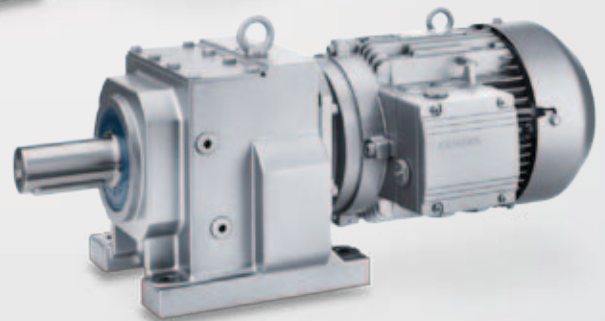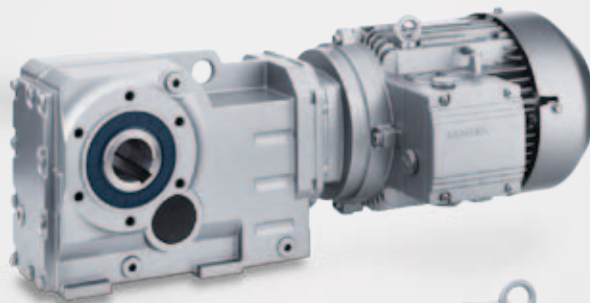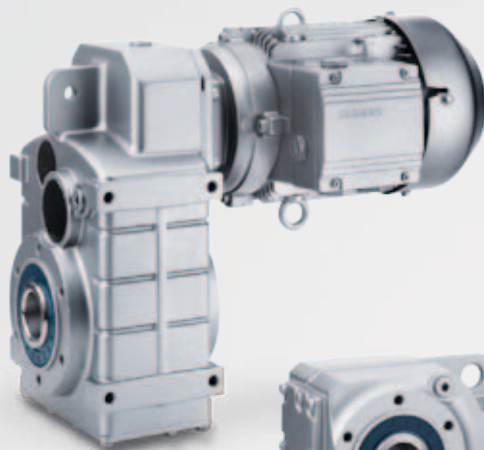# MOTOX Geared Motors

Catalog D 87.1 · 2011

MOTOX

Answers for industry.

SIEMENS

Related catalogs

Low-Voltage Motors D 81.1
IEC Squirrel-Cage Motors

E86060-K5581-A111-A3-7600

**FLENDER
Standard Couplings** MD 10.1

E86060-K5710-A111-A3-7600

SINAMICS G110, SINAMICS G120 D 11.1
Standard Inverters
SINAMICS G110D, SINAMICS G120D
Distributed Inverters

E86060-K5511-A111-A6-7600

SINAMICS G130 D 11
Drive Converter Chassis Units
SINAMICS G150
Drive Converter Cabinet Units

E86060-K5511-A101-A4-7600

MICROMASTER DA 51.2
MICROMASTER 420/430/440
Inverters
0.12 kW to 250 kW

E86060-K5151-A121-A6-7600

MICROMASTER/COMBIMASTER DA 51.3
MICROMASTER 411 Inverter
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Distributed Drive Solutions

E86060-K5251-A131-A2-7600

Industrial Communication IK PI
Part 5:
SIMATIC ET 200 Distributed I/O
ET 200S FC Frequency converter

E86060-K6710-A101-B6-7600

AC NEMA & IEC Motors D 81.2
Further details available on the U.S./
Internet at: Canada

Only PDF
http://www.sea.siemens.com/motors

MOTOX Konfigurator MOTOX
MOTOX Configurator
Information / Configuration
(CD)

E86060-D5203-A100-A5-X100

Additional documentation

You will find all information material, such as brochures, catalogs, manuals and operating instructions for standard drive systems up-to-date on the Internet at the address:

http://www.siemens.com/gearedmotors

You can order the listed documentation or download it in common file formats (PDF, ZIP).

MOTOX
Geared Motors

Catalog D 87.1 · 2011

The products and systems described in this catalog are manufactured/distributed under application of a certified quality management system in accordance with DIN EN ISO 9001 (Certified Registration No. DE-409908 QM08). The certificate is recognized by all IQNet countries.

Supersedes:
Catalogs D 87.1 · 2008 and 2010

The products contained in this catalog can also be found in the electronic catalog MOTOX Configurator 7.4.
Order No.:
E86060-D5203-A100-A5-X100 (CD-ROM)

Please contact your local Siemens branch

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Helical worm geared motors	5
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Input units	7
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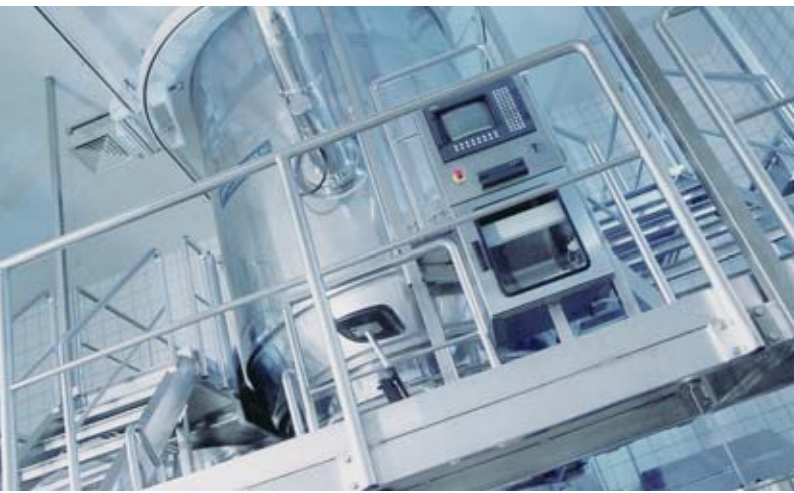
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Siemens Industry answers the challenges in the manufacturing and the process industry as well as in the building automation business. Our drive and automation solutions based on Totally Integrated Automation (TIA) and Totally Integrated Power (TIP) are employed in all kinds of industry. In the manufacturing and the process industry. In industrial as well as in functional buildings.

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Industrial Software for
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• Operation

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• Modernization and Upgrade
• Energy Management

SIMOTION
Motion Control System

SINUMERIK
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It provides maximum transparency at all levels with reduced interfacing requirements – covering the field level, production control level, up to the corporate management level. With TIA you also profit throughout the complete life cycle of your plant – starting with the initial planning steps through operation up to modernization, where we offer a high measure of investment security resulting from continuity in the further development of our products and from reducing the number of interfaces to a minimum.

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The result: maximum interoperability – covering the controller, HMI, drives, up to the process control system. This reduces the complexity of the automation solution in your plant. You will experience this, for example, in the engineering phase of the automation solution in the form of reduced time requirements and cost, or during operation using the continuous diagnostics facilities of Totally Integrated Automation for increasing the availability of your plant.
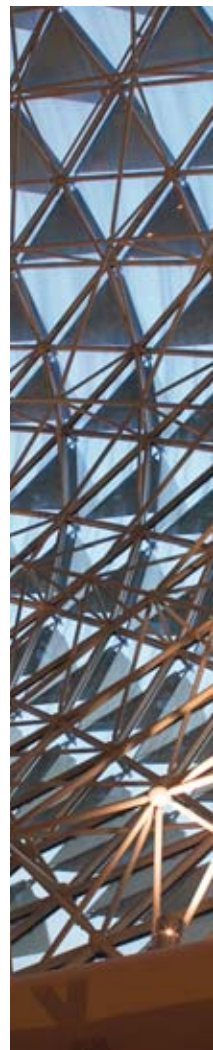
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Processes / industrial automation

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Planning and system configuration
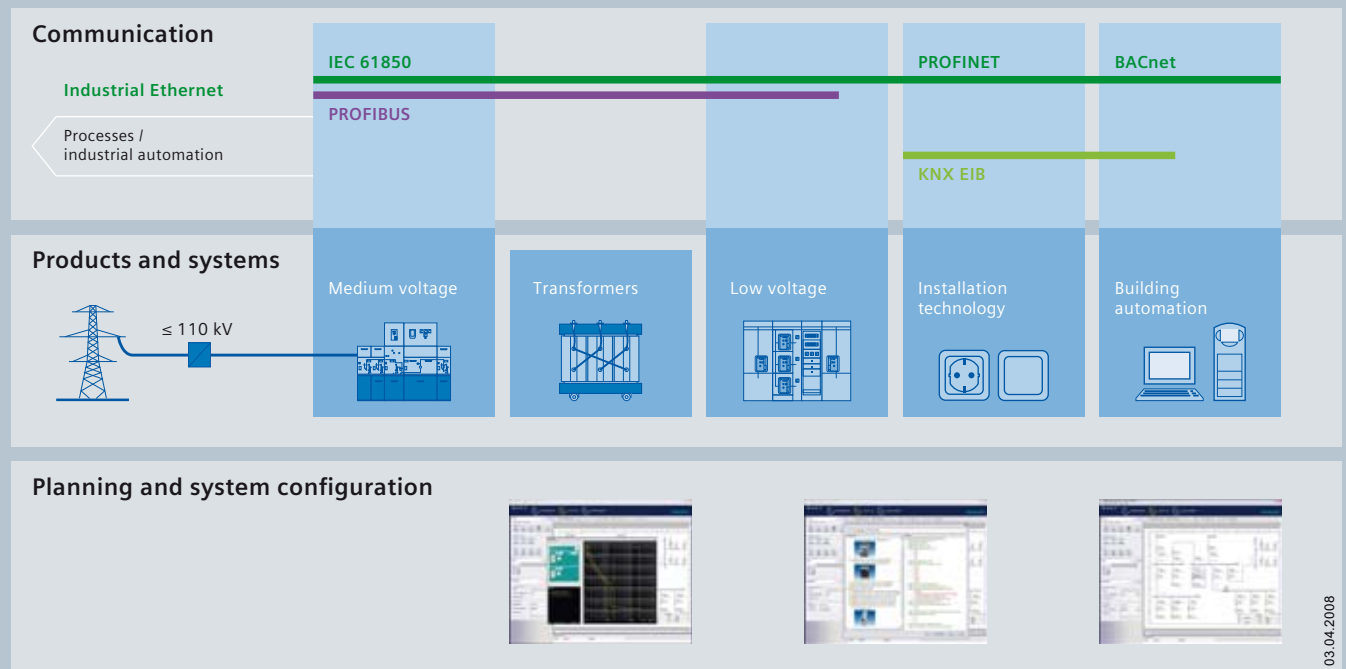
03.04.2008

Electrical power distribution in buildings requires integrated solutions. Our response: Totally Integrated Power. This means innovative and integrated, interface-optimized products and systems which have been optimally coordinated and complemented with communication and software modules that link power distribution to building automation or industrial automation. Totally Integrated Power accompanies power distribution projects from one end to the other. From A to Z. From the planning to the building's use: Totally Integrated Power offers significant advantages in every project stage and to everyone involved in the project – the investors, electrical planning engineers, electricians, users and building facility managers.

Our portfolio comprises everything from engineering tools to the matching hardware: from switchgear and distribution systems for medium voltage to transformers, from switching and circuit-protection devices to low-voltage switchgear and busbar trunking systems, as far as to the small distribution board and the wall outlet. It goes without saying that both the medium-voltage switchgear, which requires no maintenance, and the low-voltage switchgear are type-tested, and their busbar connections, too. Comprehensive protection systems ensure the safety of man and machine at any time.

Much more than a catalog. The Industry Mall.

You have a catalog in your hands that will serve you well for selecting and ordering your products. But have you heard of the electronic online catalog (the Industry Mall) and all its benefits? Take a look around it sometime:

www.siemens.com/industrymall

Selecting

Find your products in the structure tree, in the new "Bread-crumb" navigation or with the integral search machine with expert functions. Electronic configurators are also integrated into the Mall. Enter the various characteristic values and the appropriate product will be displayed with the relevant order numbers. You can save configurations, load them and reset them to their initial status.

Ordering

You can load the products that you have selected in this way into the shopping basket at a click of the mouse. You can create your own templates and you will be informed about the availability of the products in your shopping cart. You can load the completed parts lists directly into Excel or Word.

Delivery status

When you have sent the order, you will receive a short e-mail confirmation which you can print out or save. With a click on "Carrier", you will be directly connected to the website of the carrier where you can easily track the delivery status.

Added value due to additional information

So you have found your product and want more information about it? In just a few clicks of the mouse, you will arrive at the image data base, manuals and operating instructions. Create your own user documentation with My Documentation Manager.
Also available are FAQs, software downloads, certificates and technical data sheets as well as our training programs. In the image database you will find, depending on the product, 2D/3Dgraphics, dimension drawings and exploded drawings, characteristic curves or circuit diagrams which you can download.

Convinced? We look forward to your visit!

Introduction

1

MOTOX Geared Motors
Introduction

1

Description of the range of geared motors

MOTOX geared motors are available in an almost infinite number of combinations for adaptation to a wide range of drive scenarios.
All geared motors can be supplied with a mounted brake.
All the usual additional components and variants are also offered.

Made-to-measure solutions for all kinds of drive technology tasks are achieved with different gearbox types
(helical, parallel shaft, bevel helical, helical worm, and worm).

Electronic catalog

MOTOX Configurator (CD)

The MOTOX Configurator makes it easy to select the right geared motor, providing you with the correct geared motor order numbers, prices and relevant documentation.

Data sheets and dimension drawings can be created for the different products.

Product range

The printed catalog contains the basic selection of standard MOTOX geared motors. The MOTOX Configurator, however, contains practically all combinations of MOTOX geared motors which are theoretically possible. It also contains additional sector-specific applications, such as:

- Monorail conveyor drives
- Extruder geared motors
- Cooling tower drives
- Mixer and agitator geared motors

You can also use the electronic catalog to configure explosion-proof ATEX geared motors for zones 1, 2, 21, and 22.

The MOTOX Configurator can also be accessed online at:
www.siemens.com/gearedmotors.

Guide to selecting and ordering geared motors

■ **Description of the range of geared motors** (continued)

Helical geared motor D/Z

Helical geared motors and gearboxes

Torque	20 000 Nm
Power rating (50 Hz)	200 kW
Output speed (50 Hz)	0.05 ... 1 085 / min

Parallel shaft geared motor FD/FZ

Parallel shaft geared motors and gearboxes

Torque	34 000 Nm
Power rating (50 Hz)	200 kW
Output speed (50 Hz)	0.05 ... 738 / min

Bevel helical geared motor K

Bevel helical geared motors and gearboxes

Torque	20 000 Nm
Power rating (50 Hz)	200 kW
Output speed (50 Hz)	0.05 ... 403 / min

Helical worm geared motor C

Helical worm geared motors and gearboxes

Torque	1 590 Nm
Power rating (50 Hz)	9.2 kW
Output speed (50 Hz)	0.21 ... 149 / min
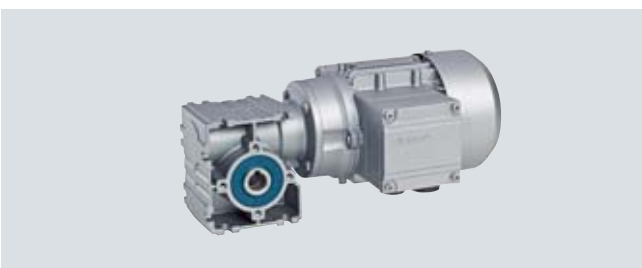
Worm geared motor S

Worm geared motors and gearboxes

Torque	116 Nm
Power rating (50 Hz)	1.1 kW
Output speed (50 Hz)	8.5 ... 566 / min

MOTOX Geared Motors
Introduction

1

Guide to selecting and ordering geared motors

■ Guide to drive selection

This "guide to drive selection" takes you to the geared motor you require in easy-to-follow steps.

1st step	Technical requirements of the geared motor -> see the "Configuring guide" section of this chapter
Determine the required product profile, the following are required:	Gearbox type
	Power rating
	Output speed
	Service factor
	Radial force
	Ambient temperature
2nd step	**Preselection of the geared motor -> see subsequent pages**
Determine the range of possible geared motors	Size of the gearbox and the motor in accordance with the power rating and output speed
3rd step	**Detailed selection of the geared motor -> see the individual chapters for the different gearbox types**
Determine the basic order number	Define the order number in accordance with the power / torque and output speed
	Add more details to the order number in accordance with the mounting type, shaft, and mounting position of the geared motor
	Define the order code for the mounting type / mounting position
4th step	**Selection of motor options -> see chapter "Technical explanations and motor options"**
Complete the order number	Add more details to the order number in accordance with the voltage and frequency
	Define additional components and the associated order codes

Order number code

The order number consists of a combination of digits and letters and is divided into three blocks linked with hyphens for a better overview,

e.g.:

2KJ1503-1CE13-1AE2-Z

+D06+M55

The first block (positions 1 to 7) identifies the gearbox type, the second (positions 8 to 12) codes the output shaft and the motor type and additional design characteristics are coded in the third block (positions 13 to 16).

Ordering data:

- Complete order number, with a **-Z** suffix, and order code(s) or plain text.
- If a quotation is available, please specify the quotation number in addition to the order number.
- When ordering a complete geared motor as a spare part, please specify the works serial number for the previously supplied geared motor as well as the order number.

Structure of the order number		Position	1	2	3	4	5	6	7	–	8	9	10	11	12	–	13	14	15	16
MOTOX geared motors																				
1st to 5th positions: Digit, letter, letter, digit, digit	Helical gearbox E, 1-stage		2	K	J	1	0													
	Helical gearbox Z, 2-stage		2	K	J	1	1													
	Helical gearbox D, 3-stage		2	K	J	1	2													
	Parallel shaft gearbox FZ, 2-stage		2	K	J	1	3													
	Parallel shaft gearbox FD, 3-stage		2	K	J	1	4													
	Bevel helical gearboxes B and K		2	K	J	1	5													
	Helical worm gearbox C		2	K	J	1	6													
	Worm gearbox S		2	K	J	1	7													
6th and 7th positions: Digit, digit	Gearbox size																			
8th position: Digit	Output shaft																			
9th to 10th positions: Letter Letter	Motor size																			
11th position: Digit	Without motor												0							
	Standard motor												1							
12th position: Digit	Motor generation													3						
13th position: Digit	Frequency, voltage																			
14th position: Letter	Foot-mounted design																A			
	Foot / flange-mounted design																B			
	Torque arm																D			
	Extruder flange																E			
	Flange-mounted design (A-type)																F			
	Housing flange (C-type)																H			
	Mixer flange																M			
	Agitator flange																R			
15th to 16th positions: Letter, digit	Transmission ratio																			
	Special order versions: • Coded: order code also required • Non-coded: plain text also required																		–	Z

MOTOX Geared Motors
Introduction

Guide to selecting and ordering geared motors

■ **Order number code** (continued)

Ordering example:

A bevel helical geared motor is required:

- Gearbox type / gearbox size K48
- Motor 0.37 kW, 4-pole with 50 Hz line frequency
- Output speed 13, transmission ratio i = 107.47
- Solid shaft V 30 x 60
- Mounting type / mounting position B3-00-A
- Terminal box position 1A

This results in the order number and order codes below:

Selection criteria	Requirements	Structure of the order number
Gearbox type	Bevel helical gearbox K, size 48	**2KJ1503**-■■■■■- ■■■■
Output shaft	Solid shaft V 30 x 60	2KJ1503-**1**■■■■- ■■■■
Motor size	Size 71; 0.37 kW; 4-pole	2KJ1503-1**CE**■■- ■■■■
Motor type	Standard motor	2KJ1503-1CE**1**■- ■■■■
Motor generation	LA / LG	2KJ1503-1CE1**3**- ■■■■
Frequency, line voltage	50 Hz, 220 … 240 / 380 … 420 V, D/Y (S100)	2KJ1503-1CE13-**1**■■■
Mounting type	Foot-mounted design	2KJ1503-1CE13-1**A**■■
Transmission ratio	i = 107.47	2KJ1503-1CE13-1A**E2**
Mounting position	B3-00-A	2KJ1503-1CE13-1AE2-**Z+D06**
Terminal box position	1A	2KJ1503-1CE13-1AE2-Z+D06**+M55**

■ **Determining the gearbox type in accordance with the power rating and output speed**

Power rating	Output speed			Torque			Gearbox ratio			For further information,
P_{Motor}	n_2 (50 Hz)			T_2			i_{tot}			see page
kW (50 Hz)	rpm			Nm						
Helical geared motors E, D, and Z										
0.09	3.00	...	6.7	285	...	128.0	208.77	...	133.57	2/8
0.12	0.05	...	313.0	15 788	...	3.7	28 260.00	...	4.47	2/8 … 2/11
0.18	0.06	...	383.0	23 784	...	4.5	24 996.00	...	3.58	2/11 … 2/15
0.25	0.08	...	405.0	23 171	...	5.9	16 361.00	...	3.33	2/15 … 2/19
0.37	0.12	...	383.0	24 391	...	9.2	11 066.00	...	3.58	2/19 … 2/22
0.55	0.20	...	414.0	23 625	...	13.0	7 008.00	...	3.31	2/22 … 2/26
0.75	0.27	...	560.0	23 327	...	13.0	5 107.00	...	2.50	2/26 … 2/30
1.1	0.40	...	906.0	23 626	...	12.0	3 580.00	...	1.59	2/30 … 2/34
1.5	0.54	...	906.0	24 171	...	16.0	2 666.00	...	1.59	2/34 … 2/39
2.2	0.85	...	944.0	22 590	...	22.0	1 682.00	...	1.52	2/39 … 2/44
3	1.10	...	1 018.0	23 069	...	28.0	1 255.00	...	1.41	2/44 … 2/49
4	1.60	...	1 021.0	21 939	...	37.0	896.00	...	1.41	2/49 … 2/54
5.5	1.90	...	1 025.0	25 081	...	51.0	746.00	...	1.41	2/54 … 2/59
7.5	2.70	...	1 032.0	24 896	...	69.0	546.00	...	1.41	2/59 … 2/59
9.2	5.70	...	1 032.0	15 282	...	85.0	253.08	...	1.41	2/64 … 2/67
11	4.40	...	1 035.0	24 093	...	101.0	243.82	...	1.41	2/67 … 2/70
15	6.00	...	1 074.0	23 923	...	133.0	243.82	...	1.36	2/70 … 2/74
18.5	7.10	...	1 081.0	24 799	...	163.0	206.34	...	1.36	2/74 … 2/77
22	9.60	...	1 077.0	21 959	...	195.0	153.12	...	1.36	2/77 … 2/80
30	12.10	...	1 085.0	23 633	...	264.0	121.67	...	1.36	2/80 … 2/83
37	14.60	...	1 081.0	24 268	...	327.0	100.96	...	1.36	2/83 … 2/85
45	18.30	...	1 085.0	23 533	...	396.0	80.77	...	1.36	2/85 … 2/88
55	21.00	...	902.0	24 634	...	582.0	69.41	...	1.64	2/88 … 2/89
75	35.00	...	512.0	20 716	...	1 399.0	42.95	...	2.90	2/89 … 2/91
90	35.00	...	512.0	24 859	...	1 678.0	42.95	...	2.90	2/91 … 2/92
110	88.00	...	180.0	11 887	...	5 852.0	16.86	...	8.30	2/92
132	88.00	...	179.0	14 312	...	7 046.0	16.86	...	8.30	2/92
160	88.00	...	179.0	17 348	...	8 540.0	16.86	...	8.30	2/92
200	88.00	...	180.0	21 612	...	10 640.0	16.86	...	8.30	2/92
Parallel shaft geared motors FZ and FD										
0.09	2.30	...	4.7	367	...	184.0	280.41	...	191.34	3/6
0.12	0.05	...	111	16 202	...	10.0	29 000.00	...	12.62	3/6 … 3/9
0.18	0.05	...	210	24 072	...	8.2	25 299.00	...	6.53	3/9 … 3/12
0.25	0.09	...	355	22 462	...	6.7	15 519.00	...	3.80	3/12 … 3/15
0.37	0.13	...	73	23 944	...	49.0	10 863.00	...	18.86	3/15 … 3/15
0.55	0.19	...	170	24 147	...	31.0	7 163.00	...	8.06	3/18 … 3/20
0.75	0.28	...	368	22 934	...	19.0	5 021.00	...	3.80	3/20 … 3/23
1.1	0.38	...	379	24 675	...	28.0	3 739.00	...	3.80	3/23 … 3/26
1.5	0.61	...	379	21 388	...	38.0	2 359.00	...	3.80	3/26 … 3/26
2.2	0.82	...	372	23 638	...	56.0	1 760.00	...	4.33	3/30 … 3/33
3	1.2	...	639	22 720	...	45.0	1 236.00	...	3.80	3/33 … 3/33
4	1.4	...	671	24 905	...	57.0	1 030.00	...	4.33	3/37 … 3/39
5.5	2.4	...	364	22 097	...	144.0	403.86	...	3.97	3/39 … 3/42
7.5	3.0	...	738	24 243	...	97.0	403.86	...	3.97	3/42 … 3/45
9.2	4.9	...	305	18 067	...	288.0	299.20	...	4.77	3/45 … 3/47
11	3.0	...	306	35 066	...	343.0	299.20	...	4.77	3/47 … 3/49
15	3.5	...	306	40 468	...	468	248.85	...	4.77	3/49 … 3/51
18.5	4.5	...	259	39 601	...	683	242.01	...	5.68	3/51 … 3/53
22	5.5	...	386	37 909	...	545	242.01	...	3.80	3/53 … 3/55
30	6.7	...	388	42 449	...	738	218.54	...	3.80	3/55 … 3/56

MOTOX Geared Motors
Introduction

Guide to selecting and ordering geared motors

1

■ **Determining the gearbox type in accordance with the power rating and output speed** (continued)

Power rating	Output speed			Torque			Gearbox ratio			For further information,
P_{Motor}	n_2 (50 Hz)			T_2			i_{tot}			see page
kW (50 Hz)	rpm			Nm						
Parallel shaft geared motors FZ and FD										
37	8.4	...	387	42 287	...	913	175.92	...	3.80	3/56 ... 3/58
45	11.0	...	388	39 088	...	1 106	134.16	...	3.80	3/58 ... 3/59
55	14.8	...	280	35 564	...	1 874	100.21	...	5.28	3/59 ... 3/59
75	18.5	...	281	38 668	...	2 547	80.17	...	5.28	3/61
90	22.0	...	281	39 878	...	3 056	68.90	...	5.28	3/61 ... 3/62
110	28.0	...	179	37 832	...	5 880	53.66	...	8.34	3/62 ... 3/63
132	35.0	...	178	36 188	...	7 080	42.63	...	8.34	3/63
160	38.0	...	178	39 965	...	8 581	38.84	...	8.34	3/63
200	49.0	...	179	38 777	...	10 691	30.25	...	8.34	3/63 ... 3/63
Bevel helical geared motors B and K										
0.09	3.70	...	7.2	231	...	120.0	179.13	...	124.78	4/6
0.12	0.05	...	187.0	16 836	...	6.1	30 135.00	...	7.49	4/6 ... 4/9
0.18	0.06	...	277.0	23 014	...	6.2	24 187.00	...	4.94	4/9 ... 4/12
0.25	0.08	...	378.0	24 007	...	6.3	16 951.00	...	3.57	4/12 ... 4/15
0.37	0.12	...	93.0	24 723	...	38.0	11 463.00	...	14.75	4/15 ... 4/18
0.55	0.19	...	300.0	24 353	...	18.0	7 224.00	...	4.56	4/18 ... 4/21
0.75	0.26	...	392.0	24 688	...	18.0	5 405.00	...	3.57	4/21 ... 4/25
1.1	0.42	...	403.0	22 504	...	26.0	3 410.00	...	3.57	4/25 ... 4/25
1.5	0.55	...	403.0	23 582	...	36.0	2 601.00	...	3.57	4/29 ... 4/32
2.2	0.77	...	374.0	25 008	...	56.0	1 862.00	...	3.84	4/32 ... 4/35
3	1.10	...	402.0	23 639	...	71.0	1 286.00	...	3.57	4/35 ... 4/38
4	1.50	...	255.0	23 702	...	142.0	968.00	...	5.36	4/38 ... 4/41
5.5	2.20	...	270.0	22 492	...	195.0	669.00	...	5.36	4/41 ... 4/43
7.5	2.70	...	271.0	24 988	...	264.0	548.00	...	5.36	4/43 ... 4/45
9.2	3.40	...	263.0	24 013	...	335.0	429.00	...	5.54	4/45 ... 4/47
11	4.20	...	264.0	25 035	...	399.0	191.34	...	5.54	4/47 ... 4/49
15	6.00	...	264.0	23 790	...	544.0	191.34	...	5.54	4/49 ... 4/50
18.5	7.70	...	207.0	22 997	...	853.0	191.34	...	7.10	4/50 ... 4/52
22	8.50	...	303.0	24 779	...	693.0	172.78	...	4.83	4/52 ... 4/53
30	12.30	...	305.0	23 340	...	938.0	120.16	...	4.83	4/53 ... 4/54
37	15.40	...	304.0	22 951	...	1 161.0	95.48	...	4.83	4/54 ... 4/54
45	18.60	...	305.0	23 084	...	1 407.0	79.23	...	4.83	4/56 ... 4/57
55	23.00	...	306.0	22 493	...	1 714.0	63.38	...	4.83	4/57
75	35.00	...	225.0	20 465	...	3 188.0	42.43	...	6.61	4/58
90	35.00	...	225.0	24 558	...	3 826.0	42.43	...	6.61	4/58
110	76.00	...	123.0	13 790	...	8 531.0	19.56	...	12.10	4/59
132	76.00	...	123.0	16 604	...	10 272.0	19.56	...	12.10	4/59
160	76.00	...	123.0	20 126	...	12 450.0	19.56	...	12.10	4/59
200	76.00	...	123.0	25 074	...	15 511.0	19.56	...	12.10	4/59
Helical worm geared motors C										
0.09	2.00	...	4	241	...	125	320.67	...	223.36	5/7
0.12	0.21	...	55	1 913	...	19	6 722.00	...	25.28	5/7 ... 5/9
0.18	0.37	...	54	1 885	...	29	3 719.00	...	25.28	5/9 ... 5/10
0.25	0.60	...	53	1 782	...	41	2 256.00	...	25.28	5/10 ... 5/12
0.37	0.91	...	54	1 918	...	60	1 510.00	...	25.28	5/12 ... 5/14
0.55	1.7	...	68	1 870	...	68	440.70	...	20.31	5/14 ... 5/14
0.75	2.4	...	145	1 969	...	44	440.70	...	9.67	5/15 ... 5/16
1.1	3.7	...	149	1 983	...	62	390.00	...	9.67	5/16 ... 5/18
1.5	5.8	...	149	1 779	...	85	247.00	...	9.67	5/18 ... 5/20
2.2	11.4	...	148	1 355	...	125	126.18	...	9.67	5/20 ... 5/21

Determining the gearbox type in accordance with the power rating and output speed (continued)

Power rating	Output speed			Torque			Gearbox ratio			For further information,
P_{Motor}	n_2 (50 Hz)			T_2			i_{tot}			see page
kW (50 Hz)	rpm			Nm						
Helical worm geared motors C										
3	14.6	…	148	1 668	…	170	98.17	…	9.67	5/21 … 5/22
4	22.0	…	149	1 482	…	227	65.32	…	9.67	5/22 … 5/23
5.5	34.0	…	130	1 302	…	367	41.85	…	11.15	5/23 ... 5/24
7.5	62.0	…	130	992	…	497	23.56	…	11.15	5/24
9.2	109.0	…	130	732	…	609	13.39	…	11.15	5/24
11	109.0	…	131	872	…	726	13.39	…	11.15	5/24
Worm geared motors S										
0.09	8.5	…	21.2	46.2	…	23.5	100	…	40	6/5
0.12	13.5	…	270	40.3	…	3.8	100	…	5	6/5 ... 6/6
0.18	10.6	…	564	82.0	…	2.8	100	…	5	6/6 ... 6/7
0.25	14.3	…	566	94.9	…	3.8	80	…	5	6/7 ... 6/8
0.37	22.8	…	548	90.9	…	5.9	60	…	5	6/8
0.55	46.5	…	560	82.1	…	8.6	30	…	5	6/8
0.75	70.0	…	574	81.9	…	11.6	30	…	5	6/9
1.1	143.0	…	572	59.4	…	17.0	20	…	5	6/9

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Guide to selecting and ordering geared motors

■ **Determining the gearbox type in accordance with the max. torque, transmission ratio, and size**

Max. gearbox torque Nm	Gearbox type	Order No.	Transmission ratio			For further information, see page
	Helical gearbox E					
82	E38	2KJ1001	1.59	...	9.33	2/93
170	E48	2KJ1002	1.52	...	11.30	2/93
250	E68	2KJ1003	1.41	...	12.40	2/94
450	E88	2KJ1004	1.71	...	10.33	2/94
745	E108	2KJ1005	1.81	...	5.46	2/95
1 000	E128	2KJ1006	1.36	...	10.14	2/95
1 550	E148	2KJ1007	1.64	...	13.67	2/95
	Helical gearbox Z					
90	Z18	2KJ1100	3.58	...	43.15	2/96
140	Z28	2KJ1101	3.33	...	51.35	2/97
220	Z38	2KJ1102	4.77	...	44.12	2/99
450	Z48	2KJ1103	4.28	...	51.28	2/101
800	Z68	2KJ1104	3.49	...	48.09	2/103
1 680	Z88	2KJ1105	3.11	...	50.73	2/105
3 100	Z108	2KJ1106	3.42	...	59.05	2/107
5 100	Z128	2KJ1107	3.07	...	44.19	2/109
8 000	Z148	2KJ1108	4.44	...	57.50	2/111
14 000	Z168	2KJ1110	4.46	...	46.61	2/113
20 000	Z188	2KJ1111	8.30	...	52.35	2/115
220	Z38 - Z28	2KJ1112	207.00	...	1 258.00	2/98
220	Z38 - D28	2KJ1113	1 343.00	...	5 905.00	2/98
	Helical gearbox D					
90	D18	2KJ1200	32.26	...	200.36	2/96
140	D28	2KJ1201	48.38	...	241.05	2/97
220	D38	2KJ1202	30.74	...	191.75	2/99
450	D48	2KJ1203	35.59	...	208.77	2/101
800	D68	2KJ1204	37.80	...	281.01	2/103
1 680	D88	2KJ1205	34.14	...	300.41	2/105
3 100	D108	2KJ1206	42.61	...	359.30	2/107
5 100	D128	2KJ1207	37.57	...	268.16	2/109
8 000	D148	2KJ1208	34.15	...	336.11	2/111
14 000	D168	2KJ1210	40.99	...	341.61	2/113
20 000	D188	2KJ1211	42.95	...	243.82	2/115
450	D48 - Z28	2KJ1212	223.00	...	5 019.00	2/100
450	D48 - D28	2KJ1213	5 608.00	...	27 940.00	2/100
800	D68 - Z28	2KJ1214	320.00	...	7 548.00	2/102
800	D68 - D28	2KJ1215	8 422.00	...	41 961.00	2/102
800	D88 - Z28	2KJ1218	341.00	...	8 305.00	2/104
800	D88 - D28	2KJ1220	9 279.00	...	46 233.00	2/104
3 100	D108 - Z38	2KJ1223	392.00	...	15 853.00	2/106
3 100	D108 - D38	2KJ1224	15 280.00	...	68 896.00	2/106
5 100	D128 - Z38	2KJ1225	1 280.00	...	51 420.00	2/108
5 100	D128 - D38	2KJ1226	11 404.00	...	51 420.00	2/108
5 100	D128 - Z48	2KJ1227	285.00	...	1 271.00	2/108
8 000	D148 - Z38	2KJ1228	1 604.00	...	14 830.00	2/110
8 000	D148 - D38	2KJ1230	14 294.00	...	64 450.00	2/110
8 000	D148 - Z48	2KJ1231	398.00	...	1 631.00	2/110
14 000	D168 - Z48	2KJ1232	1 463.00	...	17 519.00	2/112
14 000	D168 - D48	2KJ1233	17 080	...	71 317	2/112
14 000	D168 - Z68	2KJ1234	376	...	1 226	2/112
20 000	D188 - Z48	2KJ1235	1 044	...	12 504	2/114

Determining the gearbox type in accordance with the max. torque, transmission ratio, and size (continued)

Max. gearbox torque Nm	Gearbox type	Order No.	Transmission ratio		For further information, see page
	Helical gearbox D				
20 000	D188 - D48	2KJ1236	12 191	... 50 901	2/114
20 000	D188 - Z68	2KJ1237	322	... 896	2/114
	Parallel shaft gearbox FZ				
150	FZ28	2KJ1300	56.20	... 280.00	3/65
290	FZ38B	2KJ1301	4.52	... 56.72	3/67
540	FZ48B	2KJ1302	4.33	... 60.71	3/69
1 000	FZ68B	2KJ1303	3.97	... 61.17	3/71
1 900	FZ88B	2KJ1304	4.77	... 64.58	3/73
3 400	FZ108B	2KJ1305	5.68	... 64.21	3/75
6 100	FZ128B	2KJ1306	3.80	... 56.42	3/77
9 000	FZ148B	2KJ1307	5.39	... 68.23	3/79
14 000	FZ168B	2KJ1308	5.28	... 53.48	3/81
20 000	FZ188B	2KJ1310	8.34	... 52.63	3/83
32 681	FZ208	2KJ1311	9.01	... 20.06	3/85
290	FZ38B - Z28	2KJ1313	303.00	... 1 617.00	3/66
290	FZ38B - D28	2KJ1314	1 726.00	... 7 591.00	3/66
	Parallel shaft gearbox FD				
150	FD28	2KJ1400	3.80	... 59.65	3/65
290	FD38B	2KJ1401	56.28	... 280.41	3/67
540	FD48B	2KJ1402	43.09	... 268.80	3/69
1 000	FD68B	2KJ1403	50.48	... 296.18	3/71
1 900	FD88B	2KJ1404	54.47	... 404.92	3/73
3 400	FD108B	2KJ1405	48.24	... 424.49	3/75
6 100	FD128B	2KJ1406	53.13	... 447.96	3/77
9 000	FD148B	2KJ1407	62.93	... 449.21	3/79
14 000	FD168B	2KJ1408	41.85	... 369.26	3/81
20 000	FD188B	2KJ1410	48.46	... 403.86	3/83
34 000	FD208	2KJ1411	24.03	... 242.01	3/85
540	FD48B - Z28	2KJ1413	299.00	... 4 197.00	3/68
540	FD48B - D28	2KJ1414	4 480.00	... 19 701.00	3/68
1 000	FD68B - Z28	2KJ1417	317.00	... 4 454.00	3/70
1 000	FD68B - D28	2KJ1418	4 755.00	... 39 638.00	3/70
1 900	FD88B - Z28	2KJ1422	461.00	... 6 000.00	3/72
1 900	FD88B - D28	2KJ1423	6 703.00	... 54 705.00	3/72
3 400	FD108B - Z38	2KJ1426	466.00	... 15 230.00	3/74
3 400	FD108B - D38	2KJ1427	16 603.00	... 66 190.00	3/74
6 100	FD128B - Z38	2KJ1428	1 970.00	... 15 663.00	3/76
6 100	FD128B - D38	2KJ1430	17 075.00	... 68 070.00	3/76
6 100	FD128B - Z48	2KJ1431	439.00	... 1 504.00	3/76
9 000	FD148B - Z38	2KJ1432	1 757.00	... 16 239.00	3/78
9 000	FD148B - D38	2KJ1433	17 704.00	... 70 576.00	3/78
9 000	FD148B - Z48	2KJ1434	477.00	... 1 634.00	3/78
14 000	FD168B - Z48	2KJ1435	1 337.00	... 16 007.00	3/80
14 000	FD168B - D48	2KJ1436	17 454.00	... 65 160.00	3/80
14 000	FD168B - Z68	2KJ1437	398.00	... 1 298.00	3/82
20 000	FD188B - Z48	2KJ1438	1 465.00	... 17 537.00	3/82
20 000	FD188B - D48	2KJ1440	19 122.00	... 71 388.00	3/82
20 000	FD188B - Z68	2KJ1441	444.00	... 1 449.00	3/82
34 000	FD208 - Z68	2KJ1442	766.00	... 8 251.00	3/84
34 000	FD208 - D68	2KJ1443	9 924.00	... 61 412.00	3/84
34 000	FD208 - Z88	2KJ1444	284.00	... 694.00	3/84

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Guide to selecting and ordering geared motors

■ **Determining the gearbox type in accordance with the max. torque, transmission ratio, and size** (continued)

Max. gearbox torque	Gearbox type	Order No.	Transmission ratio			For further information,
Nm						see page
Bevel helical gearbox B and K						
130	B28	2KJ1500	3.57	...	57.53	4/60
250	B38	2KJ1501	3.84	...	65.69	4/61
250	K38	2KJ1502	5.65	...	179.13	4/63
450	K48	2KJ1503	7.22	...	169.53	4/65
820	K68	2KJ1504	5.36	...	243.72	4/67
1 650	K88	2KJ1505	5.54	...	302.68	4/69
3 000	K108	2KJ1506	7.68	...	307.24	4/71
4 700	K128	2KJ1507	7.10	...	295.38	4/73
8 000	K148	2KJ1508	4.83	...	306.08	4/75
13 500	K168	2KJ1510	6.61	...	287.95	4/77
20 000	K188	2KJ1511	12.10	...	191.34	4/79
250	K38 - Z28	2KJ1514	181.00	...	2 797.00	4/62
250	K38 - D28	2KJ1515	2 986.00	...	13 129.00	4/62
450	K48 - Z28	2KJ1516	181.00	...	2 798.00	4/64
450	K48 - D28	2KJ1517	2 987.00	...	13 135.00	4/64
820	K68 - Z28	2KJ1518	277.00	...	4 282.00	4/66
820	K68 - D28	2KJ1520	4 572.00	...	20 103.00	4/66
1 650	K88 - Z28	2KJ1523	344.00	...	5 309.00	4/68
1 650	K88 - D28	2KJ1524	5 667.00	...	24 920.00	4/68
3 000	K108 - Z38	2KJ1527	1 466.00	...	13 556.00	4/70
3 000	K108 - D38	2KJ1528	13 066.00	...	58 914.00	4/70
3 000	K108 - Z48	2KJ1530	301.00	...	1 343.00	4/70
4 700	K128 - Z38	2KJ1531	1 410.00	...	13 032.00	4/72
4 700	K128 - D38	2KJ1532	12 562.00	...	56 640.00	4/72
4 700	K128 - Z48	2KJ1533	313.00	...	1 400.00	4/72
8 000	K148 - Z38	2KJ1534	1 466.00	...	13 505.00	4/74
8 000	K148 - D38	2KJ1535	13 017.00	...	58 692.00	4/74
8 000	K148 - Z68	2KJ1536	296.00	...	1 392.00	4/74
13 500	K168 - Z48	2KJ1537	1 233.00	...	14 767.00	4/76
13 500	K168 - D48	2KJ1538	14 397.00	...	60 115.00	4/76
13 500	K168 - Z68	2KJ1540	317.00	...	1 033.00	4/76
20 000	K188 - Z68	2KJ1541	669.00	...	9 201.00	4/78
20 000	K188 - D68	2KJ1542	8 689.00	...	53 767.00	4/78
20 000	K188 - Z88	2KJ1543	225.00	...	669.00	4/78
Helical worm gearbox C						
118	C28	2KJ1600	25.28	...	372.00	5/25 … 5/26
243	C38	2KJ1601	9.67	...	320.67	5/28 … 5/30
387	C48	2KJ1602	9.67	...	320.67	5/32 … 5/34
687	C68	2KJ1603	11.67	...	364.00	5/36 … 5/38
1 590	C88	2KJ1604	11.15	...	440.70	5/40 … 5/42
225	C38 - Z28	2KJ1605	324.00	...	4 222.00	5/27
222	C38 - D28	2KJ1606	4 717.00	...	23 503.00	5/27
369	C48 - Z28	2KJ1607	324.00	...	4 222.00	5/31
364	C48 - D28	2KJ1608	4 717.00	...	23 503.00	5/31
680	C68 - Z28	2KJ1610	398.00	...	5 066.00	5/35
675	C68 - D28	2KJ1611	5 661.00	...	28 203.00	5/35
1 590	C88 - Z28	2KJ1614	6 722.00	...	33 491.00	5/39
1 590	C88 - D28	2KJ1615	462.00	...	6 016.00	5/39
Worm gearbox S						
33	S08	2KJ1730	5	...	80	6/10 ... 6/10
64	S18	2KJ1731	5	...	80	6/10 ... 6/10
116	S28	2KJ1732	5	...	100	6/10 ... 6/10

Overview of "special versions"

Order code	Special version Designation	For further information, see page
Input units		
A00	Input unit A with free input shaft	7/3, 7/30
A03	Input unit K2 (coupling lantern) with flexible coupling for connecting an IEC motor	7/3, 7/20
A04	Input unit K4 (short coupling lantern) with clamp connection for connecting an IEC motor	7/3, 7/23
A07	Input unit KQ (lantern for servomotor) with zero-free, flexible coupling for connecting a servomotor (with feather key)	7/3, 7/28
A08	Input unit KQS attachment (lantern for servomotor) with zero-free, flexible coupling for connecting a servomotor (with plain shaft)	7/3, 7/28
A09	Input unit P with free input shaft and piggy back for connecting an IEC motor	7/3, 7/33
A10	Input unit PS with free input shaft, piggy back and protective belt cover	7/3
N61	Size index .2 for KQ/KQS coupling lantern for servomotor	7/3
N62	Size index .3 for KQ/KQS coupling lantern for servomotor	7/3
N63	Size index .4 for KQ/KQS coupling lantern for servomotor	7/3
Backstop in the input unit		
A15	Backstop X	7/18
Coupling types and input unit options		
A16	Flexible coupling	7/3
A17	Friction clutch	7/18
A18	Proximity switch	7/18
A19	Speed monitor	7/18
Piggy back position		
A22	3h	7/33
A23	9h	7/33
A24	12h	7/33
Brake type		
B00 to B66	Brake types according to size and braking torque	8/29 … 8/30
Brake design		
C01	Enclosed brake	8/42
C02	Manual brake release lever	8/39
C03	Manual brake release lever with locking mechanism	8/39
C04	Microswitch for release monitoring	8/38
C06	Reduced-noise rotor-hub connection and wear-resistant friction lining	8/36
C09	Basic anti-corrosion protection	8/42
C10	Increased anti-corrosion protection	8/42
C11	Enclosed brake with condensation drain hole	8/42
Manual brake release lever position		
C26	1	8/39
C27	2	8/39
C28	3	8/39
C29	4	8/39
Brake control voltage		
C46 ... C70	Brake standard voltage	8/32
Mounting types / mounting positions		
D00 to E17	Geared motor mounting types and mounting positions	2/119 ... 2/129, 3/92 ... 3/95, 4/87 ... 4/91, 5/47 ... 5/49, 6/15
Torque arm figure		
G09	Figure 1	4/81, 5/44
G10	Figure 2	4/81, 5/44
Output shaft bearings		
G20	Radially reinforced output shaft bearings	2/133, 3/99, 4/95, 5/53

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Guide to selecting and ordering geared motors

Overview of "special versions" (continued)

Order code	Special version Designation	For further information, see page
	Output sealing	
G22 + G31	Double radial shaft seal	2/132, 3/98, 4/94, 5/52
G23	Double sealing MSS1	2/132, 3/98, 4/94, 5/52
G24	Combination shaft sealing	2/132, 3/98, 4/94, 5/52
G25	High temperature resistant sealing	2/132, 3/98, 4/94, 5/52
	Oil level control	
G34	Oil sight glass	2/130, 3/96, 4/93, 5/50
	Gearbox ventilation	
G44	Vent filter	2/131, 3/97, 4/93, 5/51
G45	Pressure ventilation valve	2/131, 3/97, 4/93, 5/51
	Oil drain	
G53	Magnetic oil drain plug	2/131, 3/97, 4/94, 5/51
G54	Oil drain valve, straight	2/131, 3/97, 4/94, 5/51
	Hollow-shaft cover	
G60	Steel protection cover	3/99, 4/95, 5/52
G61	Steel protection cover (ATEX)	3/99, 4/95, 5/52
G62	Protection cover	3/99, 4/95, 5/52
G63	Protection cover (ATEX)	3/99, 4/95, 5/52
	Backstop for bevel helical gearbox	
G72	Backstop (gearbox)	4/96
	Options for gearbox output shafts	
G73	2nd shaft extension (output shaft on both sides)	4/96, 5/53, 6/16
	Dry-well options for mixer and agitator drives	
G89	Dry-well design with sight glass	2/133, 3/100, 4/97
G90	Dry-well design with sensor	2/133, 3/100, 4/97
	Reduced-backlash version	
G99	Reduced-backlash version	1/23, 2/93, 3/65, 4/62
	Flange diameter	
H01 to H06	Flange diameter	2/118, 3/91, 4/86, 5/46, 6/14
	Degree of protection	
K01	IP 55	8/8
K02	IP 56	8/8
K03	IP 65	8/8
	Lubricants	
K06	CLP ISO VG 220 - Mineral oil	1/46, 2/130, 3/94, 4/92
K07	CLP ISO PG VG 220 - Synthetic oil	1/46, 2/130, 3/96, 4/92
K08	CLP ISO PG VG 460 - Synthetic oil	1/46, 2/130, 3/96, 4/92, 5/50, 6/16
K10	CLP ISO E VG 220 - Biologically degradable oil	1/46, 2/130, 3/96, 4/92, 5/50
K11	CLP ISO H1 VG 460 - Oil for use in the food industry	1/46, 2/130, 3/96, 4/92, 5/50, 6/16
K12	CLP ISO PAO VG 220 - Oil for low temperature usage	1/46, 2/130, 3/96, 4/92, 5/50
K13	CLP ISO PAO VG 68 - Oil for lowest temperature usage	1/46, 2/130, 3/96, 4/92
	Long-term preservation	
K17	Long-term preservation up to 36 months	1/46
	Direction of rotation of the output shaft (required with backstop)	
K18	Clockwise	1/43, 4/96
K19	Counterclockwise	1/43, 4/96
	Rating plate and additional rating plates	
K26	Rating plate on stainless steel support plate	1/49
K41	2nd rating plate, enclosed separately	1/49
K68	2nd rating plate, mounted	1/49

Overview of "special versions" (continued)

Order code	Special version	For further information,
	Designation	see page
Surface treatment		
L00	Unpainted	1/48
L01	Primed according to corrosion category C2 G	1/48
L02	Surface protection for normal environmental stress	1/47
L03	Surface protection for minimal environmental stress	1/47
L04	Surface protection for medium environmental stress	1/47
L05	Surface protection for extremely high environmental stress	1/47
L09	Primed according to corrosion category C4 G	1/48
L19	Special pre-treatment before painting	1/48
L20	Surface protection for high environmental stress	1/47
RAL colors		
L50	RAL 5015 Sky blue	1/48
L51	RAL 7011 Steel gray	1/48
L53	RAL 7031 Blue gray	1/48
L54	RAL 7035 Light gray	1/48
L55	RAL 7030 Stone gray	1/48
	Other colors can be selected by entering order code Y80 and plain text	1/48
Insulating material class		
M08	Temperature class 180 (H)	8/25
M09	Special insulation for inverter-fed operation up to 690 V	8/25
Thermal motor protection		
M10	PTC thermistor for disconnection	8/23
M11	PTC thermistor for warning and disconnection	8/23
M12	Winding thermostat for disconnection (WT)	8/23
M13	Winding thermostat for warning and disconnection for sizes 71 to 200 (WT)	8/23
M16	KTY 84-130 temperature sensor	8/24
Fan		
M21	Metal fan	8/9
M22	High inertia fan	8/9
M23	External fan	8/10
Anti-condensation heating		
M40	115 V supply voltage	8/24
M41	230 V supply voltage	8/24
Terminal box position		
M55 to M86	Location and position of the terminal box	8/11
ECOFAST motor plugs		
N04	ECOFAST motor plug HAN 10E (single-bracket lock)	8/18
N05	ECOFAST motor plug HAN 10E with counterplug HAN 10B (single-bracket lock)	8/18
N06	ECOFAST motor plug HAN 10E, EMC design (single-bracket lock)	8/18
N07	ECOFAST motor plug HAN 10E with counterplug HAN 10B, EMC design (single-bracket lock)	8/18
Canopy		
N22	Canopy	8/8
Backstop on motor		
N23	Motor backstop	8/63
2nd shaft extension on motor		
N39	2nd shaft extension	8/64
Handwheel		
N40	Handwheel	8/65
Motor side B, can be retrofitted		
N48	Motor side B, can be retrofitted	8/2

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■ **Overview of "special versions"** (continued)

Order code	Special version Designation	For further information, see page
	Additional feet	
N49	Additional feet	8/65
	Designs in accordance with standards and specifications	
N30	Design in accordance with GOST-R	1/40, 8/3
N36	Design in accordance with CSA	1/40, 8/3
N37	Design in accordance with UL-R	1/40, 8/3
N38	Design in accordance with UL-R and CSA	1/40, 8/3
N65	Design in accordance with NEMA (electrical)	1/39, 8/3
N67	Design in accordance with CCC	1/40, 8/3
N69	Design in accordance with China Energy Efficiency Label	1/40, 8/3
	Versions for special environmental conditions	
N41	Motor-internal anti-corrosion protection	8/19
	Protection against humidity and acid	
N43	Increased protection against humidity and tropical climate	1/48
N44	Increased protection against acid and alkali	1/48
N54	Motor winding protection against humidity and acid	8/26
	External earthing	
N53	External earthing	8/19
	Motors prepared for encoder mounting	
N50	Encoder mounting prepared	8/60
	Pole number of the motor	
P00	2-pole	8/68, 8/68, 8/96
P01	6-pole	8/70, 8/84, 8/70, 8/98, 8/102, 8/132, 8/136, 8/132, 8/136
P02	8-pole	8/72, 8/86, 8/104, 8/122, 8/128
P04	4/2-pole	8/74, 8/106
P08	8/4-pole	8/76, 8/78
P07	8/2-pole	8/80
	Gateways EnDAT for absolute encoders	
Q02	Gateway EnDAT Profibus DP	8/63
Q03	Gateway EnDAT CANopen	8/63
Q04	Gateway EnDAT DeviceNET	8/63
	Incremental encoder IN	
Q44	Rotary pulse encoder 1XP8032-20 (IN 1024 TTL with coupling socket)	8/51
Q45	Rotary pulse encoder 1XP8032-21 (IN 2048 TTL with coupling socket)	8/51
Q46	Rotary pulse encoder 1XP8032-22 (IN 512 TTL with coupling socket)	8/51
Q47	Rotary pulse encoder 1XP8032-10 (IN 1024 HTL with coupling socket)	8/51
Q48	Rotary pulse encoder 1XP8032-11 (IN 2048 HTL with coupling socket)	8/51
Q49	Rotary pulse encoder 1XP8032-12 (IN 512 HTL with coupling socket)	8/51
Q50	Rotary pulse encoder 1XP8012-20 (IN 1024 TTL with flange socket)	8/50
Q51	Rotary pulse encoder 1XP8012-21 (IN 2048 TTL with flange socket)	8/50
Q52	Rotary pulse encoder 1XP8012-22 (IN 512 TTL with flange socket)	8/50
Q53	Rotary pulse encoder 1XP8012-10 (IN 1024 HTL with flange socket)	8/50
Q54	Rotary pulse encoder 1XP8012-11 (IN 2048 HTL with flange socket)	8/50
Q55	Rotary pulse encoder 1XP8012-12 (IN 512 HTL with flange socket)	8/50
Q56	Rotary pulse encoder 1XP8022-20 (IN 1024 TTL with cable terminal box)	8/52
Q57	Rotary pulse encoder 1XP8022-21 (IN 2048 TTL with cable terminal box)	8/52
Q58	Rotary pulse encoder 1XP8022-22 (IN 512 TTL with cable terminal box)	8/52
Q59	Rotary pulse encoder 1XP8022-10 (IN 1024 HTL with cable terminal box)	8/52
Q60	Rotary pulse encoder 1XP8022-11 (IN 2048 HTL with cable terminal box)	8/52
Q61	Rotary pulse encoder 1XP8022-12 (IN 512 HTL with cable terminal box)	8/52

Overview of "special versions" (continued)

Order code	Special version	For further information,
	Designation	see page
	Cable terminal boxes for encoders 1XP8012, 1XP8032, 1XP8013, 1XP8023.1XP8014 and 1XP8024	
Q62	Connector	8/61
Q69	Cable with connector and ferrules, 2 m	8/61
Q70	Cable with connector and ferrules, 8 m	8/61
Q71	Cable with connector and ferrules, 15 m	8/61
Q72	Cable with coupling socket, 2 m	8/62
Q73	Cable with coupling socket, 8 m	8/62
Q74	Cable with coupling socket, 15 m	8/62
	Cable terminal boxes for encoders 1XP8022	
Q63	Cable with ferrules, 2 m	8/61
Q64	Cable with ferrules, 8 m	8/61
Q65	Cable with ferrules, 15 m	8/61
Q66	Cable with coupling socket, 2 m	8/62
Q67	Cable with coupling socket, 8 m	8/62
Q68	Cable with coupling socket, 15 m	8/62
	Absolute encoder IA	
Q80	Absolute encoder 1XP8014-20 (IA SSI protocol with flange socket)	8/55
Q81	Absolute encoder 1XP8024-20 (IA SSI protocol cable with coupling socket)	8/55
Q82	Absolute encoder 1XP8014-10 (IA EnDAT protocol with flange socket)	8/55
Q83	Absolute encoder 1XP8024-10 (IA EnDAT protocol cable with coupling socket)	8/55
	Resolver IR	
Q85	Resolver 1XP8013-10 (IR with flange socket)	8/54
Q86	Resolver 1XP8023-11 (IR cable with coupling socket)	8/54
Q87	Resolver 1XP8013-11 (IR with flange socket)	8/54
Q88	Resolver 1XP8023-10 (IR cable with coupling socket)	8/54
	Rugged encoder	
Q92	Rotary pulse encoder LL Leine & Linde	8/57
Q93	Rotary pulse encoder HOG 9	8/58
Q94	Rotary pulse encoder HOG 10	8/59
	Mechanical protection	
Q95	Encoder under cover	8/60

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■ **Determining the drive data**

Data relating to the machine to be driven (machine type, mass, input speed, speed range, etc.) is required in order to size the machine correctly. This data is then used to determine the required power rating, torque, and input speed of the geared motor. The correct drive can be selected based on its calculated power rating and speed.

Data required for selection

The following data is required in order to select the correct gearbox:

1. Type of driven machine

2. Daily operating time h

3. Required input power kW or required torque Nm

4. Required output speed n_2 of the geared motor rpm or gearbox ratio i

5. Operating voltage V and frequency Hz

6. Operating mode, number of startings, inverter-fed operation, type of startup

7. Moment of inertia J_{Load} kgm^2 of the driving machine reduced to the motor shaft

8. Type of power transmission on gearbox shafts (direct, coupling, belt, chain, gear wheel)

9. Radial force F_r N at the input shaft and direction of force with distance from the shaft shoulder to the point of application and axial force F_{ax} [N] with direction of force

10. Ambient temperature °C

11. Degree of protection

12. Mounting position

13. Required braking torque Nm

14. Any regulations (CSA, VIK, etc.)

Efficiency of the geared motor

The efficiency of the gearbox is determined by the gear teeth, rolling-contact bearing friction, and the shaft sealing rings, among other things. The starting efficiency also has to be taken into account, particularly as regards helical worm and worm gearboxes. Efficiency may be impaired at high input speeds, if a relatively large amount of oil is used (depending on mounting position), and during cold operation in low temperature ranges.

Helical, bevel helical, and parallel shaft gearboxes

MOTOX helical, parallel shaft, and bevel helical gearboxes are extremely efficient. As a rule, efficiencies of 98 % (1-stage), 96 % (2-stage), and 94 % (3-stage) can be assumed.

Helical worm and worm gearboxes

The gear teeth of the worm gearboxes lead to high sliding friction losses at high transmission ratios. Therefore, these gearboxes can be less efficient than other types. The efficiencies of the helical worm and worm gearboxes primarily depend on the transmission ratio in question.
With helical worm gearboxes, some of the transmission ratio is realized by the helical gear stage. In this way, higher degrees of efficiency can be achieved.
For further information see the chapter dealing with helical worm gearboxes.

Self-locking with worm gearboxes

In respect of restoring torques on worm gearboxes, the efficiency is considerably reduced in comparison to standard efficiency. The restoring efficiency can be calculated as follows: $\eta' = 2 - 1/\eta$. At a standard efficiency of $\eta \leq 0.5$, worm gearboxes are usually self-locking, which is determined by the particular lead angle of the worm gear teeth.
Self-locking only occurs with certain combinations of MOTOX gearboxes and is not always of benefit, as the associated loss of efficiency is then relatively high, which in turn requires increased motor power.

A worm gearbox is "self-locking while stationary" (static self-locking), if it is not possible to start from stationary when the worm wheel is driving.
A worm gearbox is "self-braking while running" (dynamic self-locking), if it is not possible to continue running when the worm wheel is driving while the gearbox is running – that is, if the running gearbox comes to a stop while the worm wheel is driving.

Shocks can neutralize self-locking.
A self-locking gearbox is, therefore, no substitute for a brake or backstop. If you want to use the self-locking braking effect for a technical purpose, please contact us.

Run-in phase for helical worm and worm gearboxes

The tooth flanks on new helical worm and worm gearboxes will not yet be fully smoothed, meaning that the friction angle will be greater and efficiency lower during initial operation. The higher the transmission ratio, the more pronounced the effect.

The run-in procedure should take approximately 24 hours of operation at full load. In most cases, the catalog values will then be reached.

Losses of splashing

With certain gearbox mounting positions, the first stage can become completely immersed in the gear lubricant. In the case of large gearboxes with a high input speed, particularly with vertical mounting positions, this may lead to increased losses of splashing, which must not be ignored. Please contact us if you want to use such gearboxes. If at all possible, you should choose horizontal mounting positions in order to keep losses of splashing to a minimum.

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■ Determining the required service factor

The operating conditions are crucial in determining the service factor and for selecting the geared motor. These conditions are taken into account with service factor f_B.

The gearbox size or rated gear torque and the resulting service factor are not standardized and depend on the manufacturer.

In standard operation, i.e. with a uniform load provided by the driving machine, small masses to be accelerated, and a low number of startings, the service factor of $f_B = 1$ can be selected.

For different operating conditions see the tables found under "Service factor". If the motor power and the gearbox output speed are known, a gearbox type is selected with a service factor that meets the following condition.

$$f_{Btot} \leq f_B$$

For drives operating under special conditions, e.g. frequent reversing, short-time or intermittent duty, abnormal temperature ratios, reversal braking, extreme or rotating transverse forces on the gear output shaft, etc. please contact us for advice on how to design the drive configuration.

The operating conditions can vary greatly.
To determine the service factor, empirical values can be derived from the configuration of other similar applications. The driving machines can be assigned to three load groups according to their shock load. These groups can be assessed by means of their mass acceleration factor (m_{AF}).

In the case of high mass acceleration factors ($m_{AF} > 10$), a large amount of play in the transmission elements, or high transverse forces, unexpected additional loads may arise.
Please contact us in such an event.

The mass acceleration factor m_{AF} is calculated as follows:

$$m_{AF} = \frac{J_{Load}}{(J_M + J_B + J_{add})}$$

All external moments of inertia are moments of inertia of the driving machine and the gearbox, which are to be reduced to the motor speed. In most cases the moment of inertia of the gearbox has no effect and can be ignored.
The calculation is made using the following formula:

$$J_{Load} = J_2 \cdot \left(\frac{n_2}{n_1}\right)^2 = \frac{J_2}{i^2}$$

Code	Description	Unit
f_{Btot}	Service factor of the driving machine	–
f_B	Service factor of the geared motor	–
m_{AF}	Mass acceleration factor	–
J_{Load}	All external moments of inertia (based on the motor shaft)	kgm²
J_M	Moment of inertia of the motor	kgm²
J_B	Moment of inertia of the brake	kgm²
J_{add}	Additional moment of inertia (e.g. centrifugal mass or high inertia fan)	kgm²
J_2	Moment of inertia based on the output speed of the gearbox	kgm²
n_1	Input speed of the motor	rpm
n_2	Output speed of the gearbox	rpm
i	Gearbox ratio	–
DC	Relative duty cycle	%

■ Required service factor

Service factor for helical, parallel shaft, and bevel helical gearboxes

The service factor of the driving machine f_{Btot} is determined from the tables by taking the load classification, number of startings, and duration of service per day into account.
Contact our drive experts to check drive sizing in the case of high shock loads and, for example, high motor and braking torques that are greater than 2.5x the rated motor torque.

$$f_{Btot} = f_{B1}$$

Load classification for driving machines

Shock load	Driving machine
I Light shock loads	Mass acceleration factor ≤ 0.3: Electric generators, belt conveyors, apron conveyors, screw conveyors, lightweight elevators, electric hoists, machine tool feed drives, turbo blowers, centrifugal compressors, mixers and agitators for uniform densities.
II Moderate shock loads	Mass acceleration factor ≤ 3: Machine tool main drives, heavyweight elevators, turning tools, cranes, shaft ventilators, mixers and agitators for non-uniform densities, piston pumps with multiple cylinders, metering pumps.
III Heavy shock loads	Mass acceleration factor ≤ 10: Punching presses, shears, rubber kneaders, machinery used in rolling mills and the iron and steel industry, mechanical shovels, heavyweight centrifuges, heavyweight metering pumps, rotary drilling rigs, briquetting presses, pug mills.

Service factors f_{B1}:

Daily operating duration		4 hours			8 hours			16 hours			24 hours		
Starts*) / h		< 10	10 … 200	> 200	< 10	10 … 200	> 200	< 10	10 … 200	> 200	< 10	10 … 200	> 200
Shock load	I	0.8	0.9	1.0	0.9	1.0	1.1	1.0	1.1	1.2	1.2	1.3	1.5
	II	1.0	1.1	1.3	1.1	1.2	1.3	1.2	1.4	1.5	1.4	1.5	1.6
	III	1.3	1.4	1.5	1.4	1.5	1.6	1.5	1.6	1.7	1.6	1.7	1.8

*) The number of startings is calculated from the sum of times it is switched on, braking operations, and changeovers.

### *Service factors for helical worm and worm gearboxes:*

With worm gearboxes, two additional service factors are used, which take the duty cycle and ambient temperature into account. These additional factors can be determined from the graph opposite.

$$f_{Btot} = f_{B1} \cdot f_{B2} \cdot f_{B3}$$

In the standard version the gearboxes can operate at an ambient temperature of –20 °C to +40 °C.

In the case of a service factor $f_{B3} < 1$ for temperatures below 20 °C please contact us.

Service factor f_{B2} for short-time duty:
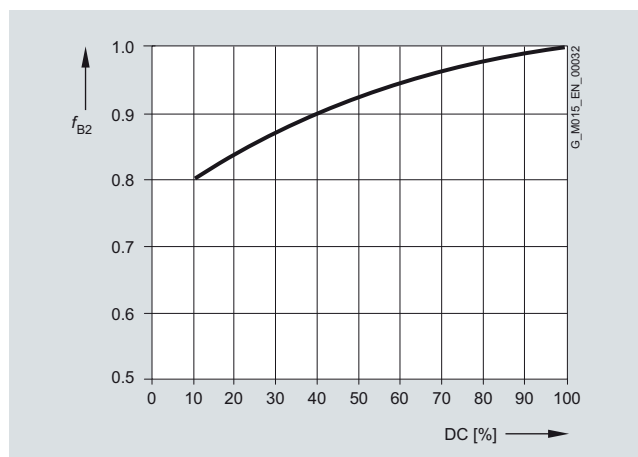
$$DC = \frac{\text{Loading time in min/h}}{60} \cdot 100$$

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Configuring guide

■ **Required service factor** (continued)

Example worm gearbox:

Mass acceleration factor 2.5 (shock load II), runtime
15 hours per day (read off at 16 hours), and 70 starts / h gives a
service factor of f_{B1} = 1.4 for service factor f_{B1} according to the
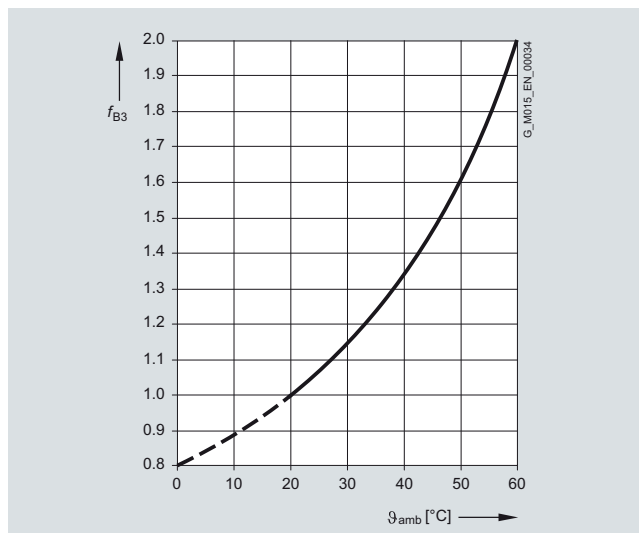table.

A load duration of 30 minutes per hour gives a duty cycle (*DC*)
of 50 %. According to the diagram, this results in a service factor
of f_B = 0.94 for service factor f_{B2}.

At an ambient temperature of ϑ_{amb} = 20 °C, the diagram gives a
service factor of f_{B3} = 1.0 for service factor f_{B3}.

So, the required service factor is
f_{Btot} = 1.4 · 0.94 · 1.0 = 1.32.

Service facor f_{B3} for the ambient temperature:

ϑ_{amb} = Ambient temperature

■ **Maximum motor speed**

At high motor speeds (>1.500 rpm) you will generally experi-
ence higher than average noise emissions and a lower than av-
erage bearing service life. This depends to a large extent on the
transmission ratio and gearbox size in question. Furthermore,
high speeds affect the thermal properties and service intervals
of the gearbox.

The maximum input speed of the gearbox is usually 3.600 rpm.
If you require higher speeds, please contact us.

■ **Ambient temperature**

In the standard version the gearboxes can operate at an
ambient temperature of –20 °C to +40 °C, if the lubricant recom-
mendations are kept. In the case of a few additional options the
category temperatures must be checked.

Other temperature ranges -10 °C ... +50 °C on request.

■ **Required torque T_{2req}**

If the drive data and the service factor are selecetd, the required
output torque can be determined.

$$T_{2req} = \frac{9550 \cdot P_1}{n_2} \cdot f_{Btot}$$

■ **Selection of the gearbox**

The following conditions need to be observed:

$P_1 \quad > P_{req}$

$T_{2rated} \quad > T_{2req}$

$f_B \quad > f_{Btot}$

$T_2 \quad > T_{req}$

Code	Description	Unit
f_{Btot}	Service factor of the driving machine	–
f_B	Service factor of the geared motor	–
P_{2m}	Input power of the motor	kW
P_{req}	Required input power	kW
T_{req}	Required torque	Nm
T_2	Output torque of the geared motor	Nm
T_{2rated}	Nominal output torque of the geared motor	Nm
T_{2req}	Required output torque of the driving machine	Nm

■ Reduced-backlash gearbox version

Helical, parallel shaft and bevel-helical gearboxes are available on request in a reduced-backlash version. In the transmission table, the torsion angle (φ) is specified for the reduced-backlash version. If a value is not specified, this gearbox cannot be realized with reduced backlash.

A high degree of positioning accuracy is achieved with reduced-backlash gearboxes and the shock loads in the gearbox are reduced at load changeover. When a gearbox is used that has a certain amount of play, the relative position of the output shaft of the gearbox cannot be determined precisely because the controller cannot detect whether the right or left flank of the tooth is engaged.

- Accurate positioning and repeatability
- Maintain position information in the case of a change of direction of rotation
- Reduced shock loading of the tooth flanks

Order code:

Reduced-backlash version   **G99**

■ Permissible radial force

Available radial force

The available radial force F_{Ravail} at the shaft journals results from the available output torque of the geared motor T and the diameter d and type of the output element (e.g. sprocket wheel).

The type of output element determines factor C (see table below), by which the available radial force is to be increased.

$$F_{Ravail} = 2000 \cdot \frac{T_2}{d} \cdot C$$

Code	Description	Unit
F_{Ravail}	Available radial force resulting from the output torque and the diameter of the output element	N
F_{Rperm}	Permissible radial force at the center of shaft extension	N
d	Diameter of the input element	mm
T_2	Output torque of the geared motor	Nm
F_{xperm1}	Permissible radial force, limited by the bearing service life, at a distance of x from the shaft shoulder	N
F_{xperm2}	Permissible radial force, limited by the shaft strength, at a distance of x from the shaft shoulder	N
C	Additional factor	–
b, d, l, y, z	Gearbox constants	mm
a	Gearbox constant	kNmm
F_{ax}	Axial force at d	N
α	Angle of action of the radial force	°
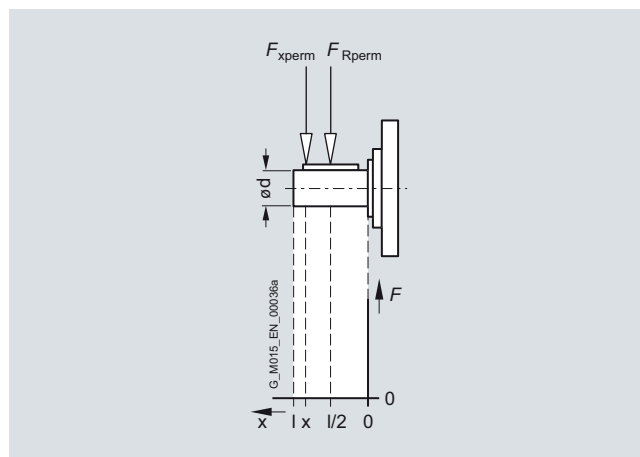
Factor C for the type of the transmission element

Transmission element	Design	C
Gear wheel	> 17 teeth	1.00
	≤ 17 teeth	1.15
Sprocket wheel	≥ 20 teeth	1.00
	14 – 19 teeth	1.25
	≤ 13 teeth	1.40
Toothed belt	Preload	1.50
V belt	Preload	2.00
Flat belt	Preload	2.50
Agitator / mixer	Rotating radial force	2.50

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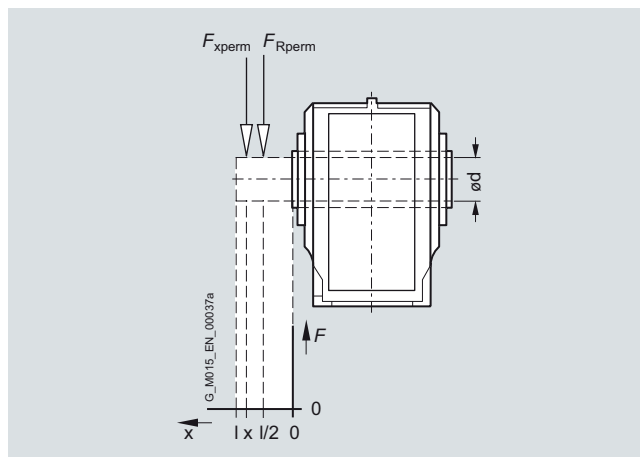
■ **Permissible radial force** (continued)

Permissible radial force

The permissible radial force F_{Rperm} is determined by the required bearing service life, among other things. The nominal service life L_{h10} is determined in accordance with ISO 281. The bearing service life can be calculated for special operating conditions on request, based on the calculation procedure for the modified service life L_{na}.

Furthermore, the permissible radial force is determined by the housing and shaft strength of the gearbox. The selection tables specify the permissible radial force F_{Rperm} for the output shafts. These values refer to the point of load at the center of the shaft extension and are minimum values, which apply to the worst possible conditions in the gearbox (force angle, mounting position, direction of rotation).

If the point of load is not at the center of the shaft extension, the permissible radial force must be calculated as follows: the smaller value of F_{xperm1} (bearing service life) and F_{xperm2} (shaft strength) is the permissible radial force. The calculation does not include additional axial forces.

If the direction of rotation of the output shaft and the additional axial forces are known, or the values in the table are insufficient, our drive experts have to perform the calculation. Our agitator and mixer drives allow you to achieve higher permissible radial forces. These drives are particularly well suited to large and rotating radial forces.

Permissible radial force in accordance with bearing service life for all gearbox types:

$$F_{xperm1} = F_{Rperm} \cdot \frac{y}{(z + x)}$$

Permissible radial force in accordance with shaft strength for bevel helical, parallel shaft, and helical worm gearboxes:

$$F_{xperm2} = \frac{a}{x}$$

Permissible radial force in accordance with shaft strength for helical and worm gearboxes:

$$F_{xperm2} = \frac{a}{(b + x)}$$

The shaft strength only has to be calculated for solid shafts, with hollow shafts this step can be omitted.

Higher permissible radial forces

The permissible radial force load can be increased, taking the angle of force action α and the direction of rotation into account. Installing reinforced bearings also means that higher loads are permitted on the input shaft.

Permissible axial loads

If no transverse force load is present, an axial force F_{ax} (tension or compression) of around 50 % of the specified radial force with standard bearings can be achieved for gearbox sizes 18 to 148.

You can use our "Calculation of input shaft bearing arrangement" assistant in the MOTOX Configurator to calculate the permissible forces. Combined forces with an axial and a radial component can also be calculated. Please contact us in case of doubt.

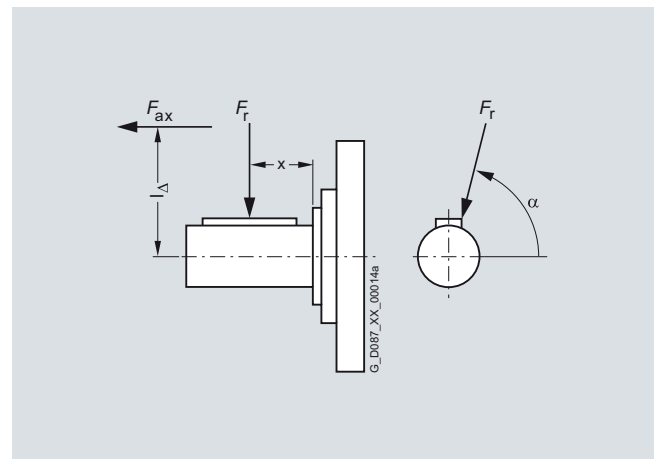The permissible radial forces are specified in the gearbox chapters.

Determining the operating mode

If no specifications are made in the power tables, the power ratings specified in the power tables apply to the **S1 operating mode** (continuous duty with constant load) according to EN 60034-1. The same regulation defines the groups of operating modes specified below:


t_B Load duration

G_D087_EN_00018
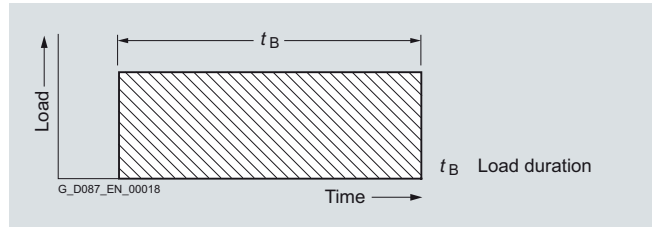
Operating mode S1 · Continuous duty

Operating modes in which starting and electrical braking **do not affect the overtemperature of the stator winding** of the motor:

Operating mode **S2**:

Short-time duty

Operating times of 10, 30, 60, and 90 min. are recommended. After each period of duty the motor remains at zero current until the winding has cooled down to the coolant temperature.
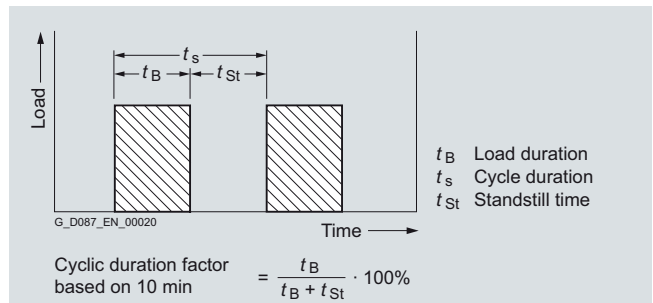

t_B Load duration

G_D087_EN_00019
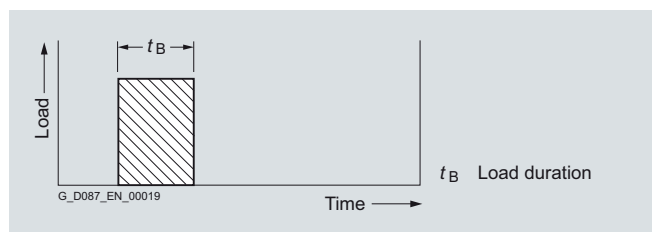
Operating mode S2 · Short-time duty

Operating mode **S3**:

Intermittent duty

Starting does not affect the temperature. Unless any agreement is made to the contrary, the cycle duration is 10 minutes. Values of 15 %, 25 %, 40 %, and 60 % are recommended for the cyclic duration factor.

t_B Load duration
t_S Cycle duration
t_{St} Standstill time

G_D087_EN_00020

$$\text{Cyclic duration factor based on 10 min} = \frac{t_B}{t_B + t_{St}} \cdot 100\%$$
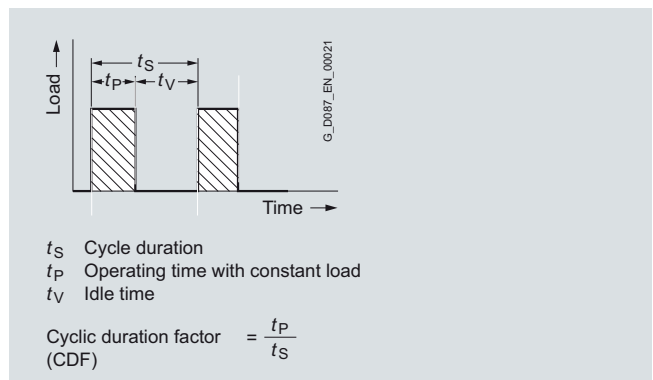
Operating mode S3 · Intermittent periodic duty

Operating mode **S6**:

Continuous duty with intermittent loading

Unless any agreement is made to the contrary, the cycle duration here is also 10 minutes. Values of 15 %, 25 %, 40 %, and 60 % are recommended for the load duration factor.

G_D087_EN_00021

t_S Cycle duration
t_P Operating time with constant load
t_V Idle time

$$\text{Cyclic duration factor (CDF)} = \frac{t_P}{t_S}$$

MOTOX Geared Motors
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■ **Determining the operating mode** (continued)

Operating mode **S10**:

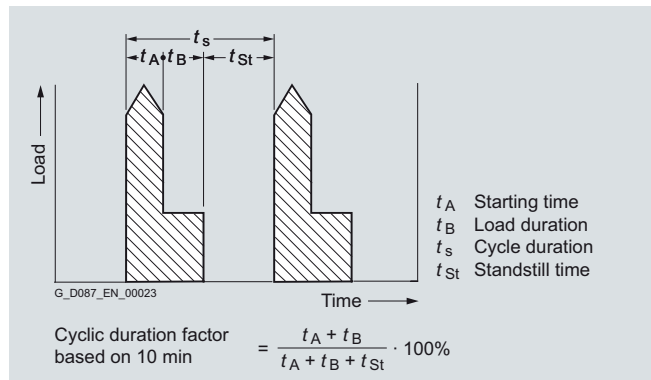Duty with discrete constant loads

In this mode a maximum of four discrete loads are available, of which each load achieves the thermal steady state.
A load of the same value as the one used in S1 operating mode should be selected for this operating mode.

P_i Constant load within one load cycle
P_{ref} Reference load
t_S Cycle duration
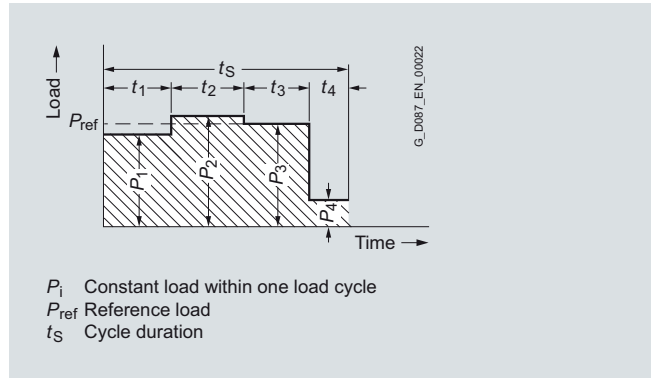
Operating modes in which starting and braking have a corresponding **effect on the overtemperature of the stator winding and of the rotor cage:**

Operating mode **S4**:

Intermittent duty where starting affects the temperature

t_A Starting time
t_B Load duration
t_s Cycle duration
t_{St} Standstill time

$$\text{Cyclic duration factor based on 10 min} = \frac{t_A + t_B}{t_A + t_B + t_{St}} \cdot 100\%$$
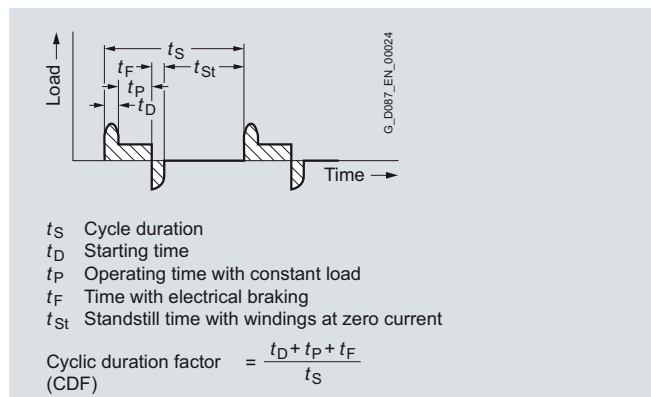
Operating mode S4 · Intermittent periodic duty with starting

Operating mode **S5**:

Intermittent duty where starting and braking affects the temperature

For the **S4** and **S5 operating modes**, this code should be followed by the cyclic duration factor, the moment of inertia of the motor (J_M), and the moment of inertia of the load (J_{Load}), both based on the motor shaft.
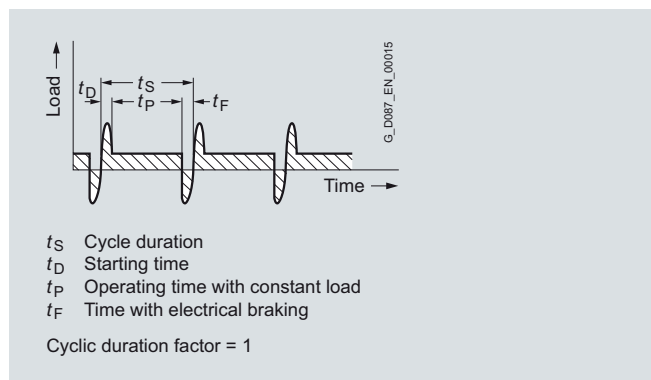
Unless any agreement is made to the contrary, the cycle duration here is also 10 minutes. Values of 15 %, 25 %, 40 %, and 60 % are recommended for the cyclic duration factor.

t_S Cycle duration
t_D Starting time
t_P Operating time with constant load
t_F Time with electrical braking
t_{St} Standstill time with windings at zero current

$$\text{Cyclic duration factor (CDF)} = \frac{t_D + t_P + t_F}{t_S}$$

Operating mode **S7**:

Continuous-operation periodic duty with starting and braking

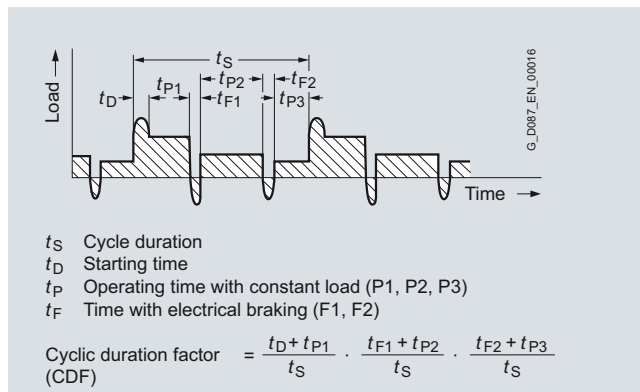For the S7 and S8 operating modes, the moment of inertia of the load (J_{Load}) based on the motor shaft must be known.

t_S Cycle duration
t_D Starting time
t_P Operating time with constant load
t_F Time with electrical braking

Cyclic duration factor = 1

■ **Determining the operating mode** (continued)

Operating mode **S8**:

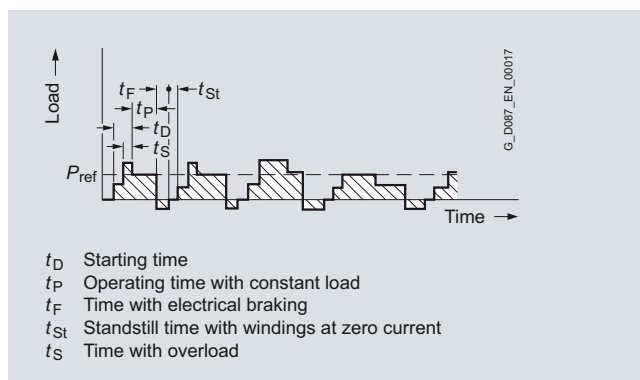Continuous-operation duty with non-periodic load and speed variations (inverter-fed operation)

Most of the intermittent operating conditions which occur in real situations are a combination of the operating modes defined above. All operating conditions must be specified in order to accurately define a suitable motor.

t_S Cycle duration
t_D Starting time
t_P Operating time with constant load (P1, P2, P3)
t_F Time with electrical braking (F1, F2)

Cyclic duration factor (CDF) $= \dfrac{t_D + t_{P1}}{t_S} \cdot \dfrac{t_{F1} + t_{P2}}{t_S} \cdot \dfrac{t_{F2} + t_{P3}}{t_S}$

Operating mode **S9**:

Continuous-operation duty with non-periodic load and speed variations (inverter-fed operation)

Most of the intermittent operating conditions which occur in real situations are a combination of the operating modes defined above. All operating conditions must be specified in order to accurately define a suitable motor.

t_D Starting time
t_P Operating time with constant load
t_F Time with electrical braking
t_{St} Standstill time with windings at zero current
t_S Time with overload

Operating modes according to EN 60034 (IEC 60034-1)

Operating mode	Description	Information required		k_{DC}
S1	Continuous duty with 100 % DC	–		
S2	Constant load for brief period, e.g. S2 - 30 min	Load duration	60 min	1.10
			30 min	1.20
			10 min	1.40
S3	Intermittent periodic duty without starting (cyclic operation), e.g. S3 - 40 %	Cyclic duration factor DC in % (based on 10 min)	60 %	1.10
			40 %	1.15
			25 %	1.30
			15 %	1.40
S4 … S10	Intermittent periodic duty with starting	Cyclic duration factor DC in %, times switched on per hour, load torque, and moment of inertia	On request	
		The operating mode and motor power can be determined if the number of startings per hour, starting time, load duration, type of braking, braking time, idle time, cycle time, standstill time, and required power are specified.		

According to the table below, the motor list powers can be converted to the lower duty cycle using the corresponding k_{DC} factors for the S1, S2, and S3 operating modes.

With enhanced performance, you should note that the breakdown torque ratio must not fall below 1.6.

$$\frac{T_{Bd}}{T_{DC}}$$

$P_{DC} = P_{rated} \cdot k_{DC}$
$T_{DC} \sim T_{rated} \cdot k_{DC}$

Code	Description	Unit
P_{DC}	Power rating for the new duty cycle	–
P_{rated}	Rated motor power	kW
k_{DC}	Factor for enhanced performance	kgm²
T_{DC}	Torque for the new duty cycle	Nm
T_{Bd}	Breakdown torque	Nm
T_{rated}	Rated torque	Nm

MOTOX Geared Motors

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Coolant temperature and site altitude

The rated power specified in the selection tables in section 8 applies to continuous duty (S1) or inverter-fed operation (S9) according to IEC 60034-1 at the corresponding rated frequency, a coolant temperature of 40 °C and a site altitude of 1.000 m above sea level. Please contact us if higher coolant temperatures are to be used. The table containing correction factors provides a rough idea of derating if conditions are different.

This results in a permissible motor power of:

$$P_{perm} = P_{rated} \cdot k_{HT}$$

If the permissible motor power is no longer adequate for the drive, a check should be performed as to whether or not the motor with the next higher rated power fulfills the requirements.

Code	Description	Unit
P_{perm}	Permissible motor power	kW
P_{rated}	Rated motor power	kW
k_{HT}	Factor for abnormal coolant temperature and site altitude	–

Factor k_{HT} for different site altitudes and / or coolant temperatures

Site altitude (SA)	Coolant temperature (CT)					
m	< 30 °C	30 … 40 °C	45 °C	50 °C	55 °C	60 °C
1 000	1.07	1.00	0.96	0.92	0.87	0.82
1 500	1.04	0.97	0.93	0.89	0.84	0.79
2 000	1.00	0.94	0.90	0.86	0.82	0.77
2 500	0.96	0.90	0.86	0.83	0.78	0.74
3 000	0.92	0.86	0.82	0.79	0.75	0.70
3 500	0.88	0.82	0.79	0.75	0.71	0.67
4 000	0.82	0.77	0.74	0.71	0.67	0.63

Selecting the brake

MOTOX geared motors can be supplied with fail-safe spring-operated disk brakes in order to reduce the motor's follow-on time or to hold loads, for example. Our MODULOG modular system can be used to assign / attach several brake sizes to one motor size. See Chapter 8 for information on assigning brake sizes to motor sizes, and on possible brake options.

The following information is required in order to select and check the brake:

- Speed
- Load torque
- Moments of inertia
- Number of startings

■ Selecting the braking torque

The braking torque must be selected in accordance with the particular drive scenario. The following criteria are crucial when it comes to making this selection: static safety, required braking time, permissible deceleration rate, and possible braking distance and brake wear.

The ambient conditions and number of startings are also important. Our drive experts will be able to provide optimum brake sizing.

In principle the selection is made according to the formula:

$$T_{br} > T_x \cdot \frac{k}{\eta}$$

Where $k = 1.0 - 2.5$ is selected. As a general rule of thumb, the factor for horizontal motion is around 1.0 - 1.5 and for vertical motion around 2.0 - 2.5. However, the exact specification of the braking torque depends to a large extent on the particular operating conditions.

Operating time of the brake

The time it takes the motor to come to a standstill comprises the following components: the application time of the brake t_1 and the braking time t_{br}. The first is the time it takes the brake to reach 90 % of its braking torque. This time may be circuit- and actuation-dependent. This information is provided for each brake in Chapter 8. The braking time can be calculated as follows:

$$t_{br} = \frac{(J_M + J_{add} + J_x \cdot \eta) \cdot n_{br}}{9.55 \cdot (T_{br} \pm T_x \cdot \eta)} \quad [s]$$

If T_x supports the braking operation, T_x is positive, otherwise it is negative.

Braking distance and positioning accuracy

Braking distance s_{br} is the distance traveled by the driven machine during braking time t_{br} and application time t_1. The formula below applies to horizontal motion and upward vertical motion. With linear motion, a positioning accuracy of around ± 15 % can be assumed. However, this can be heavily influenced by the condition of the brake.

$$s_{br} = v \cdot 100 \cdot (t_1 + 0.5 \cdot t_{br}) \quad [mm]$$

Braking energy per braking operation

The braking energy W per braking operation comprises the energy of the moments of inertia to be braked and the energy which must be applied in order to brake against a load torque:

$$W = \frac{T_{br}}{T_{br} \pm T_x \cdot \eta} \cdot \frac{(J_M + J_{perm} + J_x \cdot \eta) \cdot n_{br}^2}{182.5}$$

T_x is positive if the load torque is working against the braking torque
(horizontal motion, upward vertical motion).

T_x is negative if it supports the braking operation
(downward vertical motion).

The permissible operating energy Q_{perm} must be checked against the relevant number of startings using the "Permissible operating energy" diagram (see Chapter 8). This is of particular importance for emergency-stop circuits.

$$W < Q_{perm}$$

Code	Description	Unit
T_{br}	Rated braking torque	Nm
T_x	Load torque	Nm
k	Factor for taking operating conditions into account	kgm^2
η	Efficiency	%
t_{br}	Braking time	s
t_1	Application time of the brake	ms
J_{mot}	Moment of inertia of the motor	kgm^2
J_{add}	Additional moment of inertia (e.g. centrifugal mass or high inertia fan)	kgm^2
J_x	Reduced moment of inertia of the load	kgm^2
n_{br}	Braking speed	rpm
s_{br}	Braking distance	mm
W	Friction energy per braking operation	J
Q_{perm}	Permissible operating energy	J
L_{rated}	Service life of the brake lining until readjustment	h
$L_{ratedmax}$	Service life of the brake lining until replacement = total service life	h
v	Conveying speed	m/s
W_V	Friction energy until the brake is adjusted	MJ
W_{tot}	Friction energy until the brake lining is replaced	MJ
Z	Number of startings	1/h

Brake service life

The brake lining wears due to friction, which increases the air gap and the application time of the brake. The air gap can be readjusted. The friction lining should be replaced after it has been readjusted a certain number of times.

Service life of the brake lining until readjustment:

$$L_{rated} = \frac{W_V}{W \cdot Z}$$

Service life of the brake lining until replacement:

$$L_{ratedmax} = \frac{W_{tot}}{W \cdot Z}$$

MOTOX Geared Motors
Introduction

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Special versions

■ Motors for inverter-fed operation

Selection of motors on the inverter

For selecting electrical drives on the inverter, the torque-speed response of the motors and the driving machine is important.

With inverter-fed operation, it is particularly important to pay attention to the torque limit curve. The torque of the driving machine must be smaller during continuous operation than the motor limit torque. The design of the motor depends to a large extent on the desired speed control range. In general, a range from 25 to 50 Hz is preferable.

The effectiveness of the self-ventilation is reduced with decreasing speed, which in turn also reduces the continuous output torque. Forced ventilation can be used to prevent the torque from decreasing.

The fan noise can increase at speeds that are higher than the rated speed of self-ventilated geared motors.
Above the frequency limit, the continuous output torque decreases (field weakening).

Bearings and bearing currents

With operation with inverters, additional bearing currents can occur. They are mainly caused by the steep voltage rises which occur during switching. Without output filters, significant voltage variations can occur on the winding terminals. This phenomenon mainly occurs with larger machines.

EMC-compliant installation of the drive system is a basic prerequisite for preventing premature bearing damage via bearing currents.

The most important measures for reducing bearing currents:

- Use of cables with a symmetrical cable cross-section,
- Use of grounding cables with low impedance in a large frequency range (0 Hz up to approximately 70 MHz), for example, plaited copper ribbon cables, HF litz wires,
- Separate HF equipotential-bonding cable between the motor housing and the driving machine,
- Separate HF equipotential-bonding cable between the motor housing and the inverter PE busbar,
- 360° HF contacting of the cable shield on the motor housing and the inverter PE busbar. This can be achieved using EMC cable glands at the motor end and EMC shield clips at the inverter end, for example,
- Use of motor reactors,
- Common-mode filters at the inverter output,
- Insulated motor bearing at the non-drive end.
  Motors from size 280 are delivered with bearing insulation for inverter-fed operation.

Mechanical stress and grease lifetime

High speeds that exceed the rated speed and the resulting increased vibrations alter the mechanical running smoothness and the bearings are subjected to increased mechanical stress. This reduces the grease lifetime and the bearing service life. More detailed information is available on request.


Concentric copper or aluminum shield   Steel armor
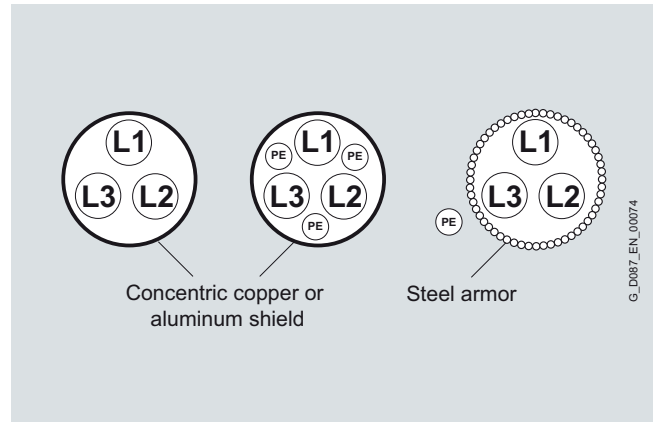
Determining the permissible number of startings Z_{perm}

A high number of startings means that the motor winding will be subject to a thermal load. The permissible no-load operating Z_0 for brake motors is specified in the no-load operating tables. The permissible number of startings Z_{perm} has to be determined for different operating cases. This value is influenced by the corresponding load torque, any additional moment of inertia, the power requirement, and the cyclic duration factor. These can be evaluated using the factors k_M, k_{FI}, and k_P.

$$Z_{perm} = Z_0 \cdot k_M \cdot k_{FI} \cdot k_P$$

| Code	Description	Unit
J_{mot}	Moment of inertia of the motor	kgm^2
J_{add}	Additional moment of inertia (e.g. centrifugal mass or high inertial fan)	kgm^2
k_M	Factor for taking the counter torque during acceleration into account	–
k_{FI}	Factor for taking the additional moment of inertia into account	–
k_P	Factor for taking the required power and duty cycle into account	–
T_{rated}	Rated torque of the motor	Nm
T_H	Acceleration torque of the motor	Nm
P_{rated}	Rated motor power	kW
Z_{perm}	Permissible number of startings	rph
Z_0	No-load operating from the list	rph

During operation at 60 Hz, the calculated permissible number of startings Z_{perm} must be reduced by 25 %. See the technical data for brakes found in Chapter 8 for the permissible number of startings during operation with function rectifiers.

$$k_{FI} = \frac{J_M}{J_M + J_{add}}$$

Additional moment of inertia

$$k_M = 1 - \frac{T_1}{T_H}$$
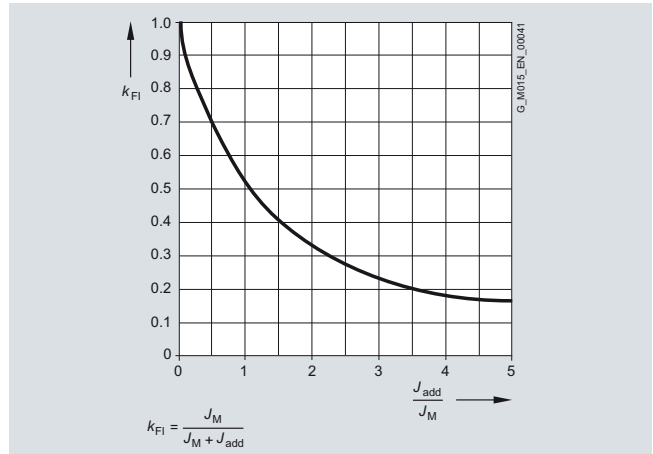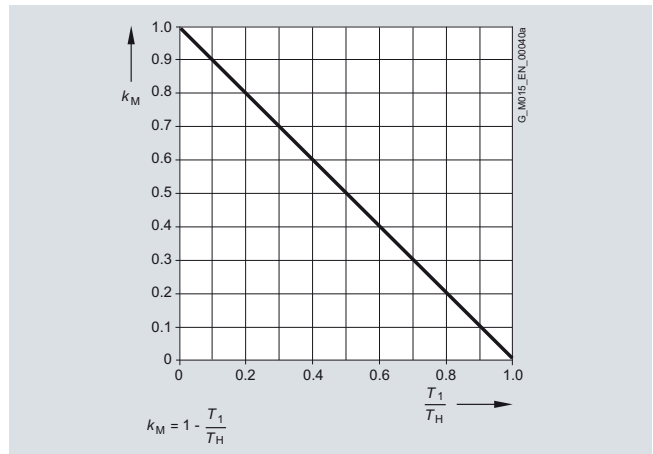
Torque during acceleration
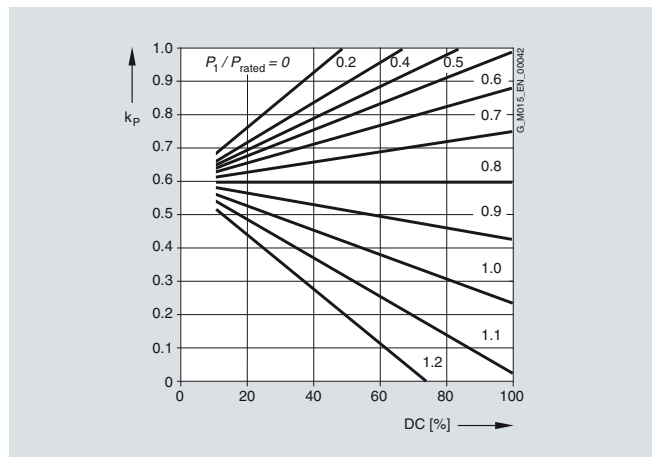
Required power and duty cycle

MOTOX Geared Motors
Introduction

1

Special versions

■ Checking the input torque for mounted units

Geared motors are usually integrated, i.e. they are mounted on the gearbox directly and the products are supplied as complete drives. Alternatively, the gearboxes can also be supplied with various input units for motor mounting. The criteria below must be taken into account, particularly for special motors.

Maximum input speed

We recommend that four-pole motors are mounted in order to achieve optimum gearbox service life. Higher input speeds can have an effect on bearing service life and the thermal properties of the gearbox, among other things.
See the section titled "Maximum speed", page 1/22.

Permissible radial force of the input shaft

Input units A and P can be powered by a V belt drive, for example. This results in a radial load on the input shaft. The permissible radial forces are specified in the section titled "Input unit".

Maximum input torque

The input units are primarily designed for four-pole standard three-phase AC motors. Considerably higher motor torques, which are above the maximum permissible input torque, may occur with special motors.

First of all, the continuous torque T_{1mot} of the motor and the permissible input torque of the input unit T_1 must be checked, along with the maximum torques (starting, breakdown, and braking). The torques for input units are specified in the section titled "Input unit". Please contact us if you have any questions.

$$T_{1mot} < T_1 = \frac{P_1 \cdot 9550}{n_1}$$

$$T_{1max} < 2.5 \cdot T_1$$

Code	Description	Unit
T_1	Permissible input torque of the input unit	Nm
T_{rated}	Rated torque of the motor	Nm
T_{1max}	Temporarily permissible max. input torque of the input unit	Nm
n_1	Input speed of the motor	rpm
P_1	Input power of the motor	kW

Overview of drive sizing data

Code	Description	Unit
a	Gearbox constant	kNmm
b, d, l, y, z	Gearbox constants	mm
C	Factor	–
d	Diameter of the input element	mm
DC	Cyclic duration factor (CDF)	%
f_{Btot}	Service factor of the driving machine	–
f_B	Service factor of the geared motor	–
F_{ax}	Axial force at d	N
F_r	Radial force at the output shaft	N
F_{Ravail}	Available radial force resulting from the output torque and the diameter of the output element	N
F_{Rperm}	Permissible radial force at the center of shaft extension (l/2)	N
F_{xperm1}	Permissible radial force, limited by the bearing service life, at a distance of x from the shaft shoulder	N
F_{xperm2}	Permissible radial force, limited by the shaft strength, at a distance of x from the shaft shoulder	N
i	Gearbox ratio	–
J_2	Moment of inertia based on the output speed of the gearbox	kgm^2
J_B	Moment of inertia of the brake	kgm^2
J_{Load}	All external moments of inertia (based on the motor shaft)	kgm^2
J_M	Moment of inertia of the motor	kgm^2
J_x	Reduced moment of inertia of the load	kgm^2
J_{add}	Additional moment of inertia (e.g. centrifugal mass or high inertia fan)	kgm^2
J_{Fan}	Centrifugal mass fan of handwheel	kgm^2
k	Factor for taking operating conditions into account	–
k_{DC}	Factor for enhanced performance	–
k_{FI}	Factor for taking the additional moment of inertia into account	–
k_{HT}	Factor for abnormal coolant temperature and site altitude	–
k_M	Factor for taking the counter torque during acceleration into account	–
k_P	Factor for taking the required power and duty cycle into account	–
L_{rated}	Service life of the brake lining until readjustment	h
$L_{ratedmax}$	Service life of the brake lining until replacement	h
m_{AF}	Mass acceleration factor	–
n_1	Input speed of the gearbox	rpm
n_2	Output speed of the gearbox	rpm
n_{br}	Braking speed	rpm

Code	Description	Unit
P_{2m}	Input power of the motor	kW
P_2	Output power of the gearbox	kW
P_{DC}	Power rating for the new duty cycle	kW
P_{req}	Required input power	kW
P_{rated}	Rated motor power	kW
P_{perm}	Permissible motor power	kW
Q_{perm}	Permissible operating energy	J
r	Radius of the output element	m
s_{br}	Braking distance	m
t_1	Application time of the brake	ms
t_{br}	Braking time	s
T_1	Permissible input torque of the input unit	Nm
T_{rated}	Rated torque of the motor	Nm
T_{1max}	Temporarily permissible max. input torque of the input unit	Nm
T_2	Output torque of the geared motor	Nm
T_{2req}	Required output torque of the driving machine	Nm
T_{2rated}	Nominal output torque of the geared motor	Nm
T_{br}	Rated braking torque	Nm
T_{DC}	Torque for the new duty cycle	Nm
T_{req}	Required torque	Nm
T_H	Acceleration torque of the motor	Nm
T_{Bd}	Breakdown torque	Nm
T_{rated}	Nominal torque	Nm
T_{avail}	Available torque of the geared motor	Nm
T_x	Load torque	Nm
v	Conveying speed	m/s
W	Friction energy per braking operation	J
W_{tot}	Friction energy until the brake lining is replaced	MJ
W_V	Friction energy until the brake is adjusted	MJ
Z	Number of startings	1/h
Z_{perm}	Permissible number of startings	1/h
Z_0	No-load operating from the list	1/h
α	Angle of action of the radial force	°
η	Efficiency	%
ϑ_{amb}	Ambient temperature	°C

MOTOX Geared Motors
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General technical data

Important drive technology variables

SI unit					
Variable	**Abbreviation**		**Unit abbreviation**		**Designation or conversion rate** [*)]
	SI	Previously	SI	Previously	
Length (distance)	l	L, s	m	m	1 km = 1.000 m
Area	A	F	m^2	m^2	1 m^2 = 100 dm^2
Volume	V	V	m^3	m^3	1 m^3 = 1.000 dm^3 1 dm^3 = 1 l
Plane angle	α, β, γ	α, β, γ	rad	Degrees °	1 rad = 1 m/m 1 L = $\pi/2$ rad 1° = $\pi/180$ rad
Rotation angle	ϕ	φ		Degrees °	1' = 1°/60; 1'' = 1'/60
Time					1 min = 60 s 1 h = 60 min
Time range	t	t	s	s	1 d = 24 h
Duration					1 a = 24 h
Frequency	f	f	Hz	1/s	1 Hz = 1/s
Speed	n	n	rpm	rev/min	Revolutions per minute
Velocity	v	v	m/s	m/s	1 km/h = $\frac{1}{3.6}$ m/s
Acceleration Free-fall acceleration	a g	b g	m/s^2	m/s^2	g = 9.81 m/s^2
Angular velocity	ω	Ω	rad/s	1/s	
Angular acceleration	α	ξ	rad/s^2	$1/s^2$	
Mass	m	m	kg	kg	1
Density		d	kg/dm^3	kg/dm^3	10^3
Force Weight force	F G	P, K G	N	kp	9.81 1 N = 1 kg · 1 m/s^2
Pressure Mechanical tension	p σ	p σ	Pa N/m^2 N/mm^2	 kp/cm^2 kp/mm^2	1 Pa = 1 N/m^2 9.81 · 10^4 9.81
Work Energy Quantity of heat	W W Q	A E Q	 J	kpm kcal	9.81 4.187 1 J = 1 Nm = 1 Ws
Force torque Torque Bending torque	 T	M_t M_d M_b	 Nm	 kpm	9.81 1 Nm = 1 J
Power rating	P	N	W	PS	735.5; 1 W = 1 J/s = 1 Nm/s = $\frac{kgm^2}{s^3}$
Moment of inertia	J	θ	kgm^2	kpm^2	9.81

[*)] The numerical value of a variable in previously used units multiplied by the conversion rate gives the numerical value of the variable in the SI unit.

Conversion between kW and hp:

1 kW = 1.34102 hp

1 hp = 0.745700 kW

1 hp = 1.01387 PS

hp = horse power (US)
PS = Pferdestärke

■ **Important drive technology variables** (continued)

SI unit				
Variable	**Abbreviation**		**Unit abbreviation**		**Designation or conversion rate** [*)]
	SI	Previously	SI	Previously	
Dynamic viscosity	η	η	Pa · s	P	10^{-1}
Kinematic viscosity	υ	υ	m^2/s	St	10^{-4}
Electrical current intensity	I	I	A	A	$1\,A = 1\,W/V = 1\,V/\Omega$
Electrical voltage	U	U	V	V	$1\,V = 1\,W/A$
Electrical resistance	R	R	Ω	Ω	$1\,\Omega = 1\,V/A = 1/S$
Electrical conductance	G	G	S	S	$1\,S = 1/\Omega$
Electrical capacitance	C	C	F	F	$1\,F = 1\,C/V$
Electric charge	Q	Q	C	C	$1\,C = 1\,A \cdot s$
Inductance	L	L	H	H	$1\,H = 1\,Vs/A$
Magnetic flux density Induction	B	B	T	G	10^4 $1\,T = 1\,Wb/m^2$
Magnetic field strength	H	H	A/m	A/m	
Magnetic flux	ϕ	ϕ	Wb	M	10^8 $1\,Wb = 1\,V \cdot s$
Temperature	T(ϑ)	t	K(°C)	°C	$0\,K = -273.15\,°C$

[*)] The numerical value of a variable in previously used units multiplied by the conversion rate gives the numerical value of the variable in the SI unit.

MOTOX Geared Motors
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■ **Overview**

MOTOX geared motors are available in an almost infinite number of combinations for adaptation to a wide range of drive scenarios. All the usual additional components and variants are also offered.

Made-to-measure solutions for all kinds of drive technology tasks are achieved with different gearbox types (helical, parallel shaft, bevel helical, helical worm, and worm), combined with motors by means of modular mounting technology.

■ **Designs in accordance with standards and specifications**

New efficiency classes and efficiences according to IEC 60034-30:2008 and IEC 60034-2-1:2007

New efficiency classes according to IEC 60034-30:2008

Different energy efficiency standards exist worldwide for asynchronous motors. To promote international harmonization, the international standard IEC 60034-30:2008 (Rotating electrical machines – Part 30: Efficiency classes of single-speed, three-phase, cage-induction motors (IE code)) was created. This groups low-voltage asynchronous motors into new efficiency classes (valid since October 2008). The efficiencies of IEC 60034-30:2008 are based on losses determined in accordance with the IEC 60034-2-1:2007 standard. This has been valid since November 2007 and will replace the previous standard IEC 60034-2:1996 as of November 2010. The supplementary losses are now measured and no longer added as a percentage.

New standard classes for efficiencies
A new nomenclature applies to the new efficiency classes (IE = International Efficiency):
- IE1 (Standard Efficiency)
- IE2 (High Efficiency)
- IE3 (Premium Efficiency)
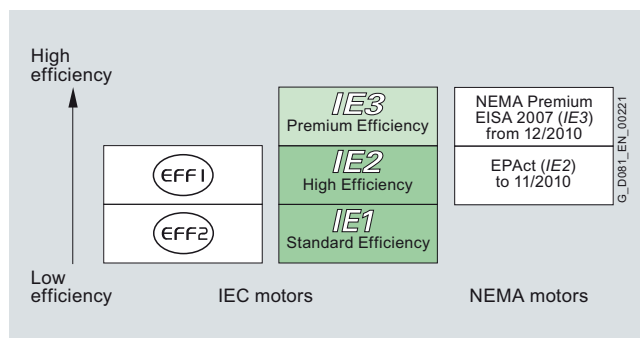
New efficiency classes

New measuring method according to IEC 60034-2-1:2007

With the new measuring method, the supplementary losses are no longer applied as a percentage (0.5 %), but instead they are determined with measurements (IEC 60034-2-1: 2007). The nominal efficiencies are therefore reduced from EFF1 to IE2 and from EFF2 to IE1, even though there have been no technical or physical changes to the motors.

Previously: P_{LL} = 0.5 % of P added

Now: P_{LL} = individual measurement

P_{LL} = load-dependent supplementary losses.
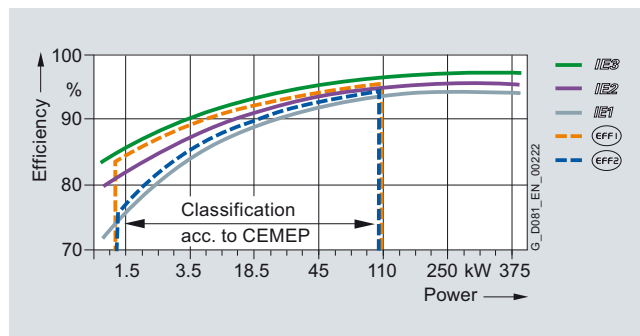
IE1 to IE3 efficiencies 4-pole 50 Hz

The following table shows examples of the efficiency values according to the new and old loss calculating methods.

	EFF measuring method (incl. percentage losses) EN / IEC 60034-2:1996 50 Hz	Losses determined according to IEC 60034-2:2007 50 Hz	Losses determined according to IEC 60034-2:2007 60 Hz
5.5 kW 4-pole	89.2 %	87.7 %	89.5 %
45 kW 4-pole	93.9 %	93.1 %	93.6 %
110 kW 4-pole	Not defined	94.5 %	95.0 %

Background information

The EuP directive (Energy Using Products) is implemented in the national laws of EU member countries. The framework conditions for the European directives have already been agreed. EU directive 2005/32/EC (= EuP directive) is based on IEC 60034-30:2008 with regard to the minimum efficiency values.

This directive is implemented in Germany in the form of the so-called "Energiebetriebene-Produkte-Gesetz" (EBPG - Energy Using Products Directive).

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■ **Designs in accordance with standards and specifications** (continued)

The most important changes at a glance:

	CEMEP voluntary EU agreement	NEMA	EuP directive based on IEC 60034-30:2008 standard EuP = Energy Using Products
Description	Voluntary agreement between the EU commission and the European sector committee of manufacturers of electrical machines (CEMEP)	The current legislature in USA/CAN/MX also governs efficiencies	The EuP directive must be implemented in national law in all EU countries. The determination of losses, and therefore of efficiency classes, is based on IEC 60034-2-1:2007
Number of poles	2, 4	2, 4, 6	2, 4, 6
Performance range	1.1 – 90 kW	0.75 – 150 kW	0.75 – 375 kW
Level	Standard – EFF3 Enhanced efficiency – EFF2 Highly efficient – EFF1	High Efficiency NEMA Premium	Standard Efficiency – IE1 High Efficiency – IE2 Premium Efficiency – IE3
Voltage	400 V, 50 Hz	230 / 460 V, 60 Hz	< 1000 V, 50 / 60 Hz
Degree of protection	IP5X	Open + closed motors	All
Motors with brake	NO	YES	In agreement
Geared motors	NO	NO	YES
Ex motors	NO	YES	EuP directive – NO IEC 60034-30 – YES (but explosion protection always has a higher priority)
Law	Voluntary agreement; will be replaced on implementation of the national measures.	Up to 11/2010 EPACT (IE2) From 12/2010 EISA 2007 Premium (IE3) minimum efficiency	IEC 600034-30 standard, valid since October 2008, EuP

For more information on EuP:

- Excluded: Explosion-proof motors according to ATEX, brake motors, smoke-extraction motors
- Deadline 16 June 2011: IE2 minimum efficiency for motors from 0.75 kW to 375 kW
- Deadline 01 January 2015: IE3 minimum efficiency for motors from 7.5 kW to 375 kW or a combination of IE2 motor and frequency converter
- Deadline 01 January 2017: IE3 minimum efficiency for all motors from 0.75 kW to 375 kW or a combination of IE2 motor and frequency converter

Abbreviations

CEMEP – Comité Européen de Constructeurs de Machines Électriques et d'Électronique de Puissance (European sector committee of manufacturers of electrical machines)

EISA 2007 – Energy Independence and Security Act of 2007

EPACT – Energy Policy Act

NEMA – National Electrical Manufacturers Association

IEC – International Electrotechnical Commission

IE – International Efficiency

What will change?

The rating plates of the motors will be adapted to the new technical data and their clarity and readability will be enhanced (for examples, see page 1/38).

For motors up to frame size 315 L, this means:

- Nominal efficiencies in accordance with the IEC 60034-30 standard are specified regardless of the actual efficiency, i.e. in accordance with the standardized performance classes such as 7.5 kW, 11 kW and 15 kW, nominal efficiencies only will be offered in accordance with efficiency class IE1 and IE2.
- The rated currents have been adapted in accordance with the new efficiencies. The motor rated currents will increase minimally (by up to 3 %).
- There is no need for a voltage range to be specified on the new rating plates. The rated voltages only are specified.

  Note: The transition period for adjustment of mains voltages with increased tolerances within the EU expired on January 1, 2008. Since then the permissible mains tolerances are 230 / 400 V ±10 %, 50 Hz and 400 / 690 V ±10 %, 50 Hz.

Summary

The standard motor series LA and LG will be converted to the new efficiency designations "IE1" and "IE2" in accordance with IEC 60034-30:2008. The order numbers will remain unchanged.

This affects all motors that were previously designated with "EFF2" and "EFF1" as well as the motor types that have been added due to the IEC 60034-30:2008 efficiency standard:

- 2-pole, 4-pole and 6-pole motors (only "single-speed motors", not pole-changing motors and not 8-pole motors)
- Output range from 0.75 kW to 375 kW

A detailed presentation of the affected motors, including their frame sizes, can be found in the overview tables in the separate catalog parts under "Orientation" in the "Selection and ordering data". The changed technical data is also listed here.

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General technical data

■ **Designs in accordance with standards and specifications** (continued)

Example of rating plate

Due to the IE changeover, the affected motors will be equipped
with new rating plates complete with the new technical data.

SIEMENS	CE IEC60034
KAF108-LA160L4-L150/100GH	
2KJ1506-5JR13-2FD1-Z FDU1001/8999999 nnn	254kg
IP55	(IM) H-01-A
G. 6.2L OIL CLP PG VG220 i=12.9	
50Hz 113/min	60Hz 136/min
1266Nm fB=1.5	1264Nm fB=1.5
3~Mot. ThCl.155(F) TP-PTC ⬡ 100Nm	190-240V AC
50Hz 400/690V D/Y	60Hz 460V Y
29/16.74A cosPhi 0.84	28.6A cosPhi 0.87
15kW IE1-90% 1460/min	15kW 1755/min

SIEMENS				1		2
3						
4		5				6
7						8
9	10	11	12			
13			14	17		18
15			16	19		20
21	22	23	24	25	26	
27	28		29	35	36	37
30			31	38		39
32	33		34	40	41	42

1   CE marking or, if required, other marking
2   Standard taken as a basis
3   Type - Type of construction - Size
4   Order No.
5   Serial No.
6   Weight m [kg]
7   Degree of protection acc. to IEC 60034-5 and IEC 60529
8   Mounting position (IM)
9   Oil quantity [l] main gearbox / intermediate gearbox
    + extruder flange
10   Kind of oil
11   Oil viscosity ISO VG Class acc. to DIN 51519 / ISO 3448
12   Total transmission ratio i

Frequency 1
13   Rated frequency f [Hz]
14   Speed at the output n_2 [rpm]
15   Torque at the output T_2 [Nm]
16   Service factor f_B

Frequency 2
17   Rated frequency f [Hz]
18   Speed at the output n_2 [rpm]
19   Torque at the output T_2 [Nm]
20   Service factor f_B

Motor data
21   Phase number and kind of current of the motor
22   Temperature class Th.Cl.
23   Motor protection (TP)
24   Symbols (IEC 60617-2): = Brake
25   Braking torque T_{br} [Nm]
26   Brake supply voltage U [V]

Frequency 1
27   Rated frequency f [Hz]
28   Rated voltage / rated voltage range U [V]
29   Circuit, graphical symbol acc. to
     DIN EN 60617 T6 / IEC 60617-6
30   Rated current I [A]
31   Power factor cos φ
32   Rated power P [kW], operating mode (if ≠ S1)
33   Designation of the efficiency class
     acc. to IEC 60034-30
34   Rated speed n_1 [rpm]

Frequency 2
35   Rated frequency f [Hz]
36   Rated voltage / rated voltage range U [V]
37   Rated current I [A]
38   Power factor cos φ
39   Circuit, graphical symbol acc. to
     DIN EN 60617 T6 / IEC 60617-6
40   Rated power P [kW], operating mode (if ≠ S1)
41   Designation of the efficiency class
42   Rated speed n_1 [rpm]

■ **Designs in accordance with standards and specifications** (continued)

Minimum efficiencies required by law

In 1997, an act was passed in the USA to define minimum efficiencies for low-voltage three-phase AC motors (EPACT = Energy Policy Act). An act is in force in Canada that is largely identical, although it is based on different verification methods. The efficiency is verified for these motors for the USA using IEEE 112, Test Method B and for Canada using CSA-C390. Apart from a few exceptions, all low-voltage three-phase AC motors exported to the USA or Canada must comply with the legal efficiency requirements.

The law demands minimum efficiency levels for motors with a voltage of 230 and 460 V at 60 Hz, in the power range 1 to 200 hp (0.75 to 160 kW) with 2, 4, and 6 poles. Explosion-proof motors must also be included. The EPACT efficiency requirements exclude, for example:

- Motors whose size power classification does not correspond with the standard series according to NEMA MG1-12.
- Flange-mounting motors without feet
- Brake motors
- Inverter-fed motors
- Motors with design letter C and higher.

For more information on EPACT:

www.eren.doe.gov/

Special requirements for the USA: Energy Policy Act

The act lays down that the nominal efficiency at full load and a "CC" number (Compliance Certification) must be included on the rating plate.
The "CC" number is issued by the US Department of Energy (DOE).
The following information is stamped on the rating plate of EPACT motors which must be marked by law:
Nominal efficiency (service factor SF 1.15), design letter, code letter, CONT, CC no. CC 032A (Siemens), and NEMA MG1-12.

Special requirements for Canada: CSA – Energy Efficiency Verification

These motors fulfill the minimum efficiency requirements laid down by the CSA standard C390. These motors can be ordered and feature the CSA-E mark on their rating plates.

NEMA – National Electrical Manufacturing Association

Data on the rating plate:

Rated voltage range, design letter, code letter, CONT, and NEMA MG1-12.

Order code:
Design in accordance with NEMA   **N65**

UL-R – Underwriters Laboratories Inc. listing

The motors are listed for up to 600 V by Underwriters Laboratories Inc. ("Recognition Mark" = R/C).

Motor voltages up to 600 V are certified in accordance with UL.

"UL Recognition Mark" is included on the rating plate of the motor.

In addition, the motor is designed to meet the NEMA MG1-12 electrical standard and includes the following data on the rating plate:
Rated voltage, nominal efficiency, design letter, code letter, CONT, and NEMA MG1-12.

Externally or internally mounted components such as:

- Motor protection
- Heating element
- External fan unit
- Brake
- Encoder
- Plug connection

are UL-R/C, CSA, or C-US listed or used by manufacturers in accordance with regulations.

UL-R/C cable glands must be used for cable entry.

Order code:
Design in accordance with UL-R   **N37**

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■ **Designs in accordance with standards and specifications** (continued)

CSA – Canadian Standard Association

Motors are approved for up to 690 V in accordance with the Canadian regulations of the "Canadian Standard Association" (CSA). Externally or internally mounted components which are used are listed by CSA or are used by manufacturers in accordance with regulations. The CSA mark and the rated voltage are included on the rating plate.

When energy-saving motors are ordered, they also include the CSA-E mark on the rating plate.

Order code:
Design in accordance with CSA **N36**

UL-R and CSA approval

UL-R approval and CSA approval can also be ordered together for the motors.

Order code:
Design in accordance with UL-R and CSA **N38**

CCC – China Compulsory Certification

"Small power motors" which are exported to China must be certified up to a rated power of:

2-pole: ≤ 2.2 kW

4-pole: ≤ 1.1 kW

6-pole: ≤ 0.75 kW

8-pole: ≤ 0.55 kW

The **LA motors which must be certified** are certified by the CQC (China Quality Cert. Center). When one of these motors is ordered, the logo "CCC (Safety Mark)" is included on the rating plate and the packaging.

Notes:

Chinese customs checks the need for certification of imported products by means of the commodity code.

The following do not need to be certified:
- Motors imported to China which have already been installed in a machine
- Repair parts

Order code:
Design in accordance with CCC **N67**

CEEL – China Energy Efficiency Label

In June 2008 China introduced mandatory energy efficiency labeling for electric motors.

Since September 1, 2008, when the transition period expired, the applicable electrical motors could only be imported and sold in China with a valid "China Energy Efficiency Label".

The motor must be labeled with the "China Energy Efficiency Label" sticker, which states the efficiency class.

Apart from the Energy Label sticker (dimensions 80 x 54 mm) the efficiency must also be stated on the rating plate.

The labeling requirements apply to 2, 4 and 6-pole motors with a line frequency of 50 Hz and rated voltages of up to 690 V.

Efficiency classes 2 and 3 apply here to motors with a rated power of 0.55 kW to 315 kW and efficiency class 1 applies to motors with a rated power from 3 kW to 315 kW.

Order code:
Design in accordance with China Energy Efficiency Label **K69**

GOST-R conformity

The following gearboxes can be supplied, certified according to GOST-R:
- Helical gearboxes
- Bevel helical gearboxes
- Parallel shaft gearboxes
- Helical worm gearboxes
- Worm gearboxes
- CAVEX worm gearboxes

Order code:
Design in accordance with GOST **N30**

VIK version

For a VIK version, select an IEC motor from Catalog D 81.1 that can be mounted on gearboxes with an input unit K2 or K4.

Explosion protection as per ATEX

In the European market ATEX Directive 94/9/EC applies to all types of equipment used in potentially explosive atmospheres - which include geared motors. It became mandatory on July 1, 2003 and has unrestricted validity for the use of all geared motors within the European Union. Other countries too have now complied with this regulation.

Helical gearboxes, parallel shaft gearboxes, bevel helical gearboxes, and helical worm gearboxes are available to comply with this Directive. A wide range of gearbox and motor designs and sizes are approved for zones 1, 2 (gases) and zones 21 and 22 (dusts).

Ex-atmosphere / Zone		Category	Frequency
G (gas and steam)	D (dust)		
0	20	1	Continuously or long-term
1	21	2	Intermittent
2	22	3	Rarely or briefly

MOTOX geared motors can be provided for categories 2 and 3.

Use in explosive atmospheres caused by gases is permissible for temperature classes T1 to T4. With use in explosive atmospheres caused by dust, the maximum temperature of 120 °C must be taken into consideration for the gearbox. An oil level sensor can be integrated for monitoring in inaccessible areas.

Motors are available in the following protection types: flameproof enclosure (Exd), flameproof enclosure and terminal box with increased safety (Exde), increased safety (Exe), and non sparking (ExnA) as well as motors for dust explosion protection.

The motors are mounted on the gearbox with an input unit K4 or K2.

MOTOX Geared Motors
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Standards

The motors comply with all applicable international (IEC),
European (EN, CENELEC), and national (DIN/VDE) standards:

IEC	EN / HD	DIN / VDE	Title
IEC 60027-4	EN 60027-4	DIN EN 60027-4	Letter symbols for electrical engineering, part 4: Rotating electrical machines
IEC 60034-1	EN 60034-1	DIN EN 60034-1 VDE 0530-1	Rotating electrical machines: - Rating and performance
IEC 60034-2-1	EN 60034-2-1	DIN EN 60034-2-1 VDE 0530-2-1	- Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles) (IEC 60034-2-1:2007); German version EN 60034-2-1:2007
IEC 60034-5	EN 60034-5	DIN EN 60034-5 VDE 0530-5	- Degrees of protection provided by integral design of rotating electrical machines (IP code) - Classification
IEC 60034-6	EN 60034-6	DIN EN 60034-6 VDE 0530-6	- Methods of cooling (IC code)
IEC 60034-7	EN 60034-7	DIN EN 60034-7 VDE 0530-7	- Classification of types of construction, mounting arrangements and terminal box position (IM code)
IEC 60034-8	EN 60034-8	DIN EN 60034-8 VDE 0530-8	- Terminal markings and direction of rotation
IEC 60034-9	EN 60034-9	DIN EN 60034-9 VDE 0530-9	- Noise limits
IEC 60034-12	EN 60034-12	DIN EN 60034-12 VDE 0530-12	- Starting performance of three-phase cage induction motors except for pole-changing motors
IEC 60034-14	EN 60034-14	DIN EN 60034-14 VDE 0530-14	- Mechanical vibration of certain machines with shaft heights 56 mm and higher
IEC TS 60034-17	–	DIN VDE 0530-17	- Cage induction motors when fed from converters - Application guide
IEC 60038	HD 472	DIN IEC 60038	IEC standard voltages
–	EN 50347	DIN EN 50347	General purpose three-phase induction motors having standard dimensions and outputs - Sizes 56 to 315 and flange sizes 65 to 740
IEC 60085	EN 60085	DIN EN 60085	Electrical insulation, thermal evaluation and designation
IEC 60445	EN 60445	DIN EN 60445 VDE 0197	Identification of equipment terminals and conductor terminations
IEC 60529	EN 60529	DIN EN 60529 VDE 0470-1	Degrees of protection provided by enclosures (IP code)
–	EN 50262	DIN EN 50262 VDE 0619	Cable glands for electrical installations
–	–	DIN 42925	Terminal box cable entries for three-phase cage induction motors at rated voltages from 400 V to 690 V

The main dimensions of all gearboxes comply with
the following DIN standards:

DIN 747	Shaft heights for machines
DIN 748-1	Cylindrical shaft extensions; dimensions, nominal torques
DIN 42955	Concentricity of shaft extensions, concentricity and axial eccentricity of mounting flange
DIN 6885-1	Drive-type fastenings without taper action; feather key, slots, high format
DIN 332-2	Center holes in shaft ends

Fits

Flange form A, C:

b1 ≤ ø 230 = j6

b1 > ø 230 = h6

Drive-side shaft extension:

d1 < ø 55 = k6

d1 ≥ ø 55 = m6

See the dimension drawings for other fits.

Degrees of protection

The geared motors are supplied with IP55 to standard IEC 60034-5. For higher degrees of protection for motors, see Chapter 8 "Motor degrees of protection".

Direction of rotation of geared motors

The geared motors are configured so the motor shaft rotates clockwise (IEC 60034-8).

The direction of rotation of the gearbox output shaft can be reversed by swapping two external connection wires on the motor.

Specifying the direction of rotation for geared motors and gearboxes with backstop

It is necessary to specify the desired direction of rotation of the output shaft when ordering a gearbox with backstop. The direction of rotation is determined by the front view of the output shaft (shaft end face). With parallel shaft, bevel helical, and helical worm gearboxes, it is again necessary to specify the side on which the output shaft is located, i.e. either "Output side A" or "Output side B". The output side is defined by specifying the mounting position.
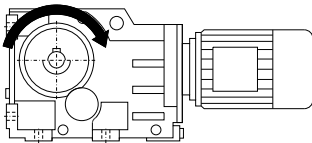
Direction of rotation of the geared motor when viewing the output shaft
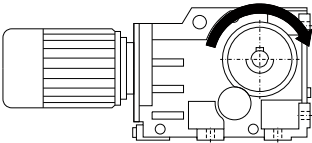
Output shaft direction of rotation order codes:

Clockwise **K18**
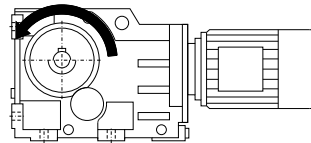
Counterclockwise **K19**
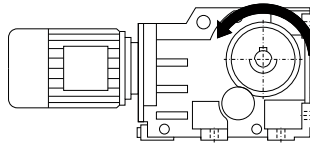
Clockwise

Output side A

Output side B

Counterclockwise

Output side A

Output side B

Gearbox	Size	Gear stages	Front view	Output shaft direction of rotation	Input shaft direction of rotation
Z	38 ... 188	2	Output shaft	Clockwise	Clockwise
				Counterclockwise	Counterclockwise
D	38 ... 188	3	Output shaft	Clockwise	Counterclockwise
				Counterclockwise	Clockwise
FZ	38B ... 188B, 208	2	Drive end of output shaft	Clockwise	Clockwise
				Counterclockwise	Counterclockwise
FD	38B ... 188B, 208	3	Drive end of output shaft	Clockwise	Counterclockwise
				Counterclockwise	Clockwise
C	38 ... 88	2	Drive end of output shaft	Clockwise	Clockwise
				Counterclockwise	Counterclockwise
B	28 ... 38	2	Drive end of output shaft	Clockwise	Clockwise
				Counterclockwise	Counterclockwise
K	38 ... 88	3	Drive end of output shaft	Clockwise	Counterclockwise
				Counterclockwise	Clockwise
K	108 ... 188	3	Drive end of output shaft	Clockwise	Clockwise
				Counterclockwise	Counterclockwise
K	38 ... 188	3	Non-drive end of output shaft	Clockwise	Counterclockwise
				Counterclockwise	Clockwise

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General technical data

Power ratings and torques

The specified power ratings and torques refer to standard versions, mounting positions B3../ B5../H01 and other comparable mounting positions, whereby the first stage is not completely immersed in oil. Normal ambient conditions and standard lubrication are also required.

Speeds

The specified output speeds are guide values, rounded to the first decimal place. You can use the rated motor speed and the gearbox speed to calculate the rated drive speed.

Please note that the actual output speed will depend on the motor load and the power supply conditions.

Noise

Noise emitted by the motors during mains operation

Noise is measured in accordance with ISO 1680 in a dead room. The noise level is specified as A-weighted measuring surface sound pressure level L_{pfA} in dB (A). This value is the spatial average value of the sound pressure levels measured at the measuring surface. The measuring surface is a cube 1 m away from the surface of the motor. The sound power level is also specified as L_{WA} in dB (A).

The values specified in the motor selection tables apply to the motor without gearbox at 50 Hz (see the selection and ordering data in the corresponding sections of the catalog).
The tolerance is +3 dB. At 60 Hz, the values are approximately 4 dB (A) higher. Please enquire about noise levels for pole-changing motors, geared motors, and inverter-fed motors.

##### *Noise emitted by the geared motors*

The geared motors do not exceed the permissible noise levels defined for gearboxes in VDI guideline 2159 and for motors in IEC 60034-9.
The values L_{pA} and L_S increase in each case by a general average of 3-5 dB (A) for geared motors as compared to motors without gears.

However, there is a strong correlation between noise level and:
- gear design
- speed and transmission ratios
- mounting positions
- other influencing factors

Precise data is available on request.
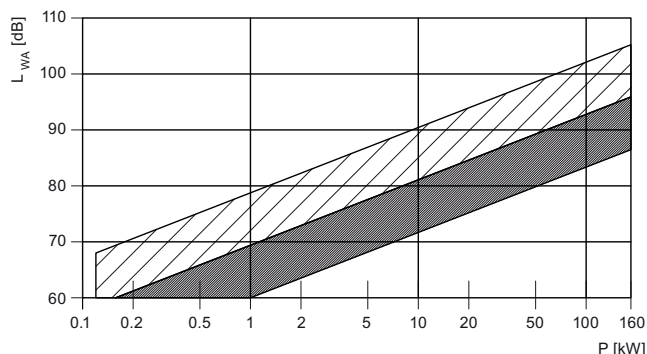
Weight of geared motors

The weight data contained in the dimension drawings are averaged values and do not take account of oil. The weights vary according to the gearbox design and size. The oil quantity depends on the mounting position.

The exact weight of the drive will be specified on the order confirmation.

Three-phase AC motors

Three-phase AC motors are designed to be perfectly coordinated with the gearbox system and can be supplied with or without a brake.

The motor series covers sizes 63 to 315.

The power ratings of the 2-, 4-, 6-, 8-, 8/2-, 8/4-, and 4/2-pole motors are classified in accordance with IEC. Pole-changing design with pole number 6/4 is available on request.
The housings of motors up to size 160 are made from high-quality aluminum alloy. Housings for sizes 180 and above are made from gray cast iron.

Brakes

The motors can be supplied with spring-operated disk brakes. These are double-disk brakes, which are spring-operated at zero current. (Safety brake)

The torque can be set within certain limits for every brake size.

Lubricants

All gearboxes are filled with lubricant at the factory. The lubricants used meet the requirements of DIN 51502. The gearboxes are filled with varying oil quantities (see operating instructions and rating plate) depending on their mounting position.
If no specifications are made to the contrary, the standard lubricant is used.

Required quality of gear lubricants

The oils used in the MOTOX gearboxes are subject to stringent quality control. For MOTOX gearboxes, only CLP-quality oils are approved which contain ingredients to DIN 51517-3 for improvement of corrosion protection, resistance to ageing, and which reduce wear in mixed-friction areas. The scuffing resistance in the FZG test to DIN 51354-2 must comply with stage 12 or higher under A/8.3/90 test conditions. In the FE-8 rolling bearing test to DIN 51817 rolling element wear must be under 30 mg and cage wear under 100 mg under D-7.5/80-80 test conditions.

In addition, the lubricants must meet the following quality requirements demanded by FLENDER:

- Sufficiently high gray-staining resistance in accordance with FVA 54 gray-staining test
- Low degree of foaming with less than 15 % foam formation in the FLENDER foam test
- Suitable for the elastomer material used in the radial shaft sealing of gearboxes
- Compatible with residues of corrosion-protection agent and run-in oils
- Compatible with the paints used by Siemens in the gearbox interiors
- Compatible with liquid sealing between bolted-joint surfaces.

For a list of approved oils from different manufacturers please refer to the Operating Instructions BA 7300.

Furthermore, for use in worm gearboxes:

Low wear, high pitting resistance, and high efficiency (low temperature) in the cylindrical worm gearbox test.

For a list of approved oils from different manufacturers please refer to the Operating Instructions BA 7303.

MOTOX Geared Motors
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■ **Lubricants** (continued)

Lubricants for helical gearboxes E / D / Z, parallel shaft gearbox F, bevel helical gearbox K:

Area of application	Ambient temperature [1]			DIN 51 502 designation	Order code
Standard oils					
Standard temperature	-10	…	+40 °C	CLP ISO VG220	**K06**
Improved oil service life	-20	…	+50 °C	CLP ISO PG VG220	**K07**
High temperature usage	0	…	+60 °C	CLP ISO PG VG460	**K08**
Low temperature usage	-40	…	+40 °C	CLP ISO PAO VG220	[2]
Lowest temperature usage	-40	…	+10 °C	CLP ISO PAO VG68	[2]
Physiologically safe oils (for use in the food industry) in acc. with NSF (USDA)-H1					
Standard temperature	-30	…	+40 °C	CLP ISO H1 VG460	**K11**
Biologically degradable oils					
Standard temperature	-20	…	+40 °C	CLP ISO E VG220	**K10**

[1] Recommended
[2] On request

Lubricants for bevel helical gearbox B and helical worm gearbox C:

Area of application	Ambient temperature [1]			DIN 51 502 designation	Order code
Standard oils					
Standard temperature	0	…	+60 °C	CLP ISO PG VG460	**K08**
Low temperature usage	-20	…	+50 °C	CLP ISO PG VG220	**K07**
Lowest temperature usage	-40	…	+40 °C	CLP ISO PAO VG220	[2]
Physiologically safe oils (for use in the food industry) in acc. with NSF (USDA)-H1					
Standard temperature	-30	…	+40 °C	CLP ISO H1 VG460	**K11**
Biologically degradable oils					
Standard temperature	-20	…	+40 °C	CLP ISO E VG220	**K10**

[1] Recommended
[2] On request

Lubricants for worm gearbox S:

Area of application	Ambient temperature [1]			DIN 51 502 designation	Order code
Standard oils					
Standard temperature	0	…	+60 °C	CLP ISO PG VG460	**K08**
Lowest temperature usage	-40	…	+40 °C	CLP ISO PAO VG 220	[2]
Physiologically safe oils (for use in the food industry) in acc. with NSF (USDA)-H1					
Standard temperature	-30	…	+50 °C	CLP ISO H1 VG460	**K11**

[1] Recommended
[2] On request

The ambient temperatures are applicable for gearboxes in standard operation. The data is based on our experience with standard applications. The oil sump temperature is a decisive factor for the service life of the lubricant and depends to a large extent on the gearbox type, gearbox size, transmission ratio, mounting position, input speed, and operating mode.

The standard gearbox version can be used in the range -20 °C to +40°C. Operation outside this range requires a variety of measures. Please contact us.

The data on usage in high, low, and lowest temperature ranges only refers to the lubricant.

It may be necessary to take other design measures. Please contact us.

With low ambient temperatures, critical startup characteristics need to be taken into account.

With higher ambient temperatures (> 40 °C), the permissible oil sump temperature must not be exceeded. Please contact us if you require your drive to be thermally tested.

■ **Long-term preservation**

Helical gearboxes, parallel shaft gearboxes, bevel helical gearboxes, and helical worm gearboxes can be delivered with a long-term preservation of up to 36 months. The free shaft extensions, sealing elements, and flanges are coated with a protective layer of grease. The gearbox is completely filled with oil for long-term preservation.

See the operating instructions for information on storage and commissioning.

Order code:
Long-term preservation up to 36 months   **K17**

Surface treatment

We offer 5 high-quality paint systems in different hues to protect drives against corrosion and external influences.

Our corrosion protection range is available in accordance with the corrosion categories of the DIN EN ISO 12944-2 standard.

Geared motors of size 38 and above are painted in RAL 5015 (sky blue) as standard according to corrosion category C1. This ensures that they are protected against corrosion for installation in interior areas. Gearboxes of size 08, 18 and 28 with an aluminum housing are supplied unpainted as standard.

For transport, the bare parts are coated with anti-corrosion paint which will last for a limited amount of time.

Overview of surface treatment

Corrosion category	Order code	Paint system	Hue	Description
Surface protection for normal environmental stress				
C1	L02	1-component water-based coating	Standard: 5015 On request: RAL 1003, 1007, 1012, 1018, 1023, 2000, 2004, 3000, 5007, 5009, 5010, 5012, 6011, 6018, 7001, 7011, 7016, 7030, 7031, 7032, 7035, 9005, 9006, 9010	• Indoor installation • Heated buildings with neutral atmospheres • Resistance to greases and some resistance to mineral oils, aliphatic solvents • Standard paint finish
Surface protection for minimal environmental stress				
C2	L03	2-component polyurethane primer 2-component polyurethane top coat	Standard: RAL 7031 On request: RAL 1003, 1012, 1018, 1023, 2004, 3000, 5002, 5007, 5009, 5010, 5012, 5015, 6011, 6018, 7000, 7001, 7011, 7030, 7032, 7035, 9005, 9006, 9010, 9011, 9016	• Indoor and outdoor installation • Unheated buildings with condensation, production areas with low humidity, e. g. warehouses and sports facilities • Atmospheres with little contamination, mostly rural areas • Resistant to greases, mineral oils and sulfuric acid (10 %), caustic soda (10 %) and some resistance to aliphatic solvents
Surface protection for medium environmental stress				
C3	L04	2-component polyurethane primer 2-component polyurethane top coat	Standard: RAL 7031 On request: RAL 1003, 1012, 1018, 1023, 2004, 3000, 5002, 5007, 5009, 5010, 5012, 5015, 6011, 6018, 7000, 7001, 7011, 7016, 7030, 7031, 7032, 7035, 9005, 9006, 9010, 9011, 9016	• Indoor and outdoor installation • Production areas with high levels of humidity and some air pollution, e. g. plants for food manufacturing, dairies, laundries and breweries • Urban and industrial atmospheres, moderate contamination from sulfur dioxide, coastal areas with low salt levels • Resistant to greases, mineral oils, aliphatic solvents, sulfuric acid (10 %), caustic soda (10 %)
Surface protection for high environmental stress				
C4	L20	2-component epoxy zinc phosphate primer 2-component polyurethane top coat	Standard: RAL 7031 On request: RAL 1003, 1012, 1018, 1023, 2004, 3000, 5002, 5007, 5009, 5010, 5012, 5015, 6011, 6018, 7000, 7001, 7011, 7016, 7030, 7031, 7032, 7035, 9005, 9006, 9010, 9011, 9016	• Indoor and outdoor installation • Chemical plants, swimming pools, wastewater treatment plants, electroplating shops, and boathouses above seawater • Industrial areas and coastal areas with moderate salt levels • Resistant to greases, mineral oils, aliphatic solvents, sulfuric acid (10 %), caustic soda (10 %)
Surface protection for extremely high environmental stress				
C5	L05	2-component epoxy zinc phosphate primer 2-component epoxy iron mica 2-component polyurethane top coat	Standard: RAL 7031 On request: RAL 1003, 1012, 1018, 1023, 2004, 3000, 5002, 5007, 5009, 5010, 5012, 5015, 6011, 6018, 7000, 7001, 7011, 7016, 7030, 7031, 7032, 7035, 9005, 9006, 9010, 9011, 9016	• Indoor and outdoor installation • Buildings and areas with almost constant condensation and with heavy pollution, e. g. malt factories and aseptic areas • Industrial areas with high humidity and aggressive atmosphere, coastal areas and offshore environments with high salt levels • Resistant to greases, mineral oils, aliphatic solvents, sulfuric acid (10 %), caustic soda (20 %)

MOTOX Geared Motors
Introduction

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General technical data

Surface treatment (continued)

Corrosion category	Order code	Paint system	Hue	Description
Primed according to corrosion category C2 G				**Repaintability with *)**
C2 G	L01	2-component polyurethane primer		• 2-component polyurethane paint, 2-component epoxide paint and acid hardening paint, 2-component acrylic paint
Primed according to corrosion category C4 G				**Repaintability with *)**
C4 G	L09	2-component epoxy zinc phosphate primer		• 2-component polyurethane paint, 2-component epoxide paint and acid hardening paint, 2-component acrylic paint
Unpainted				**Repaintability with *)**
C1 G	L00			• Plastic paint, synthetic resin paint, oil paint, 2-component polyurethane paint, 2-component epoxide paint
Special pre-treatment before painting				
	L19			• For special requirements for the surface treatment and priming of drives, especially as a primer and intermediate coating for surface protection under severe environmental stress

*   Note:
Information about repaintability is not a guarantee of the quality of the paint product purchased from your supplier. Only the paint manufacturer is liable for the quality and compatibility.

Order codes for RAL colors:

5015 Sky blue (standard)	**L50**
7011 Steel gray	**L51**
7031 Blue gray	**L53**
7035 Light gray	**L54**
7030 Stone gray	**L55**

The colors listed above can be specified using order code Y80 and the RAL color code in plain text.
Example: Reseda green (RAL6011)
Order code: **Y80**
Plain text: **Y80*RAL @ 6011***

Increased protection against humidity and tropical climate

Increased protection against humidity and tropical climate can be supplied as an option for (geared) motors of frame sizes 71 to 200L. This version is designed for humidity in the range from 30 to 60 g water per m^3 air depending on the temperature (see page 8/26). This version comprises a surface treatment for corrosion category C2 (**L03**), increased humidity and acid protection for the winding (**N54**), motor-internal corrosion protection (**N41**) and temperature class (155) F.

Combination with increased acid and alkali protection is not possible.

If function expansions (brakes, backstop, encoder systems) are required on the motor, consultation with the manufacturer is necessary beforehand.

Increased protection against humidity and tropical climate is not possible together with worm geared motors S.

Order code:
Increased protection against humidity
and tropical climate   **N43**

Increased protection against acid and alkali

Increased protection against acid and alkali can be supplied as an option for (geared) motors of frame sizes 71 to 200L. This version is suitable for city and industrial atmospheres with moderate pollution with sulfur dioxide, coastal areas with low salt levels and aggressive atmospheres with up to 1 % concentrations of acids or alkalis. This version comprises a surface treatment for corrosion category C3 (**L04**), increased humidity and acid protection for the winding (**N54**), motor-internal corrosion protection (**N41**), temperature class (155) F and pressure ventilation in the gearbox (**G45**).

Combination with increased humidity and tropical climate protection is not possible.

If function expansions (brakes, backstop, encoder systems) are required on the motor, consultation with the manufacturer is necessary beforehand.

Increased protection against acid and alkali is not possible together with worm geared motors S.

Order code:
Increased protection against acid and alkali   **N44**

Rating plate

The rating plates of the gearboxes or geared motors are made of coated aluminum foil. They are covered by a special adhesive foil which gives them permanent resistance to ultraviolet rays and a variety of other substances (oils, greases, salt water, cleaning agents, etc.).

The adhesives and materials have been specially selected to ensure reliable adhesion and good legibility for the service life of the product, even when it is operated at the boundaries of the permissible temperature range (-40 °C ... +155 °C).

In accordance with DIN EN 60034-1, the total weight (as of approximately 30 kg) is specified on the rating plate for all geared motors.

Rating plate on stainless steel support plate

For geared motors with motors up to and including size 200, the rating plate can also be attached to a stainless steel support plate.

Order code:

Rating plate on stainless steel support plate **K26**

2nd rating plate enclosed separately

An additional rating plate can be supplied as a separately enclosed item for all gearboxes and geared motors.

Order code:

2nd rating plate, enclosed separately **K41**

2nd rating plate mounted

On request, the 2nd rating plate can be supplied mounted to the motor for geared motors with motors up to and including size 200.

Order code:

2nd rating plate, mounted **K68**

The rating plate is labeled in international format as standard.

For geared motors with motors up to and including size 200, the rating plate is mounted on an aluminum support plate which is attached to the motor.

In the case of gearboxes without motor and geared motors with motor of size 225 to 315, the rating plate is attached to the gearbox housing.

Motors of $\geq$ size 225 also have a rating plate with the motor data.

Example of a rating plate:

Documentation

The geared motors are supplied with the following documentation as standard:

• Commissioning guide (paper) English/German

• Manual Collection (on CD) with all operating instructions in Czech, Dutch, English, French, German, Italian, Russian, Spanish, and Swedish.

The following documents are optionally available:

• Circuit diagram of motor

• Certificate of compliance with the order EN 10204-2.1 and works test certificate EN 10204-2.2 for the geared motor on request

• Works test certificate EN 10204-2.2 for the material on request

• Works test certificate EN 10204-3.1 for the gearbox, tests carried out on:
  - Output shaft diameter
  - The concentricity of the output shaft
  - The concentricity of input shaft
    (for solo gearboxes only, input units A and P)
  - The input shaft diameter
    (for solo gearboxes only, input units A and P)
  - Noise (subjective evaluation)
    The concentricity of the input shaft (for solo gearboxes only)

• Works test certificate EN 10204-3.1 for motors, tests carried out on:
  - The 3 no-load currents of the 3 phases
  - The power loss during no-load operation
  - The no-load speed.

MOTOX Geared Motors
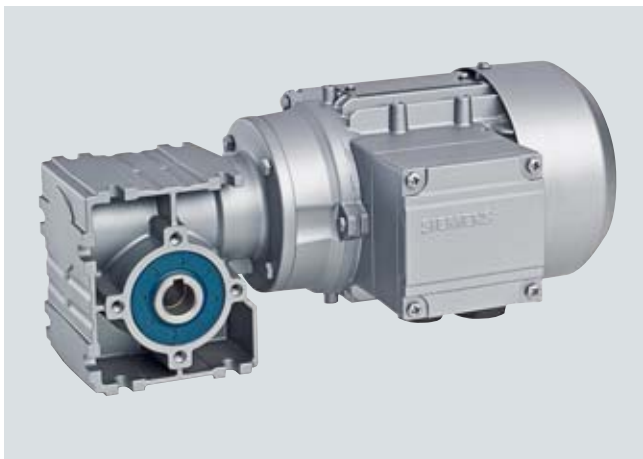## Introduction

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Notes

Worm geared motors

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MOTOX Geared Motors
Worm geared motors

■ **Overview**

The worm gearbox series S is designed for different mechanical engineering tasks for the lower torque range. Thanks to the small dimensions and low weight, the products are suitable for a wide range of different applications.

The compact MOTOX S worm gearboxes have worm gear teeth that are characterized by particularly low-noise operating characteristics at high levels of efficiency. The mounting position and the position of the output shafts can be freely selected. At the output, solid shafts and hollow shafts are available as alternatives. The gearbox housings have a centering edge at both output sides by default. They can also be secured with a flange or torque arm. Foot mounting is possible on three sides.

The worm gearboxes of the S series are single-stage worm gearboxes. The worm toothing has been manufactured in accordance with the latest technical know-how and is based on the worm form ZK, whereby the best gliding properties are achieved using worm gears made of high-quality bronze and worm shafts made of steel. The worm shafts undergo additional grinding to ensure that the gearbox performs its task with as little noise and as few losses as possible. The highly stable and light cast-metal housings are made from high-quality aluminum alloy. This means that the gearboxes have low surface temperatures.

The gear teeth and the rolling-contact bearings are lubricated with synthetic lubricant in all of the types of construction. The oil fill level is optimized for every mounting angle and the gearbox can be operated as required in any mounting angle. The gearboxes are permanently lubricated, an oil change is not required. No oil control or drain plugs are required.

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Worm gearboxes S are designated as follows:

Gearbox type:

    S   Worm gearbox

Transmission stage (-) Unspecified

Type:

Shaft   (-) Solid shaft
                      - With one shaft extension
                        (position A or B)
                      - With two shaft extensions (pos. AB)
             A Hollow shaft

Mounting   (-) Foot-mounted design
             F Flange-mounted design (A-type)
             Z Housing flange (C-type), on both sides
             D Torque arm

Input unit:

    K4   Short coupling lantern with clamp connection for connecting an IEC motor

Example: **S F 08 - K4 (71)**

Gearbox type
Type
Size
Input unit
(for motor size)

Overview (continued)

Modular system

The MOTOX S worm gearboxes are supplied in a basic version. With further components, the gearboxes can be mounted in the installation with a flange or torque arm. The mounting surfaces on the housing can be utilized for the foot mounting.

The geared motors are delivered completely assembled. The torque arm is supplied loose to enable it to be mounted as required on site. The position of the torque arm can be freely selected.

G_D087_XX_00128
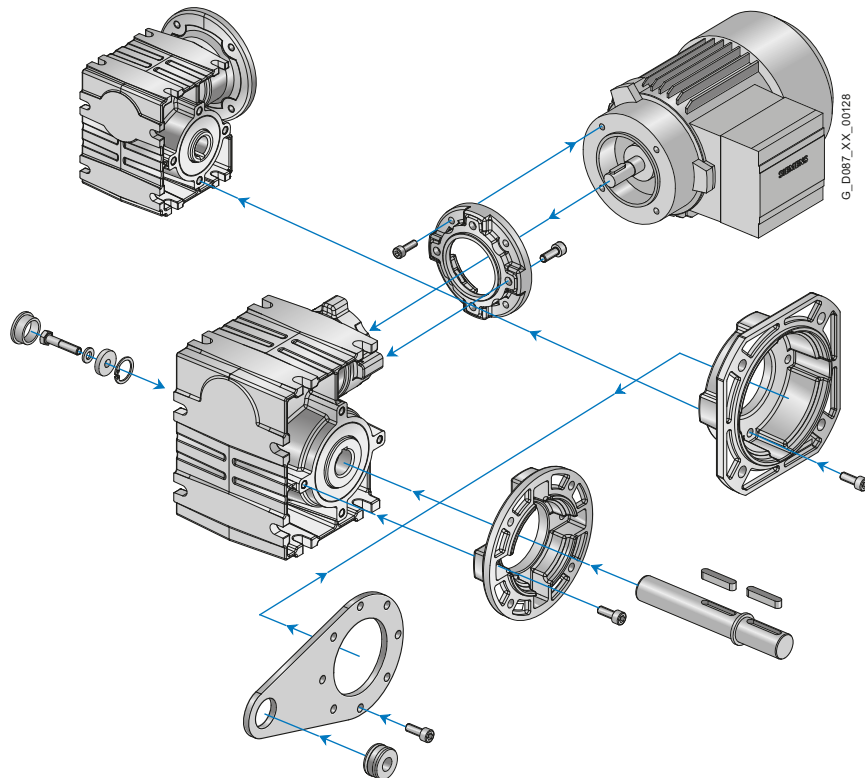
Use

MOTOX S worm gearboxes are characterized by high throughput in a very small space and a high transmission ratio in a single stage. Thanks to their compact design, worm gearboxes are an ideal solution when installation space is at a premium and they offer a range of mounting options due to their flange, foot, and torque-arm housing designs.

Output shafts are available in different versions and diameters, as solid or hollow shafts. The gearbox housings, made from die-cast aluminum with good thermal conductivity, are strong and absorb vibrations.

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MOTOX Geared Motors
Worm geared motors

General technical data

■ **Permissible radial force F_{Rperm}**

Gearbox type	d mm	l mm	y mm	z mm	a kNmm	F_{Rperm} in N with x = l/2 for output speeds n_2 in rpm							
						≤ 16	≤ 25	≤ 40	≤ 63	≤ 100	≤ 160	≤ 250	≤ 400
S08	16	40	83.5	63.5	36 000	1 800	1 800	1 800	1 800	1 800	1 690	1 400	1 120
SF08			106.0	86.0		1 800	1 800	1 800	1 800	1 620	1 330	1 100	880
S18	20	40	98.0	78.0	76 000	3 800	3 800	3 800	3 200	2 650	2 180	1 780	1 420
SF18			128.0	108.0		3 200	3 120	2 920	2 450	2 030	1 670	1 360	1 090
S28	20	40	120.5	100.5	72 000	3 600	3 600	3 600	3 600	3 600	3 290	2 680	2 120
SF28			153.5	133.5		3 600	3 600	3 600	3 600	3 150	2 580	2 110	1 660

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Selection and ordering data

The selection tables show the most common variants and combinations. Other combinations can be selected using our MOTOX Configurator or made available on request.

Power rating P_{Motor}	Output speed	Output torque	Service factor	Gearbox ratio	Order No.	Order code	Weight *)
kW (50 Hz)	n_2 (50 Hz) rpm	T_2 Nm	f_B	i_{tot}		(No. of poles)	kg
0.09	**S.28-LAI63M6**						
	8.5	46.2	1.6	100	**2KJ1732 - ■BE13 - ■■A1**	**P01**	8
	10.6	41.0	2.1	80	**2KJ1732 - ■BE13 - ■■B1**	**P01**	8
	14.2	34.5	2.8	60	**2KJ1732 - ■BE13 - ■■C1**	**P01**	8
	S.18-LAI63M6						
	10.6	39.6	0.9	80	**2KJ1731 - ■BE13 - ■■B1**	**P01**	6
	14.2	33.8	1.4	60	**2KJ1731 - ■BE13 - ■■C1**	**P01**	6
	17	30.0	1.7	50	**2KJ1731 - ■BE13 - ■■D1**	**P01**	6
	S.08-LAI63M6						
	14.2	29.9	0.8	60	**2KJ1730 - ■BE13 - ■■C1**	**P01**	5
	17.0	26.8	1	50	**2KJ1730 - ■BE13 - ■■D1**	**P01**	5
	21.2	23.5	1.3	40	**2KJ1730 - ■BE13 - ■■E1**	**P01**	5
0.12	**S.28-LAI63S4**						
	13.5	40.3	1.7	100	**2KJ1732 - ■BC13 - ■■A1**		8
	16.9	35.7	2.3	80	**2KJ1732 - ■BC13 - ■■B1**		8
	22.5	29.9	2.7	60	**2KJ1732 - ■BC13 - ■■C1**		8
	27	26.5	3	50	**2KJ1732 - ■BC13 - ■■D1**		8
	33.8	22.9	3.4	40	**2KJ1732 - ■BC13 - ■■E1**		8
	45	18.5	4.1	30	**2KJ1732 - ■BC13 - ■■F1**		8
	S.18-LAI63S4						
	16.9	34.8	1	80	**2KJ1731 - ■BC13 - ■■B1**		6
	22.5	29.5	1.5	60	**2KJ1731 - ■BC13 - ■■C1**		6
	27	26.2	1.7	50	**2KJ1731 - ■BC13 - ■■D1**		6
	33.8	22.6	2	40	**2KJ1731 - ■BC13 - ■■E1**		6
	45	18.2	2.4	30	**2KJ1731 - ■BC13 - ■■F1**		6
	54	15.9	2.5	25	**2KJ1731 - ■BC13 - ■■G1**		6
	67.5	13.5	3.2	20	**2KJ1731 - ■BC13 - ■■H1**		6
	90	10.6	4.1	15	**2KJ1731 - ■BC13 - ■■J1**		6
	135	7.4	5.7	10	**2KJ1731 - ■BC13 - ■■K1**		6
	193	5.4	7.6	7	**2KJ1731 - ■BC13 - ■■L1**		6
	270	3.9	10	5	**2KJ1731 - ■BC13 - ■■M1**		6
	S.08-LAI63S4						
	22.5	26.4	0.88	60	**2KJ1730 - ■BC13 - ■■C1**		5
	27.0	23.5	1.1	50	**2KJ1730 - ■BC13 - ■■D1**		5
	33.8	20.5	1.4	40	**2KJ1730 - ■BC13 - ■■E1**		5
	45.0	16.9	1.7	30	**2KJ1730 - ■BC13 - ■■F1**		5
	54.0	14.8	1.9	25	**2KJ1730 - ■BC13 - ■■G1**		5
	67.5	12.7	2.2	20	**2KJ1730 - ■BC13 - ■■H1**		5

Shaft designs, see page 6/13 ———————————— 1, 5 or 6 ————————

Frequency and voltage, see page 8/20 ———————————— 1 to 9 ————————

Gearbox housing mounting position, see page 6/15 ———————————— A, D, F or H ————————

*) Design: worm gearbox S with solid shaft

MOTOX Geared Motors
Worm geared motors

Geared motors up to 1.1 kW

■ **Selection and ordering data** (continued)

Power rating P_{Motor} kW (50 Hz)	Output speed n_2 (50 Hz) rpm	Output torque T_2 Nm	Service factor f_B	Gearbox ratio i_{tot}	Order No.	Order code (No. of poles)	Weight *) kg
0.12	**S.08-LAI63S4**						
	90	10.1	2.7	15	2KJ1730 - ■BC13 - ■■J1		5
	135	7.2	3.9	10	2KJ1730 - ■BC13 - ■■K1		5
	193	5.2	5.3	7	2KJ1730 - ■BC13 - ■■L1		5
	270	3.8	6.7	5	2KJ1730 - ■BC13 - ■■M1		5
0.18	**S.28-LAI71S6**						
	10.6	82	1.1	80	2KJ1732 - ■CD13 - ■■B1	P01	10
	14.2	69.1	1.4	60	2KJ1732 - ■CD13 - ■■C1	P01	10
	17	61.5	1.5	50	2KJ1732 - ■CD13 - ■■D1	P01	10
	21.2	53.2	1.8	40	2KJ1732 - ■CD13 - ■■E1	P01	10
	28.3	43.3	2.1	30	2KJ1732 - ■CD13 - ■■F1	P01	10
	S.28-LAI63M4						
	13.5	60.4	1.2	100	2KJ1732 - ■BE13 - ■■A1		8
	16.9	53.5	1.5	80	2KJ1732 - ■BE13 - ■■B1		8
	22.5	44.8	1.8	60	2KJ1732 - ■BE13 - ■■C1		8
	27	39.8	2	50	2KJ1732 - ■BE13 - ■■D1		8
	33.8	34.3	2.3	40	2KJ1732 - ■BE13 - ■■E1		8
	45	27.7	2.8	30	2KJ1732 - ■BE13 - ■■F1		8
	54	24	3.1	25	2KJ1732 - ■BE13 - ■■G1		8
	67.5	20.4	3.7	20	2KJ1732 - ■BE13 - ■■H1		8
	S.28-LAI63S2						
	282	5.4	9.9	10	2KJ1732 - ■BC13 - ■■K1	P00	8
	403	3.9	13.4	7	2KJ1732 - ■BC13 - ■■L1	P00	8
	564	2.8	18.1	5	2KJ1732 - ■BC13 - ■■M1	P00	8
	S.18-LAI71S6						
	17	60.1	0.86	50	2KJ1731 - ■CD13 - ■■D1	P01	8
	21.2	52.4	1	40	2KJ1731 - ■CD13 - ■■E1	P01	8
	S.18-LAI63M4						
	22.5	44.3	1	60	2KJ1731 - ■BE13 - ■■C1		6
	27	39.2	1.1	50	2KJ1731 - ■BE13 - ■■D1		6
	33.8	34	1.3	40	2KJ1731 - ■BE13 - ■■E1		6
	45	27.4	1.6	30	2KJ1731 - ■BE13 - ■■F1		6
	54	23.8	1.6	25	2KJ1731 - ■BE13 - ■■G1		6
	67.5	20.3	2.2	20	2KJ1731 - ■BE13 - ■■H1		6
	90	15.9	2.7	15	2KJ1731 - ■BE13 - ■■J1		6
	135	11.1	3.8	10	2KJ1731 - ■BE13 - ■■K1		6
	193	8	5.1	7	2KJ1731 - ■BE13 - ■■L1		6
	270	5.8	6.7	5	2KJ1731 - ■BE13 - ■■M1		6
	S.18-LAI63S2						
	282	5.4	5.6	10	2KJ1731 - ■BC13 - ■■K1	P00	6
	403	3.9	7.5	7	2KJ1731 - ■BC13 - ■■L1	P00	6
	564	2.8	9.9	5	2KJ1731 - ■BC13 - ■■M1	P00	6

Shaft designs, see page 6/13 —— **1, 5 or 6**
Frequency and voltage, see page 8/20 —— **1 to 9**
Gearbox housing mounting position, see page 6/15 —— **A, D, F or H**

*) Design: worm gearbox S with solid shaft

Selection and ordering data (continued)

Power rating P_{Motor}	Output speed	Output torque	Service factor	Gearbox ratio	Order No.	Order code	Weight *)
kW (50 Hz)	n_2 (50 Hz)	T_2	f_B	i_{tot}		(No. of poles)	
	rpm	Nm					kg
0.18	**S.08-LAI63M4**						
	33.8	30.7	0.91	40	2KJ1730 - ■BE13 - ■■E1		5
	45.0	25.3	1.1	30	2KJ1730 - ■BE13 - ■■F1		5
	54.0	22.2	1.3	25	2KJ1730 - ■BE13 - ■■G1		5
	67.5	19.1	1.4	20	2KJ1730 - ■BE13 - ■■H1		5
	90	15.2	1.8	15	2KJ1730 - ■BE13 - ■■J1		5
	135	10.8	2.6	10	2KJ1730 - ■BE13 - ■■K1		5
	193	7.8	3.5	7	2KJ1730 - ■BE13 - ■■L1		5
	270	5.8	4.5	5	2KJ1730 - ■BE13 - ■■M1		5
	S.08-LAI63S2						
	282	5.2	3.9	10	2KJ1730 - ■BC13 - ■■K1	P00	5
	403	3.8	5.3	7	2KJ1730 - ■BC13 - ■■L1	P00	5
	564	2.8	7	5	2KJ1730 - ■BC13 - ■■M1	P00	5
0.25	**S.28-LAI71M6**						
	14.3	94.9	1	60	2KJ1732 - ■CE13 - ■■C1	P01	10
	17.2	84.5	1.1	50	2KJ1732 - ■CE13 - ■■D1	P01	10
	S.28-LAI71S4						
	16.9	74.3	1.1	80	2KJ1732 - ■CD13 - ■■B1		10
	22.5	62.3	1.3	60	2KJ1732 - ■CD13 - ■■C1		10
	27	55.3	1.4	50	2KJ1732 - ■CD13 - ■■D1		10
	33.8	47.6	1.7	40	2KJ1732 - ■CD13 - ■■E1		10
	45	38.5	2	30	2KJ1732 - ■CD13 - ■■F1		10
	54	33.4	2.3	25	2KJ1732 - ■CD13 - ■■G1		10
	S.28-LAI63M2						
	283	7.4	7.1	10	2KJ1732 - ■BE13 - ■■K1	P00	8
	404	5.4	9.7	7	2KJ1732 - ■BE13 - ■■L1	P00	8
	566	3.9	13.1	5	2KJ1732 - ■BE13 - ■■M1	P00	8
	S.18-LAI71S4						
	27	54.5	0.82	50	2KJ1731 - ■CD13 - ■■D1		8
	33.8	47.2	0.95	40	2KJ1731 - ■CD13 - ■■E1		8
	45	38	1.2	30	2KJ1731 - ■CD13 - ■■F1		8
	54	33.1	1.2	25	2KJ1731 - ■CD13 - ■■G1		8
	67.5	28.1	1.5	20	2KJ1731 - ■CD13 - ■■H1		8
	90	22.1	2	15	2KJ1731 - ■CD13 - ■■J1		8
	135	15.5	2.8	10	2KJ1731 - ■CD13 - ■■K1		8
	193	11.2	3.7	7	2KJ1731 - ■CD13 - ■■L1		8
	270	8.1	4.8	5	2KJ1731 - ■CD13 - ■■M1		8
	S.18-LAI63M2						
	283	7.4	4	10	2KJ1731 - ■BE13 - ■■K1	P00	6
	404	5.4	5.4	7	2KJ1731 - ■BE13 - ■■L1	P00	6
	566	3.9	7.1	5	2KJ1731 - ■BE13 - ■■M1	P00	6
	S.08-LAI63M2						
	70.8	21.3	1	40	2KJ1730 - ■BE13 - ■■E1	P00	5
	94.3	17.2	1.2	30	2KJ1730 - ■BE13 - ■■F1	P00	5

Shaft designs, see page 6/13 ──────── 1, 5 or 6 ────────

Frequency and voltage, see page 8/20 ──────── 1 to 9 ────────

Gearbox housing mounting position, see page 6/15 ──────── A, D, F or H ────────

*) Design: worm gearbox S with solid shaft

MOTOX Geared Motors
Worm geared motors

Geared motors up to 1.1 kW

■ **Selection and ordering data** (continued)

Power rating P_{Motor}	Output speed	Output torque	Service factor	Gearbox ratio	Order No.	Order code	Weight *)
kW (50 Hz)	n_2 (50 Hz)	T_2	f_B	i_{tot}		(No. of poles)	
	rpm	Nm					kg
0.25	**S.08-LAI63M2**						
	113	15.2	1.4	25	2KJ1730 - ■BE13 - ■■G1	P00	5
	142	13	1.6	20	2KJ1730 - ■BE13 - ■■H1	P00	5
	189	10.3	2	15	2KJ1730 - ■BE13 - ■■J1	P00	5
	283	7.3	2.8	10	2KJ1730 - ■BE13 - ■■K1	P00	5
	404	5.3	3.8	7	2KJ1730 - ■BE13 - ■■L1	P00	5
	566	3.8	5	5	2KJ1730 - ■BE13 - ■■M1	P00	5
0.37	**S.28-LAI71M4**						
	22.8	90.9	0.89	60	2KJ1732 - ■CE13 - ■■C1		10
	27.4	80.7	0.98	50	2KJ1732 - ■CE13 - ■■D1		10
	34.2	69.5	1.1	40	2KJ1732 - ■CE13 - ■■E1		10
	45.7	56.2	1.4	30	2KJ1732 - ■CE13 - ■■F1		10
	54.8	48.7	1.5	25	2KJ1732 - ■CE13 - ■■G1		10
	68.5	41.3	1.8	20	2KJ1732 - ■CE13 - ■■H1		10
	S.28-LAI71S2						
	274	11.4	4.8	10	2KJ1732 - ■CD13 - ■■K1	P00	10
	391	8.2	6.5	7	2KJ1732 - ■CD13 - ■■L1	P00	10
	548	6	8.7	5	2KJ1732 - ■CD13 - ■■M1	P00	10
	S.18-LAI71M4						
	54.8	48.3	0.81	25	2KJ1731 - ■CE13 - ■■G1		8
	68.5	41.1	1.1	20	2KJ1731 - ■CE13 - ■■H1		8
	91.3	32.2	1.3	15	2KJ1731 - ■CE13 - ■■J1		8
	137	22.6	1.9	10	2KJ1731 - ■CE13 - ■■K1		8
	196	16.3	2.5	7	2KJ1731 - ■CE13 - ■■L1		8
	274	11.8	3.3	5	2KJ1731 - ■CE13 - ■■M1		8
	S.18-LAI71S2						
	274	11.4	2.7	10	2KJ1731 - ■CD13 - ■■K1	P00	8
	391	8.2	3.6	7	2KJ1731 - ■CD13 - ■■L1	P00	8
	548	5.9	4.7	5	2KJ1731 - ■CD13 - ■■M1	P00	8
0.55	**S.28-LAI80S4**						
	46.5	82.1	0.92	30	2KJ1732 - ■DB13 - ■■F1		14
	55.8	71.1	1	25	2KJ1732 - ■DB13 - ■■G1		14
	69.8	60.3	1.2	20	2KJ1732 - ■DB13 - ■■H1		14
	93	47.3	1.6	15	2KJ1732 - ■DB13 - ■■J1		14
	140	33.1	2.3	10	2KJ1732 - ■DB13 - ■■K1		14
	199	23.9	3.1	7	2KJ1732 - ■DB13 - ■■L1		14
	279	17.4	4	5	2KJ1732 - ■DB13 - ■■M1		14
	S.28-LAI71M2						
	280	16.5	3.2	10	2KJ1732 - ■CE13 - ■■K1	P00	10
	400	11.9	4.4	7	2KJ1732 - ■CE13 - ■■L1	P00	10
	560	8.7	5.9	5	2KJ1732 - ■CE13 - ■■M1	P00	10
	S.18-LAI71M2						
	112	35.8	0.83	25	2KJ1731 - ■CE13 - ■■G1	P00	8
	140	30.4	1	20	2KJ1731 - ■CE13 - ■■H1	P00	8

Shaft designs, see page 6/13 ———————— 1, 5 or 6 ————————

Frequency and voltage, see page 8/20 ———————— 1 to 9 ————————

Gearbox housing mounting position, see page 6/15 ———————— A, D, F or H ————————

*) Design: worm gearbox S with solid shaft

■ **Selection and ordering data** (continued)

Power rating P_{Motor}	Output speed	Output torque	Service factor	Gearbox ratio	Order No.	Order code	Weight *)
kW (50 Hz)	n_2 (50 Hz)	T_2	f_B	i_{tot}		(No. of poles)	
	rpm	Nm					kg
0.55	**S.18-LAI71M2**						
	187	23.7	1.3	15	2KJ1731 - ■CE13 - ■■J1		8
	280	16.5	1.8	10	2KJ1731 - ■CE13 - ■■K1		8
	400	11.9	2.4	7	2KJ1731 - ■CE13 - ■■L1		8
	560	8.6	3.2	5	2KJ1731 - ■CE13 - ■■M1		8
0.75	**S.28-LAI80ZMB4**						
	70	81.9	0.92	20	2KJ1732 - ■DE13 - ■■H1		14
	93.3	64.3	1.2	15	2KJ1732 - ■DE13 - ■■J1		14
	140	45	1.7	10	2KJ1732 - ■DE13 - ■■K1		14
	200	32.5	2.3	7	2KJ1732 - ■DE13 - ■■L1		14
	280	23.7	3	5	2KJ1732 - ■DE13 - ■■M1		14
	S.28-LAI80M2						
	95.7	54.9	0.97	30	2KJ1732 - ■DC13 - ■■F1	P00	14
	115	47.5	1.1	25	2KJ1732 - ■DC13 - ■■G1	P00	14
	144	40.3	1.3	20	2KJ1732 - ■DC13 - ■■H1	P00	14
	191	31.5	1.7	15	2KJ1732 - ■DC13 - ■■J1	P00	14
	287	22	2.4	10	2KJ1732 - ■DC13 - ■■K1	P00	14
	410	15.9	3.3	7	2KJ1732 - ■DC13 - ■■L1	P00	14
	574	11.6	4.4	5	2KJ1732 - ■DC13 - ■■M1	P00	14
1.1	**S.28-LAI80ZMB2**						
	143	59.4	0.91	20	2KJ1732 - ■DN13 - ■■H1	P00	14
	191	46.4	1.1	15	2KJ1732 - ■DN13 - ■■J1	P00	14
	286	32.4	1.6	10	2KJ1732 - ■DN13 - ■■K1	P00	14
	409	23.4	2.2	7	2KJ1732 - ■DN13 - ■■L1	P00	14
	572	17.0	3	5	2KJ1732 - ■DN13 - ■■M1	P00	14

Shaft designs, see page 6/13 ——————— **1, 5 or 6** ———————

Frequency and voltage, see page 8/20 ——————— **1 to 9** ———————

Gearbox housing mounting position, see page 6/15 ——————— **A, D, F or H** ———————

*) Design: worm gearbox S with solid shaft

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MOTOX Geared Motors
Worm geared motors

Transmission ratios and maximum torques

■ **Selection and ordering data**

Gearbox size	Ratio code Order No.	Gearbox ratio	Lead angle of the worm	Output speed n_1 = 2 800 rpm				Output speed n_1 = 1 400 rpm				IEC motor size		
	15th and 16th position	i_{tot}	γ_m °	n_2 rpm	T_2 Nm	P_{1N} kW	η %	n_2 rpm	T_2 Nm	P_{1N} kW	η %	63	71	80
S08	**B1**	80	2.1	35.0	18	0.14	48	17.5	19	0.07	47	•		
	C1	60	2.7	46.7	22	0.20	55	23.3	24	0.11	52	•		
	D1	50	3.2	56.0	21	0.21	58	28.0	27	0.14	56	•		
	E1	40	3.8	70.0	21	0.24	63	35.0	28	0.17	61	•		
	F1	30	4.6	93.3	20	0.29	68	46.7	28	0.20	67	•		
	G1	25	5.2	112.0	20	0.33	72	56.0	27	0.23	70	•		
	H1	20	7.4	140.0	21	0.40	77	70.0	27	0.26	75	•		
	J1	15	9.2	186.7	20	0.48	81	93.3	27	0.33	80	•		
	K1	10	14	280.0	20	0.68	86	140.0	27	0.47	85	•		
	L1	7	19	400.0	19	0.89	89	200.0	26	0.62	88	•		
	M1	5	25	560.0	19	1.22	91	280.0	25	0.81	91	•		
S18	**B1**	80	3.5	35.0	33	0.22	55	17.5	35	0.12	54	•		
	C1	60	3.5	46.7	33	0.26	61	23.3	44	0.18	59	•		
	D1	50	4.0	56.0	33	0.30	64	28.0	44	0.20	63	•	•	
	E1	40	4.5	70.0	31	0.33	68	35.0	43	0.24	67	•	•	
	F1	30	5.5	93.3	31	0.42	73	46.7	41	0.28	72	•	•	
	G1	25	6.5	112.0	31	0.48	76	56.0	41	0.32	75	•	•	
	H1	20	9.5	140.0	31	0.56	81	70.0	41	0.38	80	•	•	
	J1	15	11	186.7	30	0.70	84	93.3	41	0.48	84	•	•	
	K1	10	17	280.0	30	1.00	88	140.0	40	0.67	88	•	•	
	L1	7	17	400.0	29	1.33	91	200.0	39	0.91	90	•	•	
	M1	5	23	560.0	28	1.78	92	280.0	37	1.18	92	•	•	
S28	**A1**	100	2.0	28.0	57	0.33	50	14.0	72	0.22	49	•		
	B1	80	2.5	35.0	57	0.39	54	17.5	80	0.27	54	•	•	
	C1	60	3.0	46.7	57	0.46	60	23.3	78	0.32	59	•	•	
	D1	50	3.5	56.0	55	0.50	64	28.0	75	0.35	63	•	•	
	E1	40	4.5	70.0	55	0.59	68	35.0	74	0.40	68	•	•	
	F1	30	5.0	93.3	53	0.71	73	46.7	73	0.49	73	•	•	•
	G1	25	6.0	112.0	53	0.82	76	56.0	73	0.56	76	•	•	•
	H1	20	8.5	140.0	53	0.96	81	70.0	73	0.67	80	•	•	•
	J1	15	10	186.7	53	1.23	84	93.3	72	0.84	84	•	•	•
	K1	10	15	280.0	53	1.77	88	140.0	72	1.20	88	•	•	•
	L1	7	15	400.0	53	2.44	91	200.0	71	1.63	91	•	•	•
	M1	5	21	560.0	51	3.22	93	280.0	69	2.18	93	•	•	•

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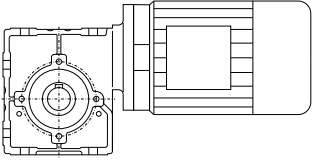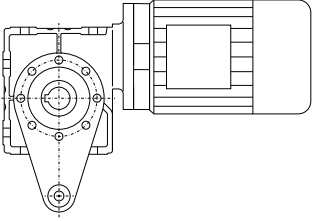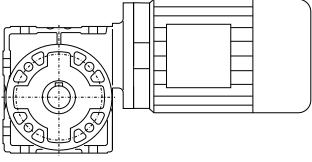■ **Selection and ordering data** (continued)

Gearbox size	Ratio code Order No. 15th and 16th position	Gearbox ratio i_{tot}	Lead angle of the worm γ_m °	Output speed $n_1 = 900$ rpm n_2 rpm	T_2 Nm	P_{1N} kW	η %	Output speed $n_1 = 500$ rpm n_2 rpm	T_2 Nm	P_{1N} kW	η %	IEC motor size 63	71	80
S08	**B1**	80	2.1	11.3	19	0.05	44	6.3	20	0.03	40	•		
	C1	60	2.7	15.0	24	0.08	50	8.3	24	0.05	45	•		
	D1	50	3.2	18.0	27	0.10	53	10.0	28	0.06	49	•		
	E1	40	3.8	22.5	31	0.13	58	12.5	31	0.08	54	•		
	F1	30	4.6	30.0	32	0.16	64	16.7	33	0.10	60	•		
	G1	25	5.2	36.0	32	0.18	68	20.0	32	0.10	64	•		
	H1	20	7.4	45.0	31	0.20	73	25.0	31	0.12	70	•		
	J1	15	9.2	60.0	33	0.27	78	33.3	33	0.15	75	•		
	K1	10	14	90.0	32	0.36	84	50.0	33	0.21	81	•		
	L1	7	19	128.6	31	0.48	87	71.4	33	0.29	85	•		
	M1	5	25	180.0	30	0.63	90	100.0	33	0.39	88	•		
S18	**B1**	80	3.5	11.3	35	0.08	51	6.3	36	0.05	47	•		
	C1	60	3.5	15.0	49	0.14	57	8.3	51	0.09	52	•		
	D1	50	4.0	18.0	51	0.16	61	10.0	59	0.11	56	•	•	
	E1	40	4.5	22.5	51	0.18	65	12.5	64	0.14	61	•	•	
	F1	30	5.5	30.0	50	0.22	70	16.7	63	0.17	66	•	•	
	G1	25	6.5	36.0	49	0.25	74	20.0	62	0.19	70	•	•	
	H1	20	9.5	45.0	50	0.30	78	25.0	62	0.22	75	•	•	
	J1	15	11	60.0	50	0.38	82	33.3	62	0.27	79	•	•	
	K1	10	17	90.0	49	0.53	87	50.0	61	0.38	85	•	•	
	L1	7	17	128.6	47	0.70	90	71.4	58	0.49	88	•	•	
	M1	5	23	180.0	44	0.91	91	100.0	56	0.65	90	•	•	
S28	**A1**	100	2.0	9.0	72	0.14	47	5.0	72	0.09	43	•		
	B1	80	2.5	11.3	92	0.21	52	6.3	93	0.13	48	•	•	
	C1	60	3.0	15.0	93	0.26	57	8.3	116	0.19	53	•	•	
	D1	50	3.5	18.0	90	0.28	61	10.0	115	0.21	57	•	•	
	E1	40	4.5	22.5	90	0.32	66	12.5	113	0.24	62	•	•	
	F1	30	5.0	30.0	86	0.38	72	16.7	110	0.28	68	•	•	•
	G1	25	6.0	36.0	85	0.43	75	20.0	109	0.32	71	•	•	•
	H1	20	8.5	45.0	85	0.51	79	25.0	109	0.38	76	•	•	•
	J1	15	10	60.0	85	0.64	83	33.3	109	0.47	81	•	•	•
	K1	10	15	90.0	85	0.92	87	50.0	109	0.66	86	•	•	•
	L1	7	15	128.6	84	1.26	90	71.4	107	0.90	89	•	•	•
	M1	5	21	180.0	82	1.68	92	100.0	105	1.21	91	•	•	•

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MOTOX Geared Motors
Worm geared motors

■ **Selection and ordering data**

Mounting type	Order No. 14th position	Code in type designation 4th position	Representation
Housing flange (C-type)	**H**	Z	
Design with torque arm	**D**	D	
Flange-mounted design (A-type)	**F**	F	

Worm gearbox with torque arm

The torque arm consists of an arm with an eye; it can be screwed onto the gearbox housing with an axis intersection of 45° in any one of five positions around the output.

If **D** appears in the **14th position** of the order number, the torque arm will be delivered loose.
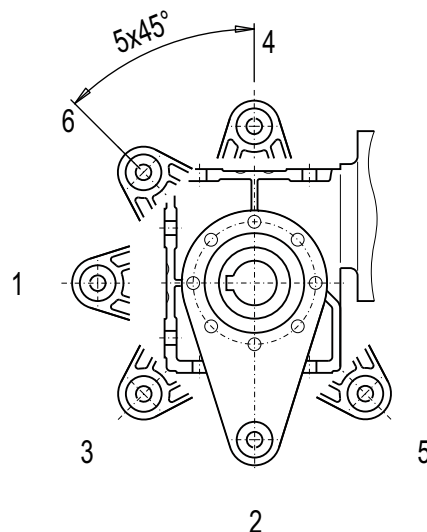
■ **Selection and ordering data**

Shaft design	Order No. 8th position	Order No. suffix	Shaft dimensions		
Worm gearbox S, foot-mounted design					
Size			**S.08**	**S.18**	**S.28**
Solid shaft with feather key	**1**		V16x 40	V20 x 40	V20 x 40
Worm gearbox SAZ with housing flange					
Size			**S.08**	**S.18**	**S.28**
Hollow shaft	**5**		H16 x 84		H20 x 121
	6			H20 x 100	
Worm gearbox SAD with torque arm					
Size			**S.08**	**S.18**	**S.28**
Hollow shaft	**5**		H16 x 84		H20 x 121
	6			H20 x 100	
Worm gearbox SF/SAF, flange-mounted design (A-type)					
Size			**S.F08**	**S.F18**	**S.F28**
Solid shaft with feather key	**2**		V16x 40	V20 x 40	V20 x 40
Hollow shaft	**5**		H16 x 84		H20 x 121
	6			H20 x 100	

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MOTOX Geared Motors
Worm geared motors

Flange-mounted designs (A-type)

Selection and ordering data

Order code	Flange diameter		
Worm gearbox S.F			
Size	**S.F08**	**S.F18**	**S.F28**
H01	80	110	120
H02	120 / Q90	120	160 / Q136

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MOTOX Geared Motors
Worm geared motors

Mounting types and mounting positions

■ **Selection and ordering data**

The gearbox is lubricated for its entire service life in such a way that it can be installed and operated using all the mounting types / mounting positions listed below.

Please contact customer service to discuss the oil quantity if you wish to use a mounting position which is not shown here.

Position of the terminal box

The terminal box of the motor can be mounted in four different positions. See Chapter 8 for an accurate representation of the terminal box position and the corresponding order codes.

Worm gearbox S, flange-mounted design, and with housing flange

Oil control valves:

These types are lubricated for life.

No ventilation, oil level, or drain plugs are present.

1 ... 4   Position of the terminal box, see Chapter 8.

1) Standard mounting type

S: B3-00 (IM B3-00) [1]
Order code: output side A **D06**, output side B **D08**

SF: B5-01 (IM B5-01) [1]
Order code: output side A **D22**, output side B **D24**

SAD, SAF, SAZ: H-01 [1]
Order code: output side A **D76**, output side B **D77**
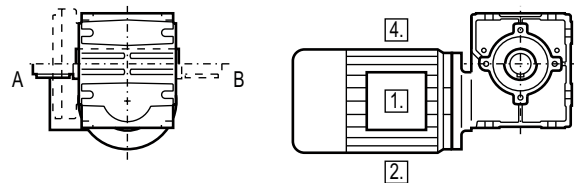
S: B8-00 (IM B8-00)
Order code: output side A **D68**, output side B **D70**

SF: B5-03 (IM B5-03)
Order code: output side A **D32**, output side B **D34**

SAD, SAF, SAZ: H-02
Order code: output side A **D78**, output side B **D79**
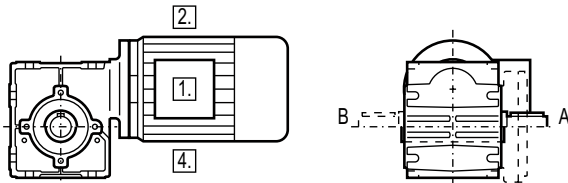
S: B6-00 (IM B6-00)
Order code: output side A **D38**, output side B **D40**

SF: B5-00 (IM B5-00)
Order code: output side A **D18**, output side B **D20**

SAD, SAF, SAZ: H-04
Order code: output side A **D82**, output side B **D83**
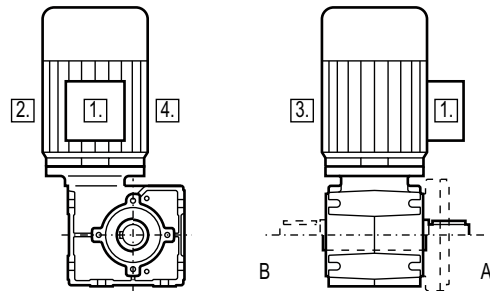
S: B7-00 (IM B7-00)
Order code: output side A **D59**, output side B **D61**

SF: B5-02 (IM B5-02)
Order code: output side A **D27**, output side B **D29**

SAD, SAF, SAZ: H-03
Order code: output side A **D80**, output side B **D81**
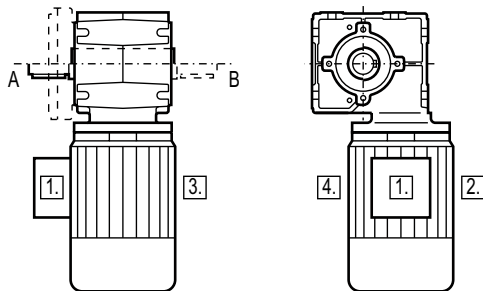
S: V5-00 (IM V5-00)
Order code: output side A **E03**, output side B **E05**

SF: V1-00 (IM V1-00)
Order code: output side A **D90**, output side B **D92**

SAD, SAF, SAZ: H-05
Order code: output side A **D84**, output side B **D85**

S: V6-00 (IM V6-00)
Order code: output side A **E15**, output side B **E17**

SF: V3-00 (IM V3-00)
Order code: output side A **D98**, output side B **E00**

SAD; SAF; SAZ: H-06
Order code: output side A **D86**, output side B **D87**

6
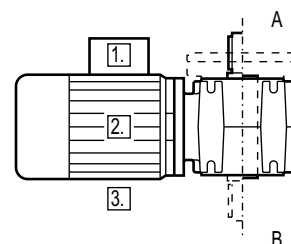
MOTOX Geared Motors
Worm geared motors

Special versions

Lubricants

Worm gearbox S is always filled with synthetic lubricant prior to despatch and is supplied ready for use. The rating plate contains information about the appropriate type of oil (PGLP) and ISO viscosity class.

If the gearbox is to be used in an application with special requirements, the lubricants listed in the table below can be used.

Area of application	Ambient temperature [1]			DIN ISO designation	Order code
Standard oils					
Standard temperature	0	…	+60 °C	CLP ISO PG VG460	**K08**
Lowest temperature usage	-40	…	+40 °C	CLP ISO PAO VG 220	[2]
Physiologically safe oils (for use in the food industry) in acc. with USDA-H1					
Standard temperature	-30	…	+50 °C	CLP ISO H1 VG460	**K11**

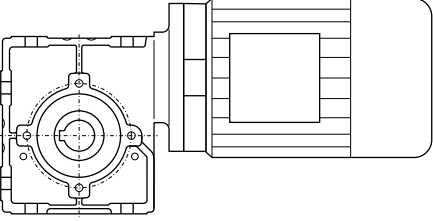[1] Recommendation
[2] On request

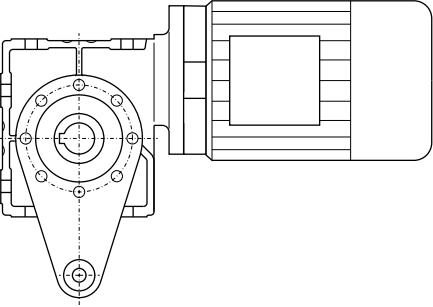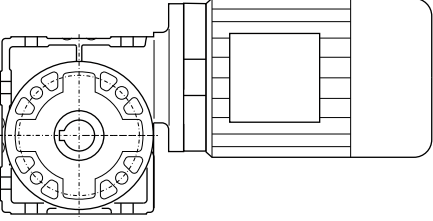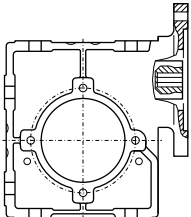### 2nd output shaft extension
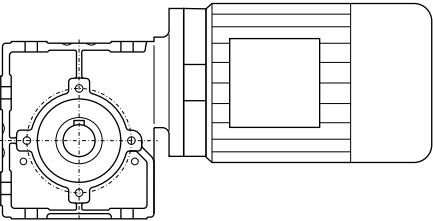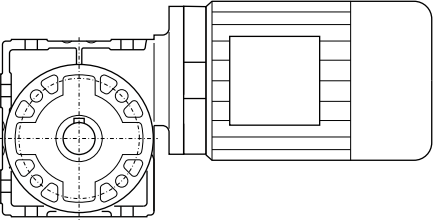
See the dimension drawings for the corresponding design for the relevant dimensions.

Order code:
2nd output shaft extension **G73**

Plug-in shaft

If required, hollow-shaft designs of the gearboxes are available additionally with a plug-in shaft.

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■ **Dimension drawing overview**

	Gearbox type	Dimension drawing on page
	S08	6/18
	S18	6/23
	S28	6/28
	SF08	6/19
	SF18	6/24
	SF28	6/29
	SAZ08	6/20
	SAZ18	6/25
	SAZ28	6/30
	SAD08	6/21
	SAD18	6/26
	SAD28	6/31
	SAF08	6/22
	SAF18	6/27
	SAF28	6/32
	S.08-K4 ... S.28-K4	6/33

6

MOTOX Geared Motors
Worm geared motors

Dimensions

Gearbox S08, foot-mounted design
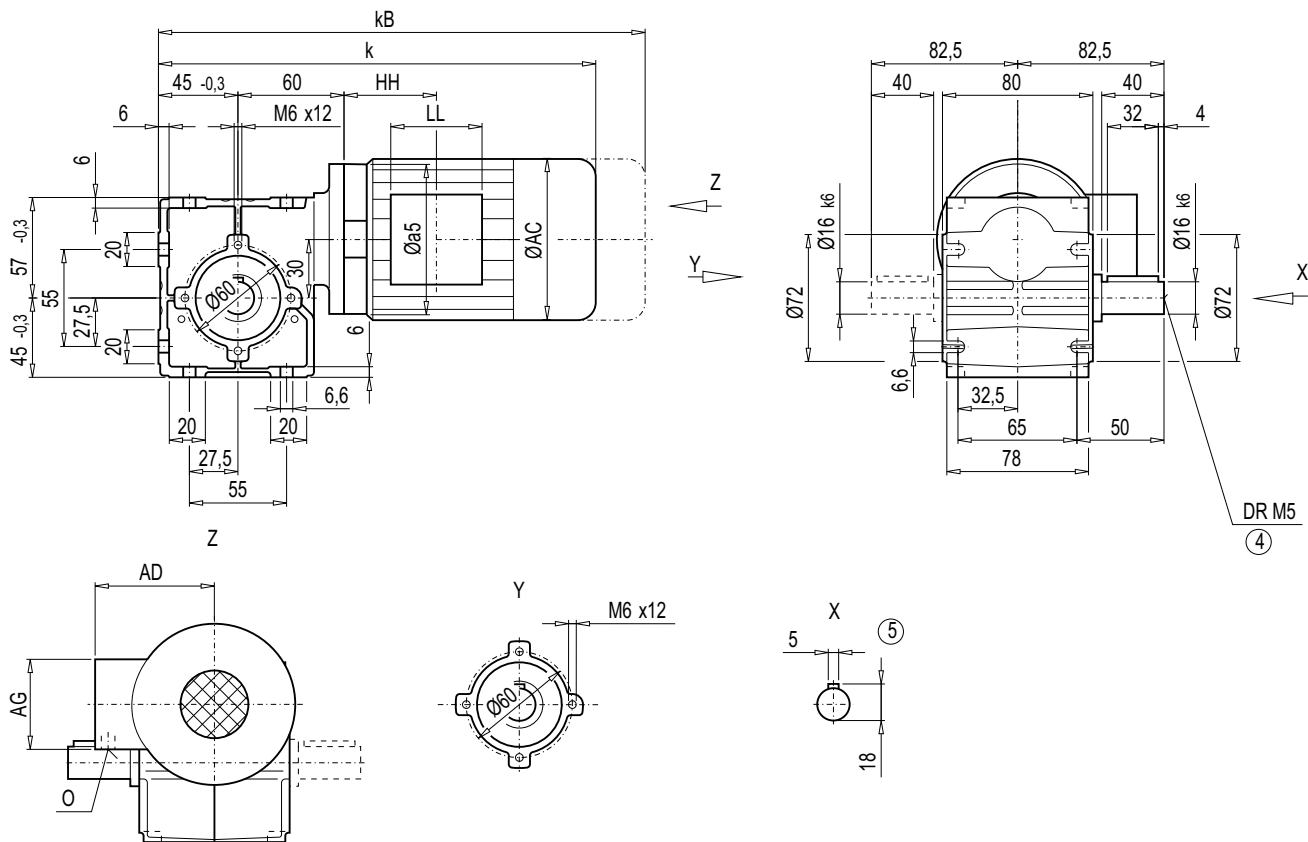
S012

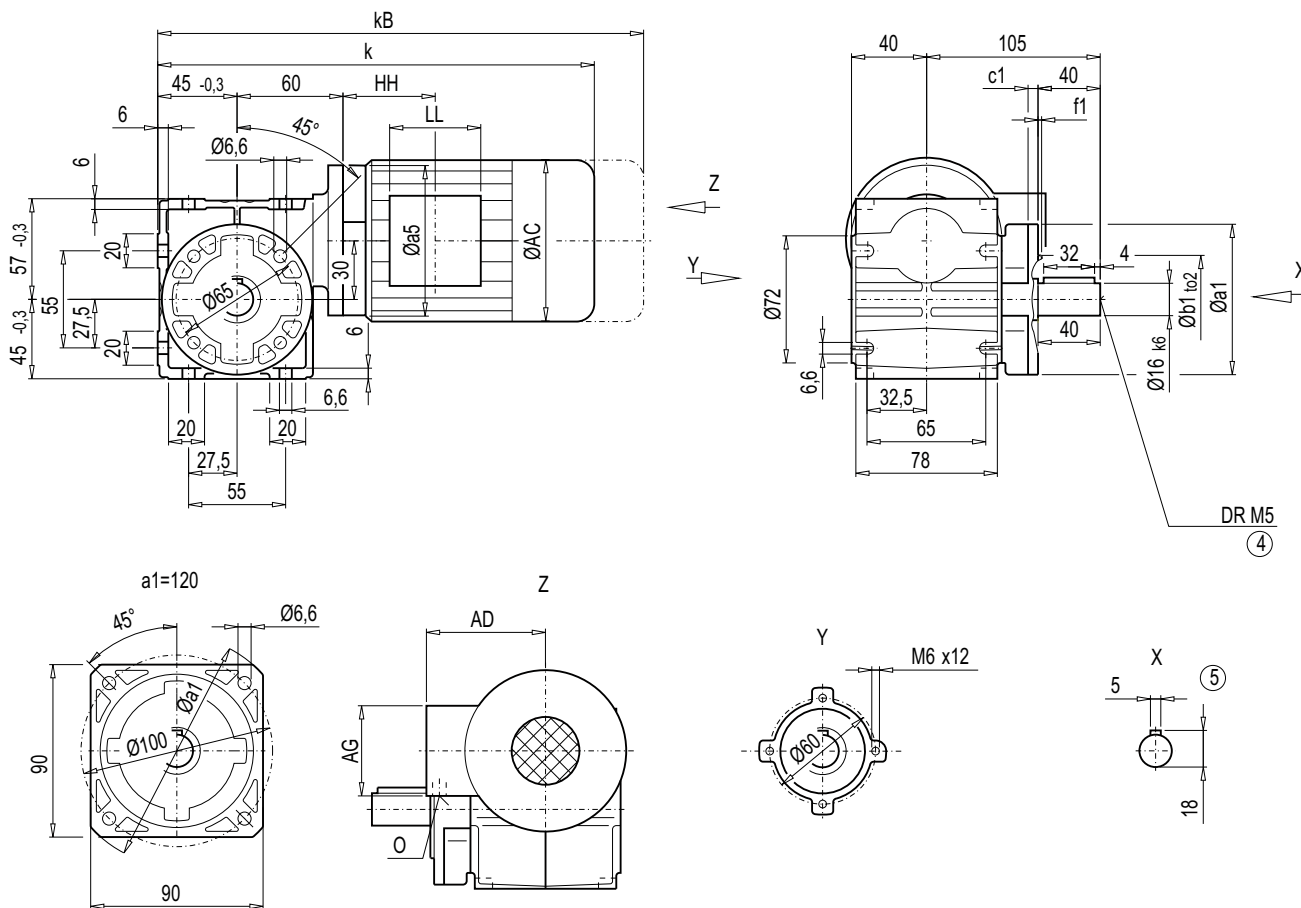|	S08									Weight
Motor	k	kB	AC	AD	AG	LL	HH	a5	O	S08
LAI63	284.5	335.5	118	101 (135.5)	75 (90)	75 (90)	69.5	90	M20x1.5/M25x1.5	5

④ DIN 332　　　⑤ Feather key / keyway DIN 6885　　　( ) Values in brackets for motor with brake and / or with encoder

■ **Gearbox SF08, flange-mounted design (A-type)**

SF012

Flange	a1	b1	to2	c1	f1
A80	80	50	j6	7	2.5
A120/Q90	120	80	j6	7	3.0

	SF08									Weight
Motor	k	kB	AC	AD	AG	LL	HH	a5	O	SF08
LAI63	284.5	335.5	118	101 (135.5)	75 (90)	75 (90)	69.5	90	M20x1.5/M25x1.5	5

④ DIN 332   ⑤ Feather key / keyway DIN 6885   ( ) Values in brackets for motor with brake and / or with encoder
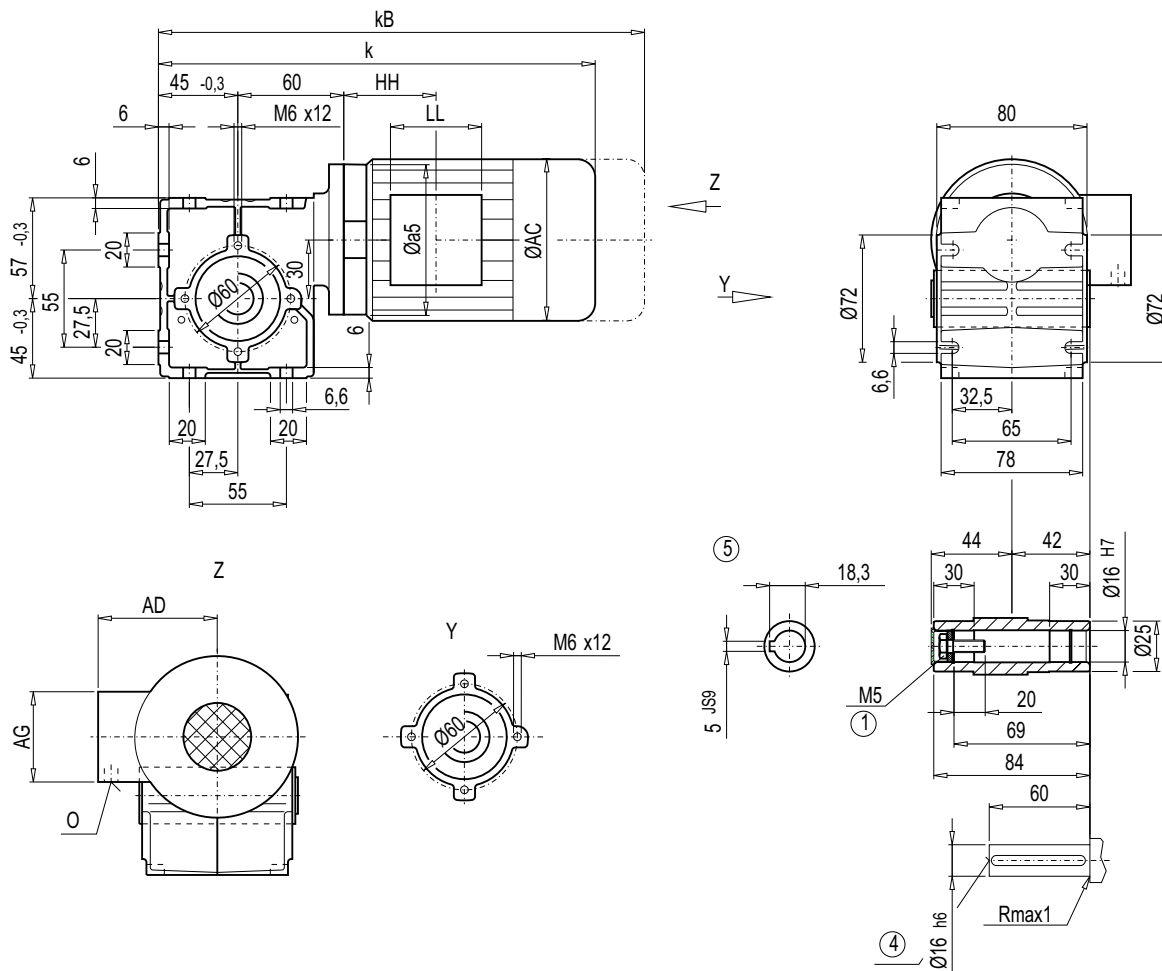
MOTOX Geared Motors
Worm geared motors

Gearbox SAZ08, housing-flange-mounted design (C-type)

SAZ012

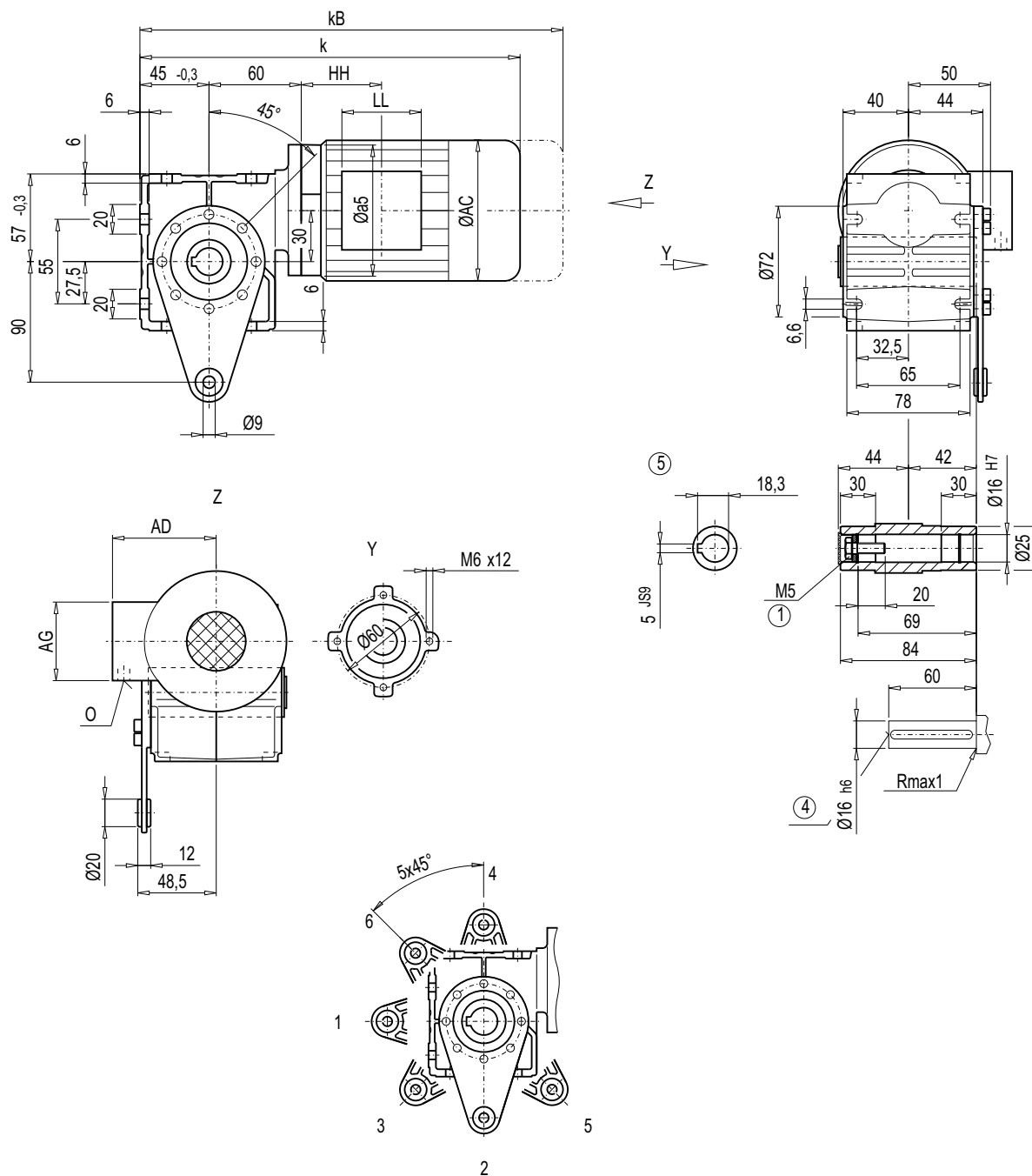| Motor	SAZ08									Weight
	k	kB	AC	AD	AG	LL	HH	a5	O	SAZ08
LAI63	284.5	335.5	118	101 (135.5)	75 (90)	75 (90)	69.5	90	M20x1.5/M25x1.5	5

① EN ISO 4014   ④ DIN 332   ⑤ Feather key / keyway DIN 6885   ( ) Values in brackets for motor with brake and / or with encoder

■ **Gearbox SAD08, shaft-mounted design with torque arm**

SAD012

Motor	SAD08										Weight
	k	kB	AC	AD	AG	LL	HH	a5	O		SAD08
LAI63	284.5	335.5	118	101 (135.5)	75 (90)	75 (90)	69.5	90	M20x1.5/M25x1.5		5

① EN ISO 4014　　④ DIN 332　　⑤ Feather key / keyway DIN 6885　　　　( ) Values in brackets for motor with brake and / or with encoder

MOTOX Geared Motors
Worm geared motors

Dimensions

Gearbox SAF08, flange-mounted design

SAF012

Flange	a1	b1	to2	c1	f1
A80	80	50	j6	7	2.5
A120/Q90	120	80	j6	7	3.0

	SAF08									Weight
Motor	k	kB	AC	AD	AG	LL	HH	a5	O	SAF08
LAI63	284.5	335.5	118	101 (135.5)	75 (90)	75 (90)	69.5	90	M20x1.5/M25x1.5	5

① EN ISO 4014   ④ DIN 332   ⑤ Feather key / keyway DIN 6885   ( ) Values in brackets for motor with brake and / or with encoder
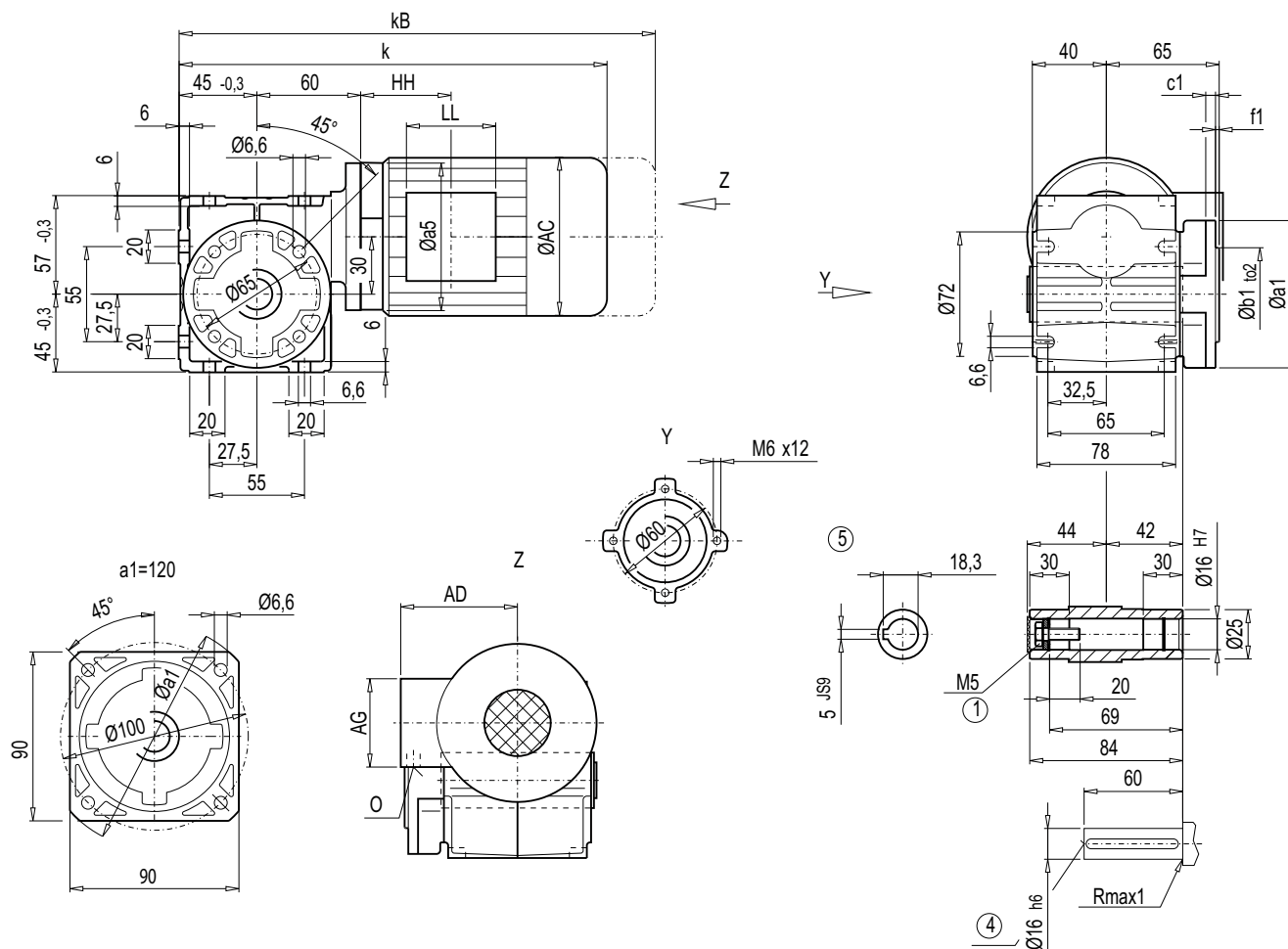
MOTOX Geared Motors
Worm geared motors

Dimensions

Gearbox S18, foot-mounted design

S012
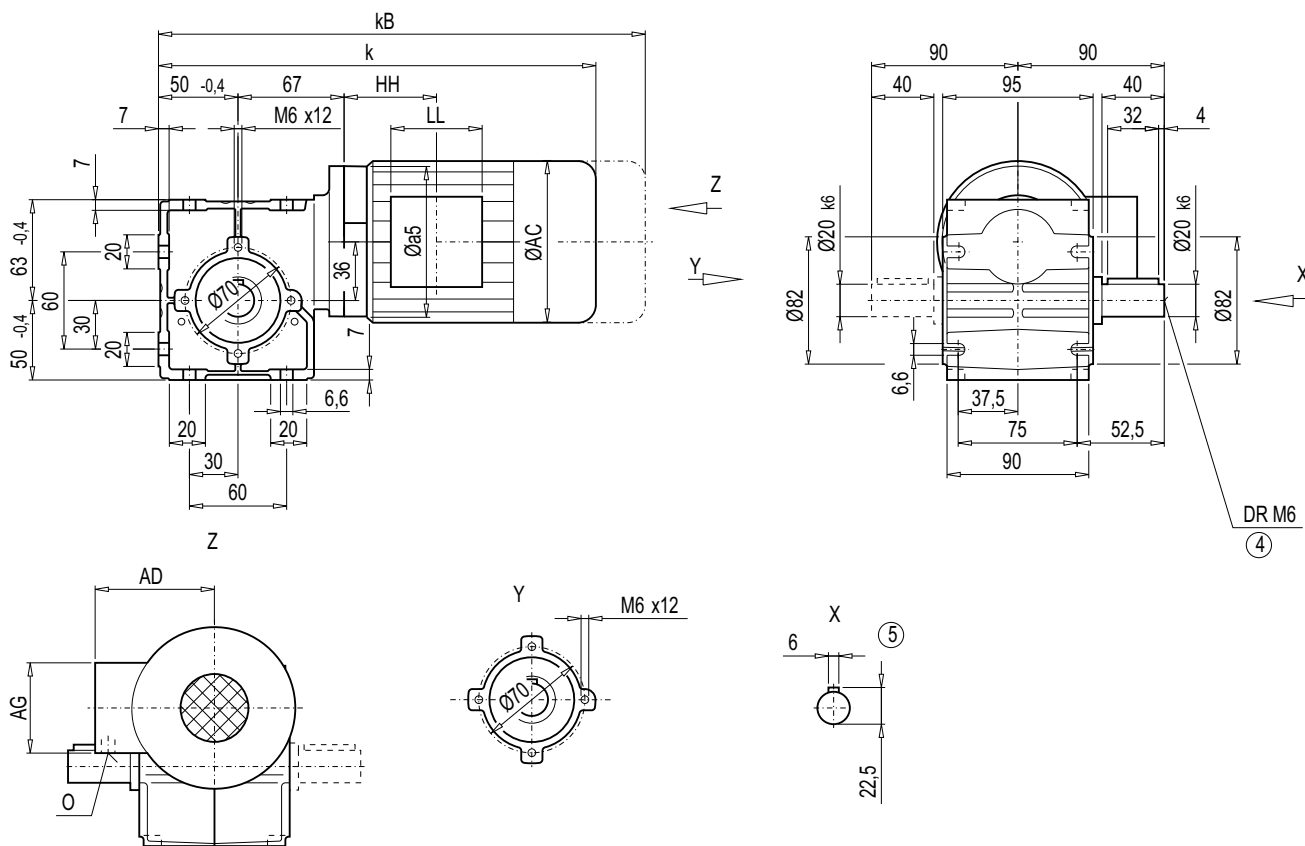
	S18										**Weight**
Motor	**k**	**kB**	**AC**	**AD**	**AG**	**LL**	**HH**	**a5**	**O**		**S18**
LAI63	296.5	347.5	118	101 (135.5)	75 (90)	75 (90)	69.5	90	M20x1.5/M25x1.5		6
LAI71	327.0	378.5	139	111.0 (146)	75 (90)	75 (90)	63.5	105	M20x1.5/M25x1.5		8

④ DIN 332   ⑤ Feather key / keyway DIN 6885   ( ) Values in brackets for motor with brake and / or with encoder

MOTOX Geared Motors
Worm geared motors

Dimensions

■ **Gearbox SF18, flange-mounted design (A-type)**

SF012

Flange	a1	b1	to2	c1	e1	f1	s1
A110	110	60	H8	8	87	4	9
A120	120	80	j6	8	100	3	6.6

	SF18									Weight
Motor	**k**	**kB**	**AC**	**AD**	**AG**	**LL**	**HH**	**a5**	**O**	**SF18**
LAI63	296.5	347.5	118	101 (135.5)	75 (90)	75 (90)	69.5	90	M20x1.5/M25x1.5	6
LAI71	327.0	378.5	139	111.0 (146)	75 (90)	75 (90)	63.5	105	M20x1.5/M25x1.5	8

④ DIN 332   ⑤ Feather key / keyway DIN 6885   ( ) Values in brackets for motor with brake and / or with encoder
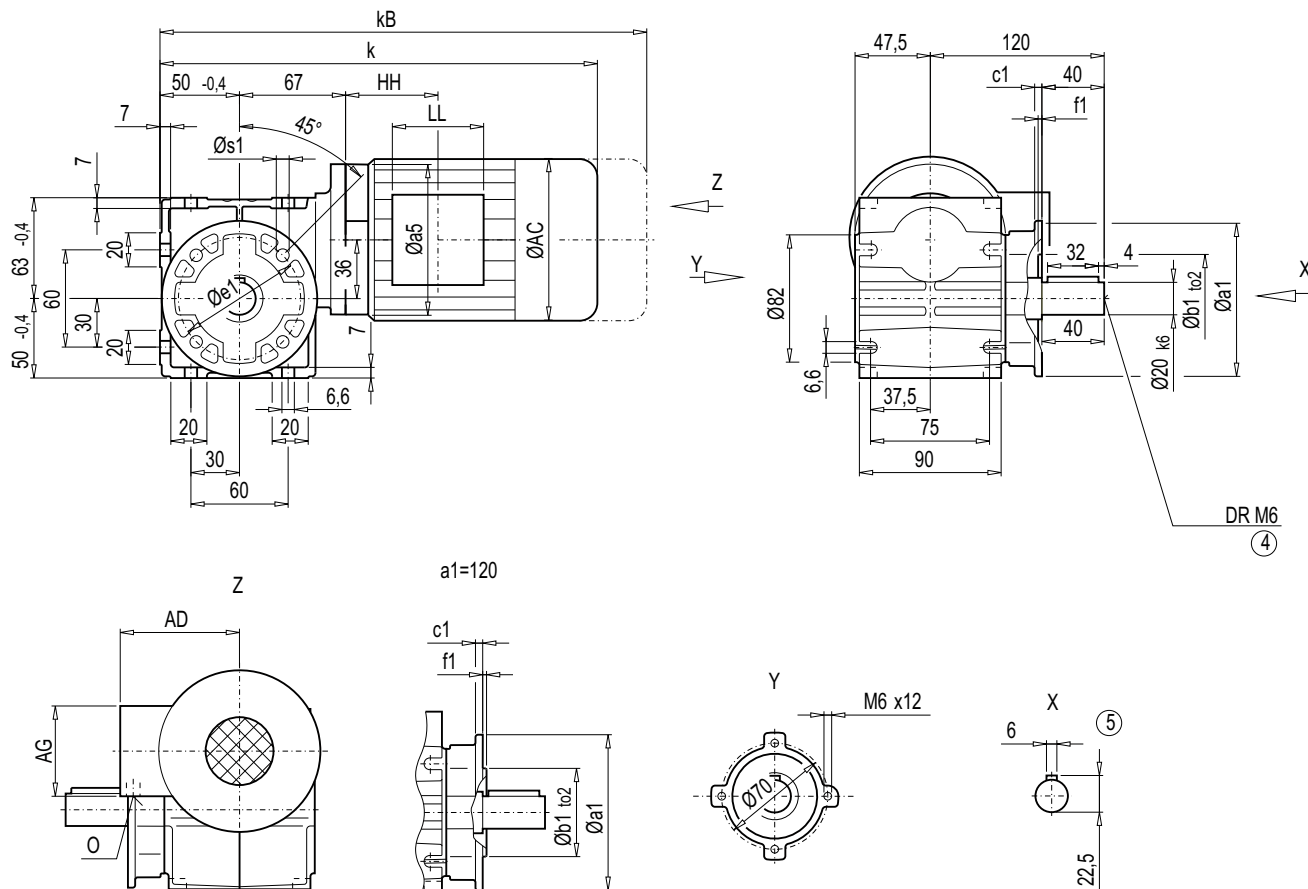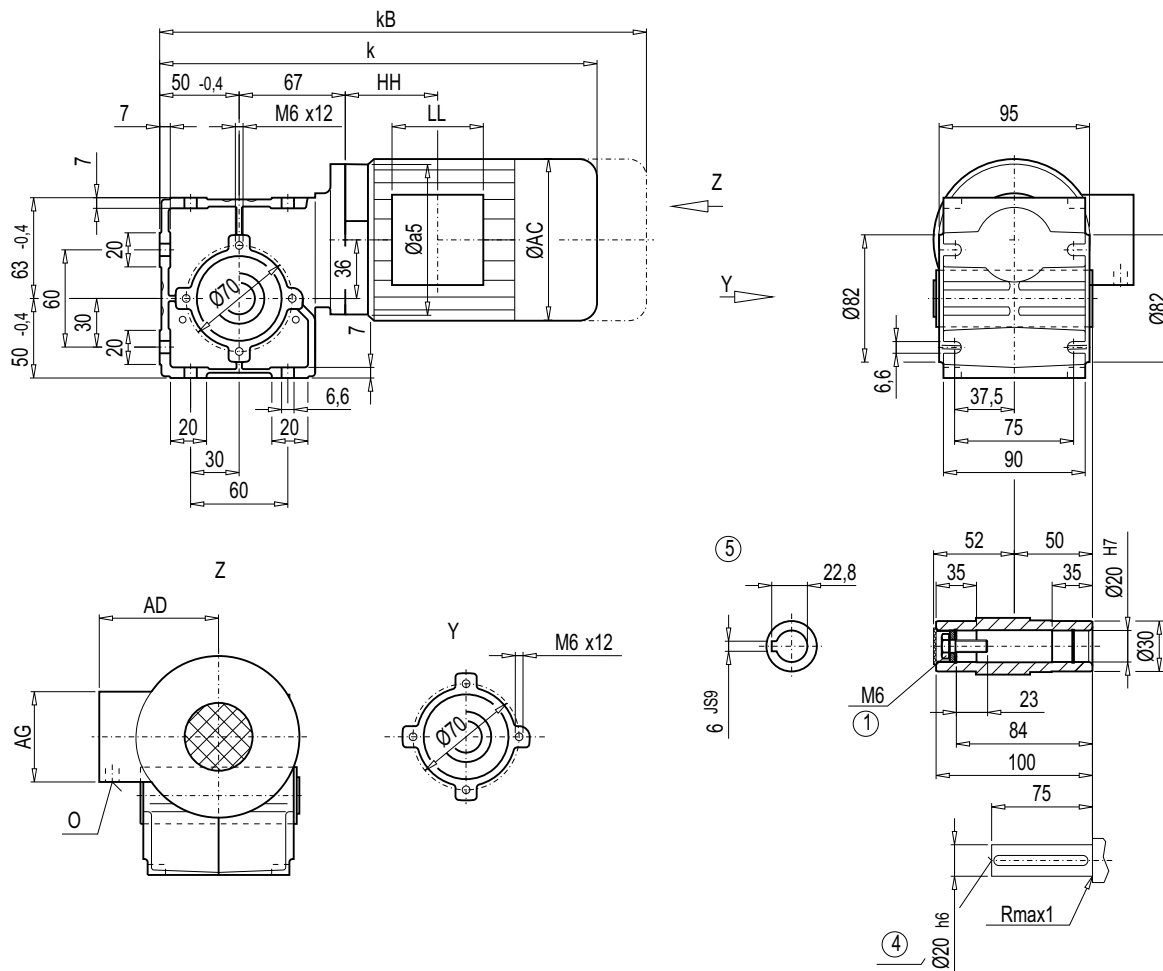
Gearbox SAZ18, housing-flange-mounted design (C-type)

SAZ012

	SAZ18									Weight
Motor	k	kB	AC	AD	AG	LL	HH	a5	O	SAZ18
LAI63	296.5	347.5	118	101 (135.5)	75 (90)	75 (90)	69.5	90	M20x1.5/M25x1.5	6
LAI71	327.0	378.5	139	111.0 (146)	75 (90)	75 (90)	63.5	105	M20x1.5/M25x1.5	7

① EN ISO 4014   ④ DIN 332   ⑤ Feather key / keyway DIN 6885   ( ) Values in brackets for motor with brake and / or with encoder

MOTOX Geared Motors
Worm geared motors

Dimensions

Gearbox SAD18, shaft-mounted design with torque arm

SAD012

Motor	SAD18										Weight
	k	kB	AC	AD	AG	LL	HH	a5	O		SAD18
LAI63	296.5	347.5	118	101 (135.5)	75 (90)	75 (90)	69.5	90	M20x1.5/M25x1.5		6
LAI71	327.0	378.5	139	111.0 (146)	75 (90)	75 (90)	63.5	105	M20x1.5/M25x1.5		8

① EN ISO 4014   ④ DIN 332   ⑤ Feather key / keyway DIN 6885   ( ) Values in brackets for motor with brake and / or with encoder
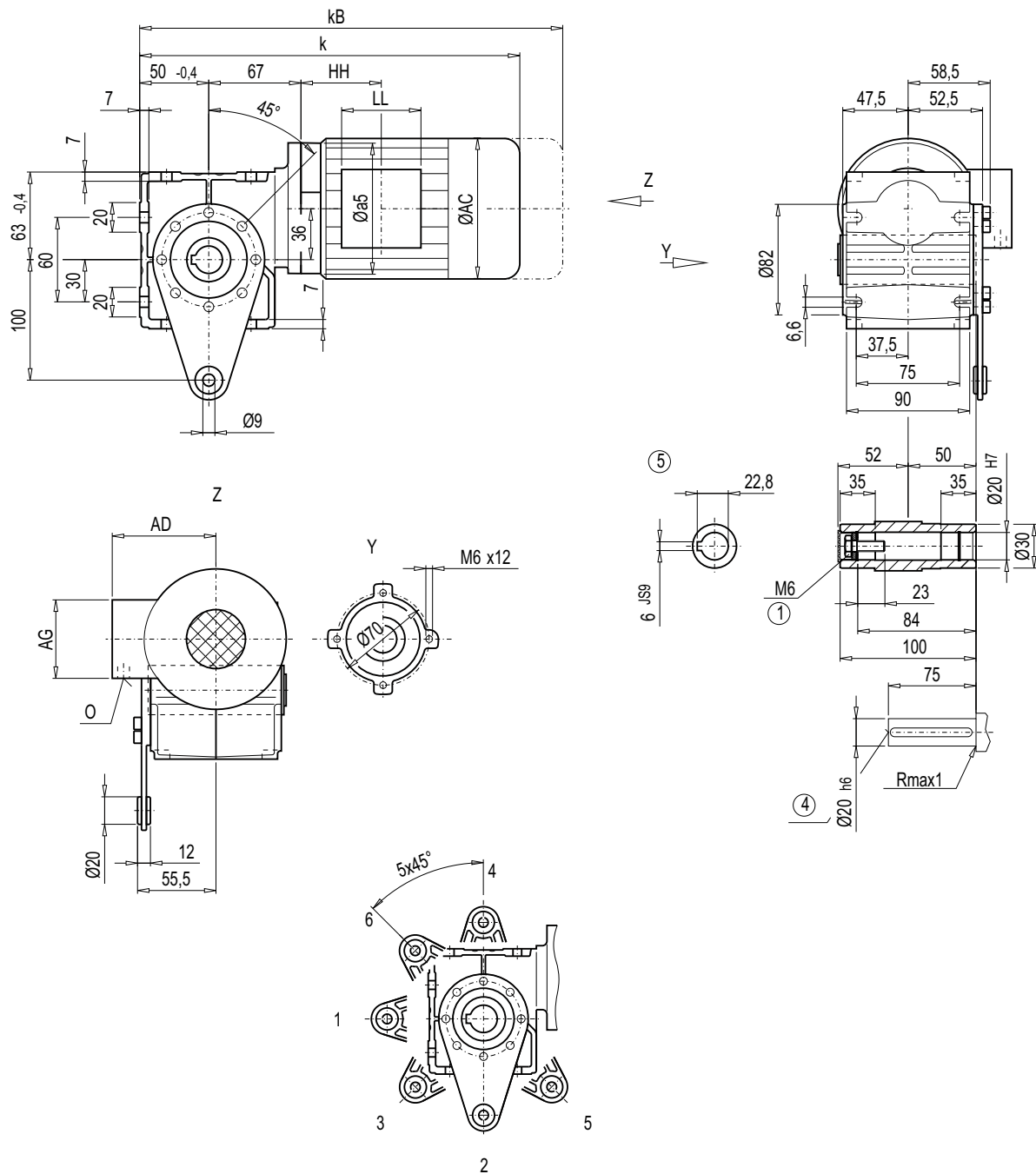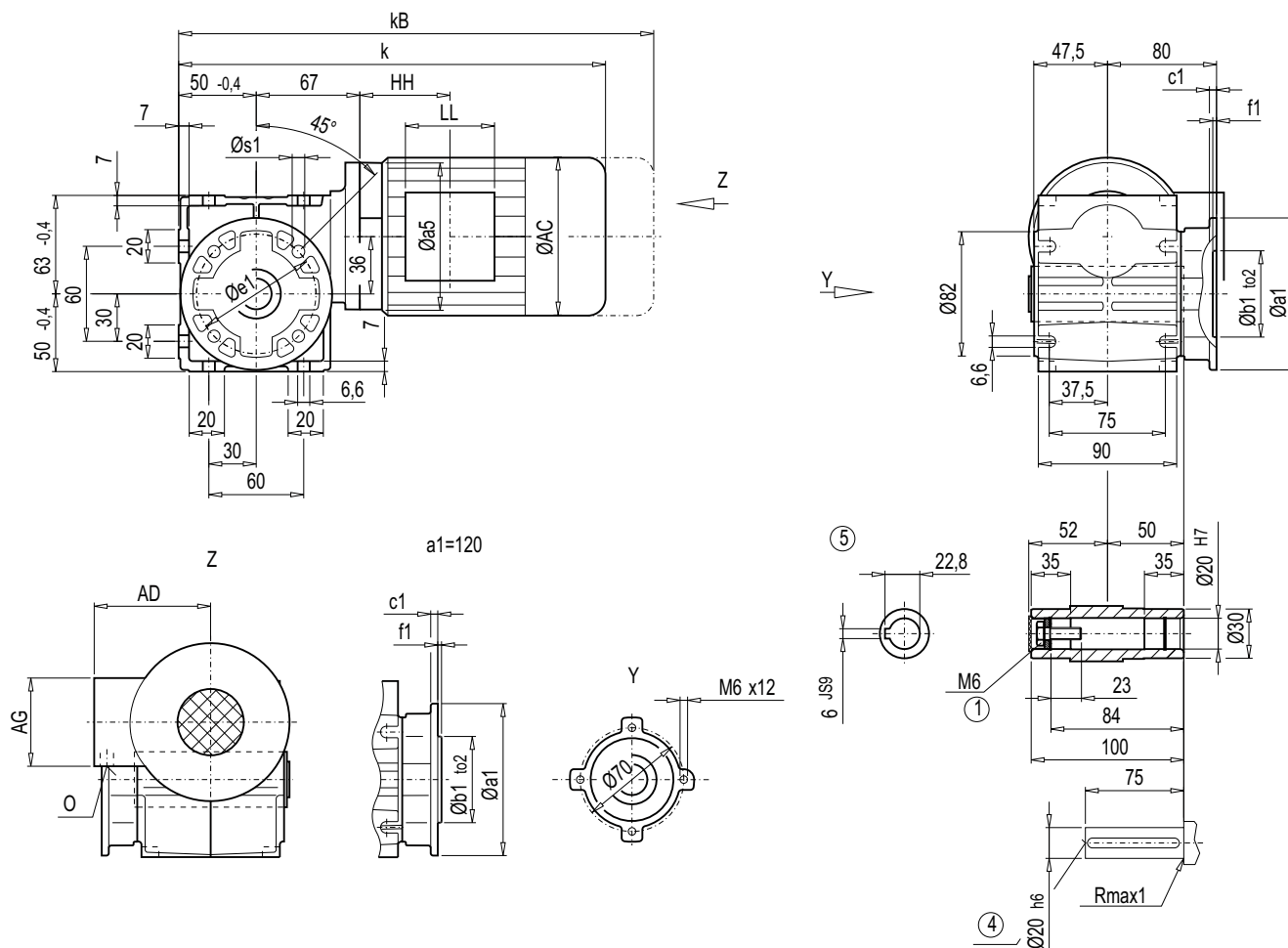
■ **Gearbox SAF18, flange-mounted design**

SAF012

Flange	a1	b1	to2	c1	e1	f1	s1
A110	110	60	H8	8	87	4	9
A120	120	80	j6	8	100	3	6.6

	SAF18									Weight
Motor	k	kB	AC	AD	AG	LL	HH	a5	O	SAF18
LAI63	296.5	347.5	118	101 (135.5)	75 (90)	75 (90)	69.5	90	M20x1.5/M25x1.5	6
LAI71	327.0	378.5	139	111.0 (146)	75 (90)	75 (90)	63.5	105	M20x1.5/M25x1.5	8

① EN ISO 4014   ④ DIN 332   ⑤ Feather key / keyway DIN 6885   ( ) Values in brackets for motor with brake and / or with encoder
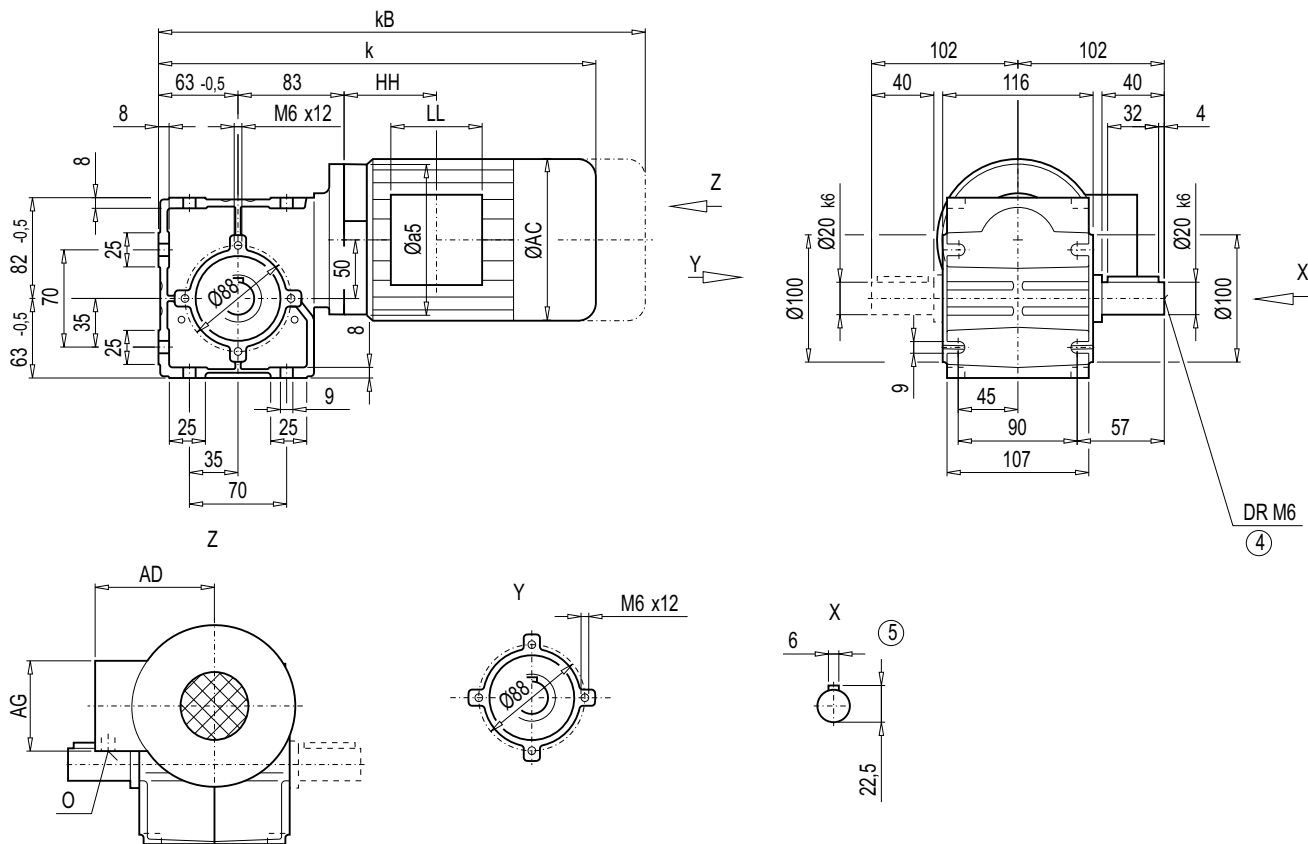
MOTOX Geared Motors
Worm geared motors

Dimensions

Gearbox S28, foot-mounted design

S012

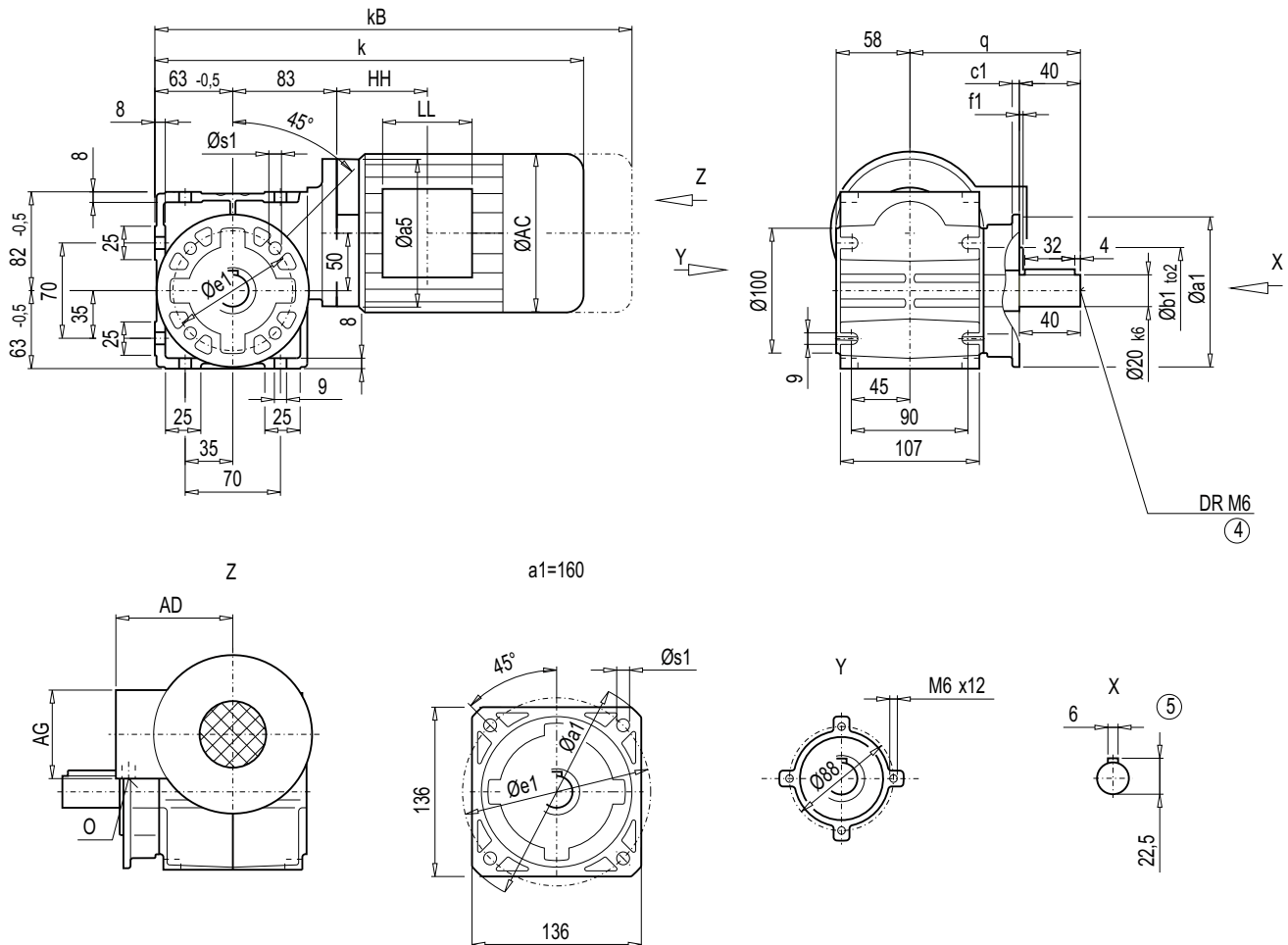|	**S28**									**Weight**
Motor	**k**	**kB**	**AC**	**AD**	**AG**	**LL**	**HH**	**a5**	**O**	**S28**
LAI63	325.5	376.5	118	101.0 (135.5)	75 (90)	75 (90)	69.5	90	M20x1.5/M25x1.5	8
LAI71	356.0	407.5	139	111.0 (146)	75 (90)	75 (90)	63.5	105	M20x1.5/M25x1.5	10
LAI80	379.5	433.5	156.5	120.0 (155)	75 (90)	75 (90)	63.5	120	M20x1.5/M25x1.5	14
LAI80Z	414.5	478.5	156.5	120.0 (155)	75 (90)	75 (90)	63.5	120	M20x1.5/M25x1.5	16

④ DIN 332   ⑤ Feather key / keyway DIN 6885   ( ) Values in brackets for motor with brake and / or with encoder

■ **Gearbox SF28, flange-mounted design (A-type)**

SF012

Flange	a1	b1	to2	c1	e1	f1	s1	q
A120	120	80	j6	8	100	3	6.6	120
A160/Q136	160	110	j6	8	130	3.5	9	135

	SF28									Weight
Motor	k	kB	AC	AD	AG	LL	HH	a5	O	SF28
LAI63	325.5	376.5	118	101.0 (135.5)	75 (90)	75 (90)	69.5	90	M20x1.5/M25x1.5	9
LAI71	356.0	407.5	139	111.0 (146)	75 (90)	75 (90)	63.5	105	M20x1.5/M25x1.5	10
LAI80	379.5	433.5	156.5	120.0 (155)	75 (90)	75 (90)	63.5	120	M20x1.5/M25x1.5	14
LAI80Z	414.5	478.5	156.5	120.0 (155)	75 (90)	75 (90)	63.5	120	M20x1.5/M25x1.5	16

④ DIN 332   ⑤ Feather key / keyway DIN 6885   ( ) Values in brackets for motor with brake and / or with encoder
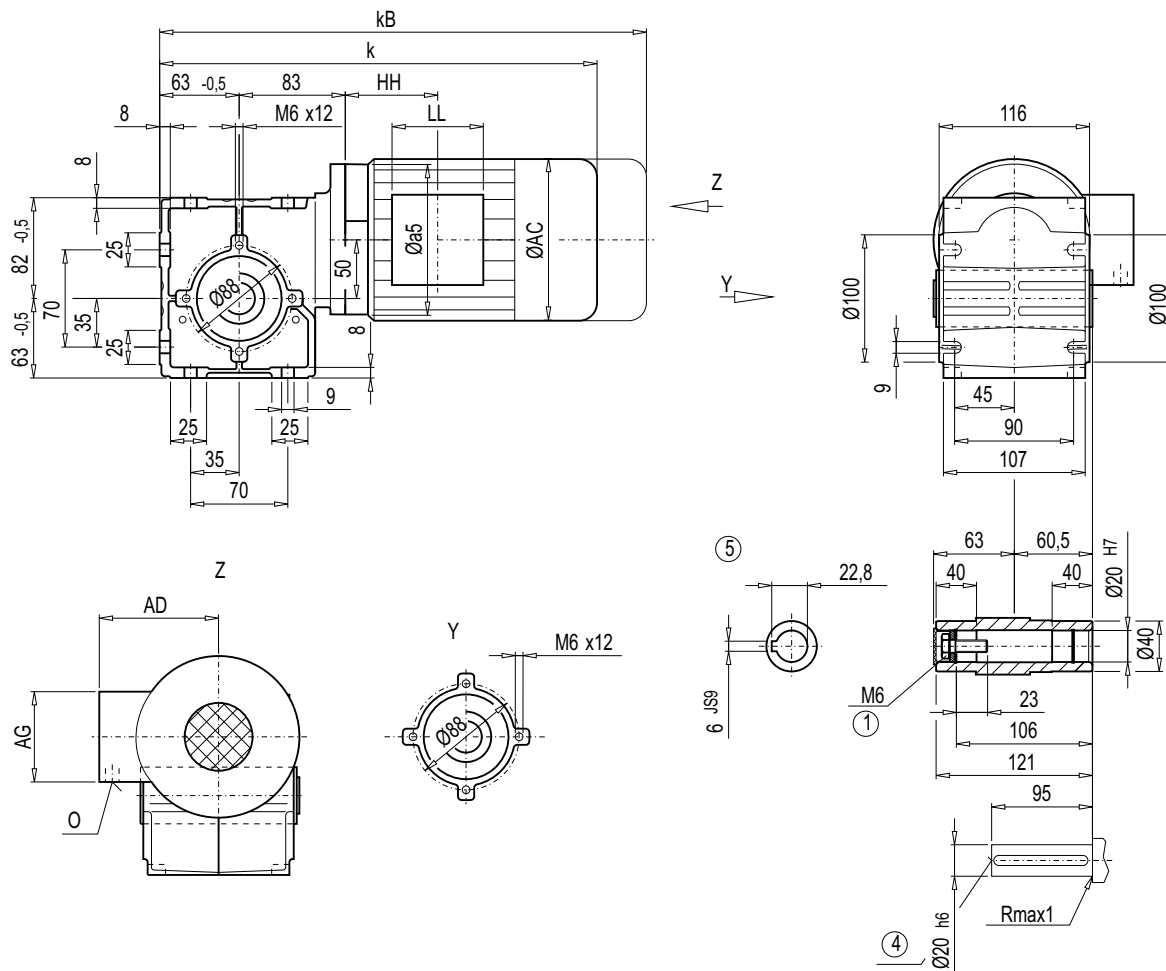
MOTOX Geared Motors
Worm geared motors

Dimensions

■ **Gearbox SAZ28, housing-flange-mounted design (C-type)**

SAZ012

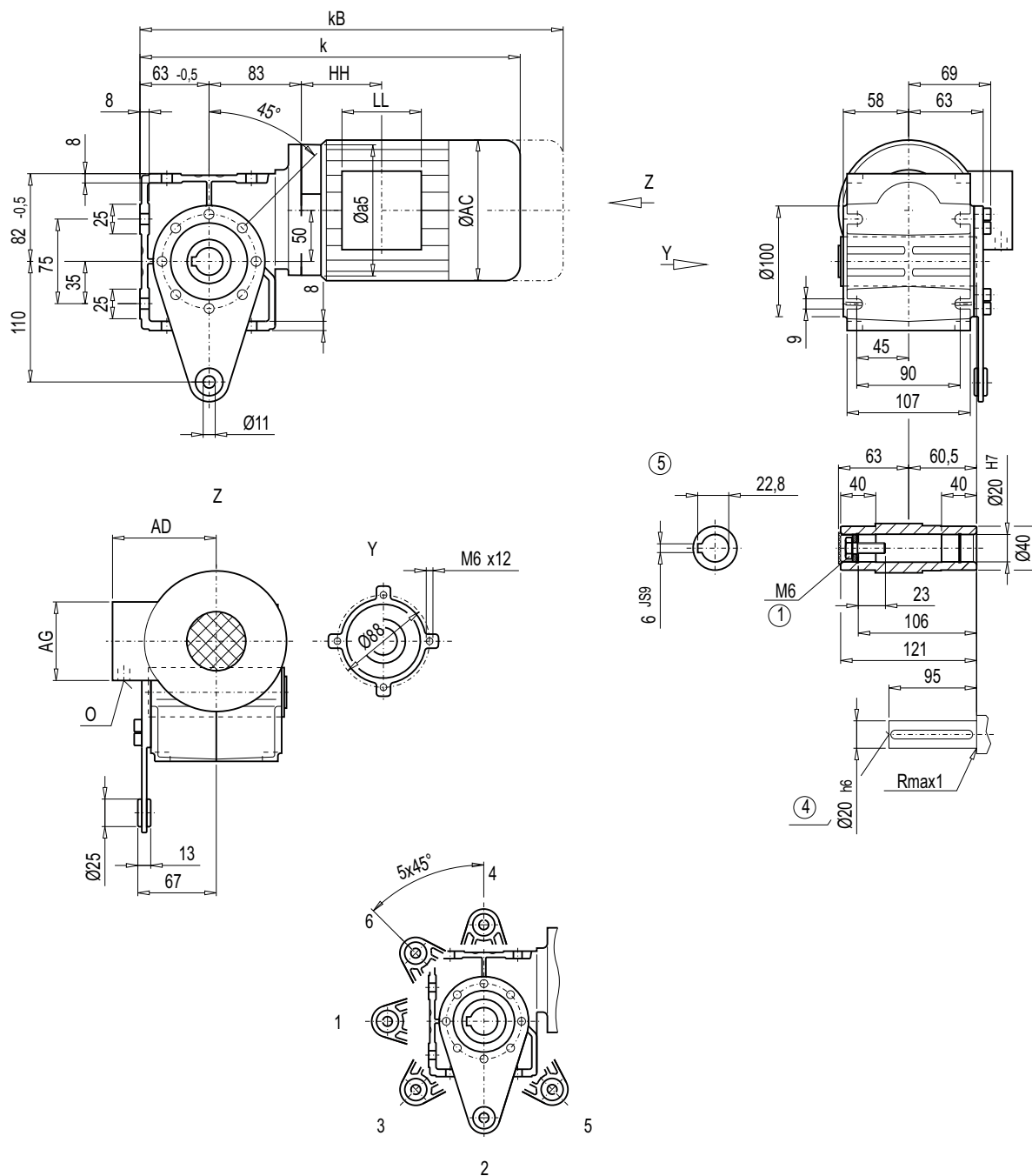| Motor	SAZ28									Weight
	k	kB	AC	AD	AG	LL	HH	a5	O	SAZ28
LAI63	325.5	376.5	118	101.0 (135.5)	75 (90)	75 (90)	69.5	90	M20x1.5/M25x1.5	8
LAI71	356.0	407.5	139	111.0 (146)	75 (90)	75 (90)	63.5	105	M20x1.5/M25x1.5	10
LAI80	379.5	433.5	156.5	120.0 (155)	75 (90)	75 (90)	63.5	120	M20x1.5/M25x1.5	14
LAI80Z	414.5	478.5	156.5	120.0 (155)	75 (90)	75 (90)	63.5	120	M20x1.5/M25x1.5	16

① EN ISO 4014   ④ DIN 332   ⑤ Feather key / keyway DIN 6885   ( ) Values in brackets for motor with brake and / or with encoder

Gearbox SAD28, shaft-mounted design with torque arm

SAD012

Motor	SAD28									Weight
	k	kB	AC	AD	AG	LL	HH	a5	O	SAD28
LAI63	325.5	376.5	118	101.0 (135.5)	75 (90)	75 (90)	69.5	90	M20x1.5/M25x1.5	8
LAI71	356.0	407.5	139	111.0 (146)	75 (90)	75 (90)	63.5	105	M20x1.5/M25x1.5	10
LAI80	379.5	433.5	156.5	120.0 (155)	75 (90)	75 (90)	63.5	120	M20x1.5/M25x1.5	14
LAI80Z	414.5	478.5	156.5	120.0 (155)	75 (90)	75 (90)	63.5	120	M20x1.5/M25x1.5	16

① EN ISO 4014   ④ DIN 332   ⑤ Feather key / keyway DIN 6885   ( ) Values in brackets for motor with brake and / or with encoder
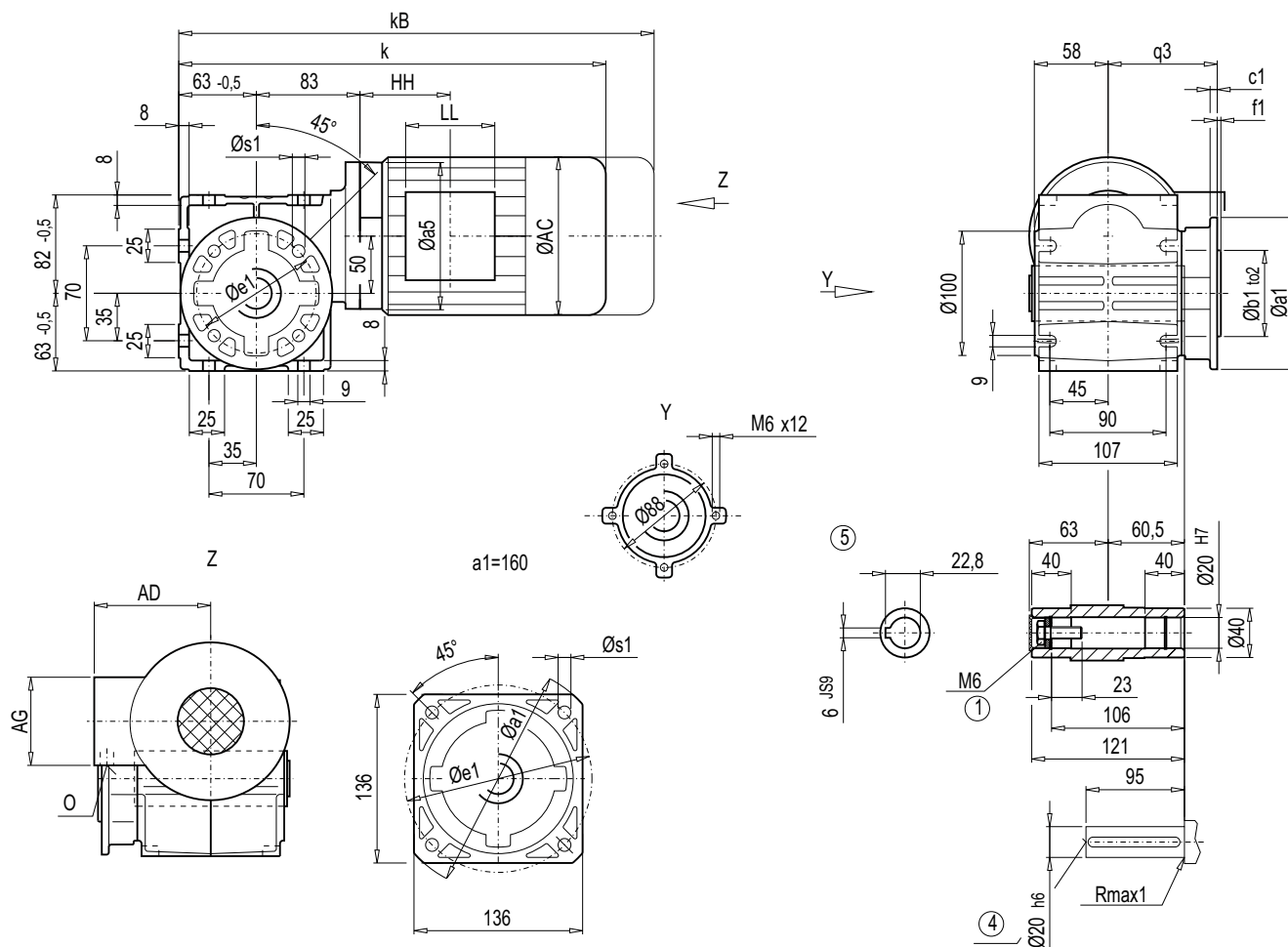
MOTOX Geared Motors
Worm geared motors

Dimensions

Gearbox SAF28, flange-mounted design

SAF012

Flange	a1	b1	to2	c1	e1	f1	s1	q3
A120	120	80	j6	8	100	3	6.6	80
A160/Q136	160	110	j6	8	130	3.5	9	95

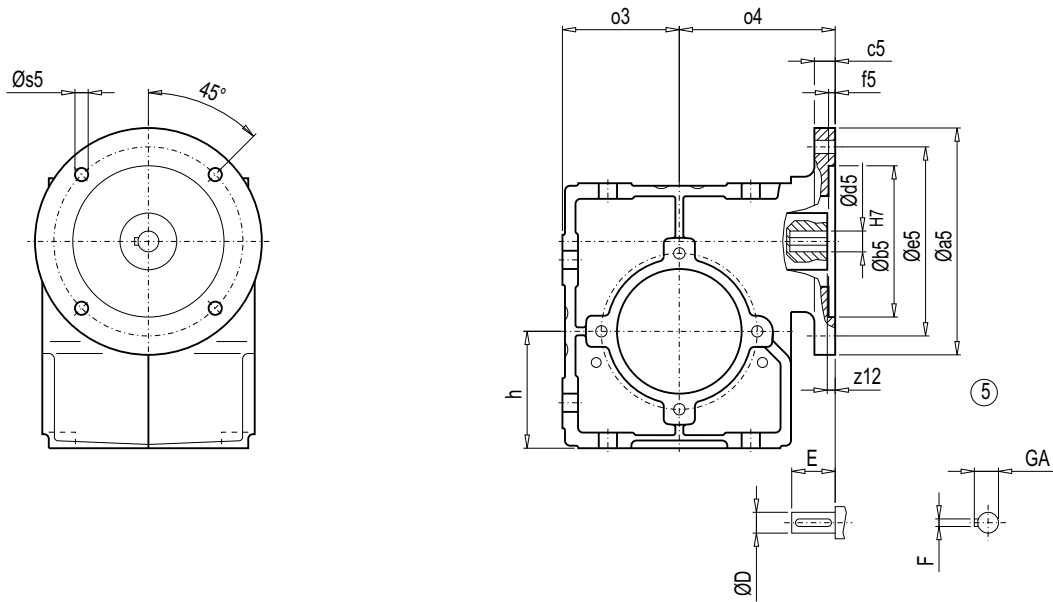|	SAF28									Weight
Motor	k	kB	AC	AD	AG	LL	HH	a5	O	SAF28
LAI63	325.5	376.5	118	101.0 (135.5)	75 (90)	75 (90)	69.5	90	M20x1.5/M25x1.5	8
LAI71	356.0	407.5	139	111.0 (146)	75 (90)	75 (90)	63.5	105	M20x1.5/M25x1.5	10
LAI80	379.5	433.5	156.5	120.0 (155)	75 (90)	75 (90)	63.5	120	M20x1.5/M25x1.5	14
LAI80Z	414.5	478.5	156.5	120.0 (155)	75 (90)	75 (90)	63.5	120	M20x1.5/M25x1.5	16

① EN ISO 4014   ④ DIN 332   ⑤ Feather key / keyway DIN 6885   ( ) Values in brackets for motor with brake and / or with encoder

Gearbox S.-K4

S.-K4

	Motor	a5	e5	b5	f5	c5	z12	s5	d5/D	E	F	GA	o3	o4	h
S08-K4	63	90	75	60	3	7	2	5.8	11	23	4	12.5	45	60	45
S18-K4	63	90	75	60	3	7	2	5.8	11	23	4	12.5	50	67	50
	71	105	85	70				7	14	30	5	16			
S28-K4	63	90	75	60	3	8	6	5.8	11	23	4	12.5	63	83	63
	71	105	85	70				7	14	30	5	16			
	80	120	100	80	3.5			7	19	40	6	21.5			

⑤ Feather key / keyway DIN 6885

MOTOX Geared Motors
Worm geared motors

Notes

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