

Rexroth IndraDyn S Synchronous Motors QSK061, -075, -100

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Project Planning Manual



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Important Instructions on Use

1 Important Instructions on Use

1.1 Intended Use

1.1.1 Introduction

Rexroth products are developed and manufactured according to the state of the art. Before they are delivered, they are inspected to ensure that they operate safely.

A WARNING

Personal injury and material damage due to improper use of the products

The products must only be used as intended. If they are not used as intended, situations may arise that result in personal injuries or damage to property.

Rexroth, as the manufacturer, does not provide any warranty, assume any liability, or pay any damages for damage caused by products not being used as intended. Any risks resulting from the products not being used as intended are the sole responsibility of the user.

Before using Rexroth products, the following condition precedent must be fulfilled so as to ensure that they are used as intended:

- Everyone who in any way whatsoever handles one of our products must read and understand the corresponding notes regarding safety and regarding the intended use.
- If the products are hardware, they must be kept in their original state, i.e. no constructional modifications must be made. Software products must not be decompiled; their source codes must not be modified.
- Damaged or improperly working products must not be installed or put into operation.
- It must be ensured that the products are installed according to the regulations specified in the documentation.

1.1.2 Areas of Use and Application

Rexroth IndraDyn S series synchronous motors QSK are designed to be used as rotary main and servo drive motors. The following are typical fields of application:

- Machine tools
- Printing and paper-processing machines,
- Packaging and Food-processing machines,
- Metal-forming machines
- Robotics

Device types with different driving powers and different interfaces are available for an application-specific use of the motors.

Controlling and monitoring of the motors may require connection of additional sensors and actuators.

Important Instructions on Use

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QSK motors must only be used with the accessories specified in this documentation. Components that are not explicitly mentioned must neither be attached nor connected. The same is true for cables and lines.

The operation must only be carried out in the explicitly mentioned configurations and combinations of the component and with the software and firmware specified in the corresponding functional description.

Any connected drive control device must be programmed before startup in order to ensure that the motor executes the functions specifically to the particular application.

The QSK motors may only be operated under the assembly, mounting and installation conditions, in the normal position, and under the environmental conditions (temperature, degree of protection, humidity, EMC etc.) specified in this documentation.

1.2 Inappropriate Use

Any use of QSKmotors outside of the fields of application mentioned above or under operating conditions and technical data other than those specified in this documentation is considered as "non-intended use".

QSK motors may not be used if . . .

- They are subject to operating conditions which do not comply with the ambient conditions described above. For example, they must not be operated under water, under extreme temperature fluctuations or extreme maximum temperatures.
- The intended application is not explicitly released by Bosch Rexroth. Please make absolutely sure that the instructions given in the general safety notes are also complied with!

2 Safety Instructions for Electric Drives and Controls

2.1 Definitions of Terms

Application Documentation	Application documentation comprises the entire documentation used to in- form the user of the product about the use and safety-relevant features for configuring, integrating, installing, mounting, commissioning, operating, main- taining, repairing and decommissioning the product. The following terms are also used for this kind of documentation: User Guide, Operation Manual, Commissioning Manual, Instruction Manual, Project Planning Manual, Appli- cation Manual, etc.
Component	A component is a combination of elements with a specified function, which are part of a piece of equipment, device or system. Components of the elec- tric drive and control system are, for example, supply units, drive controllers, mains choke, mains filter, motors, cables, etc.
Control System	A control system comprises several interconnected control components placed on the market as a single functional unit.
Device	A device is a finished product with a defined function, intended for users and placed on the market as an individual piece of merchandise.
Electrical Equipment	Electrical equipment encompasses all devices used to generate, convert, transmit, distribute or apply electrical energy, such as electric motors, transformers, switching devices, cables, lines, power-consuming devices, circuit board assemblies, plug-in units, control cabinets, etc.
Electric Drive System	An electric drive system comprises all components from mains supply to mo- tor shaft; this includes, for example, electric motor(s), motor encoder(s), sup- ply units and drive controllers, as well as auxiliary and additional compo- nents, such as mains filter, mains choke and the corresponding lines and ca- bles.
Installation	An installation consists of several devices or systems interconnected for a defined purpose and on a defined site which, however, are not intended to be placed on the market as a single functional unit.
Machine	A machine is the entirety of interconnected parts or units at least one of which is movable. Thus, a machine consists of the appropriate machine drive elements, as well as control and power circuits, which have been assembled for a specific application. A machine is, for example, intended for processing, treatment, movement or packaging of a material. The term "machine" also covers a combination of machines which are arranged and controlled in such a way that they function as a unified whole.
Manufacturer	The manufacturer is an individual or legal entity bearing responsibility for the design and manufacture of a product which is placed on the market in the in- dividual's or legal entity's name. The manufacturer can use finished products, finished parts or finished elements, or contract out work to subcontractors. However, the manufacturer must always have overall control and possess the required authority to take responsibility for the product.
Product	Examples of a product: Device, component, part, system, software, firmware, among other things.
Project Planning Manual	A project planning manual is part of the application documentation used to support the sizing and planning of systems, machines or installations.
Qualified Persons	In terms of this application documentation, qualified persons are those per- sons who are familiar with the installation, mounting, commissioning and op- eration of the components of the electric drive and control system, as well as with the hazards this implies, and who possess the qualifications their work

requires. To comply with these qualifications, it is necessary, among other things,

1) to be trained, instructed or authorized to switch electric circuits and devices safely on and off, to ground them and to mark them

- 2) to be trained or instructed to maintain and use adequate safety equipment
- 3) to attend a course of instruction in first aid
- **User** A user is a person installing, commissioning or using a product which has been placed on the market.

2.2 General Information

2.2.1 Using the Safety Instructions and Passing Them on to Others

Do not attempt to install and operate the components of the electric drive and control system without first reading all documentation provided with the product. Read and understand these safety instructions and all user documentation prior to working with these components. If you do not have the user documentation for the components, contact your responsible Rexroth sales partner. Ask for these documents to be sent immediately to the person or persons responsible for the safe operation of the components.

If the component is resold, rented and/or passed on to others in any other form, these safety instructions must be delivered with the component in the official language of the user's country.

Improper use of these components, failure to follow the safety instructions in this document or tampering with the product, including disabling of safety devices, could result in property damage, injury, electric shock or even death.

2.2.2 Requirements for Safe Use

Read the following instructions before initial commissioning of the components of the electric drive and control system in order to eliminate the risk of injury and/or property damage. You must follow these safety instructions.

- Rexroth is not liable for damages resulting from failure to observe the safety instructions.
- Read the operating, maintenance and safety instructions in your language before commissioning. If you find that you cannot completely understand the application documentation in the available language, please ask your supplier to clarify.
- Proper and correct transport, storage, mounting and installation, as well as care in operation and maintenance, are prerequisites for optimal and safe operation of the component.
- Only qualified persons may work with components of the electric drive and control system or within its proximity.
- Only use accessories and spare parts approved by Rexroth.
- Follow the safety regulations and requirements of the country in which the components of the electric drive and control system are operated.
- Only use the components of the electric drive and control system in the manner that is defined as appropriate. See chapter "Appropriate Use".
- The ambient and operating conditions given in the available application documentation must be observed.
- Applications for functional safety are only allowed if clearly and explicitly specified in the application documentation "Integrated Safety Technolo-

gy". If this is not the case, they are excluded. Functional safety is a safety concept in which measures of risk reduction for personal safety depend on electrical, electronic or programmable control systems.

• The information given in the application documentation with regard to the use of the delivered components contains only examples of applications and suggestions.

The machine and installation manufacturers must

- make sure that the delivered components are suited for their individual application and check the information given in this application documentation with regard to the use of the components,
- make sure that their individual application complies with the applicable safety regulations and standards and carry out the required measures, modifications and complements.
- Commissioning of the delivered components is only allowed once it is sure that the machine or installation in which the components are installed complies with the national regulations, safety specifications and standards of the application.
- Operation is only allowed if the national EMC regulations for the application are met.
- The instructions for installation in accordance with EMC requirements can be found in the section on EMC in the respective application documentation.

The machine or installation manufacturer is responsible for compliance with the limit values as prescribed in the national regulations.

• The technical data, connection and installation conditions of the components are specified in the respective application documentations and must be followed at all times.

National regulations which the user must take into account

- European countries: In accordance with European EN standards
- United States of America (USA):
 - National Electrical Code (NEC)
 - National Electrical Manufacturers Association (NEMA), as well as local engineering regulations
 - Regulations of the National Fire Protection Association (NFPA)
- Canada: Canadian Standards Association (CSA)
- Other countries:
 - International Organization for Standardization (ISO)
 - International Electrotechnical Commission (IEC)

2.2.3 Hazards by Improper Use

- High electrical voltage and high working current! Danger to life or serious injury by electric shock!
- High electrical voltage by incorrect connection! Danger to life or injury by electric shock!
- Dangerous movements! Danger to life, serious injury or property damage by unintended motor movements!
- Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electric drive systems!

- Risk of burns by hot housing surfaces!
- Risk of injury by improper handling! Injury by crushing, shearing, cutting, hitting!
- Risk of injury by improper handling of batteries!
- Risk of injury by improper handling of pressurized lines!

2.3 Instructions with Regard to Specific Dangers

2.3.1 Protection Against Contact With Electrical Parts and Housings

This section concerns components of the electric drive and control system with voltages of **more than 50 volts**.

Contact with parts conducting voltages above 50 volts can cause personal danger and electric shock. When operating components of the electric drive and control system, it is unavoidable that some parts of these components conduct dangerous voltage.

High electrical voltage! Danger to life, risk of injury by electric shock or serious injury!

- Only qualified persons are allowed to operate, maintain and/or repair the components of the electric drive and control system.
- Follow the general installation and safety regulations when working on power installations.
- Before switching on, the equipment grounding conductor must have been permanently connected to all electric components in accordance with the connection diagram.
- Even for brief measurements or tests, operation is only allowed if the equipment grounding conductor has been permanently connected to the points of the components provided for this purpose.
- Before accessing electrical parts with voltage potentials higher than 50 V, you must disconnect electric components from the mains or from the power supply unit. Secure the electric component from reconnection.
- With electric components, observe the following aspects:

Always wait **30 minutes** after switching off power to allow live capacitors to discharge before accessing an electric component. Measure the electrical voltage of live parts before beginning to work to make sure that the equipment is safe to touch.

- Install the covers and guards provided for this purpose before switching on.
- Never touch electrical connection points of the components while power is turned on.
- Do not remove or plug in connectors when the component has been powered.
- Under specific conditions, electric drive systems can be operated at mains protected by residual-current-operated circuit-breakers sensitive to universal current (RCDs/RCMs).

• Secure built-in devices from penetrating foreign objects and water, as well as from direct contact, by providing an external housing, for example a control cabinet.

High housing voltage and high leakage current! Danger to life, risk of injury by electric shock!

- Before switching on and before commissioning, ground or connect the components of the electric drive and control system to the equipment grounding conductor at the grounding points.
- Connect the equipment grounding conductor of the components of the electric drive and control system permanently to the main power supply at all times. The leakage current is greater than 3.5 mA.
- Establish an equipment grounding connection with a minimum cross section according to the table below. With an outer conductor cross section smaller than 10 mm² (8 AWG), the alternative connection of two equipment grounding conductors is allowed, each having the same cross section as the outer conductors.

Cross section outer con-	Minimum cross section equipment grounding conductor				
ductor	Leakage current ≥ 3.5 mA				
	1 equipment grounding conductor	2 equipment grounding conductors			
1,5 mm² (AWG 16)		2 × 1,5 mm² (AWG 16)			
2,5 mm ² (AWG 14)		2 × 2,5 mm² (AWG 14)			
4 mm ² (AWG 12)	10 mm² (AWG 8)	2 × 4 mm ² (AWG 12)			
6 mm² (AWG 10)		2 × 6 mm ² (AWG 10)			
10 mm ² (AWG 8)		-			
16 mm² (AWG 6)		-			
25 mm ² (AWG 4)	16 mm² (AWG 6)	-			
35 mm² (AWG 2)		-			
50 mm ² (AWG 1/0)	25 mm² (AWG 4)	-			
70 mm ² (AWG 2/0)	35 mm² (AWG 2)	-			

Fig.2-1: Minimum Cross Section of the Equipment Grounding Connection

2.3.2 Protective Extra-Low Voltage as Protection Against Electric Shock

Protective extra-low voltage is used to allow connecting devices with basic insulation to extra-low voltage circuits.

On components of an electric drive and control system provided by Rexroth, all connections and terminals with voltages between 5 and 50 volts are PELV ("Protective Extra-Low Voltage") systems. It is allowed to connect devices equipped with basic insulation (such as programming devices, PCs, note-books, display units) to these connections.

Danger to life, risk of injury by electric shock! High electrical voltage by incorrect connection!

If extra-low voltage circuits of devices containing voltages and circuits of more than 50 volts (e.g., the mains connection) are connected to Rexroth products, the connected extra-low voltage circuits must comply with the requirements for PELV ("Protective Extra-Low Voltage").

2.3.3 Protection Against Dangerous Movements

Dangerous movements can be caused by faulty control of connected motors. Some common examples are:

- Improper or wrong wiring or cable connection
- Operator errors
- Wrong input of parameters before commissioning
- Malfunction of sensors and encoders
- Defective components
- Software or firmware errors

These errors can occur immediately after equipment is switched on or even after an unspecified time of trouble-free operation.

The monitoring functions in the components of the electric drive and control system will normally be sufficient to avoid malfunction in the connected drives. Regarding personal safety, especially the danger of injury and/or property damage, this alone cannot be relied upon to ensure complete safety. Until the integrated monitoring functions become effective, it must be assumed in any case that faulty drive movements will occur. The extent of faulty drive movements depends upon the type of control and the state of operation.

Dangerous movements! Danger to life, risk of injury, serious injury or property damage!

A **risk assessment** must be prepared for the installation or machine, with its specific conditions, in which the components of the electric drive and control system are installed.

As a result of the risk assessment, the user must provide for monitoring functions and higher-level measures on the installation side for personal safety. The safety regulations applicable to the installation or machine must be taken into consideration. Unintended machine movements or other malfunctions are possible if safety devices are disabled, bypassed or not activated.

To avoid accidents, injury and/or property damage:

- Keep free and clear of the machine's range of motion and moving machine parts. Prevent personnel from accidentally entering the machine's range of motion by using, for example:
 - Safety fences
 - Safety guards
 - Protective coverings
 - Light barriers
- Make sure the safety fences and protective coverings are strong enough to resist maximum possible kinetic energy.
- Mount emergency stopping switches in the immediate reach of the operator. Before commissioning, verify that the emergency stopping equip-

ment works. Do not operate the machine if the emergency stopping switch is not working.

- Prevent unintended start-up. Isolate the drive power connection by means of OFF switches/OFF buttons or use a safe starting lockout.
- Make sure that the drives are brought to safe standstill before accessing or entering the danger zone.
- Additionally secure vertical axes against falling or dropping after switching off the motor power by, for example,
 - mechanically securing the vertical axes,
 - adding an external braking/arrester/clamping mechanism or
 - ensuring sufficient counterbalancing of the vertical axes.
- The standard equipment **motor holding brake** or an external holding brake controlled by the drive controller is **not sufficient to guarantee personal safety**!
- Disconnect electrical power to the components of the electric drive and control system using the master switch and secure them from reconnection ("lock out") for:
 - Maintenance and repair work
 - Cleaning of equipment
 - Long periods of discontinued equipment use
- Prevent the operation of high-frequency, remote control and radio equipment near components of the electric drive and control system and their supply leads. If the use of these devices cannot be avoided, check the machine or installation, at initial commissioning of the electric drive and control system, for possible malfunctions when operating such high-frequency, remote control and radio equipment in its possible positions of normal use. It might possibly be necessary to perform a special electromagnetic compatibility (EMC) test.

2.3.4 Protection Against Magnetic and Electromagnetic Fields During Operation and Mounting

Magnetic and electromagnetic fields generated by current-carrying conductors or permanent magnets of electric motors represent a serious danger to persons with heart pacemakers, metal implants and hearing aids.

Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electric components!

- Persons with heart pacemakers and metal implants are not allowed to enter the following areas:
 - Areas in which components of the electric drive and control systems are mounted, commissioned and operated.
 - Areas in which parts of motors with permanent magnets are stored, repaired or mounted.
- If it is necessary for somebody with a heart pacemaker to enter such an area, a doctor must be consulted prior to doing so. The noise immunity of implanted heart pacemakers differs so greatly that no general rules can be given.
- Those with metal implants or metal pieces, as well as with hearing aids, must consult a doctor before they enter the areas described above.

2.3.5 Protection Against Contact With Hot Parts

Hot surfaces of components of the electric drive and control system. Risk of burns!

- Do not touch hot surfaces of, for example, braking resistors, heat sinks, supply units and drive controllers, motors, windings and laminated cores!
- According to the operating conditions, temperatures of the surfaces can be **higher than 60 °C** (140 °F) during or after operation.
- Before touching motors after having switched them off, let them cool down for a sufficient period of time. Cooling down can require **up to 140 minutes**! The time required for cooling down is approximately five times the thermal time constant specified in the technical data.
- After switching chokes, supply units and drive controllers off, wait **15 minutes** to allow them to cool down before touching them.
- Wear safety gloves or do not work at hot surfaces.
- For certain applications, and in accordance with the respective safety regulations, the manufacturer of the machine or installation must take measures to avoid injuries caused by burns in the final application. These measures can be, for example: Warnings at the machine or installation, guards (shieldings or barriers) or safety instructions in the application documentation.

2.3.6 Protection During Handling and Mounting

Risk of injury by improper handling! Injury by crushing, shearing, cutting, hitting!

- Observe the relevant statutory regulations of accident prevention.
- Use suitable equipment for mounting and transport.
- Avoid jamming and crushing by appropriate measures.
- Always use suitable tools. Use special tools if specified.
- Use lifting equipment and tools in the correct manner.
- Use suitable protective equipment (hard hat, safety goggles, safety shoes, safety gloves, for example).
- Do not stand under hanging loads.
- Immediately clean up any spilled liquids from the floor due to the risk of falling!

2.3.7 Battery Safety

Batteries consist of active chemicals in a solid housing. Therefore, improper handling can cause injury or property damage.

Risk of injury by improper handling!

- Do not attempt to reactivate low batteries by heating or other methods (risk of explosion and cauterization).
- Do not attempt to recharge the batteries as this may cause leakage or explosion.
- Do not throw batteries into open flames.
- Do not dismantle batteries.

- When replacing the battery/batteries, do not damage the electrical parts installed in the devices.
- Only use the battery types specified for the product.
- Environmental protection and disposal! The batteries contained in the product are considered dangerous goods during land, air, and sea transport (risk of explosion) in the sense of the legal regulations. Dispose of used batteries separately from other waste. Observe the national regulations of your country.

2.3.8 Protection Against Pressurized Systems

According to the information given in the Project Planning Manuals, motors and components cooled with liquids and compressed air can be partially supplied with externally fed, pressurized media, such as compressed air, hydraulics oil, cooling liquids and cooling lubricants. Improper handling of the connected supply systems, supply lines or connections can cause injuries or property damage.

Risk of injury by improper handling of pressurized lines!

- Do not attempt to disconnect, open or cut pressurized lines (risk of explosion).
- Observe the respective manufacturer's operating instructions.
- Before dismounting lines, relieve pressure and empty medium.
- Use suitable protective equipment (safety goggles, safety shoes, safety gloves, for example).
- Immediately clean up any spilled liquids from the floor due to the risk of falling!

Environmental protection and disposal! The agents (e.g., fluids) used to operate the product might not be environmentally friendly. Dispose of agents harmful to the environment separately from other waste. Observe the national regulations of your country.

2.4 Explanation of Signal Words and the Safety Alert Symbol

The Safety Instructions in the available application documentation contain specific signal words (DANGER, WARNING, CAUTION or NOTICE) and, where required, a safety alert symbol (in accordance with ANSI Z535.6-2011).

The signal word is meant to draw the reader's attention to the safety instruction and identifies the hazard severity.

The safety alert symbol (a triangle with an exclamation point), which precedes the signal words DANGER, WARNING and CAUTION, is used to alert the reader to personal injury hazards.

A DANGER

In case of non-compliance with this safety instruction, death or serious injury **will** occur.

A WARNING

In case of non-compliance with this safety instruction, death or serious injury $\ensuremath{\textit{could}}$ occur.

In case of non-compliance with this safety instruction, minor or moderate injury could occur.

NOTICE

In case of non-compliance with this safety instruction, property damage could occur.

Type Codes

3 Type Codes

3.1 Type Code QSK061



Fig.3-1: Type code QSK061

Type Codes

3.2 Type Code QSK075

	ZN-40024-075_NOR_N_EN_2011-04-05.fh11
Abbrev 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2	3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0
Example: Q S K 0 7 5 E - 0 3 0 0 - N N - M 5 - U G 0	- N N N N
Product	
Size	
75=075	
Length = C. D. F.	
Winding	
QSK075C = 0300	
QSK075D = 0200, 0300	
QSK075E = 0200, 0300	
Cooling mode	
Natural convection	
Encoder	
with 128 increments = S5	
Optical encoder, multiturn-absolute Hiperface.	
with 128 increments	
Electrical connection	
Shaft	
Plain shaft with shaft sealing ring (standard) = G	
Holding broke	
Without holding brake = 0	
Holding brake, electrically-released, 23 Nm	
Other design	
None =	NNNN

Fig.3-2: Type code QSK075

Type Codes

3.3 Type Code QSK100



Fig.3-3:

QSK100 Type Code

4 Technical Data

4.1 Parameters on the Data Sheet

Designation	Symbol	Unit	Description		
Continuous torque at standstill 60 K	M _{0_60}	Nm	Continuous torque that can be applied to the motor output shaft at a speed of $n \ge 0.1$ Hz.		
Continuous current at standstill 60 K	I _{0_60(rms)}	А	Phase current (crest value) of the motor M_{dN} required for the con- tinuous torque at standstill at a speed of n ≥ 0.1 Hz.		
Continuous torque at standstill 100 K	M _{0_100}	Nm	Continuous torque that can be applied to the motor output shaft at a speed of $n \ge 0.1$ Hz.		
Continuous current at standstill 100 K	I _{0_100(rms)}	А	Phase current (crest value) of the motor $M_{0_{-100}}$ required for the continuous torque at standstill at a speed of n \ge 0.1 Hz.		
Maximum torque	M _{max}	Nm	The maximum torque that can be output for approx. 400 ms at maximum current I_{max} . The maximum torque that can be attained, depends on the controller used. Only the specified maximum torque in the selection lists is binding.		
Maximum current	I _{max(rms)}	А	Maximum, briefly permissible phase current of the motor winding without adverse affect on the permanent magnet circuit of the motor.		
Torque constant at 20 °C ¹⁾	K _{M_N}	Nm/A	Ratio of the created torque to the motor phase current at a motor temperature of 20°C. Unit: (Nm/A). Applicable up to approx. i = $2x I_{dN}$.		
Voltage constant at 20 °C ²⁾	К _{ЕМК_1000}	V/min⁻¹	Root-mean-square value of the induced motor voltage at a motor temperature of 20 °C and 1,000 revolutions per minute.		
Winding resistance at 20 °C	R ₁₂	Ohm	Winding resistance measured between two winding ends in ohms (Ω) .		
Winding inductivity	L ₁₂	mH	Inductivity measured between two phases in (mH).		
Discharge capacity of the compo- nent	C _{dis}	nF	Discharge capacity		
Number of pole pairs	0	-	Number of pole pairs		
Moment of inertia of the rotor	J _{rot}	kg*m²	Moment of inertia of the rotor without the optional holding brake. Unit = kgm².		
Thermal time constant	T _{th}	min	Time of the temperature increase to 63 % of the maximum temperature of the motor housing with the motor loaded with the permissible S1 continuous torque. (T _{th} Thermal time constant) . $ \begin{array}{c} & & & & \\ & & & \\ \hline & & & \\ & & & \\ \hline & & & \\ & & & \\ \hline & & & \\ & & & \\ \hline \hline & & & \\ \hline & & & \\ \hline & & & \\ \hline \hline \hline \\ \hline & & & \\ \hline \hline \end{array}$		
Maximum speed	n _{max}	min⁻¹	Maximum permissible velocity of the motor. Limiting factors can have mechanical (centrifugal forces, bearing stress) or electrical (DC link voltage) causes.		
Sound pressure level	L _P	dB(A)	Value of sound emission		

Designation	Symbol	Unit	Description	
Weight ³⁾	m	kg	Motor mass	
Ambient temperature in operation	T _{amb}	°C	0 40	
Type of protection according to IEC 60529		-	IP65	
Insulation class according to DIN EN 60034-1		-	Insulation class	
Encoder				
Current consumption max.	I _{Encoder}	mA	Maximum current consumption of encoder	
Power supply voltage	VCC _{En-}	V	Power supply voltage of encoder	
Number of lines	-	-	Number of lines	
Incremental signals	-	-	Incremental signals	
Distinguishable revolutions		-	Distinguishable revolutions	
Electric interface	-	-	Electric interface	
Holding brake (optional)				
Holding torque	M_4	Nm	Transferable holding torque	
Rated voltage (+/-10 %)	U _N	V	Input voltage of the holding brake	
Rated current	I _N	А	Current consumption of the holding brake	
Connection time	t ₁	ms	Response delay during connection	
Disconnection time	t ₂	ms	Disconnection time	
Moment of inertia of the brake J _B		kgm ²	Moment of inertia of the holding brake. Has to be added to the ment of inertia of the rotor.	

Manufacturing tolerance ±5 %
 Mass motor withour holding brak

3) Mass motor withour holding brake *Fig.4-1: QSK - Definition of Parameters*

Operating Modes

IndraDyn S motors are documented according to the inspection criteria and measurement procedures of EN 60034-1. The specified characteristic curves correspond to operating mode S1 or S3.



Duty Cycle

Operating mode S3 is supplemented by the specification of the duty cycle (DC) in %. The duty cycle is calculated as follows:

$$ED = \frac{\Delta t_{P}}{T_{C}} \cdot 100\%$$
ED Relative duty cycle in %

ΔtΡ Operating time with constant load

Fig.4-3: Relative duty cycle

The values specified in the documentation have been determined on the basis of the following parameters:

Cycle time: 10 min

Duty cycle (DC): 25 %





- natural convectionS3Continuous operation curve with25% ED, cycle duration 10 min ac-
cording to EN 60034-1; 2004; natural convection
- cording to EN 60034-1; 2004; natural convection
 Characteristic voltage limit curve When a speed at the safe commutation limit is reached, the voltage limit curve limits the available maximum torque M_{max}. Input terminal voltage on HCQ controller (tolerance -5 %) see details in characteristic curves.



4.2 Data Sheet QSK061B-0300

Designation	Symbol	Unit	QSK061B-0300-N	N-¤¤-UG¤-NNNN	
Continuous torque at standstill 60 K	M _{0_60}	Nm	3.	5	
Continuous current at standstill 60 K	I _{0_60(rms)}	А	1.9		
Continuous torque at standstill 100 K	M _{0_100}	Nm	3.9		
Continuous current at standstill 100 K	I _{0_100(rms)}	А	2.	1	
Maximum torque	M _{max}	Nm	14	.0	
Maximum current	I _{max(rms)}	А	8.	6	
Torque constant at 20 °C	K _{M_N}	Nm/A	2.0	05	
Voltage constant at 20 °C ¹⁾	$K_{EMK_{1000}}$	V/min ⁻¹	120	6.4	
Winding resistance at 20 °C	R ₁₂	Ohm	13.	50	
Winding inductivity	L ₁₂	mH	44.0	000	
Discharge capacity of the compo- nent	C _{dis}	nF	1.	8	
Number of pole pairs	0	-	4	1	
Moment of inertia of the rotor	J _{rot}	kg*m ²	0.00	044	
Thermal time constant	T _{th}	min	15	i.0	
Maximum velocity	n _{max}	min ⁻¹	4,2	00	
Sound pressure level	L _P		60.9 (±3)		
Weight ²⁾	m _{mot}	kg	5.7		
Surrounding air temperature during operation	T _{amb}	°C	0 40		
Degree of protection according to IEC 60529	IP	-	IP	65	
Insulation class according to DIN EN 60034-1	I.CL.	-	15	55	
Data encoder			M5	S5	
Encoder max. current consumption	I _{Encoder}	mA	6	0	
Encoder voltage supply	VCC _{En-}	V	7	12	
Encoder signal periods	~/J	-	12	28	
Encoder output signal	V _{out}		1Vss		
Distinguishable revolutions	U _{turn}	-	4,096	1	
EncoderInterface	-	-	Hiperface		
Holding brake data			0	1	
Holding torque	M ₄	Nm	-	10.00	
Input voltage (±10%)	U _N	V	-	24	
Rated current	I _N	A	-	0.75	
Connection time	t ₁	ms	-	25	
Disconnection time	t ₂	ms	-	40	
Holding brake moment of inertia	J _{br}	kg*m ²	-	0.0000590	
				Latest amendment: 2009-04-02	

1)

Manufacturing tolerance ± 5 %



4.3 Data Sheet QSK061C-0300

Designation	Symbol	Unit	QSK061C-0300-NN-□□-UG□-NNNN	
Continuous torque at standstill 60 K	M _{0_60}	Nm	8.	0
Continuous current at standstill 60 K	I _{0_60(rms)}	А	4.3	
Continuous torque at standstill 100 K	M _{0_100}	Nm	9.0	
Continuous current at standstill 100 K	I _{0_100(rms)}	А	4.8	
Maximum torque	M _{max}	Nm	32	2.0
Maximum current	I _{max(rms)}	A	19.4	
Torque constant at 20 °C	K _{M_N}	Nm/A	2.04	
Voltage constant at 20 °C ¹⁾	$K_{EMK_{1000}}$	V/min ⁻¹	125.7	
Winding resistance at 20 °C	R ₁₂	Ohm	4.50	
Winding inductivity	L ₁₂	mH	21.400	
Discharge capacity of the compo- nent	C _{dis}	nF	2.4	
Number of pole pairs	0	-	2	1
Moment of inertia of the rotor	J _{rot}	kg*m ²	0.00	075
Thermal time constant	T _{th}	min	18.0	
Maximum velocity	n _{max}	min⁻¹	4,200	
Sound pressure level	L _P	dB[A]	60.9 (±3)	
Mass	m _{mot}	kg	8.8	
Surrounding air temperature during operation	T _{amb}	°C	0 40	
Degree of protection according to IEC 60529	IP	-	IP65	
Insulation class according to DIN EN 60034-1	I.CL.	-	155	
Data encoder			M5	S5
Encoder max. current consumption	I _{Encoder}	mA	6	0
Encoder voltage supply	VCC _{En-}	V	712	
Encoder signal periods	~/』	-	128	
Encoder output signal	V _{out}		1Vss	
Distinguishable revolutions	U _{turn}	-	4,096	1
EncoderInterface	-	-	Hiperface	
Holding brake data			0	1
Holding torque	M ₄	Nm	-	10.00
Input voltage (±10%)	U _N	V	-	24
Rated current	I _N	A	-	0.75
Connection time	t ₁	ms	-	25
Disconnection time	t ₂	ms	-	40
Holding brake moment of inertia	J _{br}	kg*m ²	-	0.0000590
				Latest amendment: 2008-05-30

1)

Manufacturing tolerance ± 5 %



Characteristic curve QSK061C-0300 on HCQ02.1

4.4 Data Sheet QSK075C-0300

Designation	Symbol	Unit	QSK075C-0300-NN-□□-UG□-NNNN	
Continuous torque at standstill 60 K	M _{0_60}	Nm	12	0
Continuous current at standstill 60 K	I _{0_60(rms)}	А	8.4	
Continuous torque at standstill 100 K	M _{0_100}	Nm	12.5	
Continuous current at standstill 100 K	I _{0_100(rms)}	А	8.8	
Maximum torque	M _{max}	Nm	44	.0
Maximum current	I _{max(rms)}	A	37	.8
Torque constant at 20 °C	K _{M_N}	Nm/A	1.5	58
Voltage constant at 20 °C ¹⁾	$K_{EMK_{1000}}$	V/min ⁻¹	97.0	
Winding resistance at 20 °C	R ₁₂	Ohm	1.6	60
Winding inductivity	L ₁₂	mH	8.8	00
Discharge capacity of the compo- nent	C _{dis}	nF	3.2	
Number of pole pairs	0		4	L
Moment of inertia of the rotor	J _{rot}	kg*m ²	0.00	352
Thermal time constant	T _{th}	min	17.5	
Maximum velocity	n _{max}	min ⁻¹	5,000	
Sound pressure level	L _P	dB[A]	61.1 (±3)	
Weight ²⁾	m _{mot}	kg	16.4	
Surrounding air temperature during operation	T _{amb}	°C	0 40	
Type of protection according to IEC 60529	IP	-	IP65	
Insulation class according to DIN EN 60034-1	I.CL.	-	155	
Data encoder			M5	S5
Encoder max. current consumption	I _{Encoder}	mA	6	0
Encoder voltage supply	VCC _{En-}	V	712	
Encoder signal periods	~/』	-	128	
Encoder output signal	V _{out}		1Vss	
Distinguishable revolutions	U _{turn}	-	4,096	1
Encoder Interface	-	-	Hiperface	
Holding brake data			0	1
Holding torque	M_4	Nm	-	23.00
Input voltage (±10%)	U _N	V		24
Rated current	I _N	A	-	0.79
Connection time	t ₁	ms	-	130
Disconnection time	t ₂	ms	-	180
Holding brake moment of inertia	J _{br}	kg*m ²	-	0.0003000
				Latest amendment: 2011-05-09

1)

Manufacturing tolerance ±5 %



4.5 Data Sheet QSK075D-0200

Designation	Symbol	Unit	QSK075D-0200-NN-□□-UG□-NNNN	
Continuous torque at standstill 60 K	M _{0_60}	Nm	17	<i>.</i> .0
Continuous current at standstill 60 K	I _{0_60(rms)}	А	8.3	
Continuous torque at standstill 100 K	M _{0_100}	Nm	18.5	
Continuous current at standstill 100 K	I _{0_100(rms)}	А	9.0	
Maximum torque	M _{max}	Nm	64	.0
Maximum current	I _{max(rms)}	А	37.4	
Torque constant at 20 °C	K _{M_N}	Nm/A	2.2	24
Voltage constant at 20 °C ¹⁾	K _{EMK_1000}	V/min ⁻¹	138.0	
Winding resistance at 20 °C	R ₁₂	Ohm	1.80	
Winding inductivity	L ₁₂	mH	11.700	
Discharge capacity of the compo- nent	C _{dis}	nF	4.6	
Number of pole pairs	0	-	2	1
Moment of inertia of the rotor	J _{rot}	kg*m²	0.00490	
Thermal time constant	T _{th}	min	22.0	
Maximum velocity	n _{max}	min⁻¹	3,800	
Sound pressure level	L _P	dB[A]	61.1 (±3)	
Mass	m _{mot}	kg	20.1	
Surrounding air temperature during operation	T _{amb}	°C	0 40	
Degree of protection according to IEC 60529	IP	-	IP65	
Insulation class according to DIN EN 60034-1	I.CL.	-	155	
Data encoder			M5	S5
Encoder max. current consumption	I _{Encoder}	mA	6	0
Encoder voltage supply	VCC _{En-}	V	712	
Encoder signal periods	~/J	-	128	
Encoder output signal	V _{out}		1Vss	
Distinguishable revolutions	U _{turn}	-	4,096	1
Encoder Interface	-	-	Hiperface	
Holding brake data			0	1
Holding torque	M ₄	Nm	-	23.00
Input voltage (±10%)	U _N	V	-	24
Rated current	I _N	А	-	0.79
Connection time	t ₁	ms	-	130
Disconnection time	t ₂	ms	-	180
Holding brake moment of inertia	J _{br}	kg*m ²	_	0.0003000
				Latest amendment: 2011-05-09

1)

Manufacturing tolerance ± 5 %



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)	Power supply voltage -5 %
-ig.4-12:	Characteristic curve QSK075D-0200 on HCQ02.1

4.6 Data Sheet QSK075D-0300

Designation	Symbol	Unit	QSK075D-0300-N	N-¤¤-UG¤-NNNN
Continuous torque at standstill 60 K	M _{0_60}	Nm	17	<i>.</i> .0
Continuous current at standstill 60 K	I _{0_60(rms)}	А	11.7	
Continuous torque at standstill 100 K	M _{0_100}	Nm	18.5	
Continuous current at standstill 100 K	I _{0_100(rms)}	А	12.7	
Maximum torque	M _{max}	Nm	66	i.0
Maximum current	I _{max(rms)}	А	52.7	
Torque constant at 20 °C	K _{M_N}	Nm/A	1.60	
Voltage constant at 20 °C ¹⁾	$K_{EMK_{1000}}$	V/min⁻¹	98	.2
Winding resistance at 20 °C	R ₁₂	Ohm	0.91	
Winding inductivity	L ₁₂	mH	5.7	00
Discharge capacity of the compo- nent	C _{dis}			
Number of pole pairs	0	-	2	1
Moment of inertia of the rotor	J _{rot}	kg*m²	0.00	490
Thermal time constant	T _{th}	min	22.0	
Maximum velocity	n _{max}	min ⁻¹	4,800	
Sound pressure level	L _P	dB[A]	61.1 (±3)	
Weight ²⁾	m _{mot}	kg	20.1	
Surrounding air temperature during operation	T _{amb}	°C	0 40	
Degree of protection according to IEC 60529	IP	-	IP65	
Insulation class according to DIN EN 60034-1	I.CL.	-	155	
Data encoder			M5	S5
Encoder max. current consumption	I _{Encoder}	mA	6	0
Encoder voltage supply	VCC _{En-}	V	712	
Encoder signal periods	~/』	-	128	
Encoder output signal	V _{out}		1Vss	
Distinguishable revolutions	U _{turn}	-	4,096	1
Encoder Interface	-	-	Hiperface	
Holding brake data			0	1
Holding torque	M_4	Nm	-	23.00
Input voltage (±10%)	U _N	V	-	24
Rated current	I _N	A	-	0.79
Connection time	t ₁	ms	-	130
Disconnection time	t ₂	ms	-	180
Holding brake moment of inertia	J _{br}	kg*m ²	-	0.0003000
				Latest amendment: 2011-05-11

1)

Manufacturing tolerance ±5 %


4.7 Data Sheet QSK075E-0200

Designation	Symbol	Unit	QSK075E-0200-N	N-¤¤-UG¤-NNNN
Continuous torque at standstill 60 K	M _{0_60}	Nm	21.0	
Continuous current at standstill 60 K	I _{0_60(rms)}	А	10.2	
Continuous torque at standstill 100 K	M _{0_100}	Nm	23.0	
Continuous current at standstill 100 K	I _{0_100(rms)}	A	11	.2
Maximum torque	M _{max}	Nm	88	.0
Maximum current	I _{max(rms)}	A	45	i.9
Torque constant at 20 °C	K _{M_N}	Nm/A	2.2	26
Voltage constant at 20 °C ¹⁾	K _{EMK_1000}	V/min ⁻¹	139	9.0
Winding resistance at 20 °C	R ₁₂	Ohm	1.:	24
Winding inductivity	L ₁₂	mH	8.4	.00
Discharge capacity of the compo- nent	C _{dis}	nF	5.	8
Number of pole pairs	0	-	2	1
Moment of inertia of the rotor	J _{rot}	kg*m²	0.00	613
Thermal time constant	T _{th}	min	29	0.0
Maximum velocity	n _{max}	min⁻¹	3,850	
Sound pressure level	L _P	dB[A]	61.1	(±3)
Weight ²⁾	m _{mot}	kg	23.6	
Surrounding air temperature during operation	T _{amb}	°C	0 40	
Degree of protection according to IEC 60529	IP	-	IP65	
Insulation class according to DIN EN 60034-1	I.CL.	-	155	
Data encoder			M5	S5
Encoder max. current consumption	I _{Encoder}	mA	6	0
Encoder voltage supply	VCC _{En-}	V	7	12
Encoder signal periods	~/』	-	12	28
Encoder output signal	V _{out}		1Vss	
Distinguishable revolutions	U _{turn}	-	4,096	1
Encoder Interface	-	-	Hiperface	
Holding brake data			0	1
Holding torque	M ₄	Nm	-	23.00
Input voltage (±10%)	U _N	V	-	24
Rated current	I _N	A	-	0.79
Connection time	t ₁	ms	-	130
Disconnection time	t ₂	ms	-	180
Holding brake moment of inertia	J _{br}	kg*m ²	-	0.0003000
				Latest amendment: 2011-05-11

1)

Manufacturing tolerance ±5 %



Fig.4-16: Powe

Characteristic curve QSK075E-0200 on HCQ02.1

4.8 Data Sheet QSK100B-0200

Designation	Symbol	Unit	QSK100B-0200-N	N-¤¤-¤G¤-NNNN	
Continuous torque at standstill 60 K	M _{0_60}	Nm	28.0		
Continuous current at standstill 60 K	I _{0_60(rms)}	А	14.7		
Continuous torque at standstill 100 K	M _{0_100}	Nm	33	.0	
Continuous current at standstill 100 K	I _{0_100(rms)}	А	17	.3	
Maximum torque	M _{max}	Nm	102	2.0	
Maximum current	I _{max(rms)}	А	66	2	
Torque constant at 20 °C	K _{M_N}	Nm/A	2.1	0	
Voltage constant at 20 °C ¹⁾	K _{EMK_1000}	V/min ⁻¹	129	0.5	
Winding resistance at 20 °C	R ₁₂	Ohm	0.5	8	
Winding inductivity	L ₁₂	mH	7.	6	
Discharge capacity of the component	C _{dis}	nF	10	.3	
Number of pole pairs	0	-	4		
Moment of inertia of the rotor	J _{rot}	kg*m ²	0.01	920	
Thermal time constant	T _{th_nom}	min	40)	
Maximum velocity	n _{max}	min⁻¹	4,1	00	
Sound pressure level	L _P	dB[A]	61.1	(±3)	
Weight ²⁾	m _{mot}	kg	36.5		
Surrounding air temperature during operation	T _{amb}	°C	0 40		
Protection class acc. to EN 60034	-	-	IP65		
Insulation class according to EN 60034-1	T.CL.	-	155		
Data encoder			M5		
Encoder max. current consumption	I _{Encoder}	mA	60)	
Encoder voltage supply	VCC _{Encoder}	V	7	12	
Encoder signal periods	~/5	-	12	8	
Encoder output signal	V _{out}		1V:	SS	
Distinguishable revolutions	U _{turn}	-	4,0	96	
Encoder Interface	-	-	Hiper	face	
Holding brake data			0	1	
Holding torque	M ₄	Nm	-	32.0	
Input voltage (±10%)	U _N	V	-	24	
Rated current	I _N	А	-	0.93	
Connection time	t ₁	ms	-	15	
Disconnection time	t ₂	ms	-	115	
Holding brake moment of inertia	J _{br}	kg*m ²	-	0.001242	
			Lates	st amendment: 2013-01-18	



Manufacturing tolerance ±5 % Mass motor withour holding brake

QSK - technical data



1) *Fig.4-18:*

Characteristic curve QSK100B-0200 on HCQ02.1



Rexroth IndraDyn S Synchronous Motors QSK061, -075, -100

DOK-MOTOR*-QSK******-PR03-EN-P

5

LSA Control S.L. www.lsa-control.com comercial@lsa-control.com (+34) 960 62 43 01

Dimensions

Dimensions



Dimensions QSK075

Dimensions



Fig.5-3: Dimensions QSK100

6 Connection Technique

6.1 Electric Connection Technique Overview

The electrical connections of IndraDyn S motors are standardized over all frame sizes. IndraDyn S motors are provided with

- a power connector, incl. connection for temperature sensor and holding brake,
- an encoder connection.

Both connectors are designed as plug-in connectors. When ready-made cables of Rexroth are used, a simple, fast and error-free assembly and commissioning is ensured.



Power connection with temperature sensor and holding brake Encoder connection

Fig.6-1: Overview of IndraDyn S connections I

QSK connector

2

Motor	Power connector	Encoder connector
QSK061	RLS1100	RGS1000
QSK075	RLS1200	RGS1000
QSK100	RLS1300	RGS1003

Fig.6-2: Connector on QSK motors

The maximum cable length for power and encoder cables between controllers HCQ02.1 or HCT02.1 and QSK motors is **40 m**.

Connection cable (power, ready-made)

Motor	Order designation cable	Crosssection [mm²]	Converter
QSK061B-0300	RKL0020	1.0	HCT02.1, HCQ02.1
QSK061C-0300	RKL0020	1.0	HCT02.1, HCQ02.1
QSK075C-0300	RKL0022	1.5	HCT02.1, HCQ02.1
QSK075D-0200		1.5	
QSK075D-0300		1.5	

Connection Technique

Motor	Order designation cable	Crosssection [mm ²]	Converter
QSK075E-0200	RKL0022	1.5	HCT02.1, HCQ02.1
QSK100B-0200	RKL0023	2.5	HCT02.1, HCQ02.1

Fig.6-3: Power cables

Connection cable (encoder, ready-made)

Motor	Order designation ca- ble	Converter
QSK061	RKG4200	HCT02.1, HCQ02.1
QSK075	RKG4200	HCT02.1, HCQ02.1
QSK100	RKG4200	HCT02.1, HCQ02.1

Fig.6-4:

Encoder Cables

7.1 Ambient Conditions

7.1.1 Setup Elevation and Ambient Temperature

According to DIN EN 60034-1, the motor performance data specified below are valid for:

- Ambient temperatures 0 ... 40 °C
- Setup elevation 0 ... 1,000 m above sea level

When exceeding the given limits, the performance data of the motors must be reduced.



Ambient temperature > 40 °C

 $M_{0_{red}} = M_0 \times f_T$

linstallation altitude > 1,000 m $M_0 _{red} = M_0 \times f_H$

Ambient temperature > 40 °C and setup elevation > 1,000 m M_0 _{red} = $M_0 \times f_T \times f_H$

7.1.2 Humidity / Temperature

Ambient climatic conditions are defined in different classes according to DIN EN 60721-3-3, Table 1. They are based on observations made over long periods of time throughout the world and take into account all influencing quantities that could have an effect, such as the air temperature and humidity.

Based on this table, Rexroth recommends class 3K4 for continuous use of the motors.

The following table provides extracts from this class.

Environmental factor	Unit	Class 3K4
Low air temperature	C°	+5 ¹)
High air temperature	C°	+40
Low rel. air humidity	%	5
High rel. air humidity	%	95
Low absolute air humidity	g/m³	1
High absolute air humidity	g/m³	29
Temperature change rate	°C/min	0.5

1)

Rexroth permits 0 °C as the lowest air temperature.

Fig.7-2: Classification of ambient climatic conditions according to DIN EN 60721-3-3, Table 1

7.1.3 Vibration

Sinusoidal Vibrations

Vibrations are sine-wave oscillations in stationary use, which vary in their effect on the resistance of the motors depending on their intensity.

The resistance of the overall system is determined by the weakest component.

Based on DIN EN 60721-3-3 and DIN EN 60068-2-6, the following values result for Rexroth motors:

Maximum permissible vibration load (10-2,000 Hz)

Direction	Encoder S5, M5
Axial	10 m/s²
Radial	30 m/s²
	Latest amendment: 2009-03-20

Fig.7-3: Permissible vibration load for QSK motors

Operating Conditions and Application Notes

7.1.4 Shock

The shock load of the motors is indicated by providing the maximum permitted acceleration in non-stationary use, such as during transport.

Function-impairing effects are avoided as long as the limits specified are kept.

Based on DIN EN 60721-3-3 and DIN EN 60068-2-6, the following values result for Rexroth motors:

Maximum allowed shock load (6 ms)

Direction	QSK061	QSK075	QSK100
Axial		10 m/s²	
Radial	500 m/s²	300 m/s²	200 m/s²
		Latest ame	endment: 2009-03-20

Fig.7-4: Permitted shock load for QSK motors

Degree of protection 7.2

The motors are subdivided into corresponding types of protection (IP) regarding their applicability for different ambient conditions. These types of protection (IP) are described in DIN EN 60529. The protection of the device is characterized by a two-digit number. The first digit defines the degree of protection against contact and penetration of foreign particles. The second digit defines the degree of protection against water.

Degree of protection IP

1st digit	Degree of protection	2nd digit	Degree of protection
6	Protection against penetra- tion of dust (dust-proof); complete contact protection	5	Protection against a water jet from a nozzle directed against the housing from all directions (jet water)

Definition degree of protection (IP) Fig.7-5:

The IndraDyn S motor construction corresponds to the following degrees of protection according to DIN VDE 0470, part 1, ed. 11/1992 (EN 60529):



1 Output shaft with shaft sealing ring

Connector for power and encoder connection

Fig.7-6: IP degree of protection with QSK motors

Design and Installation Positions 7.3

2

Motor design B05

IM B5	IM V1	IM V3	
Flange attachment on the drive side of the flange	Flange attachment on the drive side of the flange, drive side facing down	Flange attachment on the drive side of the flange, drive side facing up	
Fig.7-7: Permissible conditions of installation according to EN 60034-7:1993			

NOTICE

Motor damage due to penetration of liquids!

If motors are attached according to IM V3, fluid present at the output shaft over a prolonged time may penetrate and cause damage to the motors.

Ensure that fluid cannot be present at the output shaft.

7.4 Compatibility with Foreign Materials

All Rexroth controls and drives are developed and tested according to the state of the art.

However, since it is impossible to follow the continuing further development of every material with which our controls and drives could come into contact (e.g. lubricants on tool machines), reactions with the materials that we use cannot be ruled out in every case.

For this reason, you must execute a compatibility test between new lubricants, cleansers, etc. and our housings and device materials before using these products.

7.5 Priming and Housing Varnish

Color	Black (RAL9005)		
Resistance	Resistant against		
	•	diluted acids/lyes	
	•	water, seawater, sewage	
	•	current mineral oils	
	Resi	stant to a limited degree against	
	organic solvents		
	•	hydraulic oil	
	Not r	esistant against	
	•	concentrated acids/lyes	
Additional paint	•	It is permitted to provide the housing with additional var- nish (coat thickness no more than 40 μ m). Before painting the housing, check the adhesiveness and resistance of the new paint.	
Fig.7-8: Char	acteri	stics of the housing varnish	

Specification Housing Varnish

Protect all safety notes, type plates and open connectors with a painting protection when painting additionally.

7.6 Output Shaft

7.6.1 Plain Shaft

The recommended standard model for IndraDyn S motors provides a nonpositive, zero-backlash shaft-hub connection with a high degree of quiet running. Use clamping sets, pressure sleeves or clamping elements for coupling the machine elements to be driven.

7.6.2 Output Shaft with Shaft Sealing Ring

IndraDyn S motors are designed with radial shaft sealing rings according to DIN 3760 – design A.



Radial shaft sealing ring
 Sin Z O

Fig.7-9: IndraDyn S radial shaft sealing ring

Wear Radial shaft sealing rings are friction seals. They are therefore subject to wear and generate frictional heat.

Wear of the friction seal can be reduced only if lubrication is adequate and the sealing point is clean. Here, the lubricant also acts as a coolant, supporting the discharge of frictional heat from the sealing point.

Prevent the sealing point from becoming dry and dirty. Make sure everything is clean.

Under normal environmental conditions, the shaft seal is greased for its lifetime. Under unfavorable environmental conditions (e.g. grinding dust, metal shavings), however, maintenance intervals could be necessary.

Resistance The materials used for radial shaft sealing rings are highly resistant against oils and chemicals. However, the machine manufacturer is responsible to check whether the rings are suitable for the particular conditions of use.

The complex interactions between the sealing ring, the shaft and the sealing fluid, as well as the particular operating conditions (frictional heat, soiling, etc.), do not allow calculation of the lifetime of the shaft sealing ring.

Vertical Installation Positions IM V3

Motors with shaft sealing ring have IP 65 degree of protection on their flange side. Hence, tightness is ensured only in case of splashing fluids. Fluid levels present on the A-side require a higher degree of protection. For vertical installation position (shaft at the top) of the motor, please observe the additional notes in chapter 7.3 "Design and Installation Positions" on page 48.

Rexroth recommends that any direct contact of the drive shaft and the radial shaft sealing ring with the processing medium (coolant, material corrosion) caused by the machine or system construction be avoided.

7.7 Bearing and Shaft Load

7.7.1 Radial Load, Axial Load

During operation, both radial and axial forces act upon the motor shaft and the motor bearings. The construction of the machine, the selected motor type and the attachment of driving elements on the shaft side must be adapted to each other to ensure that the load limits specified are not exceeded.

Bearing Lifetime

If motors are operated within the limits specified for radial and axial loads, the bearing lifetime is as follows:

L_{10h} = 20,000 operating hours

(calculated according to ISO 281, ed. 12/1990)



Shaft load diagrams show the load limit for output shaft and motor bearing.









n [min⁻¹] Mean speed *Fig.7-13: Shaft load QSK*

7.8 Attachment of Drive Elements

Motor damage caused by penetration of fluids!

If motors are attached according to IM V3, fluid present at the output shaft over a prolonged time may enter into and cause damage to the motors.

 \Rightarrow Ensure that fluid cannot be present at the output shaft.

Whenever attaching drive elements to the output shaft, such as

- Gearboxes
- Couplings
- Gear pinion

it is absolutely necessary that the following guidelines be followed.

Gearbox Mounting on Motors

Overdetermined Bearing

Are gearboxes mounted on motors, the thermal coupling of the motors on machines or constructions changes.

Depending on the gearbox type, the heat development on the gearbox is different. The heat dissipation of the motor via the flange is reduced in every case when a gearbox is mounted. This must be heeded at the project planning.

A reduction of the given performance data is necessary, to do not overload motors when using gearboxes.



The indicated torques in the characteristic curves of the motor have to be reduced by **20-30%** when mounting gearboxes.

Please, heed all further notes and specifications within this documentation for the used gearboxes.

Generally, overtermined bearings are to be avoided by all means when connecting drive elements. The tolerances inevitably present in such cases will lead to additional forces acting on the bearing of the motor shaft and, as the case may be, to a distinctly reduced service life of the bearing.

If a redundant attachment cannot be avoided, it is absolutely necessary to consult with Rexroth.

Couplings The machine construction and the drive elements used must be carefully adapted to the motor type so as to make sure that the load limits of the shaft and the bearing are not exceeded.

	A CAUTION Motor damage due to mechanical overload
	When extremely stiff couplings are attached, the radial force which constantly changes the angular position may cause an impermissibly high load on the shaft and bearing.
Ball bearing pinion or helical drive pinion	Owing to thermal effects, the flange-sided end of the output shaft may shift by 0.6 mm in relation to the motor housing. If helical drive pinions or bevel gear pinions directly attached to the output shaft are used, this change in position will lead to
	• a shift in the position of the axis, if the driving pinions are not defined axially on the machine side,
	• a thermally dependent component of the axial force, if the driving pin- ions are defined axially on the machine side. This causes the risk of ex- ceeding the maximum permissible axial force or of the play within the gears increasing to an impermissible degree.
	• Damage of the motor bearing on the B-side due to exceeding of the maximum permissible axial force.
	In such cases, drive elements should preferably be used with their own bearings which are connected to the motor drive shaft via axially compensating couplings.

7.9 Holding Brakes

7.9.1 Holding Brake Electrically-Released

The holding brake of the IndraDyn S motors works according to the principle "electrically-released". Non-operative closed holding brakes open when applying the voltage.

The voltage supply of the holding brake has to be designed so as to make a voltage of 24 V \pm 10% available on the motor for safe operation of the holding brake (releasing/applying).

The voltage incoming at the motor is subject to the line length and the cable properties, e.g., conductor resistance.





The electrically releasing holding brake is used to hold the axes at a standstill and when the "controller enable" signal is off. When the supply voltage fails and the controller is enabled, the electrically-releasing holding brake will close automatically.



If the holding brake is repeatedly activated with the drive rotating or the allowed braking energy is exceeded, premature wear and tear may occur.

7.9.2 Holding Brakes - Notes Regarding Safety

Observe the safety requirements for the system planning and development.

Personal injury through hazardous movements caused by falling or descending axes!

Secure vertical axes against falling or descending after disconnection:

lock the vertical axes mechanically,

- provide an external braking / collecting / clamping device, or
- Ensure sufficient weight compensation of the axes.

The serially delivered holding brakes which are driven by the control device are **not** suited for personal safety!

Personal protection must be realized by superordinate fail-safe measures, such as e.g. the locking off of the danger zone by means of a protective fence or grill.

RF RF	Beside the specified details and notes about holding brakes, heed the additional standards and directives when planning the system.
	For Europian countries:
	• EN 954 and ISO 13840-1 and ISO 13840-2 Safety-related

- EN 954 and ISO 13849-1 and ISO 13849-2 Safety-related components of controls
- Information sheet no. 005 "Gravity-loaded axes (vertical axes)" published by: Fachausschuss Maschinenbau, Fertigungssysteme, Stahlbau

For the USA:

 See National Electric Code (NEC), National Electrical Manufacturers Association (NEMA) as well as local building regulations.

The following is generally valid: Comply with all applicable national regulations!

The permanent magnetic brake is no safety brake. This means, a torque reduction by non-influenceable disturbance factors can occur (see EN 954 and ISO 13849-1 and ISO 13849-2 or the information leaflet No. 005 about "Gravity-loaded axes (vertical axes)").

Please pay particular attention to the following:

- Corrosion on friction surfaces, as well as dust, perspiration and sediments reduce the braking effect.
- Grease must not hit the friction surface.
- Overvoltage and too high temperatures can durably weaken the permanent magnets and thus the brake.

Functioning of the holding brake is no longer ensured, if the air gap between armature and pole is improperly increased due to deterioration. In this case, no braking occurs.

7.9.3 Layout of Holding Brakes

Holding brakes on motors are basically not designed for service braking. The effective braking torques are physically conditionally different in static and dynamic operation.

Normal operation and EMERGENCY STOP	event of faults		
In normal operation , using the holding brake for clamping of a standstill axes, the "statistic holding torque" (M4), applies as indicated in the data sheets.	For fault conditions to deactivate a mov- ing axis ($n \ge 10 \text{ min}^{-1}$), a "dynamic brak- ing moment" acts (M_{dyn}) - sliding friction.		
For EMERGENCY STOP to deactivate an axis ($n < 10 \text{ min}^{-1}$), a "dynamic brak- ing moment" acts (M_{dyn}) - sliding friction.			
M4 > M _{dyn}			
Therefore, note the following description of dynamic sizing.			

Fig.7-16: Dynamic Sizing

	which the holding brake can provide. Otherwise the dynamic holding brake torque is not sufficient to stop the axes. If a mass is to be decelerated in a defined time or in a defined route, the addi-
	count.
Project planning recommendation	To ensure construction safety, reduce the required holding torque to 60% of the static holding torque (M4) of the holding brake.

7.9.4 Holding Brake–Commissioning and Maintenance Instructions

In order to ensure proper functioning of the holding brake, it must be checked before the motors are commissioned. The test as well as the resurfacing may be carried out "mechanically by hand" **or** "automatically by means of the software function".

Checking and resurfacing of holding brakes by hand Measure the holding torque (M4) of the holding brake. If necessary, resurface the holding brake.

Measuring the Holding Torque (M4) of the Holding Brake

- 1. De-energize the motor and secure it against re-energization.
- 2. Measure the transferable holding torque of the holding brake with a torque wrench. For holding torque (M4) refer to the technical data.

If the holding torque (M4) is achieved, the motor is ready for assembly. If the holding torque (M4) **is not achieved**, the subsequent resurfacing-process can be used to reconstitute the holding torque.

Resurfacing the Holding Brake

- 1. At closed holding brake, turn the output shaft by hand, e.g. with the help of a torque wrench, by about 5 revolutions.
- 2. Measure the holding torque (M4).

If the holding torque (M4) is achieved, the motor is ready for assembly. If the specified holding torque (M4) is not attained after several grindingin processes, the holding brake is not operable. Please, contact the Rexroth Service.

Checking the Holding Torque (M4) via P-0-0541, C2100 Command Holding system check

1. The efficiency of the holding brake and the opened state are checked by the control device by starting the routine "P-0-0541, C2100 Command Holding system check".

If the holding brake is operational, the drive is in an operational state after the routine was run through. If the braking torque is too low, the control device outputs a corresponding message.

The brake test can also be carried out cyclically in the framework of a preventive maintenance.

Restoring the Holding Torque (M4) by means of the Software Function

The following possibilities are available:

Checking and resurfacing of holding brakes by means of the software function

1. Realization of the resurfacing routine IndraDrive "Restoring the holding torque "(see"P-0-0544, C3900 Command Resurfacing of motor holding brake"). A repeated realization of the resurfacing routine is possible.

Upon the execution of the command C3900 it is not checked whether the resurfacing of the holding brake was successful. It is recommended to execute the command C2100 (Command Holding system check) once again.

2. Resurfacing routine by superior control. Here, special control programs adapted to the machine and system concepts are required. If necessary, please contact your Bosch Rexroth distribution partner and discuss the resurfacing routine parameters for your application.

For more detailed information about software functions refer to the functional description "Rexroth IndraDrive Firmware for Drive Control Devices MPx-xx, DOK-INDRV*-MP*-xxVRS**-FKxx-EN-P."

7.10 Motor Cooling

Rexroth motors of the standard design are self-cooling motors.

Pollution of the motors reduces the heat dissipation. Ensure tidiness!

7.11 Motor Temperature Monitoring

7.11.1 General Information

The motor temperature is monitored by two systems that are operated independently of each other

- Temperature sensor
- Temperature model

and ensures thus the best protection of motors against irreversible damage by thermal overload.

7.11.2 Temperature Sensor

The monitoring of the motor temperature is ensured via the temperature sensor of the KTY84 type, which is built into the stator. The motor temperature measured is controlled via the following threshold values:

- Motor warning temperature (140 °C)
- Motor switch-off temperature (150 °C)

The threshold values are filed within the encoder memory of the QSK motors.



Fig.7-17: Characteristic curve KTY84-130

The IndraDrive control devices monitor the functionality of the temperature sensors.

For further information, please refer to the functional description of IndraDrive control devices.

7.12 Acceptances and Approvals

7.12.1 CE Symbol

Declaration of Conformity

The certificates of conformity certifying the structure of and the compliance with the valid EN standards and EC guidelines are available for all IndraDyn S. If necessary, these declarations of conformity can be requested from the responsible sales office.

The CE mark is applied to the motor type label of the IndraDyn S.



Fig.7-18: CE mark

8.1 Transport Instructions

Transport our products only in their original package. Also observe specific ambient factors to protect the products from transport damage.

Based on EN 60721-3-2, the tables below specify classifications and limit values which are allowed for our products while they are transported by land, sea or air. Observe the detailed description of the classifications to take all of the factors which are specified in the particular class into account.

Allowed classes of ambient conditions during transport acc. to EN 60721-3-2

Classification type	Allowed class
Classification of climatic ambient conditions	2K2
Classification of biological ambient conditions	2B1
Classification of chemically active materials	2C2
Classification of mechanically active materials	2S2
Classification of mechanical ambient conditions	2M1

Fig.8-1: Allowed classes of ambient conditions during transport

For the sake of clarity, a few essential environmental factors of the aforementioned classifications are presented below. Unless otherwise specified, the values given are the values of the particular class. However, Bosch Rexroth reserves the right to adjust these values at any time based on future experiences or changed ambient factors.

Allowed transport conditions

Environmental factor	Symbol	Unit	Value
Temperature	Τ _Τ	°C	-20 +80 ¹⁾
Air humidity			
(relative air humidity, not combinable with quick temperature change)	φ	%	75 (at +30 °C)
Occurence of salt mist			Not permitted ¹⁾
			*

1) Differs from EN 60721-3-2 *Fig.8-2: Allowed transport conditions*

Before transport, empty the liquid coolant from the liquid-cooled motors to avoid frost damage.

Transport by air

r If motor components with permanent magnets are shipped by air, the DGR (Dangerous Goods Regulations) of the IATA (International Air Transport Association) for hazardous materials of class 9 which also include magnetized substances and objects must be observed. For example, these regulations are applicable for

- Secondary parts of synchronous linear motors
- Rotors of synchronous kit motors
- Rotors of synchronous housing motors (if shipped as motor components, i.e., separated from the stator or motor housing in case service work is required)

For information on the maximum allowed magnetic strenghts and methods of measuring such magnetic field strengths, please refer to the current IATA DGR (chapter 3.9.2.2).

8.2 Storage Instructions

8.2.1 Storage Conditions

Generally, Bosch Rexroth recommends to store all components until they are actually installed in the machine as follows:

- In their original package
- At a dry and dustfree location
- At room temperature
- Free from vibrations
- Protected against light or direct insolation

On delivery, protective sleeves and covers may be attached to our motors. They must remain on the motor for transport and storage. Do not remove these parts until shortly before assembly.

Based on EN 60721-3-1, the tables below specify classifications and limit values which are allowed for our products while they are stored. Observe the detailed description of the classifications to take all of the factors which are specified in the particular classification into account.

Allowed classes of ambient conditions during storage acc. to EN 60721-3-1

Classification type	Class
Classification of climatic ambient conditions	1K2
Classification of biological ambient conditions	1B1
Classification of chemically active materials	1C2
Classification of mechanically active materials	1S1
Classification of mechanical ambient conditions	1M2

Fig.8-3: Allowed classes of ambient conditions during storage

For the sake of clarity, a few essential environmental factors of the aforementioned classifications are presented below. Unless otherwise specified, the values given are the values of the particular class. However, Bosch Rexroth reserves the right to adjust these values at any time based on future experiences or changed ambient factors.

Allowed classes of ambient conditions during storage acc. to EN 60721-3-1

Environmental factor	Symbol	Unit	Value
Air temperature	TL	°C	-20 +60 ¹⁾
Relative air humidity	φ	%	5 95
Absolute air humidity	ρw	g/m³	1 29
Condensation			Not allowed
Ice formation/freezing			Not allowed
Direct solar radiation			Not allowed ¹⁾
Occurence of salt mist			Not allowed ¹⁾

1)Differs from EN 60721-3-1*Fig.8-4:*Allowed storage conditions

R

Before re-storage, empty the liquid coolant from the liquid-cooled motors to avoid frost damage.

Storage Times 8.2.2

Additional measures must be taken on commissioning to preserve proper functioning - irrespective of the storage time which may be longer than the warranty period of our products. However, this does not involve any additional warranty claims.

Motors

Bearing time / months		nonths	Massures for commissioning	
> 1	> 12	> 60		
			Visual inspection of all parts to be damage-free	
	Resurface the holding brake		Resurface the holding brake	
			Check the electric contacts to verify that they are free from corrosion	
		•	Let the motor run in without load for one hour at 800 1000 rpm	
		•	Measure insulation resistance. Dry the winding at a value of < 1kOhm per volt rated voltage.	
			Exchange bearings	
			Exchange encoders	

Fig.8-5: Measures before commissioning motors that have been stored over a prolonged period of time

Cables and Connectors

Bearing time / months		nonths	Measures for commissioning	
> 1	> 12	> 60	indasures for commissioning	
•		•	Visual inspection of all parts to be damage-free	
		•	Check the electric contacts to verify that they are free from corrosion	
			Visually inspect the cable jacket. Do not use the cable if you detect any abnormalities (squeezed or kinked spots, color deviations,).	

Fig.8-6:

Measure before commissioning cables and connectors that have been stored over a prolonged period of time

9 Delivery Status, Identification, Handling

9.1 State of Delivery

9.1.1 General Information

On delivery, the QSK motors are packed in cardboard boxes or wooden crates. Packing units on pallets are secured by means of retaining straps.

Injuries due to uncontrolled movement of the retaining straps when cutting!

Maintain a sufficient distance and carefully cut the bandages.

Upon delivery from the factory, the motor drive shaft and the connectors have protective sleeves. Remove the protective sleeves just before assembly.

9.1.2 Inspection at the Factory

All QSK motors undergo the following tests, among others, at the factory:

- Electrical test

 High voltage test
 - Isolation resistance test
 - Protective conductor connection
 - Test of winding resistance

Mechanical test

- Axial eccentricity of the flange face to the shaft
- Coaxiality of the centering shoulder to the shaft
- Test of brake holding torque (option)

9.1.3 Test Realized by the Customer

Since all QSK motors undergo a standardized inspection procedure, highvoltage tests on the customer side are not required. Motors and components could be damaged if they undergo several high-voltage inspections.

Concentricity and position tolerances of shaft end and fastening flange



Destruction of motor components due to improperly executed high-voltage inspection! Invalidation of warranty!

Avoid repeated inspections.

Please observe the target values of the EN 60034-1.

9.2 Identification

9.2.1 Scope of Delivery

The total scope of a delivery can be seen in the delivery note or waybill. However, the contents of a delivery can be distributed over several packages. Each individual package can be identified using the shipment label attached. Please, check after receiving the delivery, if the delivered goods comply with your order and the shipping documents.

Complain any deviation at your responsible Rexroth sales partner, immediately.

Complain any visible transport damage directly at the deliverer.

9.2.2 Type Plate

Each motor has an individual type plate showing the device designation and providing technical information. Additionally, a second type plate is delivered with the motor.

If the original type plate of the motor is obscured by the machine construction, use the second type plate to an easily visible portion of the machine. This type plate is either enclosed to the motor or is removably glued onto the original type plate.

The type plate is provided for

- Identification of the motor
- Procurement of spare parts in case of a fault
- Service information.

The type designation of the motor is also filed in the encoder data memory.



Fig.9-1: Type label (example: IndraDyn S)

9.3 Handling

A CAUTION

Injuries due to improper handling during transport of motors!

Do only use suitable lifting devices (e.g. lifting sling belts, eyebolts, chain suspension ...).

Use protective equipment and personal protective clothing (gloves, safety shoes, $\ldots).$

Never walk under hanging loads.

NOTICE Damage of property and invalidation of the warranty due to incorrect storage!

Store the motors horizontally in their original packaging in a dust-free, dry, vibration-free and sun-protected environment.

Also observe the notes regarding storage and transport on the packaging.

Handling On delivery, the QSK motors have protective caps and covers on the output shaft and on the flange sockets. During transport and storage, the protective sleeves must remain on the motor.

- Remove the protective sleeves just before assembly.
- Also use the protective sleeves if you return the goods.
- Avoid any damage to the motor flange and drive shaft.



Do never beat onto the shaft end and do not exceed the allowed axial and radial forces of the motor.

Transport Please, observe the following points during transport:

LSA Control S.L. www.lsa-control.com comercial@lsa-control.com (+34) 960 62 43 01

- Use suitable means of transport and consider the weight of the components (you can find the weight information on the data sheets or on the type plate of the motor).
- Provide appropriate shock absorbers, if strong vibrations may occur during transport.
- Transport the motors only in the horizontal position.
- Use cranes with lifting sling belts to lift the motors.



Fig.9-3: Lifting and transporting motors by means of lifting sling belts
Installation

10 Installation

10.1 Safety

Injuries caused by live parts! Lifting of heavy loads!

- Install the motors only when they are de-energized and not connected electrically.
- Use suitable tackles, protective equipment and protective clothing during transport.

Observe the notes regarding safety given in previous chapters.

Carry out all working steps with particular care This minimizes the risk of accidents and damage.

10.2 Skilled Personnel

Any works on the system and on the drives or in their vicinity must only be carried out by appropriately trained technical personnel.

Please make sure that all persons carrying out

- installation works
- maintenance, or
- operating activities

on the system are adequately familiar with the contents of this documentation as well as with all warnings and precautionary measures contained therein.

Qualified technical personnel are those persons who have been trained, instructed or are authorized to activate and deactivate, ground and mark electric circuits and equipment according to the technical safety regulations. Qualified technical personnel must possess appropriate safety equipment and have been trained in first aid.

10.3 Mechanical Attachment

10.3.1 Flange Assembly

To attach the motors properly and safely to the machine, Bosch Rexroth recommends the following screws and washers for attachment.

The screwed connections must be able to take up both the force due to the weight of the motor and the forces acting during operation.

Normally, use pan head screw DIN 912 - M... x ... -8.8 and appropriate washers acc. to DIN EN 28738. For some motors, it is not necessary to enclose washers, see table.

If the screws and washers used do not comply with this recommendation, the property class of the screws and the hardness class must be equivalent in order to transmit the required tightening torques.

Installation

IndraDyn S motors are designed for flange assembly (B05). Details on the mounting holes are given in the corresponding dimension sheet. In general, the following assignment is applicable for attaching the motors:

Recommended screws for flange fastening of the QSK motors

22	B05 (flange assembly)			
	Hole	Screw (8.8)		Wash- er DIN EN 2873 8
	Ø [mm]	Type ¹⁾	M _{GA} [Nm]	Ø [mm]
QSK061	9.0	M8×20	25	10
QSK075	11.0	M10×30	51	12
QSK100	14.0	M12×40	87	14

① Mounting hole

M_{GA} 1) Tightening torque in Newton meters

Minimum screw length for screwing into steel.

Fig. 10-1: QSK mounting accessories (flange assembly)

10.3.2 Preparing Assembly

• Record all measures taken in the commissioning log.

Prepare motor assembly as follows:

- 1. Check the components for visible damage. Damaged components may not be mounted.
- 2. Ensure that the dimensions and tolerances of the plant are suitable for motor attachment (for details, see dimension drawing).
- 3. Ensure that the motor can be assembled in a clean, dry and dustfree environment.
- 4. Keep tools and auxiliary materials as well as measuring and testing equipment ready at hand.
- 5. Inspect all components, mounting surfaces and threads to ensure they are clean.
- 6. Ensure that the machine-sided receptacle for the motor flange has no burrs.
- 7. Remove the protective sleeve from the motor shaft. Keep the sleeve for later use.
- 8. Check the motors with holding brake, whether the holding brake reaches the holding torque indicated on the data sheet. If the holding brake does not reach the indicated holding torque, proceed as follows. (Also refer to chapter 7.9.4 "Holding Brake-Commissioning and Maintenance Instructions " on page 59chapter 7.9.4 Holding Brake Commissioning and Maintenance Instructions.)

10.3.3 Assembling the Motor

Mount the motor.

Please note:

- Avoid clamping or jamming the motor-sided centering collar.
- Avoid damaging the plant-sides receptacle fit.
- Connect the motor to the machine (observe tightening torques).

• Check whether the connection is firm and accurate before carrying out any further steps.

After having assembled the motor mechanically, prepare it for electrical connection.

10.4 Electrical Connection – Motor Assembly

10.4.1 General Information

It is recommended that you use ready-made Rexroth connection cables. These cables provide a number of advantages, such as UL/CSA authorization, extreme load capability and resistance as well as a design suitable for EMC.

A DANGER

Danger! Electric voltage! Handling within the area of live parts is extremely dangerous.

- Work required on the electric system may only be carried out by skilled electricians. It is absolutely necessary to use power tools.
- Before the work can be started, the system must be de-energized and the power switch be secured against unintentional or unauthorized restarting.
- Before the work can be started, an appropriate measuring device must be used to check whether parts of the system are still under residual voltage (e.g. caused by capacitors, etc.). If yes, wait until these parts have discharged.

Injuries to persons or damage to property possible! Interrupting or connecting live lines may cause unpredictable dangerous situations or lead to damage to property.

- Connect and disconnect connectors only when they are dry and deenergized.
- During operation of the system, all connectors must be securely tightened.

Risk of short-circuit caused by liquid coolant or lubricant! Short-circuits of live lines may cause unpredictable dangerous situations or lead to damage to property.

• Provide open sides of the power connectors with protective caps, when installing or replacing drive components.

10.4.2 Attaching the Connectors

Power/Encoder Connectors

When fitting the encoder connector with a screwed end fitting, proceed as follows:

- 1. Place the power connector in the correct position onto the thread of the connection housing.
- 2. Tighten the union nut of the power connector manually. By leading the cable in further, the power connector can be steadily brought to its final position.

Installation

- 3. Completely tighten the union nut.
- Only completely tightened union nuts guarantee the indicated IP65 protection against water and activate the vibration protection.

10.4.3 Adjusting the Output Direction

RLS1100, RLS1200 and RGS1000 The flange sockets can be turned through 240°.

The motor flange socket can be turned if an appropriate connector has been attached. Owing to the leverage of the attached connector, the flange socket can be turned manually to the desired position.

- 1. Connect the motor power cable to the flange socket.
- 2. Move the flange socket to the desired output direction by turning the plugged-in connector.
- Do not use any tools (e.g. pliers or screwdrivers) to turn the motor flange socket. Mechanical damage to the flange socket when using tools cannot be excluded.

The desired output direction is set.

- Whenever the flange socket is turned, the holding torque in the set position is reduced. To ensure the required holding torque of the flange socket, the output direction should be changed no more than 5 times!
- **RLS1300** The output direction of the RLS1300 is not adjustable!

11 Commissioning, Operation and Maintenance

11.1 Commissioning

Damage to life or property due to errors in the controls of motors and moving elements! Unclear operating states and product data!

- Do not carry out commissioning if connections, operating states or product data are unclear or faulty.
- Do not carry out commissioning if the safety and monitoring equipment of the system is damaged or not in operation.
- Damaged products must not be put into operation!
- Contact Rexroth for missing information or support during commissioning.

The following commission notes refer to the motors as part of a drive-system with drive and control unit.

Preparation

- 1. Keep the documentation of all products you are using ready.
- 2. Check the products for damage.
- 3. Check all mechanical and electrical connections.
- 4. Activate the safety and monitoring equipment of the system.
- 5. Make sure that the optional holding brakes are ready for operation. (described in chapter 7.9.4 Holding Brake - Commissioning and Maintenance Instructions on page 55.).

Bulk head connector

When all requirements are met, proceed as follows:

1. Carry out the commissioning of the drive system according to the instructions provided in the respective documentation. You can find the respective information in the functional description of the drive control devices.

Commissioning of drive controllers and the control unit may require additional steps. The inspection of the functioning and performance of the systems is not part of the commissioning of the motor; instead, it is carried out within the framework of the commissioning of the machine as a whole. Observe the instructions and regulations given by the machine manufacturer.

11.2 Operation

Keep the described ambient conditions during operation (cf. chapter 11 "Commissioning, Operation and Maintenance " on page 75).

11.3 Deactivation

In the case of malfunctions or maintenance, or to deactivate the motors, proceed as follows:

1. Observe the instructions of the machine documentation.

- 2. Use the machine-side control commands to bring the drive to a controlled standstill.
- 3. Switch off the power and control voltage of the drive controller.
- 4. Switch off the main switch of the machine.
- 5. Secure the machine against accidental movements and against unauthorized operation.
- 6. Wait for the discharge time of the electrical systems to expire and then disconnect all electrical connections.
- 7. Before dismantling, secure the motor against falling or movements before disconnecting the mechanical connections.

11.4 Maintenance

11.4.1 General Information

Synchronous motors operate maintenance free within the specified operating conditions and lifetime. However, operation under unfavorable conditions can lead to limitations in availability.

Increase availability with regular preventive maintenance measures. Observe the information in the maintenance schedule of the machine manufacturer and the service measures described below.

Burns may be caused through hot surfaces with temperatures over 100 °C

- Do not work on hot surfaces.
- Use safety gloves.

 \Rightarrow Let the motor cool down before maintenance. The thermal time constant stated in the technical data is a measure for the cooling time. A cooling time up to 140 minutes can be necessary!

A WARNING

Danger of injury due to moving elements!

- Do not carry out any maintenance measures, while the machine is running.
- During maintenance work, secure the system against restarting and unauthorized use.

11.4.2 Cleaning

Dirt, dust or chips may adversely affect the functionality of the motors and, in extreme cases, even cause a failure of the motors. Clean the cooling fins of the motors at regular intervals (after one year at the latest) to reach a sufficiently high heat emission surface. If the motors are dirty, sufficient heat dissipation via the environmental air is not possible any longer.

An insufficient heat radiation may have undesired consequences.

- The lifetime is reduced
- Overtemperature deactivation

11.4.3 Bearings

The nominal lifetime of the bearings is L10h = 20000 h according to DIN ISO 281, ed. 1990, provided the permissible radial and axial forces are not exceeded.

The motor bearings should be replaced if

- the nominal bearing service life has been reached,
- running noises occur.

We recommend that bearings be replaced by the Rexroth Service.

11.4.4 Connecting Cables

A DANGER Death by electrocution possible due to live parts!

If the slightest defect is detected in the cable sheath, the system must be shut down immediately. Then the cable must be replaced.

Do not repair any connection lines provisionally.

- Check connection cables for damage at regular intervals and replace them, if necessary.
- Check any optional energy management chains (drag chains) for defects.
- Check the protective conductor connection for proper state and tight seat at regular intervals and replace it, if necessary.

11.5 Notice of Malfunctions

Electrocution by live parts of more than 50 V!

Before working on live parts: De-energize the machine and secure the mains switch again unintendet or unauthorized re-energization.

Check if the voltage is dropped down under 50 V before touching live parts!

A WARNING

Combustions via hot surface with temperatures over 100 °C

Let the motor cool down, before maintenance. The thermal time constant stated in the technical data is a measure for the cooling time. A cooling time up to 140 minutes can be necessary!

Do not work on hot surfaces.

Use safety gloves.

In principle, heed the notice of malfunctions in the project planning manual and the commissioning manual. Contact the manufacturer if necessary chapter 13 "Service and Support" on page 83.

Malfunction	Failure cause	Measures
	Release of the controller is missing	Activate the release of the controller
The motor does not run	Failure of the controller	Troubleshooting according to the docu- mentation of the controller.
	Supply voltage is missing	Control the supply voltage
	Brake is not ventilated	Control the drive of the brake
	The coupling element or the attach- ments are badly balanced	Re-balancing
Vibrations	Adjustment of shaft end attachments (like coupling, gearbox) is insufficient	
	The fastening screws are loose.	Lock the screw connections as specified
Punning poiso	Foreign bodies within the motor	Set the motor on standstill -> repair by manufacturer
	Bearing is damaged	Set the motor on standstill -> repair by manufacturer
	Operation outside of the characteristics	Reduce the weight
		Clean the motor
High motor temperature The motor temperature approaches	The heat flow is impeded	Clean the fan grill of the fan unit and check the function of the fan
		Control the coolant circuit at liquid cool- ing.
Wrong or incorrect temperature dis-	Temperature sensor not connected	Connect the temperature sensor.
played	Temperature sensor is damaged	Set the motor on standstill -> repair by manufacturer

Fig. 11-1: Malfunctions at QSK motors

11.6 Dismantling

Fatal injury due to errors during the control of motors or works on moving elements!

- Do not work on unsecured and operating machines.
- Secure the machine against accidental movements and against unauthorized operation.
- Before dismantling, secure the motor and power supply against falling or movements before disconnecting the mechanical connections.

A WARNING Burns may be caused through hot surfaces with temperatures over 100 °C.

- Do not work on hot surfaces.
- Use safety gloves.
- Let the motor cool down, before maintenance. The thermal time constant stated in the technical data is a measure for the cooling time. A cooling time up to 140 minutes can be necessary!
- Observe the instructions of the machine documentation.
- Please observe the safety notes.
- Dismantle the motor from the machine. Store the motor properly!

Environmental Protection and Disposal

12 Environmental Protection and Disposal

Production processes	The products cesses which try to replace ment-friendly	are made in energy- and resource-optimized production pro- allow re-using and recycling the resulting waste. We regularly pollutant-loaded raw materials and supplies by more environ- alternatives.		
No release of hazardous substan- ces	Our products leased in cas negative influe	do not contain any hazardous substances which may be re- e of appropriate use. Normally, our products will not have any ences on the environment.		
Significant components	Basically, our copper, brass nents.	motors consist of the following components: steel, aluminum, s, permanent magnets (rare earth metal), electronic compo-		
Return of products	Our products requires that t	can be returned to us for disposal free of charge. However, this he products be free from oil, grease or other dirt.		
	Furthermore, foreign mater	the products returned for disposal may not contain any undue al or foreign components.		
	Deliver the pr	oducts "free domicile" to the following address:		
	Bosch Rexroth Electric Drives Buergermeister 97816 Lohr am	AG and Controls ⁻ -DrNebel-Strasse 2 Main, Germany		
Permanent magnets	Permanent m	agnets present a serious danger during disposal.		
	A W	ARNING Danger due to permanent magnets!		
		 Health hazard for persons with heart pacemakers, metallic implants and hearing aids in direct environment of permanent magnets. 		
	\land	 Crushing hazard of fingers and hand due to heavy attrac- tive forces of the magnets. 		
		Risk of destruction of sensitive parts such as watches, credit cards,		
	Before dispos reached by th den.	sal, permanent magnets must be demagnetized. This can be ermal conditioning. The transport of magnetized rotors is forbid-		
Packaging	Packaging ma recycled anyv	aterials consist of cardboard, wood and polystyrene and can be where without any problem.		
	For ecologica us.	I reasons, please refrain from returning the empty packages to		
Batteries and Accumulators	Batteries and	accumulators can be labeled with this symbol.		
		The symbol indicating "separate collection" for all batteries and accumulators is the crossed-out wheeled bin.		
	End users in validity of the must be follow	the EU are legally bound to return used batteries. Outside the EU Directive 2006/66/EC, the particularly applicable regulations ved.		
	Used batterie ronment or pe	Used batteries can contain hazardous substances which can harm the envi- ronment or people's health when improperly stored or disposed of.		

Environmental Protection and Disposal

After use, the batteries or accumulators contained in Rexroth products must be properly disposed of according to the country-specific collection systems.

Recycling Most of the products can be recycled due to their high content of metal. In order to recycle the metal in the best possible way, the products must be disassembled into individual assemblies.

Metals contained in electric and electronic assemblies can also be recycled by means of special separation processes.

Plastic parts of the products may contain flame retardants. These plastic parts are labeled according to EN ISO 1043. They have to be recycled separately or disposed of according to the applicable legal provisions.

Service and Support

13 Service and Support

Our worldwide service network provides an optimized and efficient support. Our experts offer you advice and assistance should you have any queries. You can contact us **24/7**.

Service Germany Our technology-oriented Competence Center in Lohr, Germany, is responsible for all your service-related queries for electric drive and controls.

Contact the Service Helpdesk & Hotline under:

	Phone:	+49 9352 40 5060
	Fax:	+49 9352 18 4941
	E-mail:	service.svc@boschrexroth.de
	Internet:	http://www.boschrexroth.com
	Additional can be four	information on service, repair (e.g. delivery addresses) and training nd on our internet sites.
Service worldwide	Outside Gennumbers, r	ermany, please contact your local service office first. For hotline effort to the sales office addresses on the internet.
Preparing information	To be able informatior	to help you more quickly and efficiently, please have the following ready:
	 Detail malfu 	ed description of malfunction and circumstances resulting in the nction
	 Type serial 	plate name of the affected products, in particular type codes and numbers

• Your contact data (phone and fax number as well as your email address)

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