Project planning EN

Servo motors

Asynchronous servo motor MQA

Lenze

Contents

Contents

About this document

Document description

This document addresses to all persons who want to carry out any configurations with the products described.

The data and information compiled in this document serve to support you in the dimensioning and selection processes and in carrying out the electrical and mechanical installation. You will receive information regarding product extensions and accessories.

- The document includes safety instructions which must be observed.
- All persons working on and with the drives must have the documentation at hand during work and observe the information and notes relevant for it.
- The documentation must always be complete and in a perfectly readable state.

NOTICE

Please observe the notes in the following chapters!

▸ Safety instructions 📖 11
▸ Information on mechanical installation 📖 18
▸ Information on electrical installation 📖 19

Further documents

Information and tools with regard to the Lenze products can be found on the Internet: http://www.lenze.com → Download

Notations and conventions

This document uses the following conventions to distinguish different types of information:

Numeric notation			
	Decimal separator	Point	The decimal point is always used. Example: 1 234.56
Warning			
	UL warning	UL	Are used in English and French.
	UR warning	UR	
Text			
	Engineering tools	» «	Software Example: »Engineer«, »EASY Starter«
Icons			
	Page reference	🕮	Reference to another page with additional information Example: 🕮 16 = see page 16
	Documentation reference	ⓚ	Reference to another documentation with additional information Example: ⓚ EDKxxx = see documentation EDKxxx

Layout of the safety instructions

⚠DANGER!

Indicates an extremely hazardous situation. Failure to comply with this instruction will result in severe irreparable injury and even death.

⚠WARNING!

Indicates an extremely hazardous situation. Failure to comply with this instruction may result in severe irreparable injury and even death.

⚠CAUTION!

Indicates a hazardous situation. Failure to comply with this instruction may result in slight to medium injury.

NOTICE

Indicates a material hazard. Failure to comply with this instruction may result in material damage.

Product information

Product description

MQA of the asynchronous servo motor with a high torque and higher dynamics.
The through blown asynchronous servo motor for applications that require a high dynamic performance, high construction-conditioned operational reliability and precisely controlled motion.

Combined with the Servo-Inverters i700, Servo Drives 9400, and Inverter Drives 8400 TopLine, high-performance drive solutions in the torque range from 66 to 1100 Nm can be obtained.

Customer benefit

- Optimum controllability and high dynamic performance thanks to low moments of inertia
- Optimum smooth running characteristics for accurate work results
- Wide speed setting range
- Field weakening operation usable
- Robust resolvers are included as a standard, and incremental or absolute value encoders ensure the highest precision

Fig. 1: Asynchronous servo motor MQA22P08-

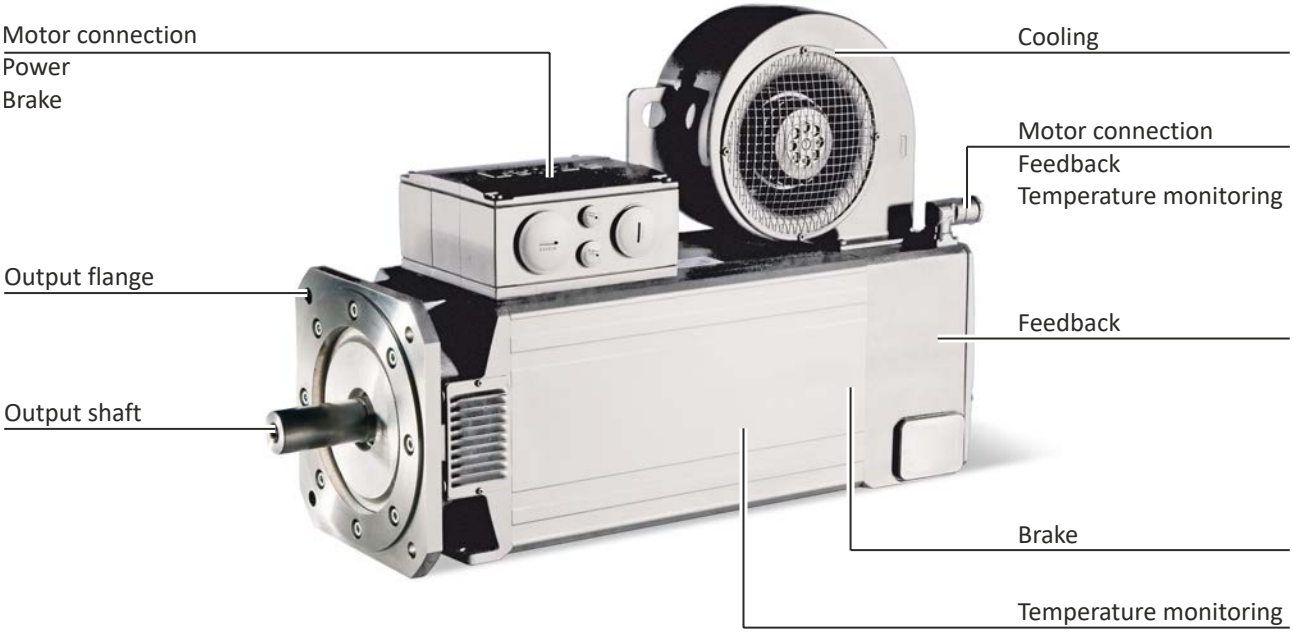
Identification of the products

Servo motor product name

	Motor				
Example	MQA	20	L	14	H

Meaning	Variant					
Product family		MQA				
Size			20 22 26			
Overall length				L ... T		
Rated speed	rpm x 100				05 ... 29	
Mains voltage	3 x 400 V, IP23s					H

Features


Motor connection
Power
Brake
Output flange
Output shaft
Cooling
Motor connection
Feedback
Temperature monitoring
Feedback
Brake
Temperature monitoring

The modular system

Values printed in bold are standard designs. Values that are not printed in bold are potential extensions, some of them including a surcharge.

Motor		MQA20	MQA22	MQA26
Technical data				
Rated power	kW	10.6 ... 20.3	11.5 ... 38.4	17.0 ... 60.2
Rated torque	Nm	66.2 ... 71.3	125 ... 145	257 ... 296
Max. torque	Nm	250	500	1100
Rated speed	rpm	1420 ... 2930	760 ... 2935	550 ... 2235
Colour		**Primed RAL9005 matt jet black** RAL colours		
Surface and corrosion protection		**OKS-G** Different types of OKS		
Output shaft				
Solid shaft with featherkey	mm	38 x 80	38 x 80	55 x 110
Solid shaft without keyway	mm	38 x 80	38 x 80	55 x 110
Shaft material		Steel		
Shaft sealing ring material		FKM		
Drive-end shield		**Not oil-tight** Oil-proof		
Design		With flange (B3/B35)		
Output flange	mm	FF215 FF265	FF265	FF265 FF350
Cooling		Forced-ventilated IP23s		
Dust filter		**Without** With		
Motor connection				
Power + brake + separate fan		**ICN connector** Terminal box	**Terminal box**	
Sensor + temperature monitoring		**ICN connector**		
Spring-applied brake - holding brake		**Without** With		
Standard braking torque	Nm	80.0	130	260
Increased braking torque	Nm	130	260	-
DC brake voltage	V	24		
AC brake voltage	V	230 (not with cURus and ICN connector)		
Feedback		**Resolver** Absolute value encoder Incremental encoder		
Temperature monitoring		**Thermal detectors PT1000** Thermal contact TCO (not with ICN connector and spring-applied brake)		

Information on project planning

In order to carry out an accurate drive dimensioning process, you can use our configuring software, the »Drive Solution Designer«.

With the» Drive Solution Designer« you can carry out the drive dimensioning process quickly and with top quality. The software contains profound and proven expertise with regard to drive applications and mechatronic drive components.

Please refer to your competent Lenze sales company.

Safety instructions

Disregarding the following basic safety measures and safety information may lead to severe personal injury and damage to property!

Observe all specifications of the corresponding documentation supplied. This is the precondition for safe and trouble-free operation and for obtaining the product features specified.

Please observe the specific safety information in the other sections!

Basic safety instructions

Personnel

The product must only be used by qualified personnel. IEC 60364 or CENELEC HD 384 define the skills of these persons:

- They are familiar with installing, mounting, commissioning, and operating the product.
- They have the corresponding qualifications for their work.
- They know and can apply all regulations for the prevention of accidents, directives, and laws applicable at the place of use.

Process engineering

The procedural notes and circuit details described are only proposals. It is up to the user to check whether they can be adapted to the particular applications. Lenze does not take any responsibility for the suitability of the procedures and circuit proposals described.

Application as directed

- The product must only be actuated under the operating conditions and power limits specified in this documentation.
- The product meets the protection requirements of 2014/35/EU: Low-Voltage Directive.
- The product is not a machine in terms of 2006/42/EU: Machinery Directive.
- Commissioning or starting the operation as directed of a machine with the product is not permitted until it has been ensured that the machine meets the regulations of the EC Directive 2006/42/EU: Machinery Directive; observe EN 60204−1.
- Commissioning or starting operation as directed is only permissible if the EMC Directive 2014/30/EU is complied with.
- The product is not a household appliance, but is only designed as a component for commercial or professional use in terms of EN 61000−3−2.
- The product can be used according to the technical data if drive systems have to comply with categories according to EN 61800−3.
- In residential areas, the product may cause EMC interferences. The operator is responsible for taking interference suppression measures.
- Do not use the built-in brakes as fail-safe brakes. Disruptive factors that cannot be influenced may cause the braking torque to be reduced.
- The product must only be actuated with inverters.

Foreseeable misuse

- Actuate directly on the mains voltage
- Use in potentially explosive areas
- Use in aggressive environments
- Use under water
- Use under radiation
- Use in generator mode

Residual hazards

Even if notes given are taken into consideration and protective measures are implemented, the occurrence of residual risks cannot be fully prevented.

The user must take the residual hazards mentioned into consideration in the risk assessment for his/her machine/system.

If the above is disregarded, this can lead to severe injuries to persons and damage to property!

Protection of persons

- The product does not provide safety-related functions.
  - A higher-level safety system must be implemented.
  - Additional monitoring and protective equipment complying with the safety regulations applicable in each case must be used.
- The power terminals may carry voltage in the switched-off state or when the motor is stopped.
  - Before working, check whether all power terminals are deenergised.
- Voltages may occur on the drive components (e.g. capacitive, caused by inverter supply).
  - Careful earthing in the marked positions of the components must be carried out.
- Risk of burns may be caused by hot surfaces!
  - Provide for a protection against accidental contact.
  - Use the personal protective equipment or wait until the components have cooled down completely!
  - Prevent contact with flammable substances.
- There is a risk of injury due to rotating parts.
  - Before working on the drive system, ensure that the motor is at a standstill.
- There is a danger of unintentional starting or electrical shocks!
- Installed brakes are no fail-safe brakes.
  - The torque may be reduced by disruptive factors that cannot be influenced such as ingressing oil.

Motor protection

- Design with plug:
  - Never disconnect the plug when energised! Otherwise, the plug can be destroyed.
  - Switch off power supply and disable inverter prior to disconnecting the plug.
- Installed thermal detectors are no full protection for the machine.
  - If required, limit the maximum current. Parameterise the inverter so that it will be switched off after seconds of operation with $I > I_N$, especially if there is the danger of blocking.
  - The installed overload protection does not prevent an overload under any conditions.
- The fuses are no motor protection.
  - Use a current-dependent motor protection switch.
  - Use the built-in thermal detectors.
- Too high torques cause a fraction of the motor shaft.
  - The maximum torques according to catalogue must not be exceeded.
- Lateral forces from the motor shaft may occur.
  - Align the shafts of motor and driven machine exactly to each other.

Drive dimensioning

The dimensioning is suitable for:

- kinematic profiles
- operating modes S1, S2, S3, S6
- simple linear speed profiles, not for S-curves or similar

The following 3 elements are taken into consideration in the dimensioning process :

Drive function

On the basis of the values required for the process that are specified, a drive is selected, for which all operating points are within the speed-torque characteristic curve of the motor.

As a result, a motor with a suitable speed with an inverter with a sufficient maximum current is selected. Further limits (maximum speed, installation height...) are specified in tables.

Mechanical strength

On the basis of the forces and torques which build, a drive is selected that has a sufficient mechanic strength (endurance strength for the periodically occurring torques and fatique strength for the sporadically occurring torques).

Thermal dimensioning

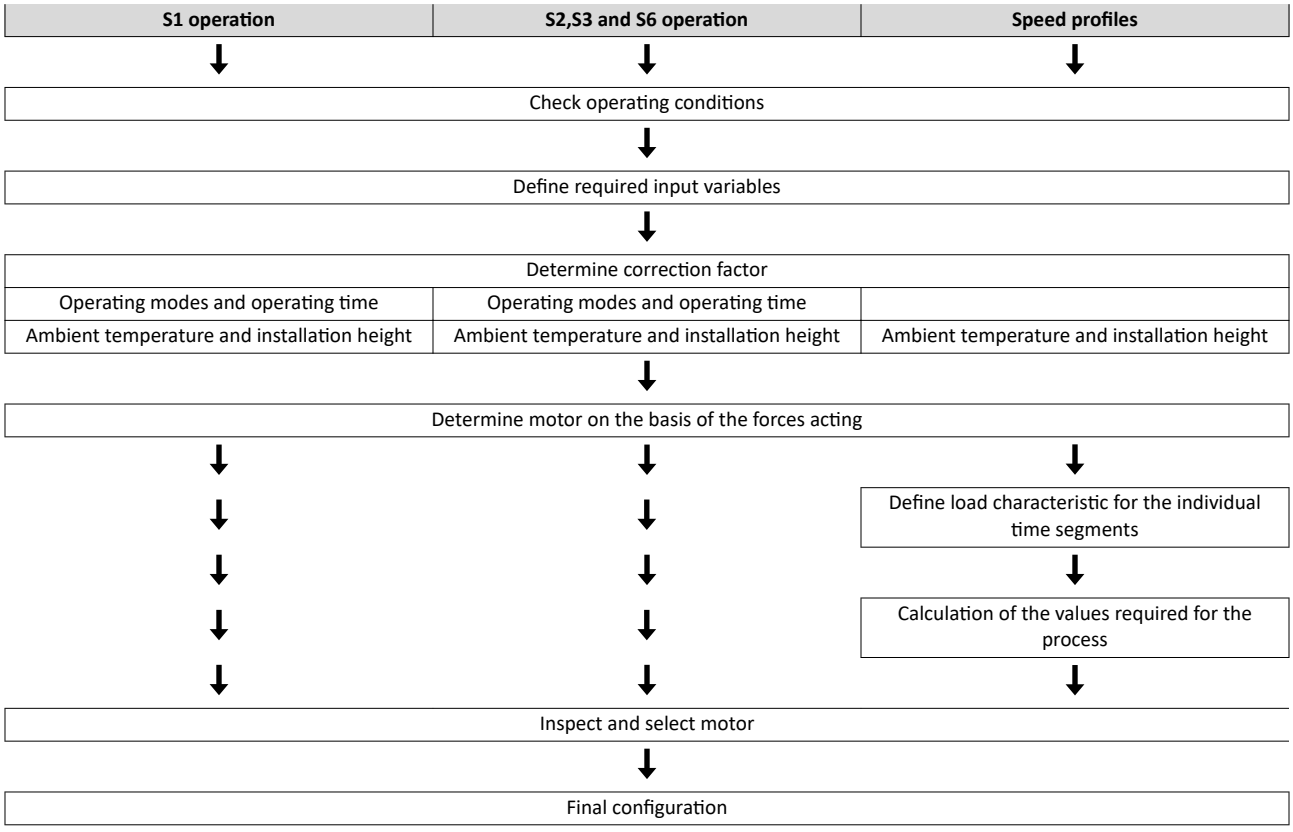
For the inverter, the thermal dimensioning process is carried out on the basis of the continuous inverter current or on the basis of the continuous torque from the motor-inverter combination, which can be reached.

The motor is thermally dimensioned on the basis of the mean speed and the effective torque.

The mean speed of the drive should not exceed the values specified.

If dimensioning processes are complex or reach limit loads, please refer to your Lenze branch office

Operation chart



Check operating conditions

Check
Approvals
Conformity declarations
Supply voltage
Enclosure
Ambient temperature
Surface protection

▸ Conformities/approvals 🕮 21

▸ Environmental conditions 🕮 17

Define required input variables

Necessary input variables	Note	Symbol	Unit
Mean speed utilisation	Relating to the load speed n_L		%
Ambient temperature		T_U	°C
Site altitude Amsl		H	m
Radial force		F_{rad}	N
Axial force		F_{ax}	N
Transmission element at the output	Gear wheels, sprockets …		
Effective diameter of the transmission element		d_w	mm
Load torque	Only with S1, S2, S3, and S6 operating modes	M_L	Nm
Load speed	Only with S1, S2, S3, and S6 operating modes	n_L	rpm
Short-time maximum torque	Emergency off, quick stop, occasional high starting duty	$M_{L,max}$	Nm
Runtime with maximum torque		t_L	%

Determine correction factor

Operating modes S1, S2, S3, S6, and operating time							
Operating mode S1		Operating mode S2		Operating mode S3		Operating mode S6	
ED	k_L	ED	k_L	ED	k_L	ED	k_L
%		min		%		%	
100	1.0	10	1.4 - 1.5	15	1.4 - 1.5	15	1.5 - 1.6
		30	1.15 - 1.2	25	1.3 - 1.4	25	1.4 - 1.5
		60	1.07 - 1.1	40	1.15 - 1.2	40	1.3 - 1.4
		90	1.0 - 1.05	60	1.05 - 1.1	60	1.15 - 1.2

▸ Operating modes of the motor 🕮 62

Ambient temperature and installation height				
Ambient temperature	Installation height amsl			
	≤ 1000 m	≤ 2000 m	≤ 3000 m	≤ 4000 m
	Correction factor			
T_U	k_H	k_H	k_H	k_H
≤ 20 °C	1.15	1.06	0.97	0.89
30 °C	1.07	0.99	0.90	0.83
40 °C	1.00	0.92	0.83	0.77
50 °C	0.92	0.85	0.76	0.71
60 °C	0.83	0.77	0.70	0.65

Determine product on the basis of the forces

Transmission element			Gear wheels	Sprockets	Toothed belt pulleys (depending on the preloading)	Narrow V-belt (depending on the preloading)
Additional radial force factor	f_z		≥ 17 teeth = 1.0 < 17 teeth = 1.15	≥ 20 teeth = 1.0 < 20 teeth = 1.25 < 13 teeth = 1.4	With belt tightener= 2.0 - 2.5 Without belt tightener= 2.5 - 3.0	1.5 - 2.0
			Calculation		**Check**	
Radial force	F_{rad}	N	$F_{rad} = 2000 \times \frac{M_{L,max} \times f_z}{dw}$		$F_{rad} \leq F_{rad,max}$	
Axial force	F_{ax}	N			$F_{ax} \leq F_{rad,max}$	

dw Effective diameter of transmission element

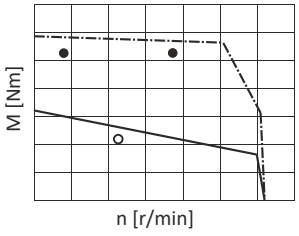
▸ Radial forces and axial forces 🕮 22

Operating mode S1

Check and select servo motor-inverter combination			
	Check	**Selection**	**Unit**
Output torque	$M_N \geq M_L / (k_L \times k_H)$	M_N	Nm
Output speed	$n_N \geq n_L$	n_N	rpm

▸ Rated data 🕮 24

Operating modes S2, S3, and S6

Check and select servo motor-inverter combination			
	Check	**Selection**	**Unit**
Output torque	$M_N \geq M_L / (k_L \times k_H)$	M_N	Nm
Output speed (recommendation)	$n_N \geq n_L$	n_N	rpm
Max. output torque	$M_{max} \geq M_L$	M_{max}	Nm
Max. output speed	$n_{max} \geq n_L$	n_{max}	rpm
All operating points (●)			
Below the maximum torque characteristic of the servo motor-inverter combination, taking $M_{L,max}$ into consideration		n_L M_L	
Thermally effective operating point (○)			
Below the S1 torque characteristic of the servo motor		n_L $M_L / (k_L \times k_H)$	

▸ Rated data 🕮 24

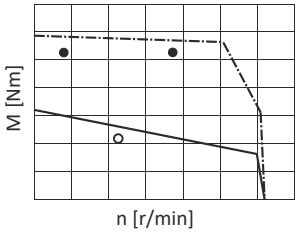
▸ Torque characteristics 🕮 31

Speed profiles

Temporal load characteristic for the individual time segments z							
Total time	**Individual time segments**	**Load speed**	**Load speed variation**	**Steady-state load torque**	**Torque**	**Acceleration torque**	**Moment of inertia**
t	**Δt_z**	**$n_{L,z}$**	**$\Delta n_{L,z}$**	**$M_{L,z}$**	**M_z**	**$M_{S,z}$**	**J_L**
s	**s**	**rpm**	**rpm**	**Nm**	**Nm**	**Nm**	**$kgcm^2$**

	Calculation	Symbol	Unit
Load cycle duration	$T = \sum \Delta t_z$	T	s

Calculation of the values required for the process			
	Calculation	**Symbol**	**Unit**
Torque per time segment	$M_z = M_{L,z} + J_L \frac{2\pi \times \Delta n_{L,z}}{60 \times \Delta t_z}$	M_z	Nm
Maximum torque of the profile	$M_{P,max}$ = max (M_z)	$M_{P,max}$	Nm
Effective torque	$M_{eff} = \sqrt{\frac{1}{T}\sum_z M_z^2 \times \Delta t_z}$, $T \leq 1min$	M_{eff}	Nm
Mean speed	$n_m = \lvert\overline{n_{L,z}}\rvert = \frac{1}{T}\sum_z \lvert n_{L,z} \rvert \times \Delta t_z$	n_m	rpm
Maximum load speed	$n_{L,max}$ = max ($n_{L,z}$)	$n_{L,max}$	rpm

Check and select servo motor-inverter combination			
	Check	**Preselection**	**Unit**
Output torque	$M_N > M_{eff} / k_H$	M_N	Nm
Output speed	$n_N \geq n_m$	n_N	rpm
Load-matching factor			
for an optimum dynamic performance/ control properties	Requirement k_J = 0.5 ... 10 Optimum k_J = 1	$k_J = J_L / (J_M + J_B)$	
Checking the motor torques			
Acceleration torque	$M_{S,z} = M_z + (J_M + J_B) \times \frac{2\pi \times \Delta n_{L,z}}{60 \times \Delta t_z}$	$M_{S,z}$	Nm
Effective torque	$M_{S,eff} = \sqrt{\frac{1}{T}\sum_z M_{S,z}^2 \times \Delta t_z}$	$M_{S,eff}$	
All operating points (●)			
Below the maximum torque characteristic of the servo motor-inverter combination, taking $M_{L,max}$ into consideration		$n_{L,z}$ $M_{S,z}$	
Thermally effective operating point (○)			
Below the S1 torque characteristic of the servo motor		n_m $M_{S,eff} / k_H$	

▸ Rated data 📖 24

▸ Torque characteristics 📖 31

Final configuration

	Check
Connection dimensions	Output shaft Output flange
Product extensions	Motor connection (connector/terminal box) Brake Feedback Blower

More information about the final configuration:

▸ The modular system 📖 9

▸ Product extensions 📖 47

Environmental conditions

Surface and corrosion protection

Depending on the ambient conditions, the surface and corrosion protection system (called OKS) offers tailor-made solutions for optimum protection.

Various surface coatings ensure that the motors operate reliably even at high air humidity, in outdoor installation or in the presence of atmospheric impurities. Any colour from the "RAL Classic" collection can be chosen for the top coat.

Surface and corrosion protection	Applications	Type
OKS-G (primed)	• Dependent on subsequent top coat applied	Standard
OKS-S (small)	• Standard applications • Internal installation in heated buildings • Air humidity up to 90 %	Optional
OKS-M (medium)	• Internal installation in non-heated buildings • Covered, protected external installation • Air humidity up to 95 %	
OKS-L (large)	• External installation • Air humidity above 95 % • Chemical industrial plants • Food industry	

Surface and corrosion protection	Corrosivity category	Surface coating	Colour	Coating thickness
	DIN EN ISO 12944-2	Design		
OKS-G (primed)		• 2K PUR priming coat	• RAL 9005 matt jet black	60 ... 90 µm
OKS-S (small)	Comparable to C1	• 2K-PUR top coat	• According to RAL Classic	80 ... 120 µm
OKS-M (medium)	Comparable to C2	• 2K PUR priming coat • 2K-PUR top coat		110 ... 160 µm
OKS-L (large)	Comparable to C3			140 ... 200 µm

Information on mechanical installation

Important notes

- You must install the product according to specifications in the chapter "standard and operating" conditions.

  ▸ Standards and operating conditions 📖 21
- The technical data and the data regarding the supply conditions can be found on the nameplate and in this documentation.
- Observe the information relating to the surface and corrosion protection.

  ▸ Environmental conditions 📖 17
- Ambient media − especially chemically aggressive ones − may damage shaft sealing rings, lacquers and plastics. If required, contact your responsible Lenze subsidiary.

NOTICE

Bearing damage caused by unbalance!

Shafts with keyway are balanced with a half featherkey!

▸ Balance transmission elements with a half featherkey!

Transport

- Ensure appropriate handling.
- Make sure that all component parts are safely mounted. Secure or remove loose component parts.
- Only use safely fixed transport aids (e.g. eye bolts or support plates).
- Do not damage any components during the transport.
- Avoid electrostatic discharge on electronic components and contacts.
- Avoid impacts.
- Check the carrying capacity of the hoists and load handling devices. The weights can be obtained from the shipping documents.
- Secure the load against tipping and falling down.
- Standing under a suspended load is forbidden.

Installation

- Avoid resonances with the rotational frequency and double mains frequency.
- The mounting surfaces must be plane, torsionally rigid and free from vibrations.
- The mounting areas must be suited to absorb the forces and torques generated during operation.
- Ensure an unhindered ventilation.
- For versions with a fan, keep a minimum distance of 10 % from the outside diameter of the fan cover in intake direction.

Information on electrical installation

Important notes

⚠ DANGER!

Hazardous voltage!

On the power connections even when disconnected from the mains: residual voltage >60 V!

- ▶ Disconnect the product from the mains and wait until the motor is at a standstill.
- ▶ Make sure that the product is safely isolated from supply!

- When working on energised products, comply with the applicable national accident prevention regulations.
- Carry out the electrical installation in compliance with the relevant regulations (e.g. cable cross-sections, fuses, PE connection).
- The manufacturer of the system or machine is responsible for adherence to the limits required in connection with EMC legislation.

Preparation

The notes for the electrical connection can be found in the enclosed mounting instructions.

EMC-compliant wiring

The EMC-compliant wiring is described in detail in the documentation of the Lenze inverters.

Technical data

Notes regarding the given data

The power values, torques and speeds specified in the configuration are rounded values and apply to

- Ambient temperature T_U = 40 °C for motors (in accordance with EN 60034)
- Site altitude ≤ 1000 m above sea level

The selection tables specify the inverter/ motor combination with the attainable torque values.

The rated data applies to the S1 operating mode S1 (in accordance with EN 60034) and the operation on an inverter with a switching frequency of at least 4 kHz.

NOTICE

In case of other operating conditions, the achievable values can differ for those mentioned.

▶ In case of extreme operating conditions, please contact your responsible Lenze sales company.

Standards and operating conditions

Conformities/approvals

Conformity		
CE	2014/35/EU	Low-Voltage Directive
	2014/30/EU	EMC Directive (reference: CE-typical drive system)
EAC	TR TC 004/2011	Eurasian conformity: safety of low voltage equipment
	TP TC 020/2011	Eurasian conformity: electromagnetic compatibility of technical means
Approval		
cURus	UL 1004-1 UL 1004-6	for USA and Canada (requirements of the CSA 22.2 No.100) Industrial Control Equipment, Lenze File No. E210321
UkrSepro		for Ukraine

Protection of persons and device protection

Degree of protection		
IP23S	EN 60034-5	Forced-ventilated
Temperature class		
F (155 °C)	EN 60034-1	
Max. voltage load		
Limit curve A	IEC/TS 60034-25:2007	
IVIC C/B/B@500V	IEC 60034-18-41	

EMC data

Noise emission	EN 60034-1	A final overall assessment of the drive system is indispensable
Noise immunity	EN 60034-1	A final overall assessment of the drive system is indispensable

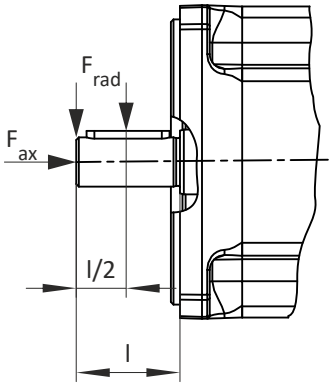
Environmental conditions

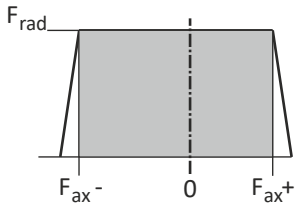
Climate		
1K3 (-20 °C ... +60 °C)	EN 60721-3-1	Storage, < 3 months
1K3 (-20 °C ... +40 °C)	EN 60721-3-1	Storage, > 3 months
2K3 (-20 °C ... +70 °C)	EN 60721-3-2	Transport
3K3 (-15 °C ... +40 °C)	EN 60721-3-3	Operation, without brake
3K3 (-10 °C ... +40 °C)	EN 60721-3-3	Operation, with brake
Relative humidity ≤ 85 %		Without condensation
Site altitude		
0 … 1000 m amsl		Without power reduction
1000 … 4000 m amsl		Pay attention to the drop in power of the inverter and servo motor
Vibration resistance		
3M6	EN 60721-3-3	Operation
Vibration severity		
A	EN 60034-14	
Vibration velocity		
1.6 mm/s		Free suspension
Smooth running, axial runout, concentricity		
Normal Class	IEC 60072	

Radial forces and axial forces

The values of the bearing service life L_{10h} refer to an average motor speed of 3000 rpm. Depending on the ambient temperatures, they are also limited by the grease lifetime.

Application of forces





Application of force at l/2

Bearing service life L_{10h}			Motor		
			MQA20	MQA22	MQA26
5000 h					
Radial force	F_{rad}	N	3,400	3600	6950
Axial tensile force	$F_{ax,-}$	N	-1330	-2370	-2500
Axial compression force	$F_{ax,+}$	N	690	1700	1580
10000 h					
Radial force	F_{rad}	N	2500	2800	5400
Axial tensile force	$F_{ax,-}$	N	-1020	-1740	-1800
Axial compression force	$F_{ax,+}$	N	380	1090	880
20000 h					
Radial force	F_{rad}	N	1950	2200	4300
Axial tensile force	$F_{ax,-}$	N	-780	-1280	-1300
Axial compression force	$F_{ax,+}$	N	140	640	380
30000 h					
Radial force	F_{rad}	N	1700	1,900	3700
Axial tensile force	$F_{ax,-}$	N	-690	-1080	-1090
Axial compression force	$F_{ax,+}$	N	40	440	160
50000 h					
Radial force	F_{rad}	N		1600	
Axial tensile force	$F_{ax,-}$	N		-880	
Axial compression force	$F_{ax,+}$	N		240	

Application of force at l

Bearing service life L_{10h}			Motor		
			MQA20	MQA22	MQA26
5000 h					
Radial force	F_{rad}	N	3150	3500	6400
Axial tensile force	$F_{ax,-}$	N	-1170	-2240	-2080
Axial compression force	$F_{ax,+}$	N	530	1600	1150
10000 h					
Radial force	F_{rad}	N	2300	2600	5000
Axial tensile force	$F_{ax,-}$	N	-920	-1640	-1600
Axial compression force	$F_{ax,+}$	N	280	1100	680
20000 h					
Radial force	F_{rad}	N	1800	2050	4000
Axial tensile force	$F_{ax,-}$	N	-710	-1200	-1160
Axial compression force	$F_{ax,+}$	N	70	560	230
30000 h					
Radial force	F_{rad}	N	1400	1800	3,400
Axial tensile force	$F_{ax,-}$	N	-650	-1020	-1090
Axial compression force	$F_{ax,+}$	N	0	380	50
50000 h					
Radial force	F_{rad}	N		1450	
Axial tensile force	$F_{ax,-}$	N		-850	
Axial compression force	$F_{ax,+}$	N		200	

Rated data

Inverter mains connection 400 V, Forced ventilated

Product name			MQA20L14H	MQA20L29H	MQA22P08H
Standstill torque	M_0	Nm	76.0	76.0	156
Rated torque	M_N	Nm	71.3	66.2	145
Max. torque	$M_{Max.}$	Nm	250	250	500
Rated speed	n_N	rpm	1420	2930	760
Max. speed	$n_{Max.}$	rpm	6500	6500	6500
Rated power	P_N	kW	10.6	20.3	11.5
Standstill current	I_0	A	27.0	54.0	29.5
Rated current	I_N	A	26.5	46.9	27.6
Max. current	$I_{Max.}$	A	106	188	110
Rated voltage	$U_{N, AC}$	V	360	360	360
Rated frequency	f_N	Hz	50	100	28
Moment of inertia	J	kgcm²	171	171	487
Efficiency	$\eta_{100\,\%}$		0.800	0.900	0.770
Stator terminal resistance	$R_{UV\ 20°C}$	Ω	0.73	0.18	1.07
Stator terminal resistance	$R_{UV\ 150°C}$	Ω	1.10	0.28	1.62
Mutual inductance	L_H	mH	57.0	13.7	92.8
Stator leakage inductance	$L_{1\sigma}$	mH	1.98	0.49	3.53
Rotor leakage inductance	$L_{2\sigma}$	mH	2.10	0.52	4.76
Mass	m	kg	63.0	63.0	102

Product name			MQA22P14H	MQA22P17H	MQA22P29H
Standstill torque	M_0	Nm	156	156	156
Rated torque	M_N	Nm	135	130	125
Max. torque	$M_{Max.}$	Nm	500	500	500
Rated speed	n_N	rpm	1425	1670	2935
Max. speed	$n_{Max.}$	rpm	6500	6500	6500
Rated power	P_N	kW	20.1	22.7	38.4
Standstill current	I_0	A	51.0	59.0	102
Rated current	I_N	A	45.6	50.3	86.0
Max. current	$I_{Max.}$	A	182	201	344
Rated voltage	$U_{N, AC}$	V	360	360	360
Rated frequency	f_N	Hz	50	58	100
Moment of inertia	J	kgcm²	487	487	487
Efficiency	$\eta_{100\,\%}$		0.860	0.880	0.900
Stator terminal resistance	$R_{UV\ 20°C}$	Ω	0.36	0.27	.09
Stator terminal resistance	$R_{UV\ 150°C}$	Ω	0.54	0.40	0.13
Mutual inductance	L_H	mH	93.3	23.9	23.2
Stator leakage inductance	$L_{1\sigma}$	mH	3.57	0.90	0.89
Rotor leakage inductance	$L_{2\sigma}$	mH	4.81	1.21	1.20
Mass	m	kg	102	102	102

Product name			MQA26T05H	MQA26T10H	MQA26T12H
Standstill torque	M_0	Nm	325	325	325
Rated torque	M_N	Nm	296	288	282
Max. torque	$M_{Max.}$	Nm	1100	1100	1100
Rated speed	n_N	rpm	550	1030	1200
Max. speed	$n_{Max.}$	rpm	5500	5500	5500
Rated power	P_N	kW	17.0	31.1	35.4
Standstill current	I_0	A	48.5	85.5	109
Rated current	I_N	A	44.5	76.2	88.8
Max. current	$I_{Max.}$	A	178	305	355
Rated voltage	$U_{N, AC}$	V	360	360	360
Rated frequency	f_N	Hz	20	36	42
Moment of inertia	J	kgcm²	1335	1335	1335
Efficiency	$\eta_{100\ \%}$		0.810	0.870	0.820
Stator terminal resistance	$R_{UV\ 20°C}$	Ω	0.59	0.20	0.15
Stator terminal resistance	$R_{UV\ 150°C}$	Ω	0.89	0.30	0.23
Mutual inductance	L_H	mH	70.0	69.2	16.8
Stator leakage inductance	$L_{1\sigma}$	mH	2.87	2.91	0.65
Rotor leakage inductance	$L_{2\sigma}$	mH	5.05	5.09	0.69
Mass	m	kg	193	193	193

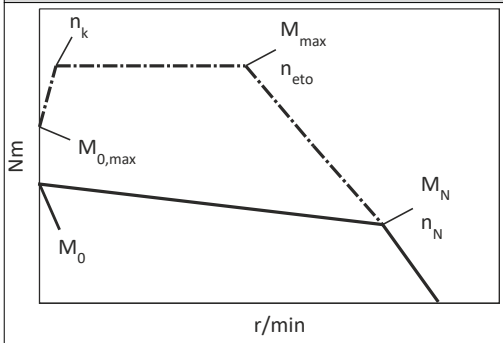
Product name			MQA26T22H
Standstill torque	M_0	Nm	325
Rated torque	M_N	Nm	257
Max. torque	$M_{Max.}$	Nm	1100
Rated speed	n_N	rpm	2235
Max. speed	$n_{Max.}$	rpm	5500
Rated power	P_N	kW	60.2
Standstill current	I_0	A	171
Rated current	I_N	A	138
Max. current	$I_{Max.}$	A	552
Rated voltage	$U_{N, AC}$	V	340
Rated frequency	f_N	Hz	76
Moment of inertia	J	kgcm²	1335
Efficiency	$\eta_{100\ \%}$		0.920
Stator terminal resistance	$R_{UV\ 20°C}$	Ω	0.05
Stator terminal resistance	$R_{UV\ 150°C}$	Ω	0.08
Mutual inductance	L_H	mH	18.4
Stator leakage inductance	$L_{1\sigma}$	mH	0.78
Rotor leakage inductance	$L_{2\sigma}$	mH	1.30
Mass	m	kg	193

Selection tables

Notes on the selection tables

The selection tables represent the combinations of servo motors and inverters. The only serve as a rough overview.

In the case of the servo inverters, the overload capacity depending on the switching frequency in the default setting is taken into consideration. For more information, please refer to the servo inverter documentation.

Graphical representation of the operating points		Explanation	Notes
	M_0	Standstill torque	
	$M_{0,max}$	Max. standstill torque	With an active load observe (e. g. vertical drive axes, hoists, test benches, unwinders).
	M_N	Rated torque	
	n_N	Rated speed	
	M_{max}	Max. torque	Can usually be used with a passive load (e. g. horizontal drive axes).
	n_{eto}	Transition speed	
	n_k	Derating speed	Due to a derating of the inverter output current to the derating speed, for some inverters the attainable max. standstill torque is smaller than the max. speed when the value of 5 Hz is not reached.

Derating speed

Motor	Derating speed
	n_k
	rpm
MQA20	150
MQA22	
MQA26	

9400 HighLine servo drives

The following data apply to an inverter mains voltage of 3x 400 V and an inverter switching frequency of 8 kHz.

If the motors are operated at a lower switching frequency, please contact your responsible Lenze sales company !

If operated at 4 kHz, the motor only produces 95 % of its rated torque with a higher noise emission.

MQA20 ... 22, forced ventilated

Motor			Inverter								
			E94A□□								
			E0174	E0244	E0324	E0474	E0594	E0864	E1044	E1454	E1724
MQA20L14H											
Standstill torque	M_0	Nm	32.5	66.0							
Rated torque	M_N	Nm	32.5	66.0							
Max. standstill torque	$M_{0,max}$	Nm	154.2	190.0							
Max. torque	M_{max}	Nm	154.2	190.0							
MQA20L29H											
Standstill torque	M_0	Nm			28.0	51.6	51.6				
Rated torque	M_N	Nm			28.0	51.6	51.6				
Max. standstill torque	$M_{0,max}$	Nm			116.0	148.2	192.8				
Max. torque	M_{max}	Nm			116.0	148.2	192.8				
MQA22P08H											
Standstill torque	M_0	Nm		116.0	156.0						
Rated torque	M_N	Nm		116.0	145.0						
Max. standstill torque	$M_{0,max}$	Nm		313.0	402.0						
Max. torque	M_{max}	Nm		313.0	402.0						
MQA22P14H											
Standstill torque	M_0	Nm					118.0				
Rated torque	M_N	Nm					118.0				
Max. standstill torque	$M_{0,max}$	Nm					372.0				
Max. torque	M_{max}	Nm					372.0				
MQA22P17H											
Standstill torque	M_0	Nm					99.0	156.0			
Rated torque	M_N	Nm					99.0	130.0			
Max. standstill torque	$M_{0,max}$	Nm					325.0	463.0			
Max. torque	M_{max}	Nm					325.0	463.0			
MQA22P29H											
Standstill torque	M_0	Nm							109.0	156.0	156.0
Rated torque	M_N	Nm							109.0	125.0	125.0
Max. standstill torque	$M_{0,max}$	Nm							335.0	416.0	486.0
Max. torque	M_{max}	Nm							335.0	416.0	486.0

MQA26, forced ventilated

Motor			Inverter									
			E94A□□									
			E0474	E0594	E0864	E1044	E1454	E1724	E2024	E2454	E2924	E3664
MQA26T05H												
Standstill torque	M_0	Nm	268.0	268.0	325.0							
Rated torque	M_N	Nm	268.0	268.0	296.0							
Max. standstill torque	$M_{0,max}$	Nm	665.0	826.0	1100.0							
Max. torque	M_{max}	Nm	665.0	826.0	1100.0							
MQA26T10H												
Standstill torque	M_0	Nm			270.0	298.0	325.0					
Rated torque	M_N	Nm			270.0	288.0	288.0					
Max. standstill torque	$M_{0,max}$	Nm			713.0	855.0	1044.0					
Max. torque	M_{max}	Nm			713.0	855.0	1044.0					
MQA26T12H												
Standstill torque	M_0	Nm				219.0	291.0	325.0	325.0			
Rated torque	M_N	Nm				219.0	282.0	282.0	282.0			
Max. standstill torque	$M_{0,max}$	Nm				609.0	739.0	840.0	950.0			
Max. torque	M_{max}	Nm				609.0	739.0	840.0	950.0			
MQA26T22H												
Standstill torque	M_0	Nm							242.0	290.0	325.0	325.0
Rated torque	M_N	Nm							242.0	257.0	257.0	257.0
Max. standstill torque	$M_{0,max}$	Nm							711.0	843.0	1001.0	1100.0
Max. torque	M_{max}	Nm							711.0	843.0	1001.0	1100.0

8400 TopLine inverter drives

The following data apply to an inverter mains voltage of 3x 400 V and an inverter switching frequency of 8 kHz.

If the motors are operated at a lower switching frequency, please contact your responsible Lenze sales company !

If operated at 4 kHz, the motor only produces 95 % of its rated torque with a higher noise emission.

MQA20 ... 22, forced ventilated

Motor			Inverter						
			E84AVTC□						
			1134	1534	1834	2234	3034	3734	4534
MQA20L14H									
Standstill torque	M_0	Nm	-	76.0	76.0	76.0	76.0		
Rated torque	M_N	Nm	-	71.3	71.3	71.3	71.3		
Max. standstill torque	$M_{0,max}$	Nm	146.0	202.0	249.2	250.0	250.0		
Max. torque	M_{max}	Nm	146.0	202.2	249.2	250.0	250.0		
MQA20L29H									
Standstill torque	M_0	Nm			-	76.0	76.0	76.0	76.0
Rated torque	M_N	Nm			-	66.2	66.2	66.2	66.2
Max. standstill torque	$M_{0,max}$	Nm			121.8	140.9	183.7	224.5	250.0
Max. torque	M_{max}	Nm			121.8	140.9	183.9	225.5	250.0
MQA22P08H									
Standstill torque	M_0	Nm	-	156.0	156.0	156.0	156.0		
Rated torque	M_N	Nm	-	144.5	144.5	144.5	144.5		
Max. standstill torque	$M_{0,max}$	Nm	222.8	310.5	377.0	372.9	374.6		
Max. torque	M_{max}	Nm	223.0	310.5	377.0	372.9	374.6		
MQA22P14H									
Standstill torque	M_0	Nm		-	-	156.0	156.0	156.0	156.0
Rated torque	M_N	Nm		-	-	134.7	134.7	134.7	134.7
Max. standstill torque	$M_{0,max}$	Nm		185.1	230.6	267.1	343.7	418.3	500.0
Max. torque	M_{max}	Nm		185.1	230.6	267.1	344.4	420.0	500.0
MQA22P17H									
Standstill torque	M_0	Nm			-	-	156.0	156.0	156.0
Rated torque	M_N	Nm			-	-	129.8	129.8	129.8
Max. standstill torque	$M_{0,max}$	Nm			198.6	230.2	300.0	365.3	447.0
Max. torque	M_{max}	Nm			198.6	230.4	300.0	367.5	449.9
MQA22P29H									
Standstill torque	M_0	Nm					-	-	156.0
Rated torque	M_N	Nm					-	-	124.9
Max. standstill torque	$M_{0,max}$	Nm					176.1	218.9	263.2
Max. torque	M_{max}	Nm					176.4	219.6	264.1

MQA26, forced ventilated

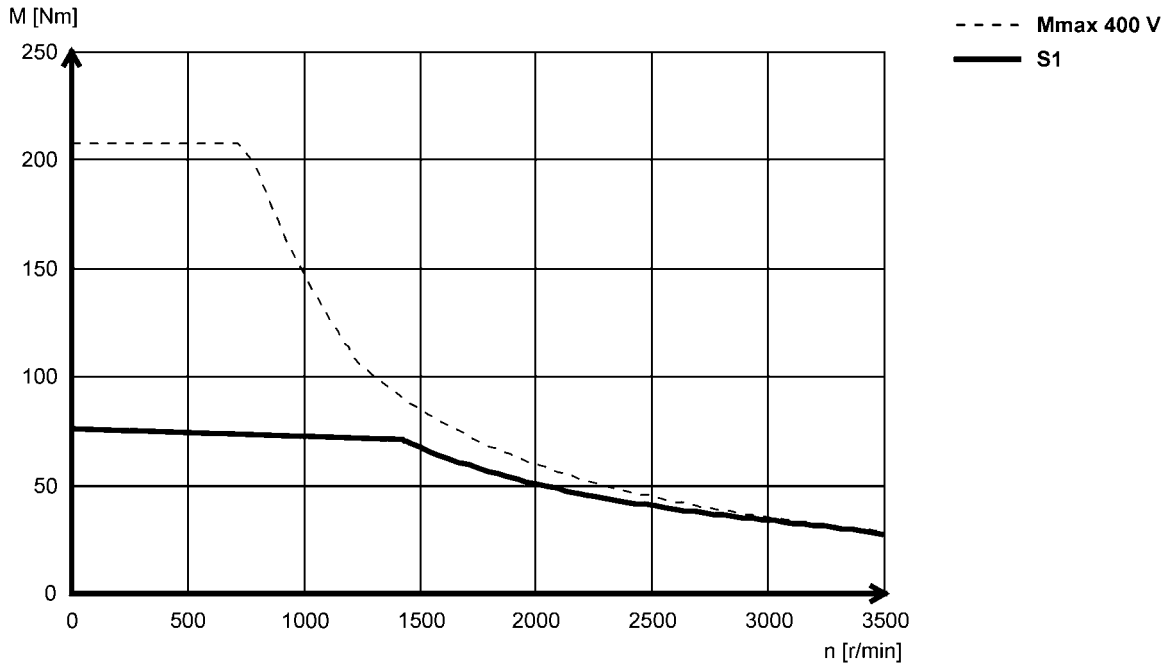
Motor			Inverter					
			E84AVTC□					
			1534	1834	2234	3034	3734	4534
MQA26T05H								
Standstill torque	M_0	Nm	-	-	325.0	325.0	325.0	325.0
Rated torque	M_N	Nm	-	-	295.2	295.2	295.2	295.2
Max. standstill torque	$M_{0,max}$	Nm	390.4	489.6	567.1	744.4	902.3	1080.2
Max. torque	M_{max}	Nm	390.4	490.2	568.0	744.8	904.7	1080.2
MQA26T10H								
Standstill torque	M_0	Nm				-	-	325.0
Rated torque	M_N	Nm				-	-	288.3
Max. standstill torque	$M_{0,max}$	Nm				429.7	532.5	638.2
Max. torque	M_{max}	Nm				431.4	534.1	641.5
MQA26T12H								
Standstill torque	M_0	Nm					-	325.0
Rated torque	M_N	Nm					-	281.7
Max. standstill torque	$M_{0,max}$	Nm					458.2	550.4
Max. torque	M_{max}	Nm					460.6	552.9

Torque characteristics

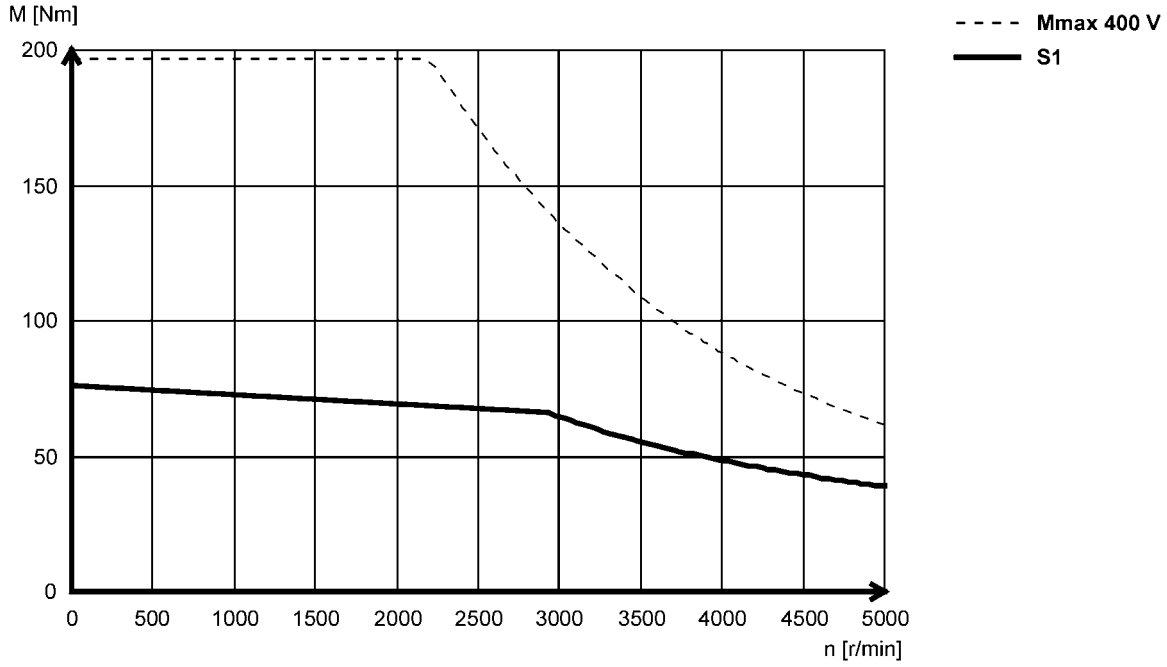
m-n characteristics for your motor-inverter combination can be found on the Internet: http://www.lenze.com → Product Finder → M-n characteristics

The data apply to an inverter mains voltage of 3 x 400 V.

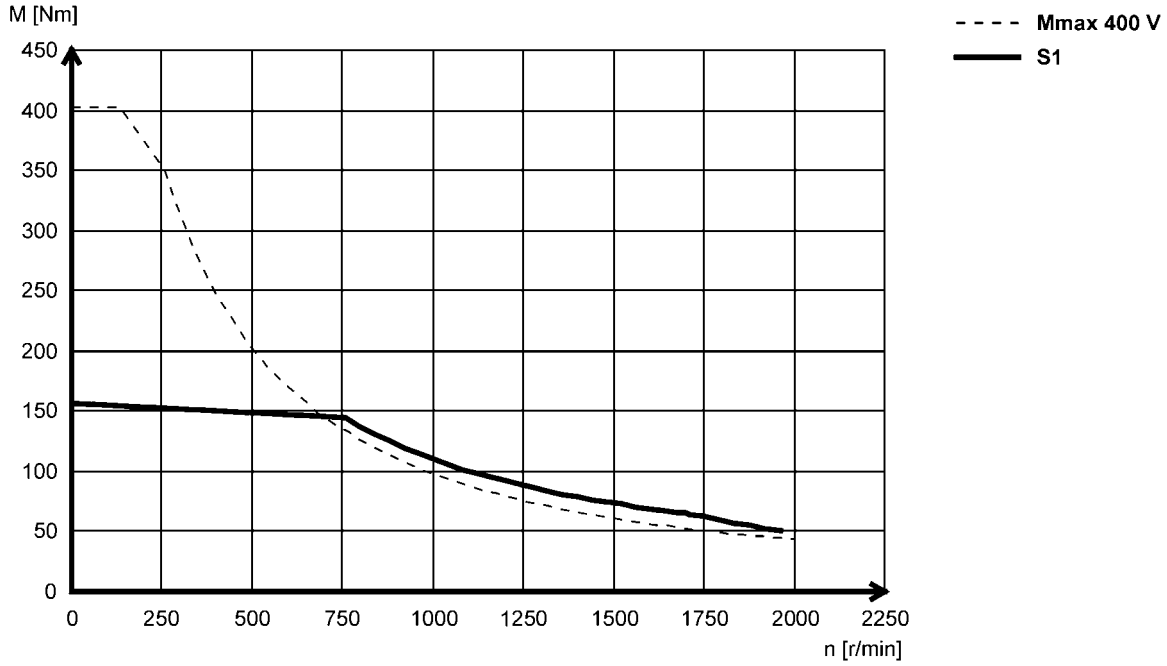
MQA20L14H (forced ventilated)



MQA20L29H (forced ventilated)



MQA22P08H (forced ventilated)



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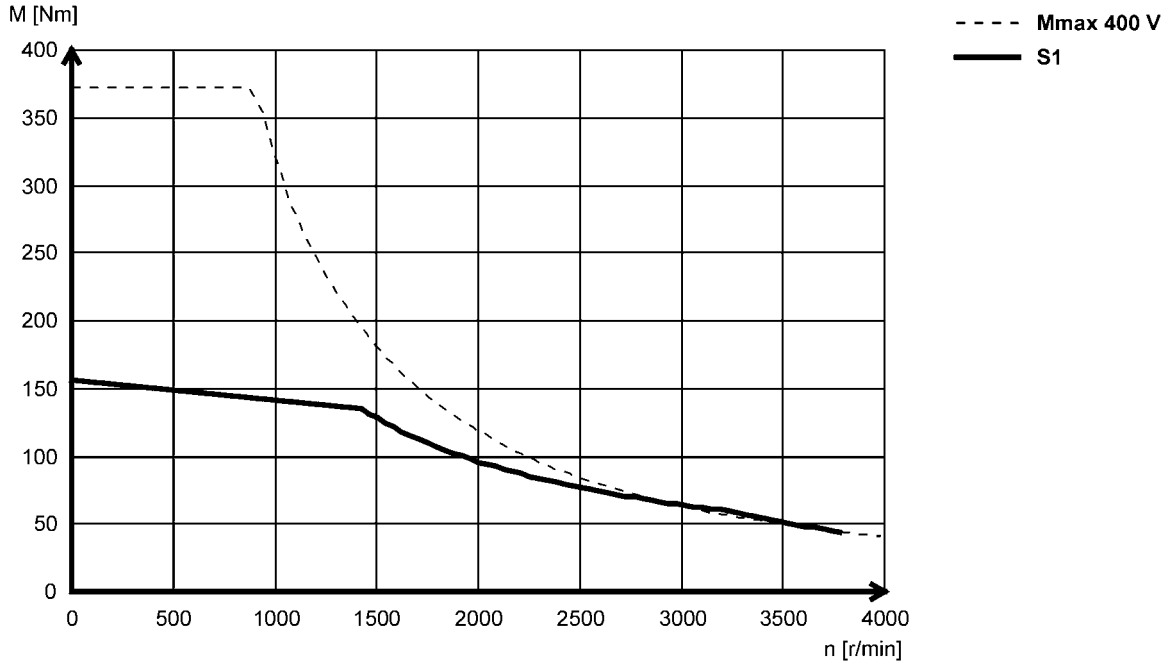
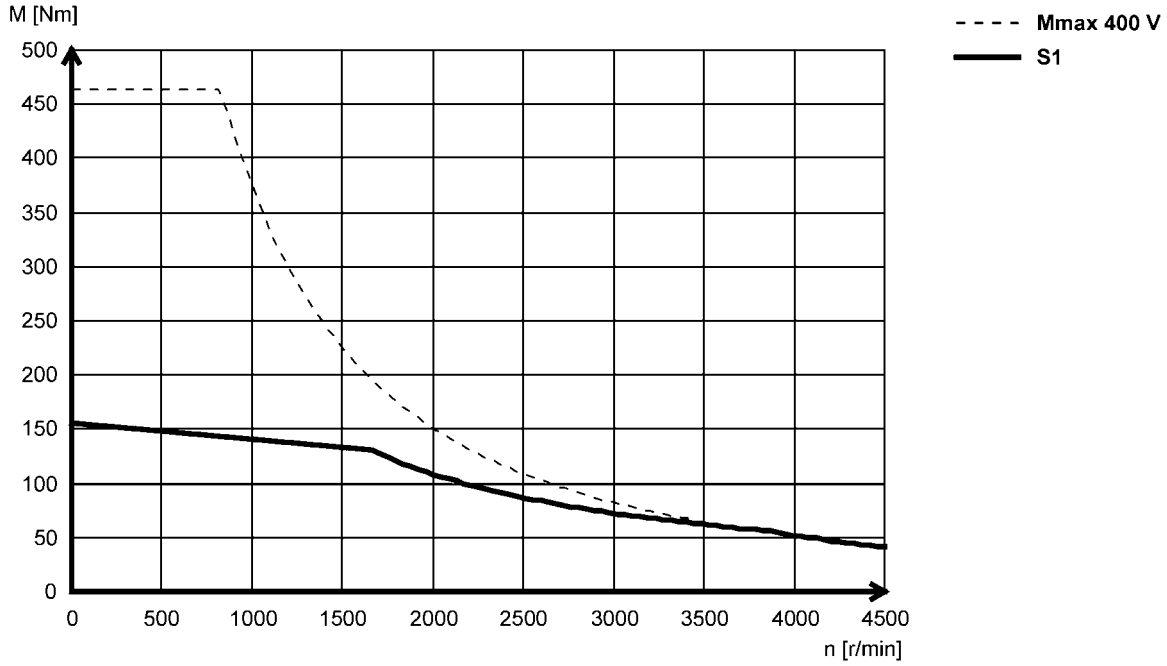
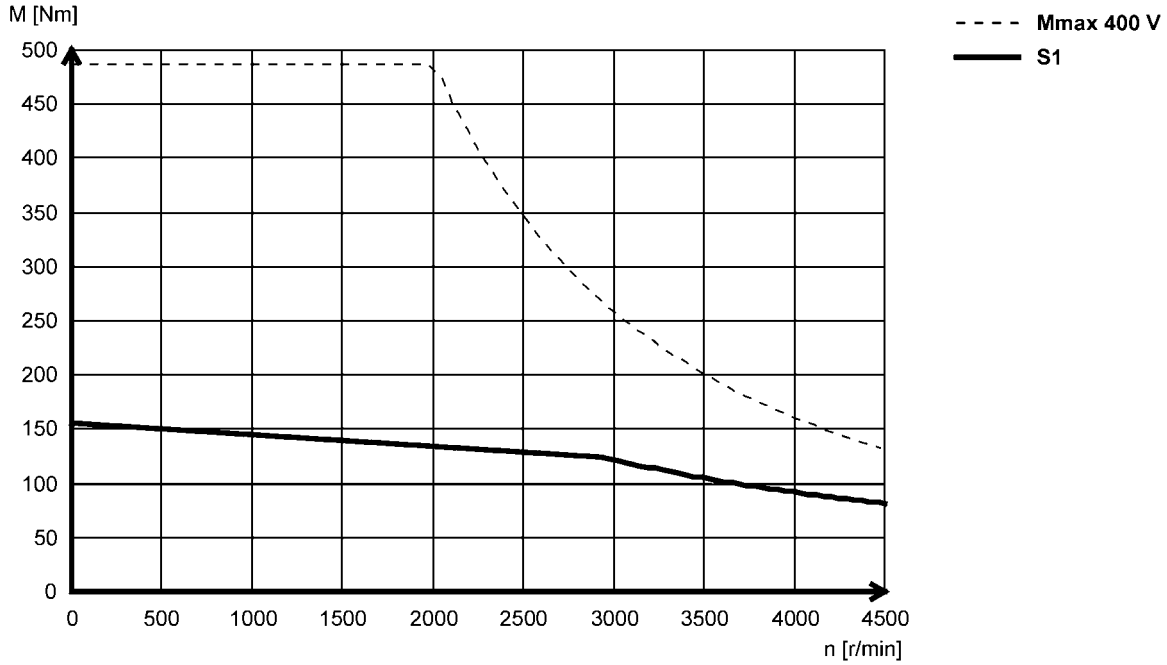


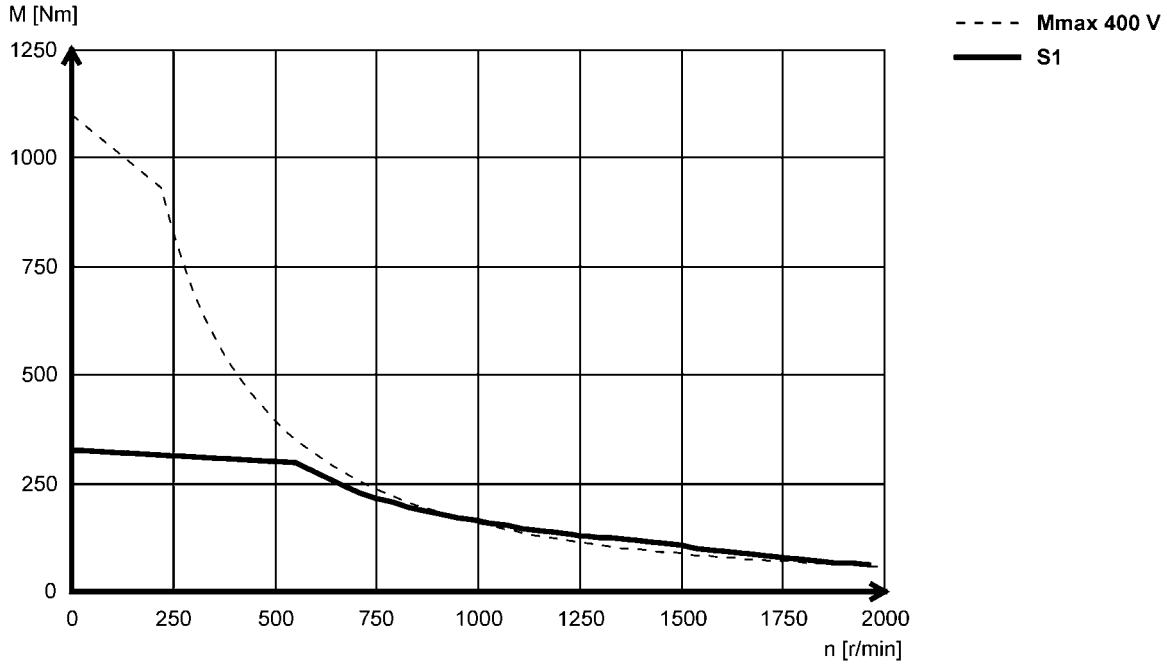
MQA22P17H (forced ventilated)



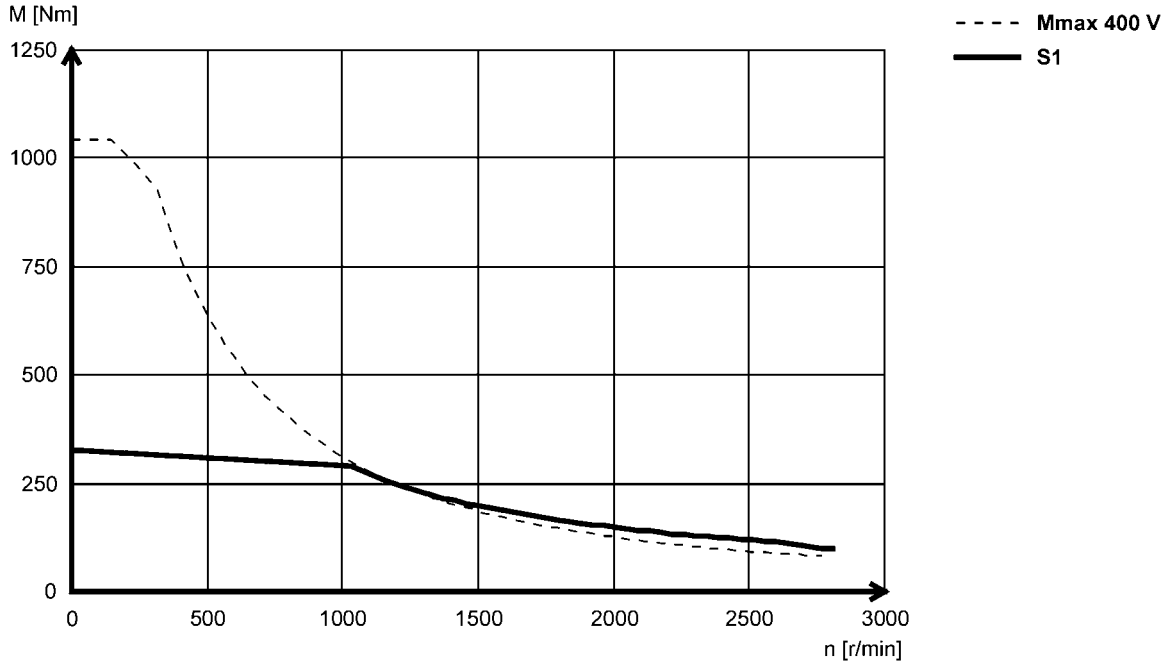
MQA22P29H (forced ventilated)



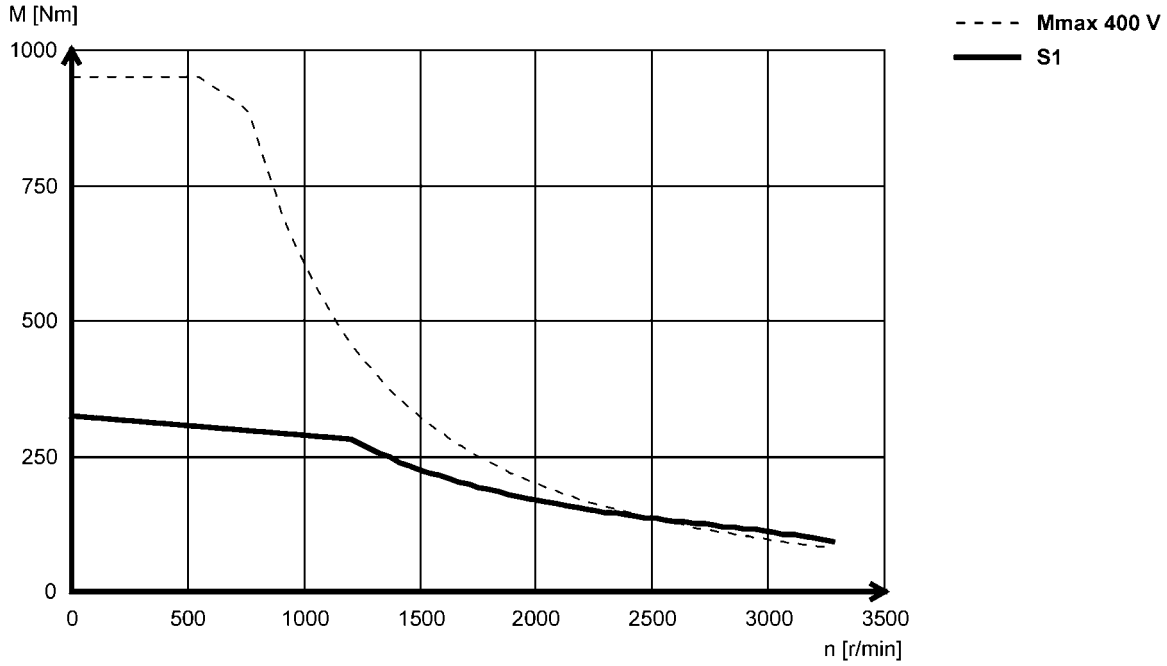
MQA26T05H (forced ventilated)



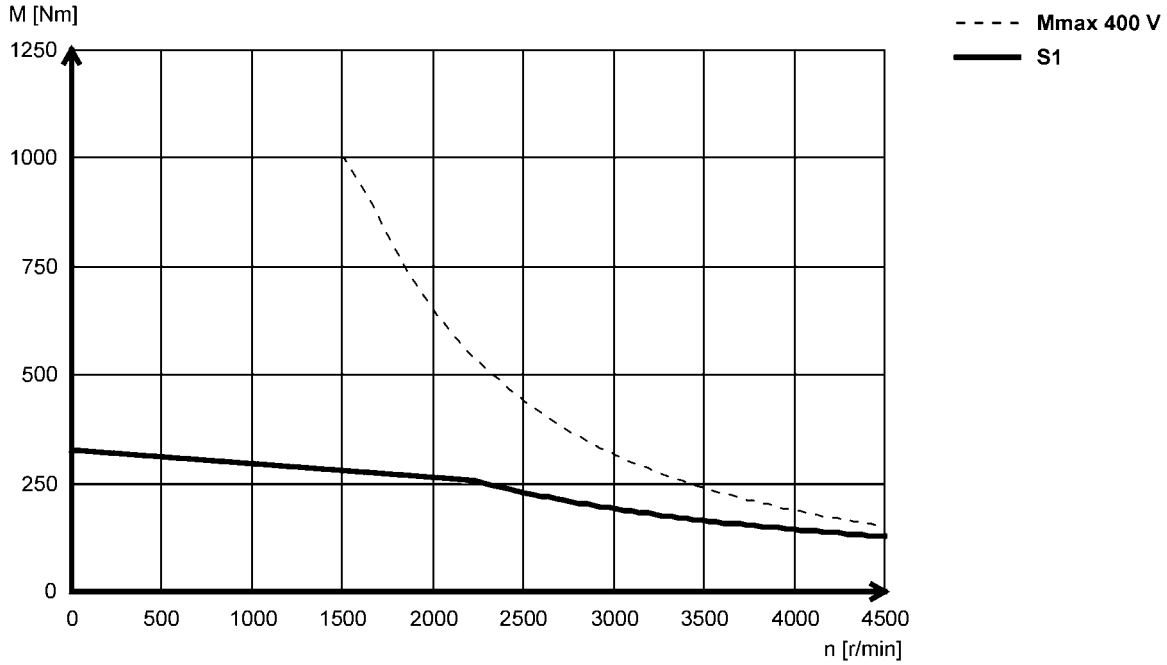
MQA26T10H (forced ventilated)



MQA26T12H (forced ventilated)



MQA26T22H (forced ventilated)



Dimensions

Basic dimensions

Notes on the basic dimensions

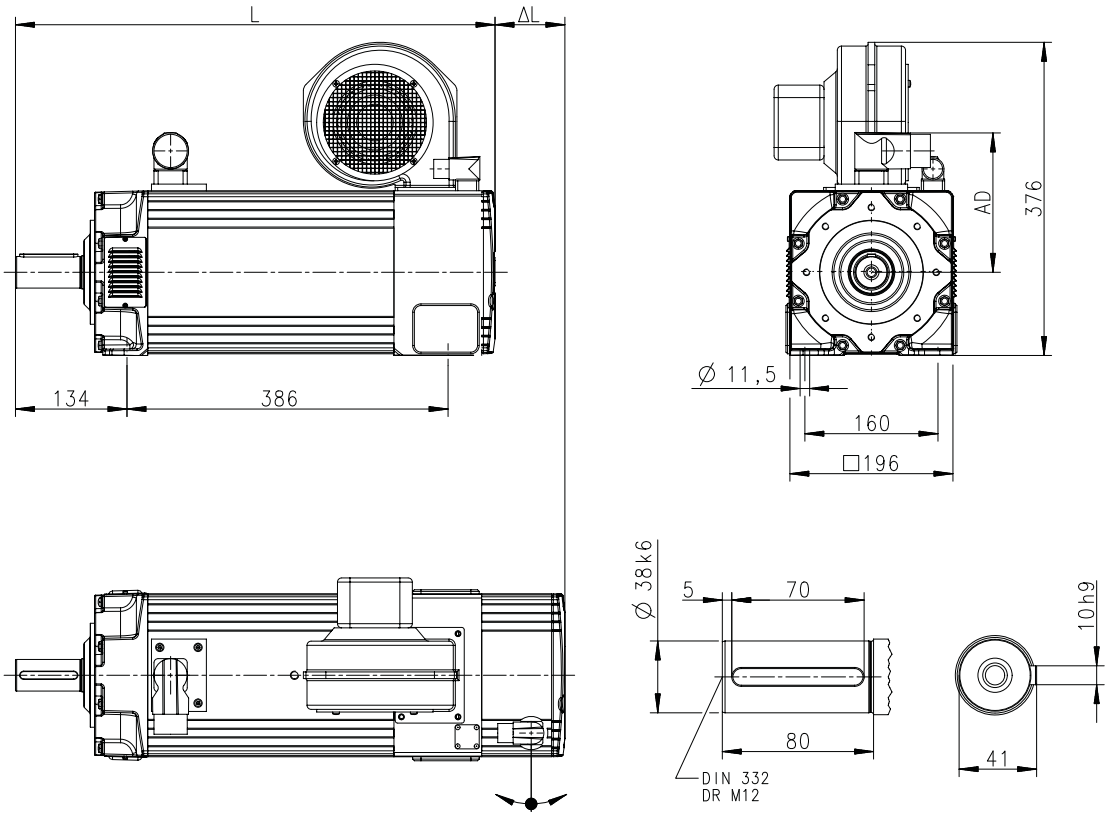
The following legend shows the layout of the dimension sheets:

Table content		Explanation
Total length without brake	L	Total length of the drive with resolver
Total length with brake	L	Total length of the drive with resolver
Length of motor options	Δ L	Additional length (longest design) In detail ▸ Additional lengths 45
Motor/connection distance	AD	Distance from motor centre to connector end / terminal box

MQA20

Forced ventilated motors

Design B3



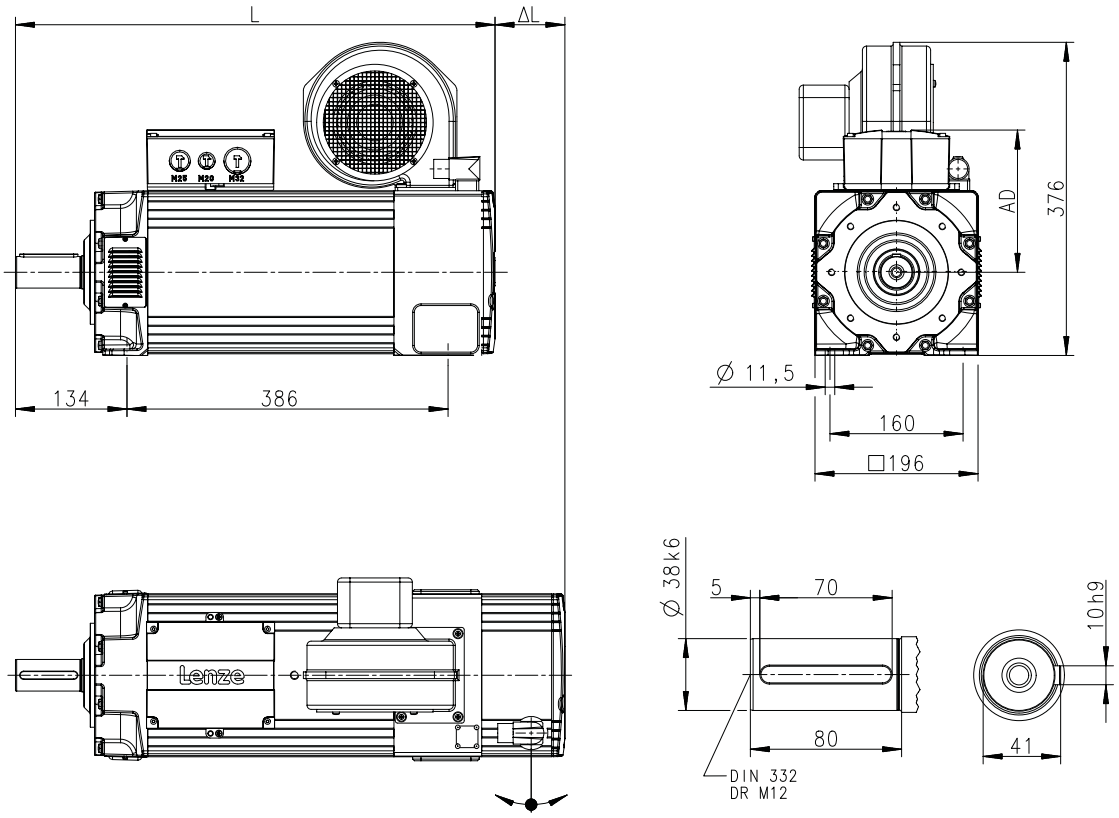
8800712-00

Motor			MQA20L14H	MQA20L29H
Total length without brake	L	mm	577	
Length of motor options	Δ L	mm	152	
Motor/connection distance	AD	mm	171	

MQA20

Forced ventilated motors

Design B3



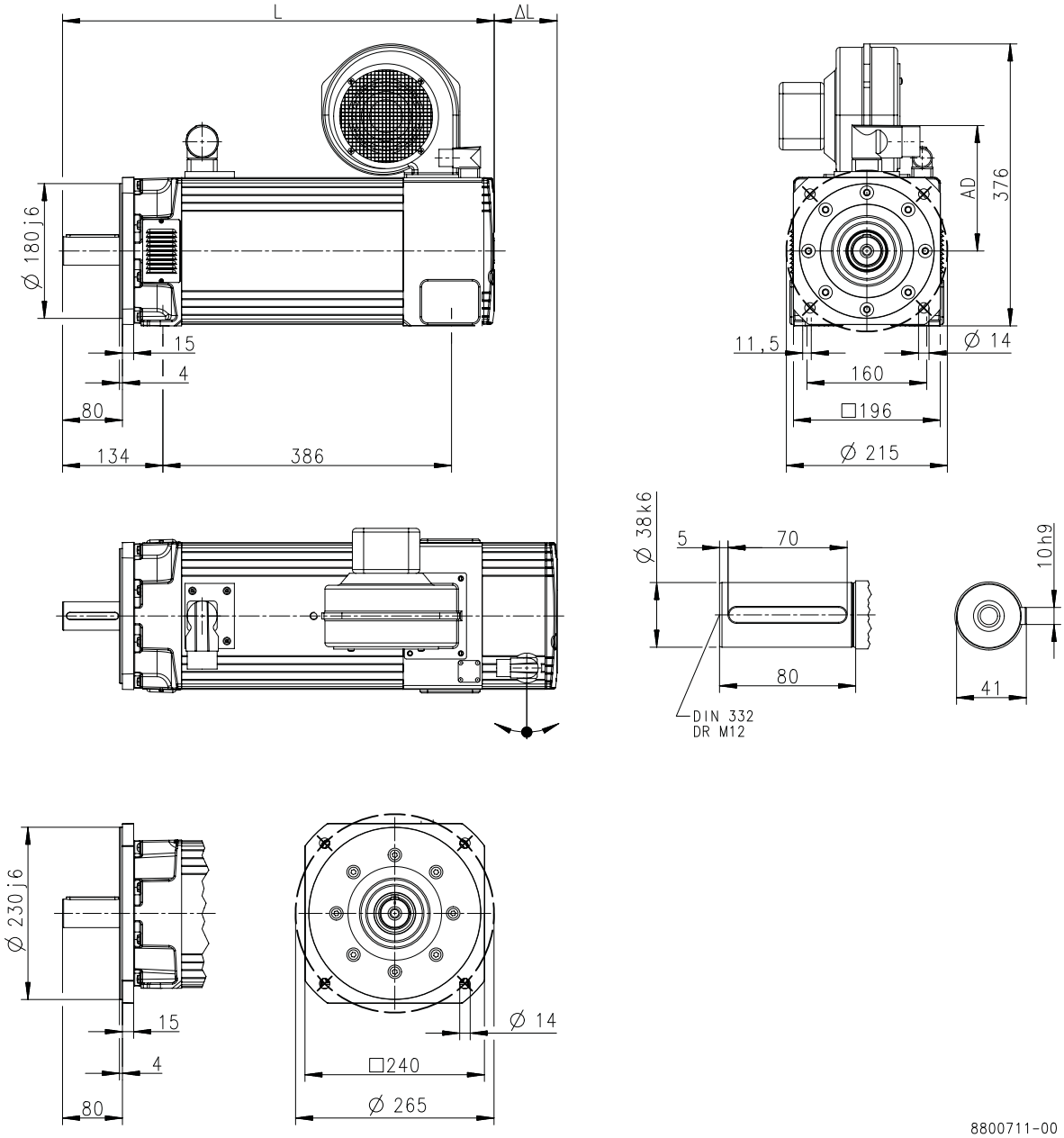
8800714-00

Motor			MQA20L14H	MQA20L29H
Total length without brake	L	mm	577	
Length of motor options	Δ L	mm	152	
Motor/connection distance	AD	mm	171	

MQA20

Forced ventilated motors

Design B35-FF215/265

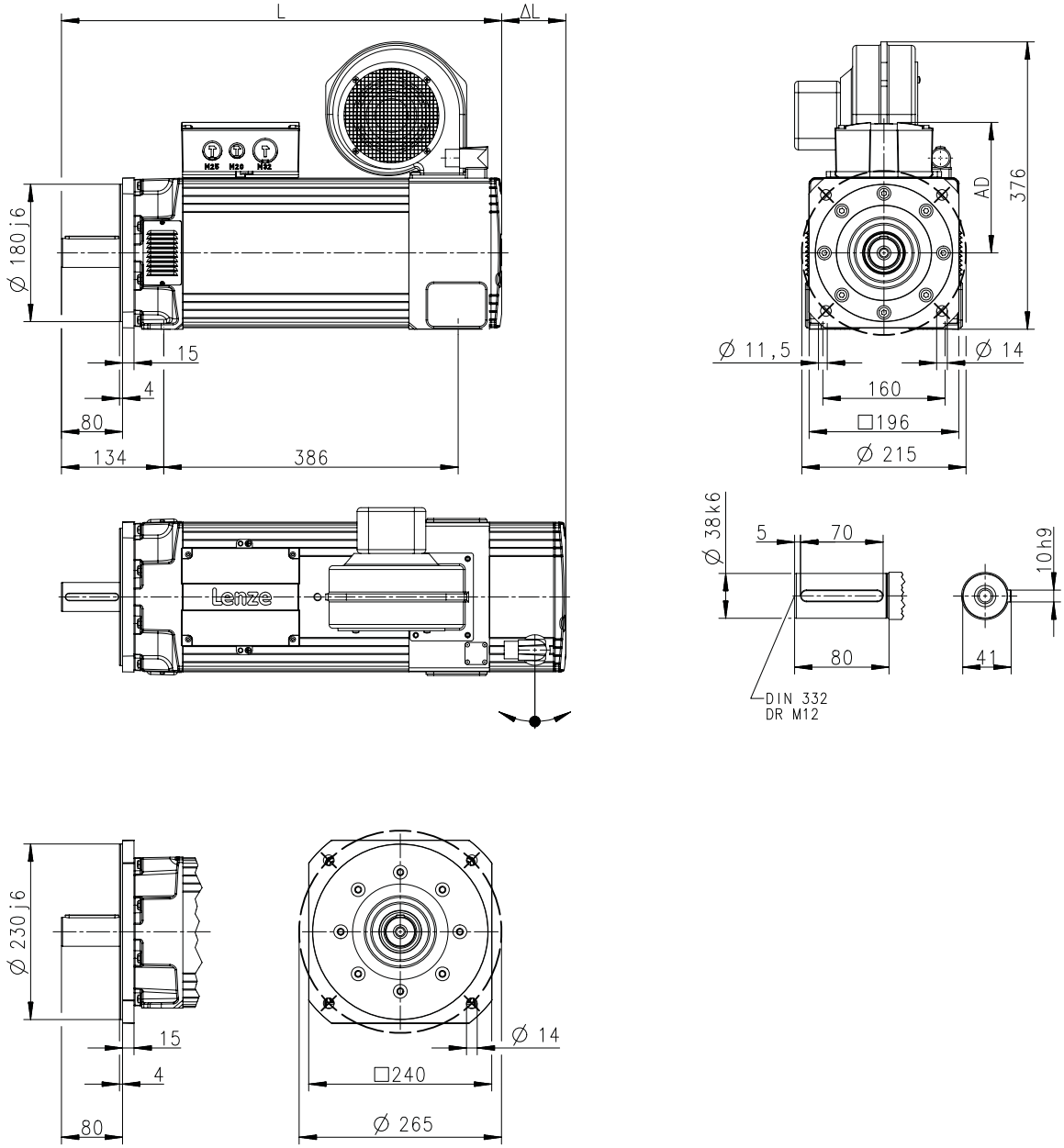


Motor			MQA20L14H	MQA20L29H
Total length without brake	L	mm	577	
Length of motor options	Δ L	mm	152	
Motor/connection distance	AD	mm	171	

MQA20

Forced ventilated motors

Design B35-FF215/265



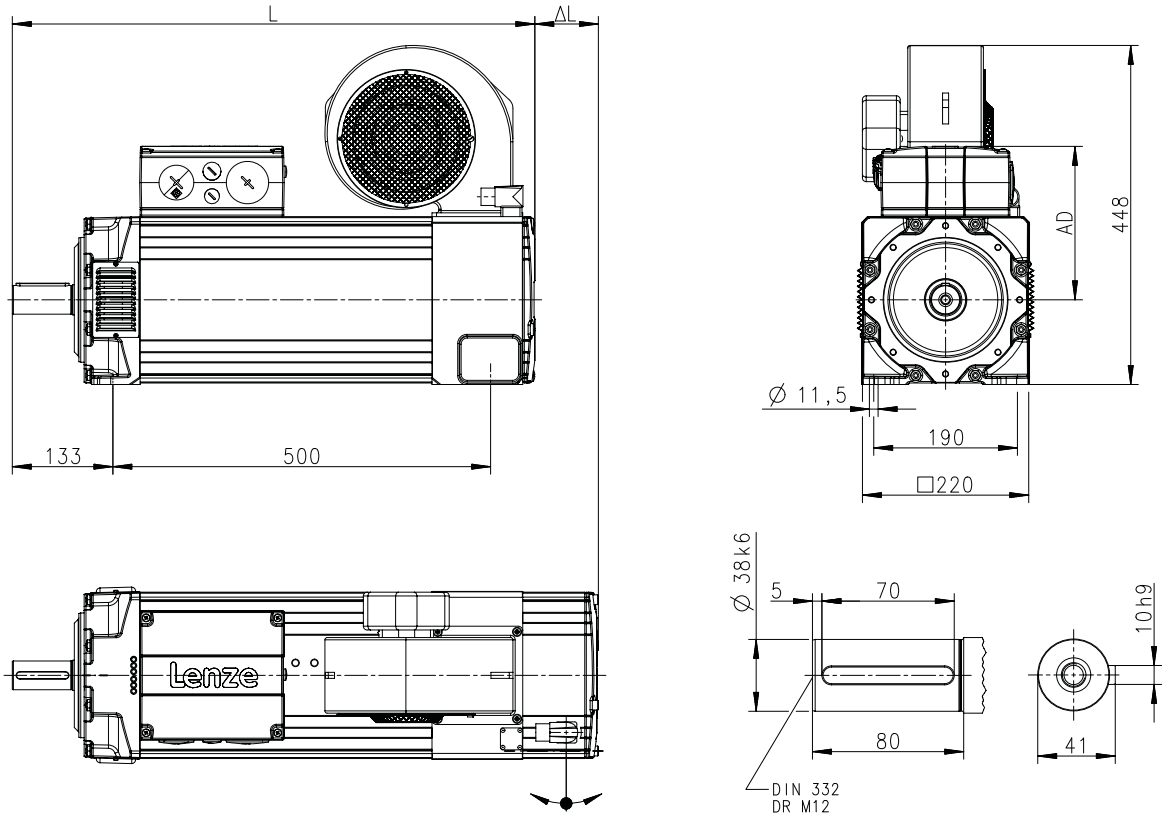
8800669-00

Motor			MQA20L14H	MQA20L29H
Total length without brake	L	mm	577	
Length of motor options	Δ L	mm	152	
Motor/connection distance	AD	mm	171	

MQA22

Forced ventilated motors

Design B3



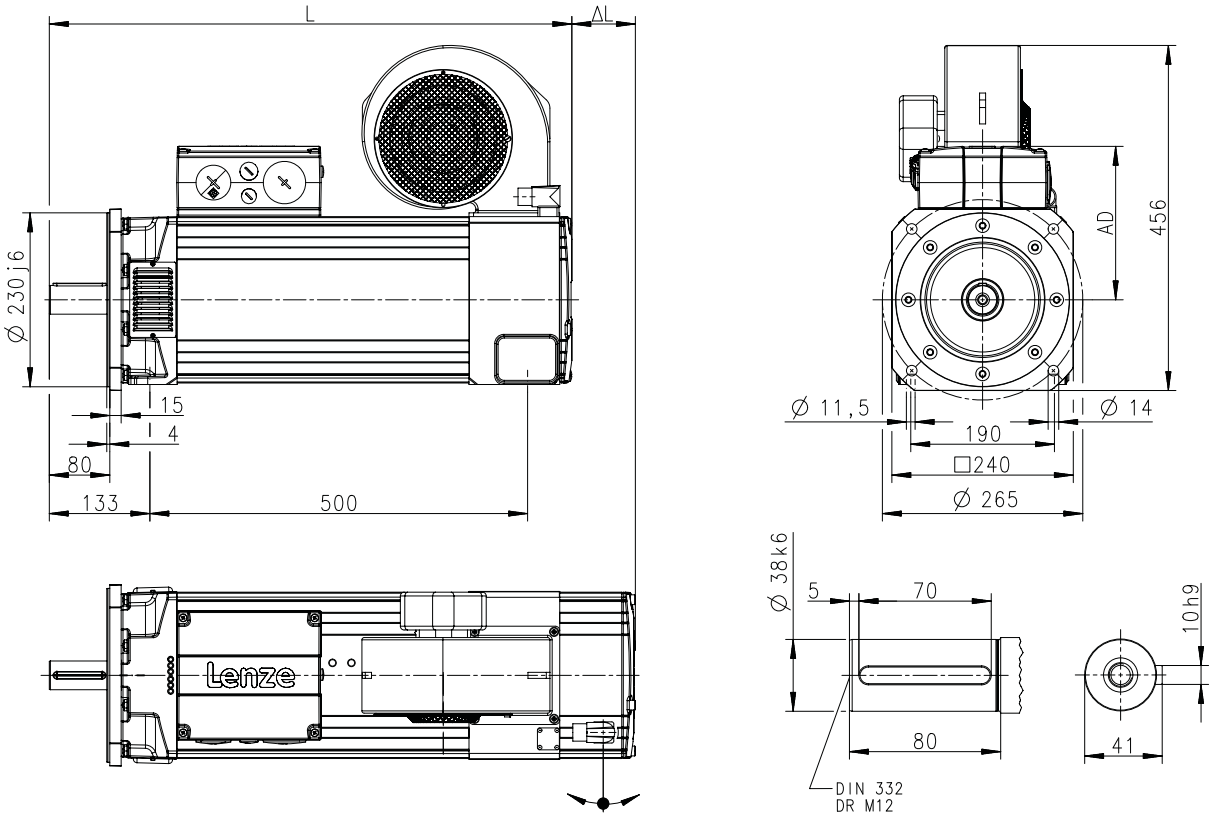
8800716-00

Motor			MQA22P08H	MQA22P14H	MQA22P17H	MQA22P29H
Total length without brake	L	mm	691			
Length of motor options	Δ L	mm	157			
Motor/connection distance	AD	mm	203			

MQA22

Forced ventilated motors

Design B35-FF265



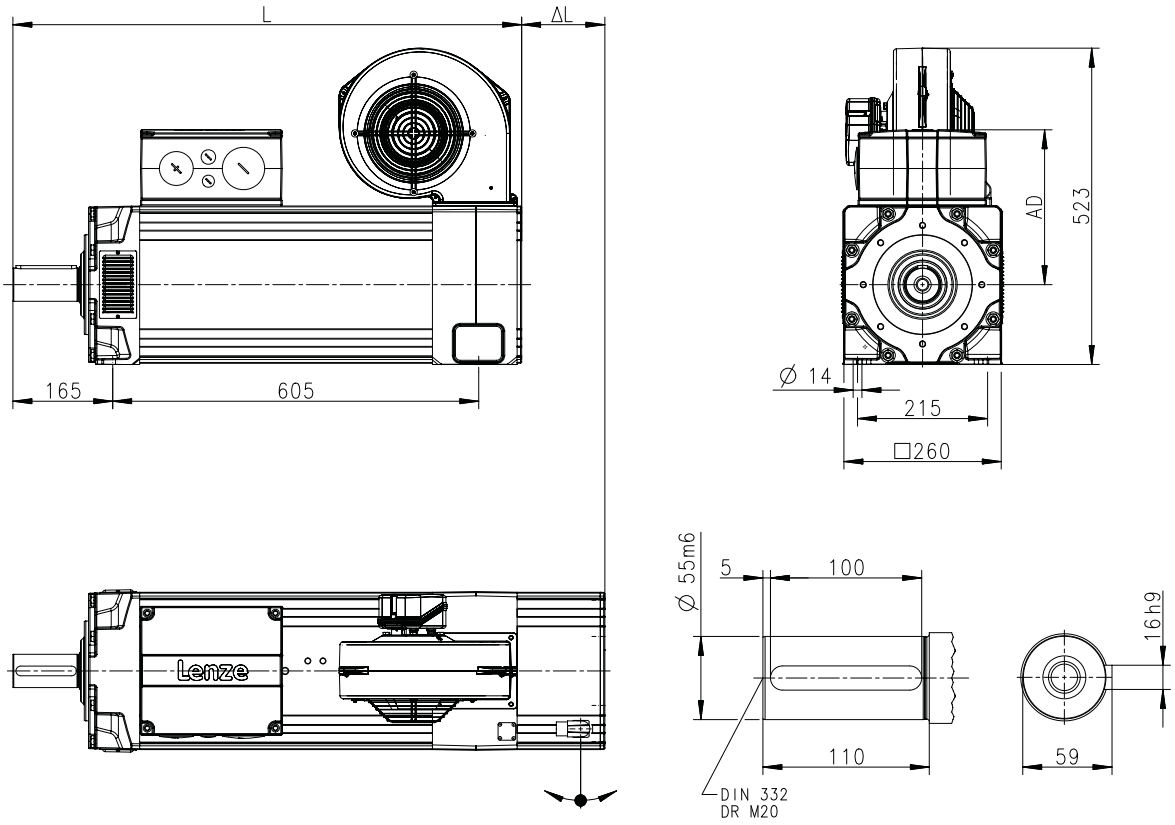
8800715-00

Motor			MQA22P08H	MQA22P14H	MQA22P17H	MQA22P29H
Total length without brake	L	mm	691			
Length of motor options	Δ L	mm	157			
Motor/connection distance	AD	mm	203			

MQA26

Forced ventilated motors

Design B3



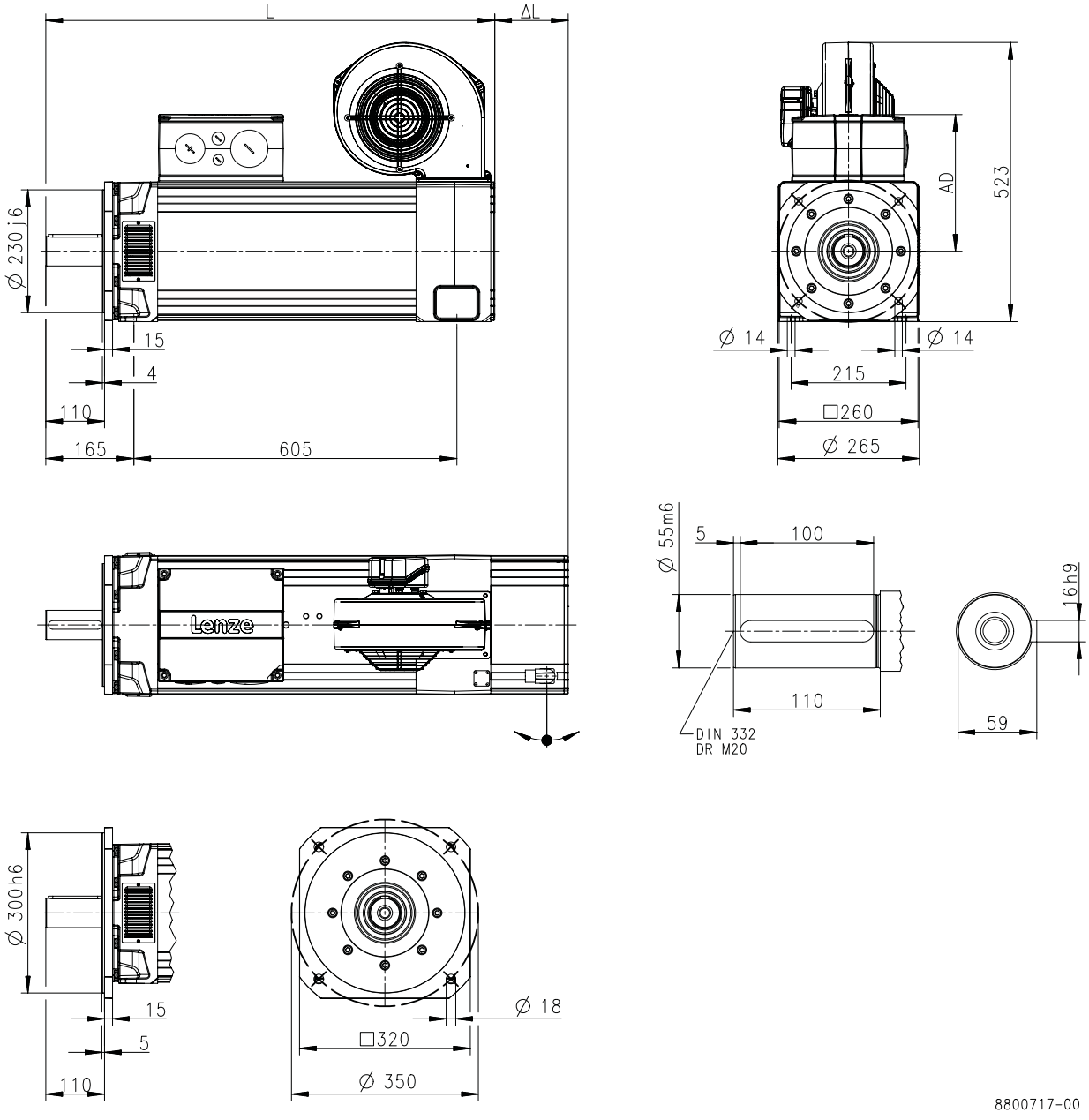
8800718-00

Motor			MQA26T05H	MQA26T10H	MQA26T12H	MQA26T22H
Total length without brake	L	mm	841			
Length of motor options	Δ L	mm	176			
Motor/connection distance	AD	mm	256			

MQA26

Forced ventilated motors

Design B35-FF350



Motor			MQA26T05H	MQA26T10H	MQA26T12H	MQA26T22H
Total length without brake	L	mm	841			
Length of motor options	Δ L	mm	176			
Motor/connection distance	AD	mm	256			

Additional lengths

The motor code indicates the short designation of the brake and feedback.
Detailed information can be found for

- Product codes 📖 60
- Brakes 📖 51
- Feedback 📖 55

MQA20

Motor			MQA20L14H	MQA20L29H
Cooling type			**Forced**	**Forced**
Feedback (without brake B0)				
R☐0	Δ L	mm	0	
S☐☐ / T☐☐ / E☐☐	Δ L	mm	0	
Brake (F1/FG) and feedback				
R☐0	Δ L	mm	84	
S☐☐ / T☐☐ / E☐☐	Δ L	mm	127	
Brake (F2/FH) and feedback				
R☐0	Δ L	mm	152	
S☐☐ / T☐☐ / E☐☐	Δ L	mm	152	

MQA22

Motor			MQA22P08H	MQA22P14H	MQA22P17H	MQA22P29H
Cooling type			**Forced**	**Forced**	**Forced**	**Forced**
Feedback (without brake B0)						
R☐0	Δ L	mm	0			
S☐☐ / T☐☐ / E☐☐	Δ L	mm	0			
Brake (F1/FG) and feedback						
R☐0	Δ L	mm	82			
S☐☐ / T☐☐ / E☐☐	Δ L	mm	125			
Brake (F2/FH) and feedback						
R☐0	Δ L	mm	157			
S☐☐ / T☐☐ / E☐☐	Δ L	mm	157			

MQA26

Motor			MQA26T05H	MQA26T10H	MQA26T12H	MQA26T22H
Cooling type			**Forced**	**Forced**	**Forced**	**Forced**
Feedback (without brake B0)						
R☐0	Δ L	mm	0			
S☐☐ / T☐☐ / E☐☐	Δ L	mm	0			
Brake (F1/FG) and feedback						
R☐0	Δ L	mm	138			
S☐☐ / T☐☐ / E☐☐	Δ L	mm	176			
Brake (F2/FH) and feedback						
R☐0	Δ L	mm	176			
S☐☐ / T☐☐ / E☐☐	Δ L	mm	176			

Weights

Additional weights

Motors

Motor			MQA20	MQA22	MQA26
Permanent magnet holding brake					
Standard braking torque	m	kg	13.0	20.5	30.7
Increased braking torque	m	kg	15.4	26	-

Product extensions

Motor connection

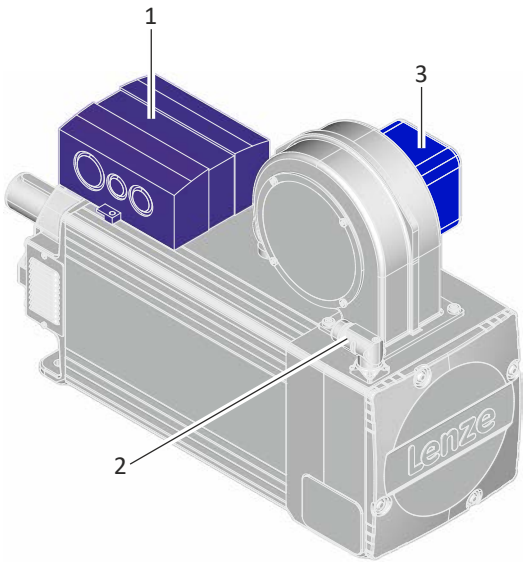
Connection via terminal box

If a motor is to be connected to an existing cable or plug connectors are not to be used for other reasons, the connection can also be made via a terminal box.

The connection for feedback and temperature monitoring is generally via the ICN connector and the electric fan is connected via a terminal box.

The terminals are designed as tension spring terminals to ensure here the long-term vibration resistance of the cable contacts with adequate contact pressure required.

Position of the connections



Position	Meaning
1	Power connection Brake connection PE connection
2	Feedback connection Connection of temperature monitoring
3	Blower connection

Cable glands

The cut-outs for the cable glands are closed with sealing plugs.

The cable glands are arranged on both sides with MQA20.

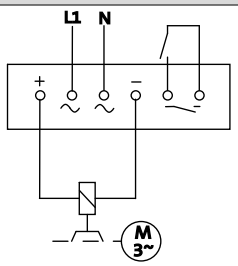
The cable glands are arranged on one side with MQA22 and MQA26. If required, the terminal box can be rotated by 180 ° after loosening the screws in the terminal box.

Motor		MQA20	MQA22	MQA26
Screwed connections		2x M20 x 1.5 2x M25 x 1.5 2x M32 x 1.5	1x M40 x 1.5 1x M50 x 1.5 1x M20 x 1.5 1x M16 x 1.5	1x M50 x 1.5 1x M63 x 1.5 1x M20 x 1.5 1x M16 x 1.5
Cable cross-section	mm^2	2.5 ... 16	10 ... 35	-
Terminal design		Spring-loaded terminal	Screw terminal	Threaded bolt
Stripping length	mm	18 ... 20	18	-
Threaded bolt		-	-	M12
Tightening torque	Nm	-	3.2	15.5

Power connection

Contact	Name	Meaning
PE	PE	PE conductor
V	V	Motor winding phase U
V	V	Motor winding phase V
W	W	Motor winding phase W

Connection of brake AC

Connection via rectifiers			
Contact	**Name**	**Meaning**	
~	BA1	Mains L1	
~	BA2	Mains N	
+	BD1	Holding brake + (factory-wired)	
-	BD2	Holding brake - (factory-wired)	
		Switching contact - DC switching	

Blower connection

1-phase		
Contact	**Name**	**Meaning**
PE	PE	PE conductor
U1	L1	Mains connection
U2	N	

three-phase			
Contact	**Name**	**Meaning**	**Note**
PE	PE	PE conductor	
U1	L1	Mains connection	Pay attention to the direction of rotation! Swap L1 and L2 if the direction of rotation is incorrect.
V1	L2		
W1	L3		

Connection of temperature monitoring

Contact	Name	Meaning
R1	+	Thermal detector +
R2	-	Thermal detector -

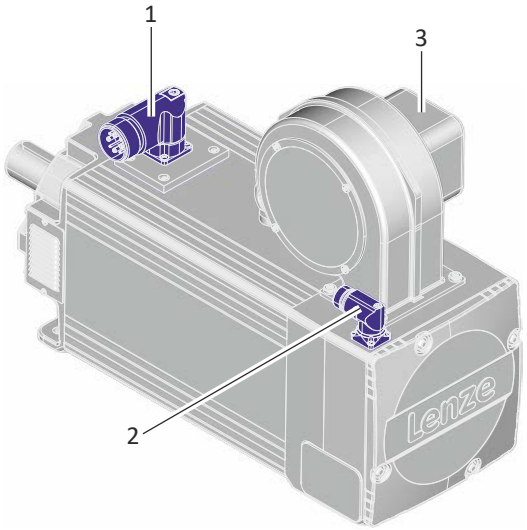
Connection via ICN connector

The connector can be rotated by 270 ° and are provided with a bayonet catch for SpeedTec connectors. Since the catch of the connector is compatible with conventional box nuts, existing counter plugs with a screw plug can be continued to use without any problems.

In order to provide for a quick and error-free connection of Lenze motors to Lenze inverters, we recommend using prefabricated Lenze system cables. In this way, proper functioning and the compliance with statutory provisions such as EMC, UL, etc. are ensured.

The use of different cables may cause unexpected faults and may void the warranty.

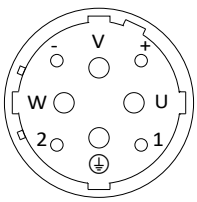
Position of the connections



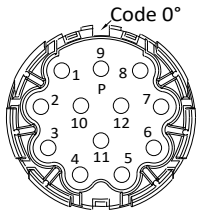
Position	Meaning
1	Power connection Brake connection PE connection
2	Feedback connection Connection of temperature monitoring
3	Blower connection

Power and brake connection

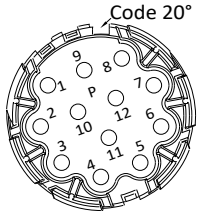
Valid for MQA20

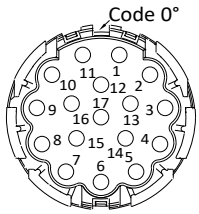
ICN-M40 connector assignment 8-pole			
Contact	**Name**	**Meaning**	
1		Not assigned	
2		Not assigned	
+	BD1	Holding brake +	
-	BD2	Holding brake -	
PE	PE	PE conductor	
V	V	Power phase U	
V	V	Power phase V	
W	W	Power phase W	

Feedback and temperature monitoring connection

ICN-M23 connector assignment Resolver			
Contact	**Name**	**Meaning**	
1	+Ref	Transformer windings	
2	-Ref		
3	+VCC ETS	Power supply: electronic nameplate	
4	+COS	Stator windings cosine	
5	-COS		
6	+SIN	Stator windings Sine	
7	-SIN		
8		Not assigned	
9			
10	Shield	Encoder housing shield	
11	+	Temperature monitoring: KTY/PT1000	
12	-		

Contact 3: only for motors and inverters which support this function.

ICN-M23 connector assignment Incremental and SinCos absolute value encoder Hiperface			
Contact	**Name**	**Meaning**	
1	B	Track B / + SIN	
2	A^-	Track A inverse / - COS	
3	A	Track A / + COS	
4	+ UB	Supply +	
5	GND	Mass	
6	Z^-	Zero track inverse / - RS485	
7	Z	Zero track / + RS485	
8		Not assigned	
9	B^-	Track B inverse/-SIN	
10	Shield	Encoder housing shield	
11	+	Temperature monitoring: KTY/PT1000	
12	-		

Pin assignment ICN-M23 SinCos absolute value encoder with EnDat interface			
Contact	**Name**	**Meaning**	
1	UP sensor	Supply: UP sensor	
2		Not assigned	
3		Not assigned	
4	0 V sensor	Supply: 0 V sensor	
5	+	Temperature monitoring: KTY/PT1000	
6	-		
7	+ UB	Supply +	
8	Cycle	EnDat interface cycle	
9	$Cycle^-$	EnDat interface inverse cycle	
10	GND	Mass	
11	Shield	Encoder housing shield	
12	B	Track B	
13	B^-	Track B inverse/-SIN	
14	Data	EnDat interface data	
15	A	Track A	
16	A^-	Track A inverse	
17	$Data^-$	Inverse EnDat interface data	

Brakes

Optionally the motors can be ordered with a spring-applied brake as holding brake.

⚠CAUTION!

They may not be used as safety elements (particularly with hoist axes) without additional measures being implemented.

The brakes used are not fail-safe brakes in the sense that prospective disruptive factors, e.g. oil ingress, can lead to a reduction in torque!

- The brakes must only be used as holding brakes for holding the axes at a standstill or in the deenergised state.
- The brake must not be used as a service brake.

⚠CAUTION!

If no suitable voltage (incorrect value, incorrect polarity) is applied to the brake, the brake will be applied and can be overheated and destroyed by the motor continuing to rotate.

If long motor supply cables are used, pay attention to the ohmic voltage drop along the cable and compensate for it with a higher voltage at the input end of the cable.

The following applies to Lenze system cables:

$U[V] = U_B[V] + 0.08\frac{[V]}{[A]\times[m]} \times l_{Lg}[m] \times I_B[A]$	V	V	Resulting supply voltage
	U_B	V	Rated voltage of the brake
	l_{Lg}	m	Cable length
	I	A	Rated current of the brake

NOTICE

- The brakes become active when the supply voltage has been switched off (closed-circuit principle).
- When using the brakes purely as holding brakes, virtually no wear occurs on the friction surfaces.
- The friction surfaces must always be free from oil and grease because even small amounts of grease or oil will considerably reduce the braking torque.

NOTICE

In case of travel axes, the compliance of the permissible ratio of mass inertia load/brake motor (J_L/J_{MB}) ensures that the permissible maximum switching energy of the brake will not be exceeded and at least the values given for the emergency stop functions from the given speed (see rated data) are applied.

For hoist axes, the load torque resulting from the weight acts additionally. In this case, the specifications for (J_L/J_{MB}) do not apply.

To simplify matters, the friction energy per switching cycle can be calculated using the formula below and must not exceed the limit value for emergency stops, which depends on the switching rate:

$$Q = \frac{1}{2} \times J_{ges} \times \left(2\pi \times \frac{\Delta n}{60} \right)^2 \times \frac{M_N}{M_N - M_L}$$

Q	J	Friction energy
J_{total}	kgm^2	Total mass inertia (motor + load)
Δn	rpm	Differential speed
M_N	Nm	Rated torque of the brake
M_L	nM	Load torque

The shortest operating times of the brakes are achieved by DC switching of the voltage and an external suppressor circuit (varistor or spark suppressor).

Without suppressor circuit, the operating times may increase. A varistor/ spark suppressor limits the breaking voltage peaks. It must be ensured that the power limit of the suppressor circuit is not exceeded. This limit depends on the brake current, brake voltage, disengagement time and the switching operations per time unit.

Furthermore the suppressor circuit is necessary for interference suppression and for increasing the service life of the relay contacts (external, is not integrated into the motor).

It is not possible to readjust the brake.

Spring-applied brakes

Rated data

Engagement and disengagement times apply to rated voltage (± 0 %) and suppressor circuit of the brakes with a varistor with DC switching. Without a suppressor circuit, the times may be longer.

The currents are the maximum values when the brake is cold (value used for dimensioning the current supply). The values for a motor at operating temperature are considerably lower.

With 24 V DC brake: smoothed DC voltage, ripple ≤ 1 %.

With 230 V AC brake: connection to an integrated rectifier (no cURus possible).

Maximum switching energy for each emergency stop with n= 3000 rpm for at least 300 , and a maximum of 4 emergency stops per hour.

Rated data with standard braking torque

DC 24 V, motor code= F1

Motor			MQA20L	MQA22P	MQA26T
Supply voltage range	$U_{in,DC}$	V	21.6 ... 26.4		
Rated voltage	$U_{N,DC}$	V	24		
Rated torque					
At 20 °C	M_N	Nm	90.0	150	300
At 120 °C	M_N	Nm	80.0	130	260
Rated current	I_N	A	3.13	3.75	3.75
Engagement time	t_1	ms	70.0	50.0	175
Disengagement time	t_2	ms	220	260	320
Maximum switching energy	Q_E	J	18000	23000	51000
Mass	m	kg	13.0	20.5	30.7
Moment of inertia					
Brake	J	$kgcm^2$	6.88	18.1	70.4
Brake motor	J_{MB}	$kgcm^2$	177	505	1405
Load/brake motor ratio	J_L/J_{MB}		19.6	8.20	12.7

AC 230 V, motor code = FG

Motor			MQA20L	MQA22P	MQA26T
Supply voltage range	$U_{in,DC}$	V	207 ... 253		
Rated voltage	$U_{N, AC}$	V	230		
Rated torque					
At 20 °C	M_N	Nm	90.0	150	300
At 120 °C	M_N	Nm	80.0	130	260
Rated current	I_N	A	0.37	0.44	0.37
Engagement time	t_1	ms	70.0	130	175
Disengagement time	t_2	ms	220	260	360
Maximum switching energy	Q_E	J	18000	23000	51000
Mass	m	kg	13.0	20.5	30.7
Moment of inertia					
Brake	J	$kgcm^2$	6.88	18.1	70.4
Brake motor	J_{MB}	$kgcm^2$	177	505	1405
Load/brake motor ratio	J_L/J_{MB}		19.6	8.20	12.7

Rated data with increased braking torque
DC 24 V, motor code= F2

Motor			MQA20L	MQA22P
Supply voltage range	$U_{in,DC}$	V	21.6 ... 26.4	
Rated voltage	$U_{N,DC}$	V	24	
Rated torque				
At 20 °C	M_N	Nm	150	300
At 120 °C	M_N	Nm	130	260
Rated current	I_N	A	2.58	3.75
Engagement time	t_1	ms	70	175
Disengagement time	t_2	ms	240	320
Maximum switching energy	Q_E	J	31000	39000
Mass	m	kg	15.4	26.0
Moment of inertia				
Brake	J	$kgcm^2$	14.1	36.3
Brake motor	J_{MB}	$kgcm^2$	185	523
Load/brake motor ratio	J_L/J_{MB}		33.0	14.1

AC 230 V, motor code= FH

Motor			MQA20L	MQA22P
Supply voltage range	$U_{in,DC}$	V	207 ... 253	
Rated voltage	$U_{N, AC}$	V	230	
Rated torque				
At 20 °C	M_N	Nm	150	300
At 120 °C	M_N	Nm	130	260
Rated current	I_N	A	0.30	0.44
Engagement time	t_1	ms	70	130
Disengagement time	t_2	ms	240	310
Maximum switching energy	Q_E	J	31000	39000
Mass	m	kg	15.4	26.0
Moment of inertia				
Brake	J	$kgcm^2$	14.1	36.3
Brake motor	J_{MB}	$kgcm^2$	185	523
Load/brake motor ratio	J_L/J_{MB}		33.0	14.1

Feedback

For speed control with a servo inverter, the servo motor can be equipped with the following feedback systems:

Feedback	Inverter			
	Connectable			Supports safety functions
	i700	E84AVTC	E94A	E94A
Resolver				
RS0	i700	E84AVTC	E94A	
RV03	i700	E84AVTC	E94A	E94A
Incremental encoder				
IG2048-5V-T		E84AVTC	E94A	
IG4096-5V-T		E84AVTC	E94A	
IG2048-5V-S		E84AVTC	E94A	
IG1024-5V-V3		E84AVTC	E94A	E94A
Absolute value encoder				
AM1024-8V-H		E84AVTC	E94A	
AM2048-5V-E			E94A	
AS1024-8V-H		E84AVTC	E94A	
AS2048-5V-E			E94A	

Safety engineering

Servo motors can perform speed-dependent safety functions for safe speed and / or safe relative position monitoring in a drive system by Lenze inverters or Controllers. In case of inverters, these functions are implemented by integrable safety modules and in case of Controllers by the additionally required Safety Controller.

When planning systems/installations of this kind, always observe the following:

- When using just one single feedback system in the environment of these safety applications, the applicable safety engineering standard IEC 61800-5-2 (adjustable speed electrical power drive systems - Part: 5-2: Safety requirements - Functional) stipulates special requirements for the connection between feedback system and motor shaft.
- This is due to the fact that two-channel safety systems at this point in the mechanical system are actually designed as single-channel systems. If this mechanical connection is designed with considerable overdimensioning, the standard permits exclusion of the fault "encoder-shaft breakage" or "encoder-shaft slip". As such, acceleration limit values must not be exceeded for the individual drive solutions.

You can find the limit values in the corresponding feedback data of the individual motor ranges.

Speed-dependent safety functions

Examples of speed-dependent safety functions:

- Safe stop 1 (SS1)
- Safe operational stop (SOS)
- Safely limited speed (SLS)
- Safe maximum speed (SMS)
- Safe direction (SDI) of motion
- Operation mode selector (OMS) with confirmation (ES)
- Safe speed monitor (SSM)
- Safely limited increment (SLI)

Resolver

The stator-supplied, 2-pole resolver with two stator windings shifted by 90 degrees and a rotor winding with a transformer winding can record both the speed and the rotor position, just like a single-turn absolute value encoder. The rotor position can be determined within one mechanical motor revolution after a voltage failure.

Feedback type			**Resolver**	
Feedback			**RS0**	**RV03**
Motor code			**RS0**	**RV03**
Speed-dependent safety functions			No	Yes
Resolution				
Angle		'	0.80	
Accuracy		'	-10 ... 10	
Absolute positioning			1 revolution	
Max. speed	n_{max}	rpm	8000	
Max. input voltage				
DC	$U_{in,max}$	V	10.0	
Max. input frequency	$f_{in,max}$	kHz	4.00	
Ratio				
Stator / rotor			0.30 ± 5 %	
Rotor impedance	Z_{ro}	Ω	51 + j90	
Stator impedance	Z_{so}	Ω	102 + j150	
Impedance	Z_{rs}	Ω	44 + j76	
Min. insulation resistance				
With DC 500 V	R_{min}	MΩ	10.0	
Number of pole pairs			1	
Max. angle error		'	-10 ... 10	

Speed-dependent safety functions

Feedback			**RV03**
Motor code			**RV03**
Max. permissible angular acceleration	α	rad/s^2	22000
Functional safety			
IEC 61508			SIL3
EN 13849-1			Up to Performance Level e

Incremental encoder

Incremental encoders can be used for speed measurement. Homing is required in order to enable positioning later.

Feedback type		TTL incremental		SinCos incremental	
Feedback		**IG2048-5V-T**	**IG4096-5V-T**	**IG2048-5V-S**	**IG1024-5V-V3**
Motor code		**T20**	**T40**	**S20**	**S1S**
Speed-dependent safety functions		No	No	No	Yes
Encoder type		-	-	Single-turn	Single-turn
Pulses		2048	4096	2048	1024
Output signals		TTL	TTL	1 Vss	1 Vss
Interfaces		A, B, N track and inverted	-	-	-
Absolute revolution		0	0	0	-
Resolution (angle)	'	2.60	1.30	0.40	0.40
Accuracy	'	-2 ... 2	-2 ... 2	-0.8 ... 0.8	-0.8 ... 0.8
Min. DC input voltage	V	4.75	4.75	4.50	4.75
Max. DC input voltage	V	5.25	5.25	5.50	5.25
Max. speed	rpm	8789	8789	5273	8000
Max. current consumption	A	0.15	0.15	0.10	0.070
Limit frequency	kHz	300	300	180	200

Speed-dependent safety functions

Feedback			SinCos incremental
Motor code			**S1S**
Max. permissible angular acceleration	α	rad/s^2	73000
Functional safety			
IEC 61508			SIL3
EN 13849-1			Up to Performance Level e

Absolute value encoder

Absolute value encoders can detect the speed, the rotor position, and the machine position with a very high resolution. They are used for the positioning of dynamic applications and do not require homing.

Feedback type		SinCos absolute value			
Feedback		**AM1024-8V-H**	**AM2048-5V-E**	**AS1024-8V-H**	**AS2048-5V-E**
Motor code		**SRM**	**EQN**	**SRS**	**ECN**
Speed-dependent safety functions		No	No	No	No
Encoder type		Multi-turn	Multi-turn	Single-turn	Single-turn
Pulses		1024	2048	1024	2048
Output signals		1 Vss	1 Vss	1 Vss	1 Vss
Interfaces		Hiperface	EnDat	Hiperface	EnDat
Absolute revolution		4096	4096	1	1
Resolution (angle)	'	0.40	0.40	0.40	0.40
Accuracy	'	-0.8 ... 0.8	-0.6 ... 0.6	-0.8 ... 0.8	-0.6 ... 0.6
Min. DC input voltage	V	7.00	4.75	7.00	4.75
Max. DC input voltage	V	12.0	5.25	12.0	5.25
Max. speed	rpm	6000	12000	6000	12000
Max. current consumption	A	0.080	0.25	0.080	0.15
Limit frequency	kHz	200	200	200	200

Blower

The motors are cooled as a standard by means of a separate radial fan.

The separate fans are optionally available with a dust filter.

Rated data 50 Hz

Motor		**MQA20L14H** **MQA20L29H**		**MQA22P08H** **MQA22P14H** **MQA22P17H** **MQA22P29H**		**MQA26T05H** **MQA26T10H** **MQA26T12H** **MQA26T22H**
Degree of protection		IP23s				
Number of phases		1	3	1	3	3
Rated voltage AC	V	230	400	230	400	400
Min. AC mains voltage	V	210	360	210	360	360
Max. AC mains voltage	V	250	440	250	440	440
Rated power	kW	0.090	0.067	0.26	0.23	0.43
Rated current	A	0.39	0.13	1.10	0.37	0.68

Rated data 60 Hz

Motor		**MQA20L14H** **MQA20L29H**		**MQA22P08H** **MQA22P14H** **MQA22P17H** **MQA22P29H**		**MQA26T05H** **MQA26T10H** **MQA26T12H** **MQA26T22H**
Degree of protection		IP23s				
Number of phases		1	3	1	3	3
Rated voltage AC	V	230	400	230	400	400
Min. AC mains voltage	V	210	360	210	360	360
Max. AC mains voltage	V	250	440	250	440	440
Rated power	kW	0.12	0.10	0.30	0.37	0.60
Rated current	A	0.49	0.16	1.28	0.48	0.79

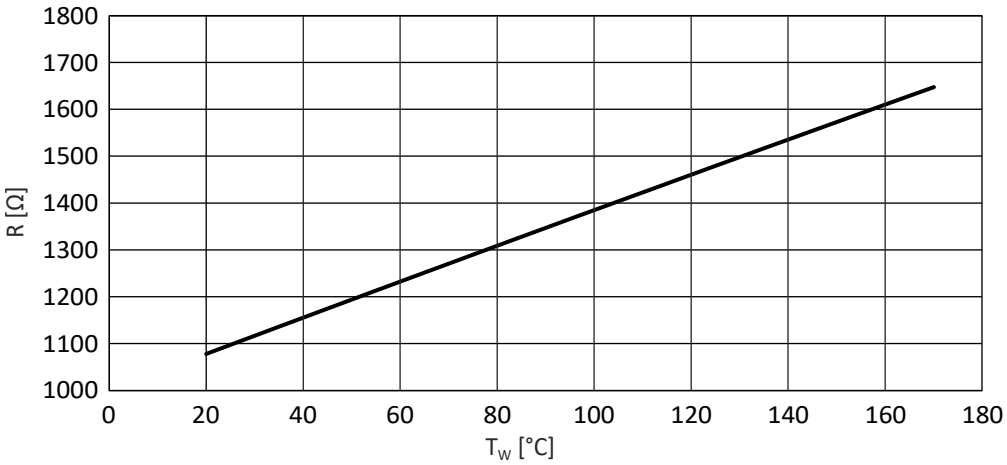
Temperature monitoring

Thermal detectors PT1000

The thermal detector used continuously monitors the motor temperature. The temperature information is transferred to the inverter using the system cable of the feedback system. **This is not a full motor protection!**

This makes it possible to determine the motor temperature in the permissible operating range with great accuracy.

When supplying the thermal sensors with a measurement current of 1 mA, the connection between the temperature and the resistance measured applies.



R	Resistance
T_W	Winding temperature

Product codes

Motor product code

Example	M	Q	A	20	L	14	-	RS0	B0

Meaning	Variant	Product code
Product family	Motor	M
Type	Compact servo motors	Q
Type	Asynchronous	A
Motor frame size	Square dimension 200 mm	20
	Square dimension 220 mm	22
	Square dimension 260 mm	26
Overall length		L P T
Rated speed	rpm x 100	05 ... 29
Inverter mains voltage	3 x 400 V, IP23	H
Feedback	SinCos single-turn absolute value encoder, EnDat AS2048-5V-E	ECN
	SinCos multi-turn absolute value encoder, EnDat AM32-5V-E	EQI
	SinCos multi-turn absolute value encoder, EnDat AM2048-5V-E	EQN
	Resolver	RS0
	Safety resolver RV03	RV0
	SinCos safety incremental encoder, IG1024-5V-V3	S1S
	SinCos incremental encoder, IG2048-5V-S	S20
	SinCos multi-turn absolute value encoder, Hiperface® AM1024-8V-H	SRM
	SinCos single-turn absolute value encoder, Hiperface® AS1024-8V-H	SRS
	TTL incremental encoder, IG2048-5V-T	T20
	TTL incremental encoder, IG4096-5V-T	T40
Brake	Without brake	B0
	Spring-applied brake DC 24 V	F1
	Spring-applied brake DC 24 V, reinforced	F2
	Spring-applied brake AC 230 V	FG
	Spring-applied brake AC 230 V, reinforced	FH

Appendix

Good to know

Approvals/directives

CCC	China Compulsory Certification documents the compliance with the legal product safety requirements of the PR of China - in accordance with Guobiao standards.
$_{C}CSA_{US}$	CSA certificate, tested according to US and Canada standards
UE	Union Européenne documents the declaration of the manufacturer that EU Directives are complied with.
CEL	China Energy Label documents the compliance with the legal energy efficiency requirements for motors, tested according to the PR of China and Guobiao standards
CSA	CSA Group (Canadian Standards Association) CSA certificate, tested according to Canada standards
$UL^{Energy}{}_{US\ CA}$	Energy Verified Certificate Determining the energy efficiency according to CSA C390 for products within the scope of energy efficiency requirements in the USA and Canada
$_{C}UL_{US}$	UL certificate for products, tested according to US and Canada standards
$_{C}UR_{US}$	UL certificate for components, tested according to US and Canada standards
EAC	Customs union Russia / Belarus / Kazakhstan certificate documents the declaration of the manufacturer that the specifications for the Eurasian conformity (EAC) required for placing electronic and electromechanical products on the market of the entire territory of the Customs Union (Russia, Belarus, Kazakhstan, Armenia and Kyrgyzstan) are complied with.
UL	Underwriters Laboratory Listed Product
UL_{LISTED}	UL Listing approval mark as proof that the product has been tested and the applicable safety requirements have been confirmed by UL (Underwriters Laboratory).
UR	UL Recognized Component approval mark as proof that the UL approved component can be used in a product or system bearing the UL Listing approval mark.

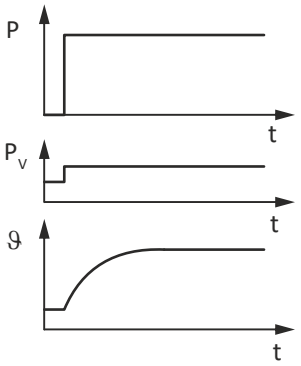
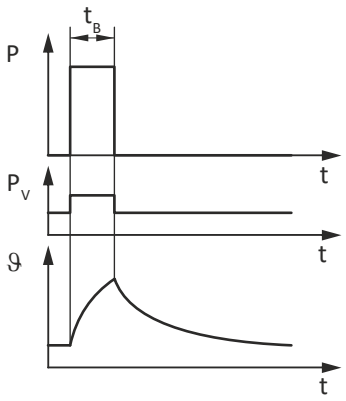
Operating modes of the motor

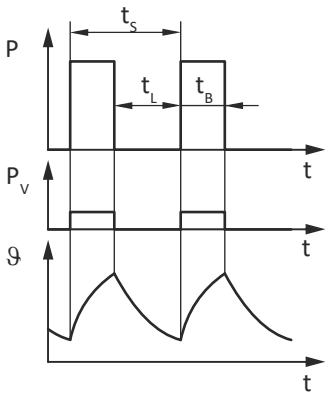
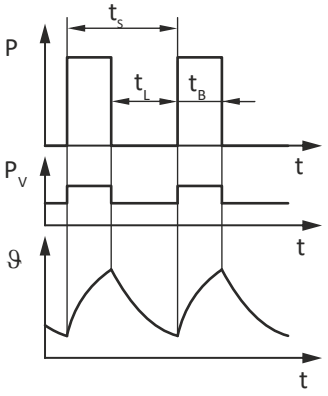
Operating modes S1 ... S10 as specified by EN 60034-1 describe the basic stress of an electrical machine.

In continuous operation a motor reaches its permissible temperature limit if it outputs the rated power dimensioned for continuous operation. However, if the motor is only subjected to load for a short time, the power output by the motor may be greater without the motor reaching its permissible temperature limit. This behaviour is referred to as overload capacity.

Depending on the duration of the load and the resulting temperature rise, the required motor can be selected reduced by the overload capacity.

The most important operating modes

Continuous operation S1	Short-time operation S2
	
Operation with a constant load until the motor reaches the thermal steady state. The motor may be actuated continuously with its rated power.	Operation with constant load; however, the motor does not reach the thermal steady state. During the following standstill, the motor winding cools down to the ambient temperature again. The increase in power depends on the load duration.

Intermittent operation S3	Non-intermittent periodic operation S6
	
Sequence of identical duty cycles comprising operation with a constant load and subsequent standstill. Start-up and braking processes do not have an impact on the winding temperature. The steady-state is not reached. The guide values apply to a cycle duration of 10 minutes. The power increase depends on the cycle duration and on the load period/ downtime ratio.	Sequence of identical duty cycles comprising operation with a constant load and subsequent no-load operation. The motor cools down during the no-load phase. Start-up and braking processes do not have an impact on the winding temperature. The steady-state is not reached. The guide values apply to a cycle duration of 10 minutes. The power increase depends on the cycle duration and on the load period/idle time ratio.

P	Power	P_V	Power loss
t	Time	t_B	Load period
t_L	Idle time	t_S	Cycle duration
ϑ	Temperature		

Enclosures

The degree of protection indicates the suitability of a motor for specific ambient conditions with regard to humidity as well as the protection against contact and the ingress of foreign particles. The degrees of protection are classified by EN 60529.

The first code number after the code letters IP indicates the protection against the ingress of foreign particles and dust. The second code number refers to the protection against the ingress of humidity.

Code number 1	Degree of protection	Code number 2	Degree of protection
0	No protection	0	No protection
1	Protection against the ingress of foreign particles d > 50 mm. No protection in case of deliberate access.	1	Protection against vertically dripping water (dripping water).
2	Protection against medium-sized foreign particles, d > 12 mm, keeping away fingers or the like.	2	Protection against diagonally falling water (dripping water), 15 ° compared to normal service position.
3	Protection against small foreign particles d > 2.5 mm. Keeping away tools, wires or the like.	3	Protection against spraying water, up to 60 ° from vertical.
4	Protection against granular foreign particles, d > 1 mm, keeping away tools, wire or the like.	4	Protection against spraying water from all directions.
5	Protection against dust deposits (dust-protected), complete protection against contact.	5	Protection against water jets from all directions.
6	Protection against the ingress of dust (dust-proof), complete protection against contact.	6	Protection against choppy seas or heavy water jets (flood protection).

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