documentation for further tests in order to prevent the risk of damage to property

Proceed in the order given:

Step	Procedure
1	Clean oil, water, dust and dirt from the inside and outside of the motor.
2	Blow out the inside of the motor with soft compressed air.
3	To remove rust inhibitor, use a lint-free cloth soaked in a mineral oil-based solvent.
4	Check the connecting bolts for oxidation and remove oxidation if necessary.
5	Work through the following checklist.

7.2 Checklist

The following points must be checked after assembly or repair:

1. The installation work carried out and the operating conditions comply with the data provided on the rating plate (voltage, circuit, degree of protection, cooling, etc.); See also the supplied documentation if applicable.
2. Due to the correspondingly designed control and speed monitoring, no higher speeds are used than specified in the technical documentation.
3. The machine is properly assembled and aligned.
4. The output elements have the correct setting conditions depending on the type, e.g.:
 - backlash for gear output
 - alignment and balancing of couplings
 - radial clearance
 - axial guidance and correct axial position for couplings of plain bearing motors with two floating bearings.
5. The minimum insulation resistances, measured according to DIN EN 60034, are observed. This also applies after prolonged breaks in operation.
6. The machine is connected according to the prescribed direction of rotation.
7. All fixing screws and connecting elements as well as the electrical connections are properly tightened.
8. The existing earthing and equipotential bonding connections are properly established.
9. Depending on the design, the bearings are relubricated or have an adequate oil supply according to the operating and maintenance instructions or according to the project-related data.
10. Any additional equipment (sensor system, temperature monitoring in the winding, on the bearing, etc.) is properly connected and functional.

11. All contact protection measures for moving parts have been carried out and secured against ejection in the event of unused feather keys at the second shaft end.
12. All contact protection measures for live parts have been carried out.
13. Any forced cooling fans are ready for operation and connected according to the prescribed direction of rotation.
14. During operation, the smooth running of the machine is not impaired and a free air inlet and outlet is guaranteed.
15. For motors with water or oil cooling: special attention must be paid to the water or oil circuit. Filling with water or oil must be carried out according to special regulations.
16. For DC motors: the smooth running of the carbon brushes in the carbon brush holder is guaranteed. The carbon brushes rest on the collector and the brush spring can exert pressure on the carbon brushes.
17. Any existing brakes have been checked for proper function (see brake manufacturer's documentation).

7.3 Initial start

NOTICE

Danger of property damage

- Non-compliance with the above measures (see checklist) may affect the performance of the motor and result in burning of the motor winding and voiding of the warranty
- If the motor is only designed for one direction of rotation and a different direction of rotation is required than the one supplied, contact Schabmüller GmbH

Proceed in the order given:

Step	Procedure
1	Check the direction of rotation of the coupled motor.
2	Operate the motor at low speed and check that no parts rub against each other and that no abnormal noises are audible.
3	For motors with oil-bath or oil-circuit lubricated roller bearings: Check that the oil supply complies with the specifications given in the special instructions for this machine.
4	For systems with oil flow meter: Generate a signal from the oil circuit on both bearings that confirms the oil pressure on the bearings. Check that the oil pressure in the circuit conforms to the specifications of the regulation specifically designed for this machine.
5	If a water-cooling system is available: Switch on the water cooling system and measure the water pressure, the water temperature (inlet / outlet) and the flow rate. Refer to the instructions specially prepared for this machine for setpoints.

8 Maintenance

8.1 Safety instructions

Before starting any work on the motor, ensure that the motor or the system has been properly disconnected. Observe the safety rules in the operating and maintenance instructions for this purpose.



WARNING

Danger due to electrical voltage

- Switch off the motor
- In addition to the main circuits, pay attention to any additional or auxiliary circuits that may be present
- Secure the motor against restarting
- Check that there is no voltage
- For voltages above 1000 V: Earth and short-circuit the motor
- Cordon off or cover live adjacent parts

8.2 Regular inspection

NOTICE

Danger of property damage

Failure to comply with these points may result in unintentional shutdown of the motor.

- Carry out a general inspection of the engine at regular intervals (see maintenance schedule, page 46)
- The inspection must include the activities listed below
The inspection distances to be observed depend on the type of machine and the operating conditions
- If repair of the motor is required or damaged parts have to be replaced, contact Schabmüller GmbH

Proceed in the order given:

Step	Procedure
1	Keep the motor, the motor housing and the coupled machines free of dust, oil residues and foreign bodies to facilitate heat exchange with the environment.
2	Measure insulation resistance in accordance with IEC 60034.
3	Measure temperature rise (windings and cooling system).
4	Check the rolling bearing for wear.
5	Check the brushes and collector for wear.
6	Check the functioning of the cooling system (air, oil, water flow).
7	Check coupled equipment (hydraulic unit, water cooling system, etc.).
8	Check accessories, guards and motor connections.

Step	Procedure
9	Carry out inspection and examination in order to detect and eliminate any faults at an early stage before damage occurs.
10	Adjust the maintenance intervals to the operating conditions and the local circumstances (dirt accumulation, switch-on frequency, load, brush wear, insulation resistance).

8.2.1 Carbon brushes (for DC motors)

The abrasion of the carbon brushes must be checked at intervals of half a year or 500 operating hours. The brush chamber must be cleaned of carbon dust and the carbons checked for ease of movement.

The abrasion must not exceed the value given in the table. This means that the resulting minimum residual height of the expired carbon brushes must not be undercut.

If the remaining height of the carbon brushes is undercut, they must be replaced by original Schabmüller carbon brushes in order to guarantee the same motor characteristics.

Brush springs with insufficient spring pressure must be replaced by new brush springs.

Carbon height	17	22	28	30	31	32	40
Max. abrasion	8	12	14	15	16	16	20
Min. remaining height	9	10	14	15	15	16	20

8.2.2 Collector (for DC motors)

Starting from the new condition, the collector may only be tapered on one side by a maximum of the machining dimensions specified below. Mica must be sawn to a depth of at least 0.5 mm. The width of the mica must not be changed. The edges must be free of burrs.

Carbon barrel diameter	One-sided planing
33 mm	1.0 mm
36 mm up to and including 64 mm	1.5 mm
67 mm up to and including 100 mm	2.0 mm
107 mm	2.5 mm
126 mm	5.0 mm

8.3 Maintenance schedule

The maintenance schedule below should be regarded as a suggestion. The maintenance intervals depend on the operating and installation conditions. Maintenance for special machines can be found in the operating and maintenance instructions specially prepared for this purpose.

Component	Every 6 months	Yearly	Every 3 years	Comment
General				
Visual inspection		X		
Cleaning		X		
Tighten the terminal fixing and earthing screw.		X		
Measure the insulation resistance of the winding according to IEC 60034			X	Not in the vehicle, only in dismantled condition
Check for noises and vibrations			X	
Bearings				
Check the bearings for noise, vibrations, tightness and temperature rise			X	
Change the bearings if necessary			X	
Shaft				
Visual inspection			X	Before installation and during bearing replacement
Cleaning			X	
Air, water and oil cooling				
Visual inspection	X			
Cleaning	X			
Check the fan for function	X			
Clean oil or water channels		X		
Brushes, brush holder, collector				
Visual inspection	X			
Cleaning	X			
Check the brushing action	X			
Check the brushes for wear and replace if necessary.	X			
Check the collector surface	X			
Customer service at Schabmüller GmbH			X	

8.4 Inspection



CAUTION

Danger of injury due to improper work

Observe the following measures for all inspection work:

- Observe the safety regulations
- Have inspections carried out by qualified personnel only
- Do not disassemble the motor

During normal inspections, it is not necessary to disassemble the motor. Disassembly is usually required for the first time when cleaning or replacing bearings.

8.4.1 Check at standstill

Check all the specified points:

Step	Procedure
1	The alignment of the machine must lie within the permissible tolerances.
2	All screws for mechanical and electrical connections must be firmly tightened.
3	The insulation resistances of the winding must be sufficient to comply with IEC 60034.
4	Cables and insulating parts must be in proper condition and must not show any discolouration.

8.4.2 Check while running

Check all the specified points:

Step	Procedure
1	The specified technical data must be observed, such as power consumption and temperatures (winding, environment, bearings, cooling air).
2	There must be no leaks (oil, grease or water).
3	No abnormal bearing running noise must be heard.

9 Troubleshooting

The following instructions do not cover all the technical details or differences between the different motors or all the situations that may occur during installation, operation or maintenance. Inquiries regarding further information should be directed to Schabmüller GmbH Customer Service.

Fault	Possible cause	Measure
Motor does not start.	Fuse blown in the vehicle.	Insert new fuses of the correct type and rating.
	Faulty power supply.	Check that the power supply complies with the specifications on the engine rating plate and is suitable for the respective load factor.
		Check that the connections are correctly fastened to the terminal board.
	Mechanical fault.	Check that the motor rotates freely. Check the bearings and lubrication. Check the bearing plates to see if one or both are broken. Check if there are any foreign bodies in the motor.
	Rotor defective.	Check for broken shaft, loose rotor core or broken fan blades. Remove any foreign bodies in the motor that block the rotor.
	Motor overloaded.	Reduce the load.
	Broken connection on the stator winding. Disconnection in the winding.	Recognisable from humming noise when switched on. Check the wiring for loose connections. Check that all contacts are closed. Motor must be rewound.
	Battery or controller defective.	Check and replace if necessary.
Motor only runs for a short period of time.	On-board power failure	Check for loose connections to mains, fuses and controls.
Motor does not start up.	Undervoltage at motor terminals due to mains voltage drop.	Use a higher voltage or higher transformer stage or reduce the load. Check the connections. Check the cables for appropriate cross-section.
	Incorrect use.	After consultation with Schabmüller GmbH, use a suitable type or size.
	Starting load too high.	Check the design of the engine with regard to idling.
	Broken shaft or loose rotor core.	A new rotor may be required, as a permanent repair is not possible in this case.

(Continued)

Fault	Possible cause	Measure
Motor starts up too slowly and/or draws too much current.	Load too high.	Reduce the load.
	Voltage at start-up too low.	Check the resistance. Use a suitable cable cross-section.
	Mains voltage too low.	Check the power supply.
Incorrect direction of rotation.	Incorrect phase sequence.	Check the connection sequence.
	Controller setting	Check the setting and change if necessary.
	Sensor connected incorrectly.	Check the connection and change if necessary.
Motor overheats during operation under load.	With permanent magnet motors: Pulse width modulation unfavourable.	If the rotor is demagnetised, replace the rotor. Check the stator (resistance and insulation) and replace if necessary.
	Overload	Reduce the load.
	Ventilation openings or cooling ducts may be dirty and prevent optimum cooling of the motor.	Clean the ventilation openings. Check that a continuous air flow is cooling the motor. Clean the cooling ducts.
	A connector may not be properly attached.	Check that all lines are correctly connected.
	Shorted winding	Stator must be rewound.
	Ambient temperature too high (adjacent vehicle parts become too hot).	Locate the heat source, switch off if necessary or shield the motor with heat protection.
Motor vibrations	Excitation by attachments (pump, gearbox, brake).	Tighten the fastening screws with the correct tightening torque (see Page 17). If necessary, remove and reinstall the attachment part (see chapter 6) or use a new component.
	Motor badly aligned.	Realign the motor.
	Lack of stability of the substructure.	Reinforce the substructure.
	Unbalance in coupling.	Balance the coupling.
	Unbalance in driven system.	Re-balance the driven system.
	Defective bearings.	Change the bearings.
	Unbalance in rotor/armature.	Re-balance the rotor/armature.
Noises	Loose fit on base plate	Tighten the foot screws.
	Fan touches the end shield or fan cover.	Correct the fan assembly.
	Air gap not uniform	Check the bearing plate mounting or bearings and correct accordingly.
	Unbalance in rotor/armature	Re-balance the rotor/armature.
	Controller settings	Check the setting and change if necessary.
	Defective bearings	Change the bearings.

10 Customer Service and Support

For any questions, please contact:

Schabmüller GmbH
Industriestraße 8
92334 Berching
Germany

Telephone: +49 8462 204-0

E-mail: service@schabmueller.de

Internet: <http://www.schabmueller.de>

When requested by Customer Service, have the information on the rating plate ready (see page 7 and page 8).

Specify the following information for complaints:

- Material number
- Serial number
- Quality sticker
- Production week

11 Disposal

NOTICE**Environmental protection**

- Observe the international, national and regional regulations for disposal
- Consider the recyclability, dismantlability and separability of recyclable materials and assemblies
- Pay attention to the environmental and health dangers of recycling and disposal

11.1 Cleaning agents, auxiliary materials and operating materials

Cleaning agents, auxiliary materials and operating materials, in particular oil and oil-containing waste (lubricants), are a great danger potential for the environment. This waste must be stored in suitable containers. The disposal of this waste must be carried out by a specialist company in accordance with the international, national and regional laws and regulations in force at the time.

11.2 Scrapping

Material groups such as plastics and metals of different types must be sorted and fed into the recycling or disposal process.

When scrapping the components, comply with the international, national and regional laws and regulations in force at the time.

11.3 Electrical and electronic components

The disposal and recycling of electronic and electrotechnical components must be carried out in accordance with the relevant laws or state ordinance.

12 Standards

The electric motors of Schabmüller GmbH are built according to the currently valid rules of technology and are considered safe to operate. The basic safety and health requirements of the applicable laws, standards and directives are applied in the design and manufacture of the motor.

The motors are developed, manufactured and tested in accordance with the following standards:

Standard	IEC	DIN	EN	VDE
Dimensioning and operational behaviour	60034-1		60034-1	0530 Part 1
Method for determining losses and efficiency	60034-2		60034-2	0530 Part 2
Connection designations and direction of rotation				0530 Part 8
IEC standard voltages	60038	60038		0175
Noise limits	60034-9		60034-9	0530 Part 9
Degrees of protection due to the overall design of rotating electrical machines (IP code) classification	60034-5		60034-5	0530 Part 5
Mechanical vibration of certain machines with shaft heights 56 mm and higher - Measurement, evaluation and limits of vibration severity	60034-14		60034-14	0530 Part 14
60° centre holes; types R, A, B, and C Centre holes 60° with thread for shaft ends		332 Part 1 332 Part 2		
Cylindrical shaft ends; dimensions, nominal transmissible torques		748-1		
Shaft extension run out and of mounting flanges for rotating electrical machinery - Tolerances, test		42955		
Drive type fastenings without taper action; parallel keys, keyways, deep pattern		6885-1		
Cable glands for electrical installations			50262	
Electrical requirements for battery-powered trucks		1175	1175	
Machinery Directive 2006/42/EC				

SCHABMÜLLER – DRIVE
SOLUTIONS MADE IN
GERMANY

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