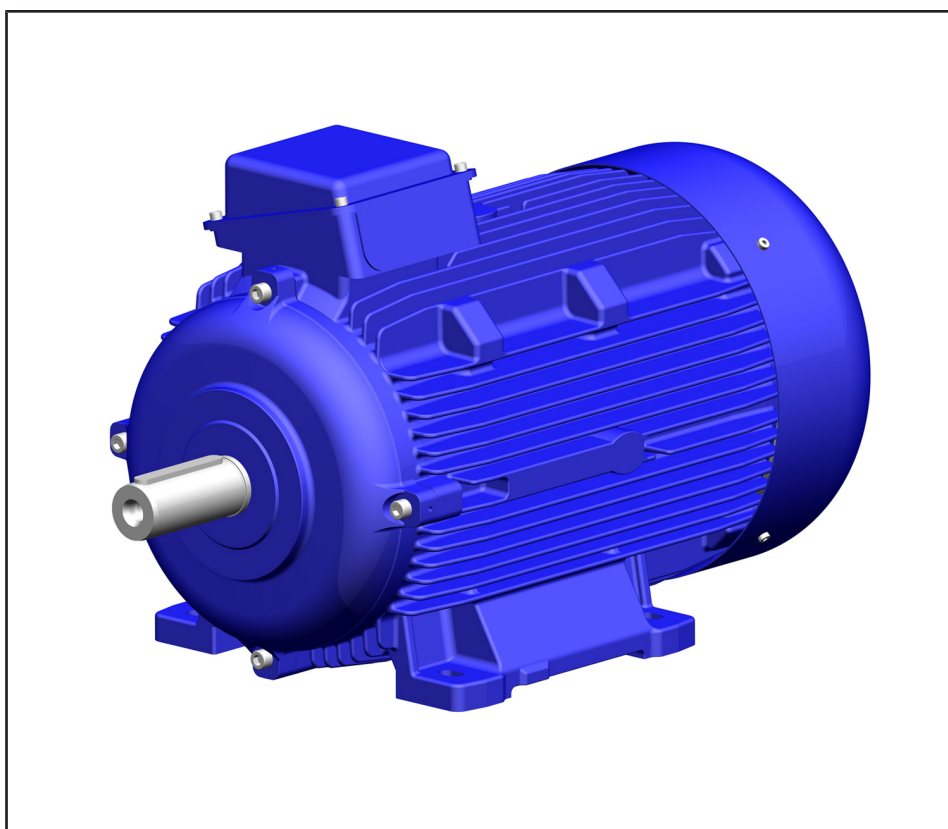


Asynchronous Motor

KSB IE4-Motor

Installation/Operating Manual



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Installation/Operating Manual KSB IE4-Motor

Original operating manual

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Glossary

Drive end

End of motor with bare shaft end for connecting the machine to be driven via a coupling or traction sheave and belt (driven output or machine element).

Non-drive end

End of motor with fan and fan hood.

1 General

1.1 Principles

This operating manual is valid for the type series and variants indicated on the front cover.

The operating manual describes the proper and safe use of this equipment in all phases of operation.

The name plate indicates the type series, the main operating data and the serial number. The serial number uniquely describes the product and is used as identification in all further business processes.

In the event of damage, immediately contact your nearest KSB service facility to maintain the right to claim under warranty.

1.2 Target group

This operating manual is aimed at the target group of trained and qualified specialist technical personnel.

1.3 Other applicable documents

Table 1: Overview of other applicable documents

Document	Contents
Pump operating manual	Proper and safe use of the pump in all phases of operation
Wiring diagram	Description of electrical connections

For accessories and/or integrated machinery components, observe the relevant manufacturer's product literature.

1.4 Symbols

Table 2: Symbols used in this manual

Symbol	Description
✓	Conditions which need to be fulfilled before proceeding with the step-by-step instructions
▷	Safety instructions
⇒	Result of an action
⇔	Cross-references
1. 2.	Step-by-step instructions
	Note Recommendations and important information on how to handle the product

1.5 Key to safety symbols/markings

Table 3: Definition of safety symbols/markings

Symbol	Description
 DANGER	DANGER This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.
 WARNING	WARNING This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.

Symbol	Description
	CAUTION This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.
	General hazard In conjunction with one of the signal words this symbol indicates a hazard which will or could result in death or serious injury.
	Electrical hazard In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage.
	Machine damage In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions.



2 Safety

All the information contained in this section refers to hazardous situations.

In addition to the present general safety information the action-related safety information given in the other sections must be observed.

2.1 General

- This operating manual contains general installation, operating and maintenance instructions that must be observed to ensure safe operation of the system and prevent personal injury and damage to property.
- Comply with all the safety instructions given in the individual sections of this operating manual.
- The operating manual must be read and understood by the responsible specialist personnel/operators prior to installation and commissioning.
- The contents of this operating manual must be available to the specialist personnel at the site at all times.
- Information and markings attached directly to the product must always be complied with and kept in a perfectly legible condition at all times. This applies to, for example:
 - Markings for connections
 - Name plate
- The operator is responsible for ensuring compliance with all local regulations not taken into account.
- If the motor is used in countries outside the European Community, adhere to the regulations applicable to the relevant country. Also observe any local and industry-specific regulations governing installation and safety.

2.2 Intended use

- This product must only be operated within the limit values stated in the technical product literature for the mains voltage, mains frequency, ambient temperature, motor rating, speed, density, pressure, temperature and in compliance with any other instructions provided in the operating manual or other applicable documents.
- The product must not be used in potentially explosive atmospheres.
- The motor is designed and manufactured in accordance with the requirements of the Electrical Equipment (Safety) Regulations 2016 . The motor is intended for use in industrial plants.

2.3 Personnel qualification and training

- All personnel involved must be fully qualified to install, operate, maintain and inspect the product this manual refers to.
- The responsibilities, competence and supervision of all personnel involved in transport, installation, operation, maintenance and inspection must be clearly defined by the operator.
- Deficits in knowledge must be rectified by means of training and instruction provided by sufficiently trained specialist personnel. If required, the operator can commission the manufacturer/supplier to train the personnel.
- Training on the product must always be supervised by specialist technical personnel.

2.4 Consequences and risks caused by non-compliance with this manual

- Non-compliance with these operating instructions will lead to forfeiture of warranty cover and of any and all rights to claims for damages.
- Non-compliance can, for example, have the following consequences:

- Hazards to persons due to electrical, thermal, mechanical and chemical effects and explosions
- Failure of important product functions
- Failure of prescribed maintenance and servicing practices
- Hazard to the environment due to leakage of hazardous substances

2.5 Safety awareness

In addition to the safety information contained in this operating manual and the intended use, the following safety regulations shall be complied with:

- Accident prevention, health regulations and safety regulations
- Safety regulations for handling hazardous substances
- Applicable standards, directives and laws

2.6 Safety information for the user/operator

- Fit protective equipment (e.g. contact guards) supplied by the operator for hot, cold or moving parts, and check that the equipment functions properly.
- Do not remove any protective equipment (e.g. contact guards) during operation.
- Provide the personnel with protective equipment and make sure it is used.
- Eliminate all electrical hazards. (In this respect refer to the applicable national safety regulations and/or regulations issued by the local energy supply companies.)

2.7 Safety information for maintenance, inspection and installation

- Modifications or alterations of the pump (set) are only permitted with the manufacturer's prior consent.
- Use only original spare parts or parts/components authorised by the manufacturer. The use of other parts/components can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.
- Any work on the product shall only be performed when it has been disconnected from the power supply (de-energised).
- Carry out work on the product during standstill only.
- As soon as the work has been completed, re-install and re-activate any safety-relevant devices and protective devices. Before returning the product to service, observe all instructions on commissioning.

2.8 Unauthorised modes of operation

Never operate the product outside the limits stated in the data sheet and in this manual.

The warranty relating to the operating reliability and safety of the product supplied is only valid if the product is used in accordance with its intended use.

2.9 Electromagnetic compatibility

When operating the motor on a frequency inverter always observe the frequency inverter manufacturer's information on compliance with the Electromagnetic Compatibility Regulations 2016.

Take additional measures to ensure compliance with the Directive and obtain a connection approval from the local energy supply company, if necessary.

3 Transport/Storage/Disposal

3.1 Checking the condition upon delivery

1. On transfer of goods, check each packaging unit for damage.
2. In the event of in-transit damage, assess the exact damage, document it and notify KSB or the supplying dealer and the insurer about the damage in writing immediately.

3.2 Transport

	 DANGER Improper transport Danger to life from falling parts! ▷ Only transport the motor in the specified position. ▷ Always use all lifting lugs available at the motor during transport. ▷ Always screw in lifting lugs (lifting eyebolts) up to the contact face and tighten. ▷ Use suitable, permitted lifting accessories.
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Only remove any transport locks provided prior to commissioning and store or disable. Use transport locks for additional transport tasks or re-enable.

To transport motors weighing more than 25 kg, suspend them from the lifting tackle as shown.

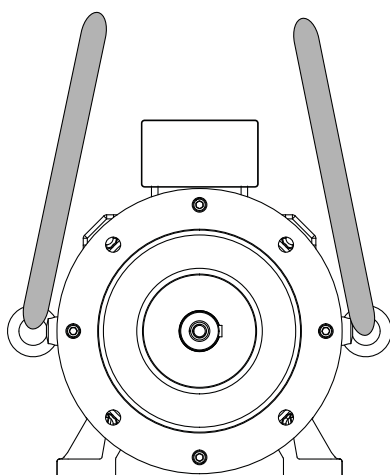


Fig. 1: Transporting the motor by two lifting lugs attached to sides of motor housing

3.3 Storage/preservation

Exposed machined metal surfaces	Exposed locating surfaces (shaft ends, flange faces, centring spigots, connector contacts) are treated with a layer of temporary corrosion protection (< 6 months) for transport. Take suitable corrosion protection measures for extended storage periods.
Storage period	Rotate the shaft once annually to avoid permanent standstill markings. Extended storage periods decrease the service life (increase ageing) of the grease applied to the rolling element bearings.
Closed rolling element bearings	Replace closed rolling element bearings after 48 months of storage.
Condensation during storage	To prevent condensation inside the motor, switch on the motor standstill heater ¹⁾ . If condensation water has formed and a drain hole is provided, position the motor in such a way that the water drain plug is at the lowest point of the housing. Drain off the condensation water. (⇒ Section 7.2.2.1, Page 33)

¹ If any

Drain off the condensation water as required by the ambient conditions but at least every 6 months.

Outdoor storage

	CAUTION Damage during storage due to humidity, dirt or vermin Corrosion/contamination of the drive! ▷ Cover all components with water-proof material. Covers or tarpaulins must not contact the surface of the stored goods. ▷ Ensure sufficient air circulation, e.g. by inserting wooden spacers. ▷ To ensure protection against ground moisture, arrange motors and packaged motors on pallets, bars or foundations. ▷ Prevent the possibility of the product sinking into the ground.
---	--

Implement appropriate measures to accommodate extreme climatic conditions, e.g. salty, dusty or moist atmospheres.

Indoor storage

Storage rooms should provide protection against extreme weather conditions and be dry, dust-free, frost-free, jolt-free, vibration-free and well ventilated.

3.4 Disposal

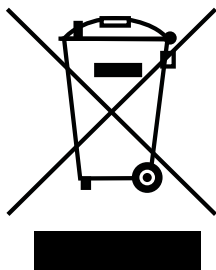
Electrical or electronic equipment marked with the adjacent symbol must not be disposed of in household waste at the end of its service life.

Contact your local waste disposal partner for returns.

If the used electrical or electronic equipment contains personal data, the operator is responsible for deleting it before the equipment is returned.

Due to some components, the product is classified as special waste.

1. Dismantle the product.
2. Separate and sort the materials, e.g. by:
 - Metals
 - Plastics
 - Electronic waste
 - Greases and other lubricants
3. Dispose of materials in accordance with local regulations or in another controlled manner. PCBs, power electronics, capacitors and electronic components are all hazardous waste.



4 Description

4.1 General description

Low-voltage asynchronous motor of efficiency class IE4 to IEC 60034-30 for operation on the public power grid or on a frequency inverter

4.2 Product information

4.2.1 Product information as per Regulation No. 1907/2006 (REACH)

For information as per European chemicals regulation (EC) No. 1907/2006 (REACH) see <https://www.ksb.com/en-global/company/corporate-responsibility/reach>.

4.2.2 Product information as per Regulation (EU) 2019/1781

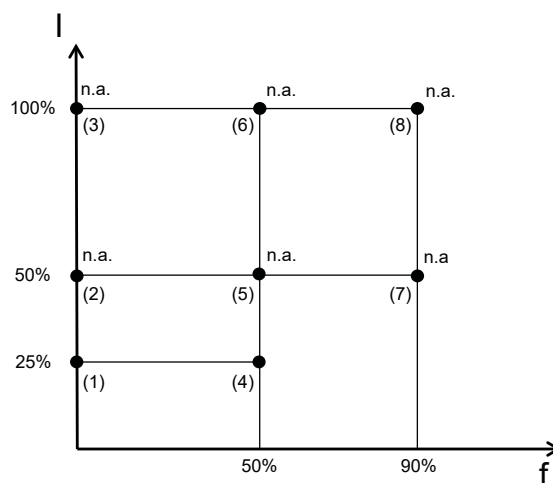


Fig. 2: Power losses (%) of rated output power (speed versus torque)

Table 4: Efficiency

Model ID						Efficiency		
Factory-dependent motor material number			KSB material number			η_N	$\eta_{75\%}^{2)}$	$\eta_{50\%}^{2)}$
						[%]	[%]	[%]
5214341	5214248	5214315	5214325	5214272	5214352	95,6	94,8	93,6
5214338	5214333	5214319	5214322	5214277	5214356	96,0	95,8	95,3
5214342	5214249	5214316	5214326	5214273	5214353	95,8	95,2	94,3
5214339	5214334	5214360	5214323	5214278	5214357	96,1	96,0	95,5
5214343	5214330	5214317	5214327	5214274	5214354	96,0	95,5	94,0
5214340	5214335	5214361	5214324	5214279	5214358	96,3	96,0	95,4
5214337	5214331	5214318	5214321	5214275	5214355	96,2	95,9	95,1
5214332	5214336	5214362	5214276	5214320	5214359	96,4	96,1	95,4

Efficiency class: IE4
 Manufacturer: KSB SE & Co. KGaA
 Johann-Klein-Straße 9
 67227 Frankenthal
 HRB 65657 Ludwigshafen

²⁾ Minimum

Table 5: Model-dependent electrical data

Model ID			Number of poles	Rated output power	Rated input frequency	Nominal voltage	Nominal speed
				P _N	f ₁	U ₁	
Factory-dependent motor material number				[kW]	[Hz]	[V]	[rpm]
5214341	5214248	5214315	2	75	50	400	2850
5214338	5214333	5214319	4				1410
5214342	5214249	5214316	2	90			2810
5214339	5214334	5214360	4				1440
5214343	5214330	5214317	2	110			2860
5214340	5214335	5214361	4				1445
5214337	5214331	5214318	2	132			2855
5214332	5214336	5214362	4				1430

Number of phases: 3
 Installation altitude [m]: 1000
 Ambient air temperature range [°C]: -20 to 40
 Maximum in-service temperature [°C]: 130

4.3 Description

Table 6: Designation example

Position																													
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
-	2	-	7	5	,	0	-	2	8	0	S	-	B	W	B	7	F	3	N	T	S	D	W	F	W	W	K	S	W

Table 7: Designation key

Position	Code	Description
1-2	Number of poles	
	2	2 poles
	4	4 poles
4-7	Rated power	
	7 5 , 0	75 kW
9-12	IEC frame size	
	2 2 5 M	Shaft centreline height [mm] = IEC size
14	Enclosure	
	B	IP55
15	Type of protection	
	W	Non-explosion-proof
16	Rated voltage and rated frequency	
	B	3~, AC, 400 VΔ, 690 VY, 50 Hz
17	Efficiency class	
	7	IE4
18	Thermal class	
	F	Thermal class F
19	Motor and winding protection	
	3	3 PTCs
20	Direction of rotation	
	N	Clockwise and counter-clockwise (bi-directional)
21	Position of terminal box	
	T	Terminal box on top
22	Bolted feet	

Position	Code	Description
22	S	Bolted feet
	W	Without feet
	H	Integrally cast feet
23	Position of fixed bearing	
	D	Fixed bearing, drive end
24	Protective roof	
	W	Without protective roof
25	Motor flange	
	F	EN 50347 Type FF
	W	Without flange
26	Operation on inverter	
	U	Operation on inverter permitted
	W	Without approvals
27	Approval	
	W	Without approvals
28-30	Manufacturer	
	K W C	KSB IE4 motor

4.4 Name plate

The name plate provides, as a minimum, the following information:

- Manufacturer: KSB SE & Co. KGaA, Johann-Klein-Straße 9, 67227 Frankenthal (Germany)
- KSB material number
- Type designation: KSB IE4 motor
- Year of construction
- Number of phase windings
- Standards for design
- Enclosure
- Efficiency class to IEC 60034-30
- Thermal class
- Rated power/ rated powers
- Rated voltage/ rated voltages
- Rated frequency/ rated frequencies
- Rated current/ rated currents
- Rated speed/ rated speeds
- Rated power factor/ rated power factors
- Total weight

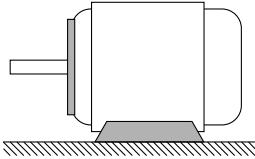
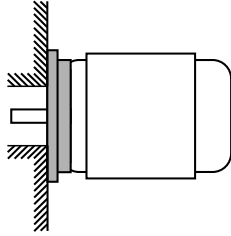
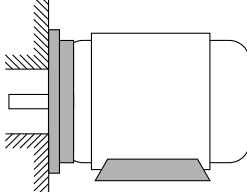
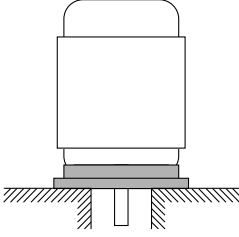
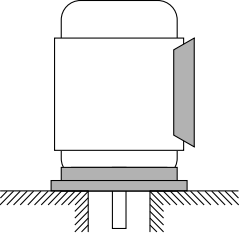
4.5 Types of construction

The motors are available in different types of construction:

Table 8: Types of construction and installation variants

Type of construction		Shaft centreline height [mm]	IM codes
Flange type ³⁾	With foot		
Without	✗	280 to 315	B3
Flange with clearance holes (FF)	-	280 to 315	V1, B5
	✗	280 to 315	V15⁴⁾, B35

4.6 Mounting arrangements

IM codes	Illustration
IM B3	
IM B5	
IM B35	
IM V1	
IM V15	

³ Designations to EN 50347

⁴ Detachable feet

4.7 Noise characteristics

The noise characteristics stipulated by DIN EN 60034-9 are complied with.

4.8 Balancing

The rotor is balanced dynamically in accordance with the ISO 1940-1 standard. The rotor is balanced to balance quality grade G 2.5.

The motor complies with vibration class A to IEC 60034-14.

Marking

- For motors with key, the rotors are balanced dynamically with a half key ("H") as standard in accordance with ISO 21940-32 requirements. The output element must also be balanced with a half key in accordance with the key convention.

5 Installation at Site

5.1 Checks to be carried out prior to installation

Place of installation

	! WARNING Installation on a mounting surface which is unsecured and cannot support the load Personal injury and damage to property! ▷ Use a concrete of compressive strength class C12/15 which meets the requirements of exposure class XC1 to BS 206. ▷ The mounting surface must be set, even, and level. ▷ Observe the weights indicated.
---	--

1. Check the structural requirements.

All structural work required must have been prepared in accordance with the dimensions stated in the outline drawing/general arrangement drawing.

Protective roof/additional roofing

Install a protective roof or additional roofing for vertical installation.

Vertical installation

- For vertical installation with the **shaft end pointed downwards** to prevent foreign objects from falling into the fan hood.
- For vertical installation with the **shaft end pointed upwards** to prevent fluid ingress along the length of the shaft.

Outdoor installation

Shield the motor by implementing suitable protection measures in order to prevent condensation from forming and to avoid the long-term effects caused by direct exposure to sunlight, rain, snow, ice and dust.

Flatness tolerance of contact surfaces

For foot-mounted motors, adhere to the following flatness tolerance of the contact surfaces for the motor feet.

Table 9: Flatness tolerance of contact surfaces for motor feet

Shaft centreline height	Flatness tolerance (mm)
≥ 280 mm	0,15

Ventilation

	! WARNING Improper installation Drive overheated! ▷ Maintain the specified minimum distances to neighbouring assemblies. ▷ Never restrict the ventilation ducting to/from the drive. ▷ Prevent exhaust air from neighbouring assemblies from being drawn in directly.
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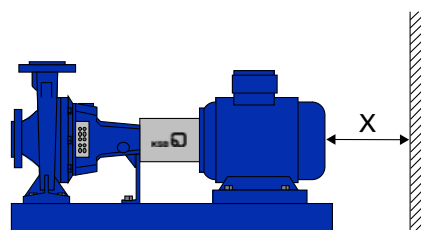


Fig. 3: Minimum distance X

Table 10: Minimum distance X to neighbouring assemblies

Motors with shaft centreline height [mm]	Minimum distance X [mm]
280 - 315	110
355	140

Condensation water drain If a drain hole is provided, position the motor in such a way that the water drain plug is at the lowest point of the housing. The motor is supplied with the water drain plug closed.

5.2 Installing the motor

Checks prior to installation work

- Repair any damage to the paintwork. (⇒ Section 7.2.2.2, Page 33)
- Remove any anti-corrosives applied to exposed metal parts that are required to ensure proper assembly or installation.

Alignment and fastening

	NOTE
	Maintain the vibration levels to ISO 10816-1 during operation.

Observe the following when aligning and fastening:

- Ensure that the motor feet are resting evenly on the support surface.
- Ensure that feet and flanges are mounted as specified in the manual.
- Avoid rigid couplings.
- Ensure precise alignment for direct coupling.
- Ensure that mounting surfaces are free from contamination.
- Avoid resonances caused by the structure at the rotational frequency and double mains frequency.
- Unusual noise that may occur when rotating the rotor by hand.

Compensation of radial misalignment at the coupling and horizontal adjustment

The following measures are required to compensate radial misalignment at the coupling and horizontally adjust the motor in relation to the driven machine (e.g. the pump):

- Vertical positioning**
To avoid distortion (warping) of the driven machine and the motor, place thin metal sheets under the motor feet.
The number of shims should be restricted to a minimum, in other words, they should only be stacked if this is unavoidable.
- Horizontal positioning**
For horizontal positioning, laterally shift the motor on the foundation while maintaining axial alignment (to prevent angular misalignment).
Ensure a uniform circumferential axial clearance at the coupling when positioning.
- Smooth running characteristics**
A stable, vibration-free foundation to DIN 4024, exact alignment of the coupling and a well-balanced output element (coupling, pulley, fan, etc.) are prerequisites for smooth, vibration-free operation of the motor.
Complete balancing of the motor with the output element may be required.
Note the information and evaluation criteria to ISO 10816.
- Foot/flange mounting**
Use the thread sizes specified by EN 50347 for fastening the foot and flange of the motor to the foundation and to the motor flange respectively. Fasten the motor at four foot holes or flange bolt holes positioned in rectangular arrangement to each other. The customer is responsible for selecting the strength of the fastening elements.

Property class recommendations: Class 5.6 or higher for fastening elements for motors with shaft centreline height up to and including 160 mm, and class 8.8 or higher for motors with shaft centreline height 180 mm.

	NOTE Lifting lugs that have been screwed in must either be tightened or removed after installation.
---	--

5.3 Electrical connection

	⚠ DANGER Hazardous voltage Danger of death from electric shock! ▷ Have all work performed only by qualified specialist personnel and only when the drive is at a standstill and secured against unintentional start-up. This also applies to auxiliary circuits (e.g. standstill heater). ▷ The drive must not be electrically connected at any point in time when work is performed on the open terminal box. ▷ Ensure that the rotor cannot turn or be turned at any point in time when work is performed on the open terminal box.
	⚠ WARNING Incorrect connection to the mains Damage to the power supply network, short circuit! ▷ Observe the technical specifications of the local energy supply companies.
	NOTE Always protect three-phase motors with a current-dependent overload protection device with additional phase failure protection.

Select the motor connection cables in accordance with IEC 60364, taking into account the current load of the cable at the given ambient temperature and the requisite heat dissipation to IEC / EN 60204-1 as a result of cable routing.

5.3.1 Motor connection inside the terminal box

Observe the following when performing any work on the terminal box:

- Always use the original sealing element to close the terminal box so that it is dust tight and watertight.
- Do not damage any components inside the terminal box, such as terminal board and cable connections.
- Ensure that no foreign matter, contamination or moisture are present in the terminal box. Terminal box cable entries to DIN 42925.
- Close additional open cable entries, using O-rings or suitable gaskets.
- Observe prescribed tightening torques for cable glands and other screws/bolts.
- When retrofitting cable glands to safeguard the required level of enclosure protection, ensure that the gasket is seated properly on the outside of the terminal box.

Connecting the motor

1. Check the electrical voltage of the available power supply network against the data on the motor name plate.
2. Connect the earth conductor (PE).

3. Knock out any knock-out openings in the terminal box. While doing this, avoid causing damage to the terminal board, cable connections, etc. inside the terminal box.
4. Connect the motor in star configuration or delta configuration in accordance with the rated voltage (see name plate) and the available power supply network. Alternatively, the 6-core connection of the three windings can be connected to an external switchgear for automatic switchover.

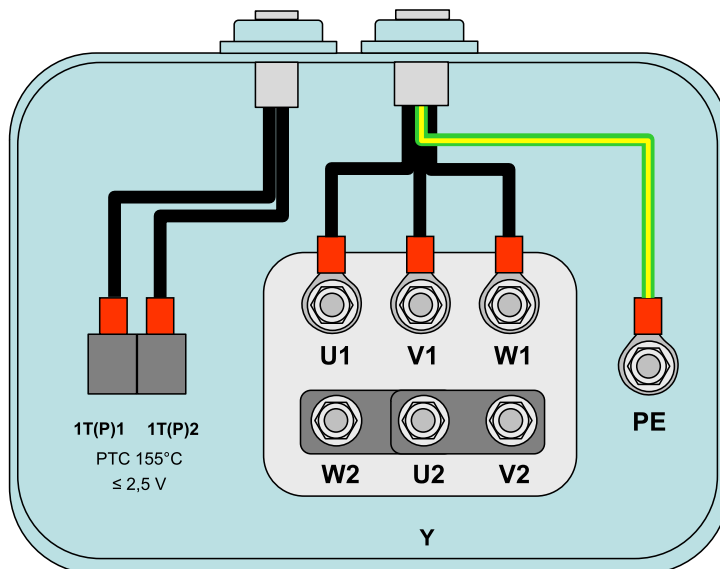


Fig. 4: Star configuration

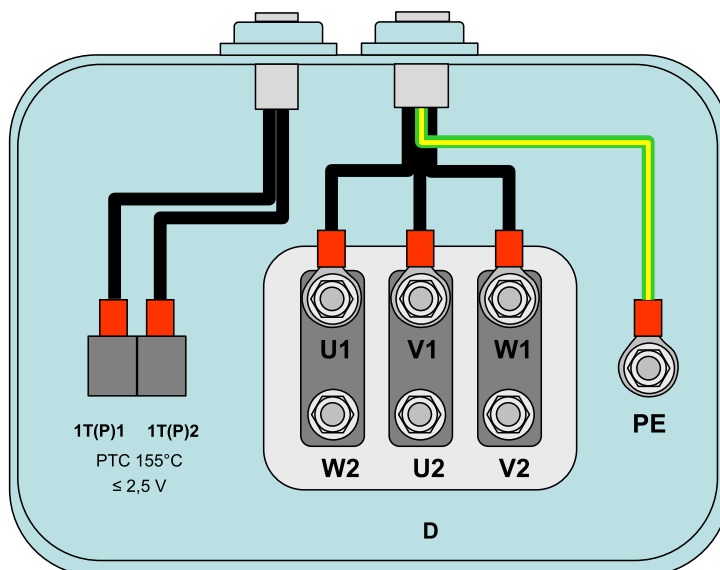


Fig. 5: Delta configuration

⇒ The terminal boards of motors with shaft centreline heights of 80 mm and 90 mm may differ from the schematic shown. In this case, star configuration or delta configuration is selected by setting jumpers.

5. Optionally, the 2-core connection of the series-connected PTC thermistors for temperature monitoring of the motor can be connected to terminals 1T1 and 1T2 with a suitable thermistor relay (PTC thermistor tripping unit). Observe the maximum measuring voltage!

Changing the jumpers

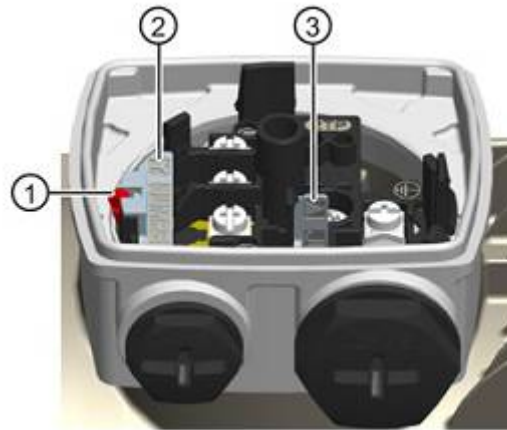


Fig. 6: Jumper position

1. Disengage the red locking lever (1) and pull the jumper (2) out of the slot.
2. Undo the snap hook at the storage pocket and take out the jumper (3).
3. Push the jumper (3) into the slot until it rests on the bottom. Engage the locking lever again.
4. Place the jumper (2) into the storage pocket and engage the snap hook.

5.3.2 Earthing

High frequency-compatible functional earthing is required to reduce the electrical bearing loads on the motor/pump caused by operation on a frequency inverter (⇒ Fig. 7) , (⇒ Fig. 8) .

Installation of the frequency inverter in a control cabinet

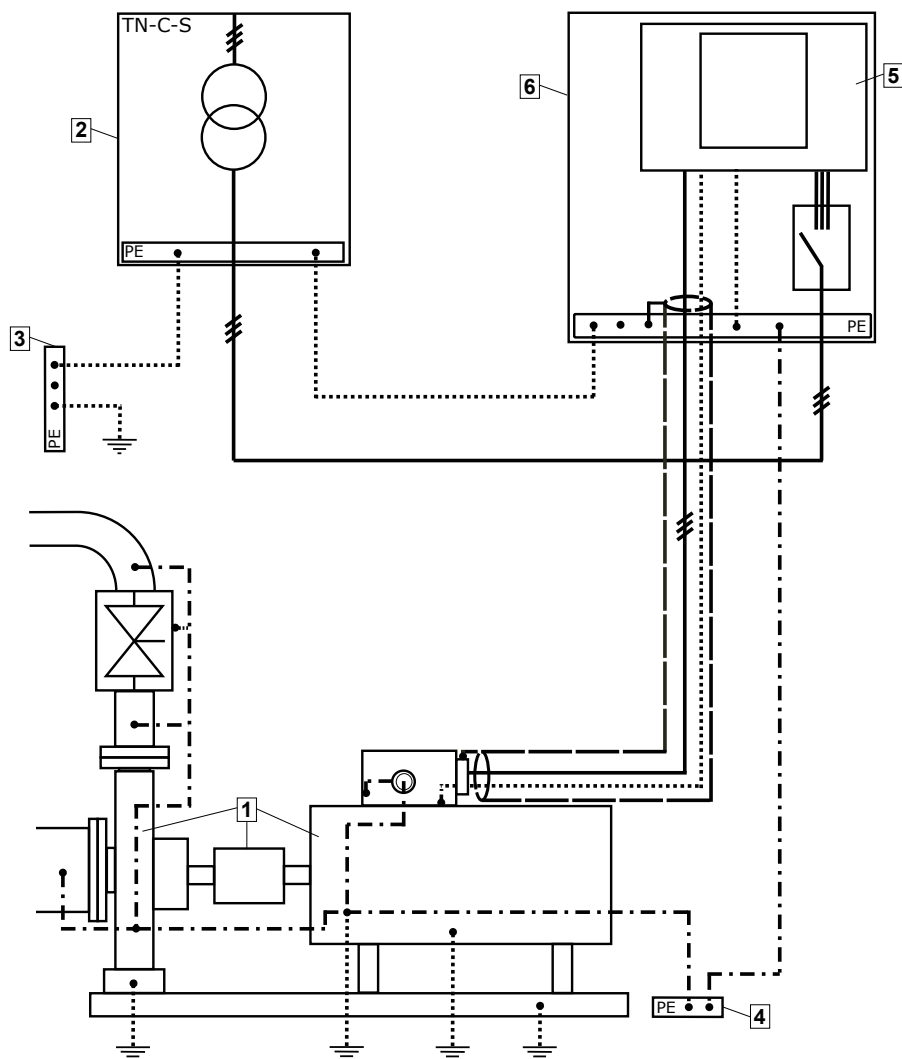


Fig. 7: Design of protective earthing and functional earthing within the drive system for installation of the frequency inverter in a control cabinet

1	Drive system (motor + pump)
2	Transformer/power supply
3	Central protective earth electrode / hall/foundation earth electrode
4	Central functional earth electrode
5	Frequency inverter
6	Control cabinet
⏏	Local earthing of drive components (personal protection/low-frequency potential equalisation)
.....	Conventional earthing, PE conductor (personal protection/low-frequency potential equalisation)
——	High-frequency potential equalisation between motor terminal box and frequency inverter (shielding)
-----	Functional earthing/low-impedance connection of all system components (for high frequencies)

Mounting the frequency inverter on the motor

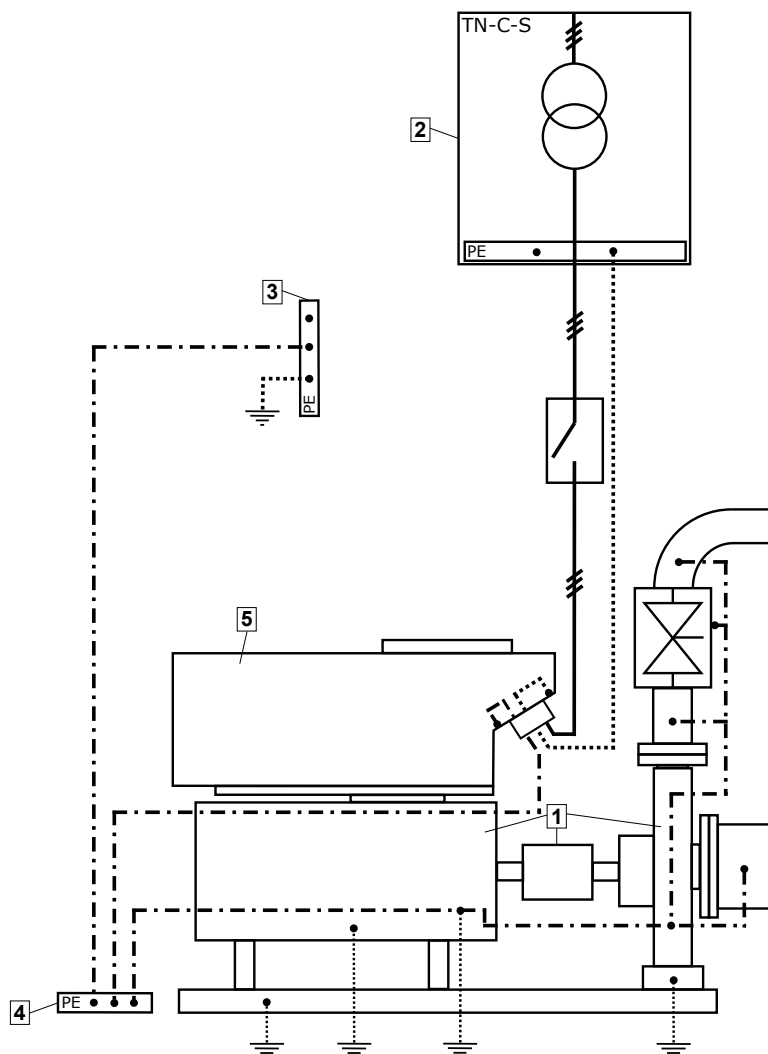


Fig. 8: Design of protective earthing and functional earthing within the drive system for mounting the frequency inverter on the motor

1	Drive system (motor + pump)
2	Transformer/power supply
3	Central protective earth electrode / hall/foundation earth electrode
4	Central functional earth electrode
5	Frequency inverter
⏏	Local earthing of drive components (personal protection/low-frequency potential equalisation)
.....	Conventional earthing, PE conductor (personal protection/low-frequency potential equalisation)
----	Functional earthing/low-impedance connection of all system components (for high frequencies)

When connecting the electric machine, ensure that it is connected in a high frequency-compatible manner.

This requires 360-degree connection of the motor supply cable's electrical shield on the motor and frequency inverter side.

Additional information and measures for reducing the bearing current loads of electrical machines during inverter operation or the implementation of functional earthing between the frequency inverter and motor connection are listed in IEC 60034-25 or DIN VDE 0530-25 ("AC electrical machines used in power drive systems – Application guide").

5.3.3 Checking the direction of rotation

	 WARNING Parts flying off Personal injury and damage to property! ▸ When checking the direction of rotation with the coupling removed, secure the respective keys to protect them from being thrown off.
---	--

The motors are configured for clockwise and anti-clockwise rotation as standard. Select the drive's direction of rotation to match the direction of rotation required by the driven centrifugal pump.

Clockwise rotation

Connecting the power cables in the phase sequence U1, V1, W1 to L1, L2, L3 of the power supply network results in clockwise rotation (looking at the drive shaft end).

Anti-clockwise rotation

Interchanging two connections, e.g. V1, U1, W1 to L1, L2, L3 results in anti-clockwise rotation.

5.4 Tightening torques

Unless other tightening torques are indicated on the motor the following torques shall be used:

Table 11: Tightening torques for terminal board connections

Thread	[Nm]
M4	2,0
M5	3,0
M6	5,0
M8	10

Table 12: Tightening torques for terminal board fastening elements

Thread	[Nm]
M4	2,0
M5	4,0
M6	9,0
M8	23

Table 13: Tightening torques for terminal box cover

Thread	[Nm]
M5	4,0
M6	7,0
M8	19
M10	37
M12	63

Table 14: Tightening torques for strain relief fasteners

Thread	[Nm]
M12	1,5
M16	2,0
M20	4,0
M25	4,0
M32	6,0
M40	6,0
M50	6,0
M63	8,0

Table 15: Tightening torques for earth conductor, bearing cover, fan hood, foot in aluminium material variant

Thread	[Nm]
M4	2,0
M5	4,5
M6	7,5
M8	19
M10	37
M12	64

Table 16: Tightening torques for earth conductor, bearing cover, fan hood, foot in grey cast iron material variant

Thread	[Nm]
M4	3,0
M5	6,0
M6	10
M8	25

Thread	[Nm]
M10	50
M12	86

5.5 Installing and removing output components

- Please also note the information about installing output components in the operating manual of the driven machine (e.g. pump).
- To install output components (coupling, pulley, etc.), use the thread on the shaft end and heat up the components if necessary.
- Use an appropriate device for removal.
- Do not apply hard impacts (e.g. with a hammer or similar) when installing and removing.
- Observe the maximum permissible radial and axial forces transmitted via the shaft end to the rolling element bearing and do not exceed them.

6 Commissioning/Start-up/Shutdown

	 DANGER
	Hazardous voltage Danger of death from electric shock! ▷ Have all work performed only by qualified specialist personnel and only when the drive is at a standstill and secured against unintentional start-up. This also applies to auxiliary circuits (e.g. standstill heater). ▷ The drive must not be electrically connected at any point in time when work is performed on the open terminal box. ▷ Ensure that the rotor cannot turn or be turned at any point in time when work is performed on the open terminal box.

Before commissioning and whenever returning the product to service, perform the electrical safety checks stipulated by EN 60204-1.

6.1 Checking earth conductor connection

Check that the earth conductor has been correctly connected in accordance with EN 60204.

6.2 Checking insulation resistance

Prior to commissioning and following prolonged storage or standstill periods, the insulation resistance will need to be checked and verified.

	NOTE
	Note that the insulation resistance of dry windings that have been reconditioned or cleaned is lower when the winding is warm. The insulation resistance can only be evaluated correctly after converting to the reference temperature of 25°C.

The insulation resistance of the stator winding must equal at least 1.5 megohms for motors with a rated voltage of 220 - 1000 V.

6.3 Prerequisites for commissioning/start-up

Before commissioning/starting up the actuator, make sure the following conditions are met:

- The drive has been mounted and aligned correctly.
- The drive is connected according to the specified direction of rotation.
- The operating conditions have been checked for compliance with the specifications on the name plate.
- The configuration of output elements depending on type (e.g. alignment and balancing of couplings, belt forces for belt drive, tooth forces and tooth flank clearance for gearwheel drive, radial and axial clearance for coupled shafts) has been checked.
- The earthing connection and potential equalisation connection have been correctly established.
- All fastening bolts/screws, connecting elements and electrical connections have been tightened to the specified torques.
- Screwed-in lifting lugs have been removed or secured to prevent loosening.
- The shaft has been checked to ensure it rotates freely.
- Measures have been taken to prevent accidental contact with moving and live parts.

- The bare shaft end has been covered. The key has been secured to protect it from being thrown off.
- Temperature-sensitive parts (e.g. electric cables) do not contact the motor housing.
- To reduce the electrical bearing load, it is recommended to leave the carrier frequency of the frequency inverter as per the factory settings. The carrier frequency should not exceed a value of 4 kHz.

6.4 Start-up

	WARNING
	High sound pressure level > 70 dB(A) can occur during operation Injury to the ear and hearing impairment. Hardness of hearing, tinnitus and hearing loss can be caused! ▷ Wear ear protection! ▷ Observe the applicable local occupational health and safety regulations.

The motor must only be started from a standstill.

1. Re-check the direction of rotation immediately after starting.
(⇒ Section 5.3.3, Page 24)

6.5 Operating limits

6.5.1 Voltages and frequencies

Motor operation off the rated point will cause a rise in motor temperature. A voltage tolerance of $\pm 5\%$ and a frequency tolerance of $\pm 2\%$ are permissible.

Any situation where both the voltage and the frequency tolerance apply simultaneously shall be governed by the provisions of range A as described in EN60034-1. The motors can be operated continuously in range A. In accordance with EN60034-1, prolonged operation in range B is not recommended.

6.5.2 Maximum permissible speed

Comply with the rotational speed indicated on the name plate.

6.5.3 Altitude, coolant temperature, ambient temperature

	CAUTION
	Operation outside the permissible ambient temperature Damage to the pump (set)! ▷ The ambient temperatures indicated only refer to the motor in operation. ▷ Observe the limits for the pump (set)!

The rated power P_R indicated refers to continuous operation (S1) as per IEC 60034-1 under the following conditions:

- Coolant temperature / ambient temperature T_c ranging from -20°C to $+40^\circ\text{C}$
- Installation at altitudes H up to 1000 m above MSL

If T_c and H are not met, the rated power must be reduced by factor k_R . Not reducing the rated power accordingly will result in a shorter motor service life.

$$P_{\text{Perm}} = P_R \times k_R$$

Table 17: Reduction factor k_R for differing altitudes and/or coolant temperatures

Installation altitude above MSL	Coolant temperature / ambient temperature				
H [m]	T _c [°C]				
	30-40	45	50	55	60
1000	1,00	0,95	0,92	0,87	0,82
1500	0,97	0,92	0,89	0,84	0,79
2000	0,94	0,90	0,86	0,82	0,77
2500	0,90	0,86	0,83	0,78	0,74
3000	0,86	0,82	0,79	0,75	0,70
3500	0,82	0,79	0,75	0,71	0,67
4000	0,77	0,74	0,71	0,67	0,63

6.6 Shutdown

The motor is only regarded as being shut down if it has been de-energised and the shaft has stopped rotating.

6.7 Idle periods

Extended idle periods (> 1 month)

For extended idle periods (> 1 month), start up the drive regularly (e.g. once per month), or at least turn the rotor. For motors with a transport lock, remove the lock prior to turning the rotor. Before you start the drive, read the information in section "Returning to service".

If you plan to take the drive out of service for more than 12 months, implement appropriate corrosion protection, preservation, packaging and drying measures.

6.8 Returning to service

	 WARNING
	High sound pressure level > 70 dB(A) can occur during operation Injury to the ear and hearing impairment. Hardness of hearing, tinnitus and hearing loss can be caused! ▸ Wear ear protection! ▸ Observe the applicable local occupational health and safety regulations.

Also follow the instructions for maintenance/inspection before you return a drive to service after storage.

7 Servicing/Maintenance

7.1 Safety regulations

	⚠ DANGER
	Improperly serviced/maintained motor Damage to the motor! ▷ Service the motor regularly. ▷ Prepare and adhere to a maintenance schedule.

The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.

	⚠ WARNING
	Unintentional starting of the motor Risk of injury by moving components and shock currents! ▷ Always make sure the electrical connections are de-energised before carrying out work on the motor. In addition to the main circuits, ensure that supplementary and auxiliary circuits are also de-energised. ▷ Ensure that the motor cannot be started up on unintentionally.

	⚠ WARNING
	Insufficient stability Risk of crushing hands and feet! ▷ Secure the motor against tilting or tipping over during assembly/dismantling.

A regular maintenance schedule will help avoid expensive repairs and contribute to trouble-free, reliable operation of the motor with a minimum of maintenance expenditure and work.

	NOTE
	All maintenance work, service work and installation work can be carried out by KSB Service or authorised workshops. Find your contact in the attached Addresses booklet or visit https://www.ksb.com/en-global/contact .

Never use force when dismantling and reassembling the motor.

Five safety rules in accordance with EN 50110-1 ensuring work is only performed after the equipment has been disconnected from the power supply (de-energised)

Observe the following safety rules:

1. Disconnect the equipment from the power supply.
2. Secure the equipment against unintentional start-up.
3. Verify that the equipment is de-energised.
4. Earth and short-circuit.
5. Cover or cordon off adjacent live parts.

7.2 Maintenance/inspection

KSB recommends the following regular maintenance schedule:

Table 18: Overview of maintenance work

Maintenance interval	Maintenance work	For details see ...
Every 500 operating hours ⁵⁾	Initial inspection	(⇒ Section 7.2.2, Page 32)
Every 14,000 operating hours ⁶⁾	General inspection	(⇒ Section 7.2.2, Page 32)
Depending on local degree of pollution	Cleaning	
Depending on climatic conditions	Drain off the condensation water.	(⇒ Section 7.2.2.1, Page 33)

Careful and regular maintenance, inspections and overhauls make it possible to identify and eliminate faults in good time before they can cause any damage.

Operating conditions can vary widely. For this reason, only general maintenance intervals for trouble-free operation can be specified here. Maintenance intervals must be scheduled to suit the local conditions (dirt, frequency of starts, load, etc).

If problems or unusual conditions arise which might cause electrical or mechanical overstressing of the motor (e.g. overload, short circuit), carry out the necessary inspection work immediately.

7.2.1 Supervision of operation

	⚠ DANGER Rotating or live parts Death, serious injury or damage to property! ▷ If covers have to be removed, de-energise the motor beforehand. ▷ Avoid touching live or rotating parts.
	⚠ DANGER Hot surface Risk of burns! ▷ Never touch a motor when it is in operation. ▷ Let the motor cool down. ▷ Only remove covers if indicated.
	⚠ WARNING Condensing air humidity inside the motor if the motor and/or ambient temperatures frequently change Risk of corrosion by condensation! ▷ Always observe the information provided on ambient conditions.

While the system is in operation, observe and check the following:

- Deviations from normal operation such as increased power consumption, temperatures or vibrations, unusual noises or odours, tripping of monitoring devices, etc.
- If rough running or abnormal noises are detected, switch off the motor and find the cause of the problem as the motor coasts down.
 - If mechanical operation improves immediately after the motor is switched off, the causes are magnetic or electrical phenomena.

⁵⁾ At least every 6 months

⁶⁾ At least every 2 years

- If mechanical operation does not improve after the motor is switched off, it can be assumed that the cause is mechanical, e.g. unbalance of the electric motor or the driven machine, poor alignment between the motor and the driven machine or operation of the motor at system resonance (system = motor + base frame + foundation, etc.)
- If mechanical operation of the motor is OK, switch on the cooling equipment, if any, and continue to observe the motor for a while as it runs under no-load conditions.
- If the motor continues to operate satisfactorily, restore the motor load. Check running characteristics and read and log values for voltage, current and output. Also read and log relevant values of the driven machine if possible.
- Monitor and log temperatures of the bearings, windings, etc. until the steady state has been reached by using whatever measuring devices are available.
- Check the effectiveness of the cooling system for frequent starting or braking, or if the operating speed continually changes below the nominal speed.

7.2.2 Inspection

Initial inspection

Inspection interval After about 500 operating hours, or 6 months at the latest

Procedure Check the following during operation:

- The specified electrical characteristics are complied with.
- Permissible temperatures at the rolling element bearings are not exceeded.
- The smooth running characteristics and running noise of the drive have not deteriorated.

Check the following during standstill:

- No depressions and cracks are visible in the foundation.

Immediately correct impermissible deviations that are detected during inspection work.



NOTE

Further inspections/tests are required in accordance with the additional operating manuals or the particular system-specific conditions.

General inspection

Inspection interval Once annually

Procedure Check the following during operation:

- The specified electrical characteristics are complied with.
- Permissible temperatures at the rolling element bearings are not exceeded.

Check the following during standstill:

- No depressions and cracks are visible in the foundation.
- The drive alignment is within the specified tolerances.
- All the fastening bolts/screws for the mechanical and electrical connections have been securely tightened.
- The insulation resistances of the windings are sufficient.
- The cables and insulating parts are in good condition and there is no evidence of discolouring.

Immediately correct impermissible deviations that are detected during inspection work.

7.2.2.1 Draining off the condensation water

	⚠ DANGER Electrical connection work by unqualified personnel Danger of death from electric shock! ▷ Always have the electrical connections installed by a trained and qualified electrician. ▷ Observe regulations IEC 60364 .
	⚠ WARNING Hot surface Risk of injury! ▷ Allow the pump set to cool down to ambient temperature.

- ✓ The pump set has been switched off and secured against unintentional re-start.
- ✓ The motor has cooled down to ambient temperature.
- ✓ The motor has a drain hole.
- ✓ The water drain plug is at the lowest point of the housing.
 1. Place a container underneath it to collect the condensation water.
 2. Remove the water drain plug.
 3. Let the condensation water drain off.
 4. Re-insert the water drain plug.

7.2.2.2 Correct damage to paintwork

	CAUTION Damage to paintwork Risk of corrosion! ▷ Immediately correct damage to paintwork to ensure sufficient corrosion protection.
---	--

We recommend contacting your nearest KSB service centre for important information about proper layering as well as paint repair instructions.

7.2.2.3 Lubrication and lubricant change

7.2.2.3.1 Maintenance of rolling element bearings

Maintenance of rolling element bearings after an extended storage period

Extended storage periods decrease the service life of the lubricating grease. This in turn reduces the service life of the bearings.

- The rolling element bearings should be completely replaced after a storage period of more than 4 years.
- After a storage period of more than 12 months, it is advisable to change the bearing grease in rolling element bearings that are not greased for life.

Maintenance of rolling element bearings under normal operating conditions

Recommended bearing replacement interval under normal operating conditions:

Table 19: Bearing replacement

Ambient temperature	Bearing replacement interval
40 °C	20,000 h

	NOTE
	The bearing service life is reduced e.g. for vertical installations, high vibration and shock loads, frequent reversing duty, higher ambient temperature and higher rotating speeds.

7.2.2.3.1.1 Grease lubrication

The bearings are supplied packed with high-quality lithium-soap grease.

7.2.2.3.1.2 Intervals

The rolling element bearings of the motor are grease-packed and maintenance-free. Motors with axially reinforced bearings are excluded. These drive-end rolling element bearings must be re-lubricated as part of the maintenance routine.

	NOTE
	On some pump designs the rolling element bearings are lubricated for life. These pumps are not provided with a lubricating nipple on the bearing bracket.

	NOTE
	If re-lubrication intervals are short, we recommend that the grease be completely replaced once a year. Otherwise, the grease fill must be replaced completely every two years. To do so, remove the rolling element bearings, clean and pack with new grease.

Motors with lubricating nipple must be re-lubricated every 2000 hours.

If the motor is operated under extreme conditions, such as vibrations or high temperatures, the bearings must be re-lubricated more frequently.

7.2.2.3.1.3 Re-lubrication

	 DANGER
	Excessive temperatures as a result of bearings running hot or defective bearing seals Fire hazard! Damage to the motor! ▷ Regularly check the condition of the lubricant. ▷ Regularly check the rolling element bearings for running noises.

	 WARNING
	Work in the immediate vicinity of rotating parts Risk of hand injury! ▷ Always have this work performed by trained personnel. ▷ Take particular caution when performing this work.

Grease quality Optimum grease properties for rolling element bearings

- High melting point lithium soap base grease
- Free of resin and acid
- Rust-preventive characteristics

Grease quantity ▪ 15 g per rolling element bearing

	CAUTION Contaminated lubricating nipples Contamination of the lubricating grease! ▸ Clean the grease lubricating nipples before re-lubricating them.
---	---

1. Clean the lubricating nipples, if contaminated.
2. Position the grease gun on the lubricating nipple.
3. Press in the grease.

	CAUTION Incomplete re-lubrication Bearing damage! ▸ Always re-lubricate the bearings while the motor is running.
---	---

7.3 Preparing disassembly

	 DANGER Work on the motor/drive by unqualified personnel Danger of death from electric shock! ▸ Have motors/drives modified and dismantled by authorised personnel only. ▸ Observe regulations IEC 60364 and, for explosion-proof models, IEC 60079.
---	---

- ✓ General safety rules are adhered to. (⇒ Section 7.1, Page 30)
1. Disconnect all electrical connections and remove all cables.
 2. Drain, collect and properly dispose of all liquids.
 3. Remove all motor fastening elements.
 4. Transport the motor to a clean dismantling area. (⇒ Section 3.2, Page 10)

7.4 Dismantling the motor

7.4.1 General information/Safety regulations

	 DANGER Hot surface Risk of burns! ▸ Never touch a motor when it is in operation. ▸ Let the motor cool down. ▸ Only remove covers if indicated.
---	---

	⚠ WARNING Improper lifting/moving of heavy assemblies or components Personal injury and damage to property! ▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.
---	---

Always observe the safety instructions and information.

For dismantling and reassembly, refer to the general assembly drawing.

In the event of damage, you can always contact our service departments.

Prior to dismantling, label the respective assignment of fastening elements as well as the arrangement of internal connections required for reassembling.

Switching connections

- Replace any corroded bolts.
- Never damage the insulation of live parts.
- Document position of any rating and additional plates to be removed.
- Avoid damaging the centring spigots.

Protect rolling element bearings against the ingress of contamination and moisture.

7.4.2 Removing the protective roof (optional)

1. Unscrew fastening bolts of the protective roof.
2. Remove protective roof.

7.4.3 Dismantling the fan hood

1. Remove bolts of the fan hood.
2. Push the fan hood back to remove it.

7.4.4 Dismantling the fan

1. Remove the clamping screws or circlip (depending on the size).
2. Pull off the fan using a suitable tool.

7.4.5 Dismantling the rotor

- ✓ Suitably sized lifting equipment is available.
- 1. Remove non-drive-end and drive-end keys and store them in a safe place.
- 2. Remove the bolts from the drive-end bearing cover.
- 3. Stand the motor housing upright (drive end up); pull the bearing cover and rotor out of the motor housing using suitable lifting equipment and set them down.

7.4.6 Dismantling the bearings

Fixed bearing at drive end

- ✓ The rotor has been removed.
- ✓ The keys have been removed and are stored in a safe place.
- 1. Remove the circlip or bearing cover plate from the bearing cover, then remove the bearing cover.
- 2. Pull off the bearing using a suitable tool.

Radial bearing at non-drive end

- ✓ The rotor has been removed.
- ✓ The keys have been removed and are stored in a safe place.
- 1. Pull off the spring washer from the shaft end.

2. Pull off the bearing using a suitable tool.

7.5 Assembling the motor

	WARNING Improper lifting/moving of heavy assemblies or components Personal injury and damage to property! ▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.
	CAUTION Incorrect assembly Damage to windings! ▷ When installing the bearing cover, take care not to damage the windings protruding out of the motor housing.

- General**
- The motor should be assembled on a marking-out plate if possible. This will ensure that the foot areas of the motor are properly aligned.
 - Always reassemble the motor in accordance with the corresponding exploded view.
 - Clean all dismantled components and check them for signs of wear.
 - Damaged or worn components must be replaced by new ones.
 - Always use new tolerance rings.
 - Make sure that sealing surfaces are clean and that O-rings or gaskets are properly fitted.

Tightening torques For reassembly, tighten all screws and bolts as specified in this manual.

7.5.1 Fitting the bearings

	CAUTION Incorrect assembly Damage to the shaft seal ring! ▷ Ensure correct centring when installing the rotor in the motor housing.
---	---

Drive-end fixed bearing

1. Fit the specified bearing on the shaft.
2. Install the bearing cover.
3. Affix bearing onto the end shield with circlip or bearing cover plate.
4. Attach drive-end key to shaft.

Non-drive-end radial bearing

1. Fit the specified bearing on the shaft.
2. Install the spring washer on the shaft.

7.5.2 Installing the rotor

	DANGER Strong magnetic field in the rotor area Danger of death for persons with pacemaker! ▷ Keep a safety distance of at least 0.3 m.
---	--

	⚠ WARNING Strong magnetic field Danger of crushing injuries when pulling out the pump rotor! Strong magnetic field can suddenly pull the pump rotor back into its original position! Danger of magnetic parts near the pump rotor being attracted! ▷ The pump rotor must be removed from the electronic system housing by authorised specialist personnel only. ▷ Remove any magnetic parts from the vicinity of the rotor. ▷ Keep the assembly area clean. ▷ Keep a safety distance of at least 0.3 m from electronic components.
	CAUTION Strong magnetic field in the pump rotor area Interference with magnetic data carriers, electronic devices, components and instruments! Uncontrolled magnetic attraction forces between magnetic components, tools or similar! ▷ The rotor must generally be removed from the electronic system housing by authorised specialist personnel only. ▷ Remove any magnetic parts from the vicinity of the pump rotor. ▷ Keep the assembly area clean.
	CAUTION Strong magnetic field Negative impact on or damage to electrical devices! ▷ The pump rotor must be removed from the electronic system housing by authorised specialist personnel only.
	CAUTION Incorrect assembly Damage to the shaft seal ring! ▷ Ensure correct centring when installing the rotor in the motor housing.

1. Apply liquid sealant to the centring spigot of the bearing cover and the motor housing.
2. Stand the motor housing upright (drive end up) and guide the bearing cover and rotor into the motor housing using suitable lifting equipment.
3. Tighten the bolts on the drive-end bearing cover.
4. Insert non-drive-end key.

7.5.3 Mounting the fan

1. Fit the fan.
2. Fit clamping screws or circlip (depending on size).

7.5.4 Mounting the fan hood

1. Position fan hood and affix with bolts .

7.5.5 Mounting the protective roof (optional)

1. Place the protective roof on the motor.
2. Tighten fastening bolts of the protective roof.

8 Trouble-shooting

	 WARNING
	Improper work to remedy faults Risk of injury! ► For any work performed to remedy faults, observe the relevant information given in this operating manual and/or in the product literature provided by the accessories manufacturer.

If problems occur that are not described in the following table, consultation with the KSB service is required.

- A Drive does not start.
- B Rumbling noise during start-up
- C Rubbing noises
- D Radial vibrations
- E Axial vibrations
- F Wrong direction of rotation

Table 20: Trouble-shooting

A	B	C	D	E	F	Possible cause	Remedy
X	-	-	-	-	-	No voltage	Check mains fuses, mains voltage and operating status of the frequency inverter.
X	-	-	-	-	-	Mains cables connected incorrectly/ Fault in supply line	Check wiring.
X	X	-	-	-	-	Driven machine is blocked	Manually clear the blockage from the driven machine, observing the operating manual of the driven machine!
-	-	X	-	-	-	Bearings defective	Check bearings and replace if necessary.
-	-	X	-	-	-	Rubbing contact between rotor and stator	Check bearings and replace if necessary. Check rotor and replace if necessary.
-	-	-	X	-	-	Rotor unbalance	Check key convention applicable to the shaft and output element; remove rotor and re-balance if required.
-	-	-	X	-	-	Improper installation	Check the foundation, the place of installation and the mounting surface.
-	-	-	-	X	-	Incorrect connection of pump/load	Check correct alignment between motor and driven machine, check coupling.
-	-	-	-	-	X	Wrong direction of rotation setting	Change the direction of rotation by altering the parameters of the frequency inverter or interchanging two phase conductors.

9 UK Declaration of Conformity

Manufacturer:

KSB SE & Co. KGaA
Johann-Klein-Straße 9
67227 Frankenthal (Germany)

This UK Declaration of Conformity is issued under the sole responsibility of the manufacturer.

The manufacturer herewith declares that **the product**:

KSB IE4 Motor

5214248 - 5214249

5214315 - 5214327

5214352 - 5214362

5214272 - 5214279

5214330 - 5214343

- is in conformity with the provisions of the following directives / regulations as amended from time to time:
 - Ecodesign for Energy-Related Products Regulations 2010
 - Electrical components: The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

The manufacturer also declares that

- EN 60034

The product must not be put into service for its intended use until the final product has been declared in conformity with the *Supply of Machinery (Safety) Regulations 2008*.

The UK Declaration of Conformity was issued in/on:

Frankenthal, 4 April 2023



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