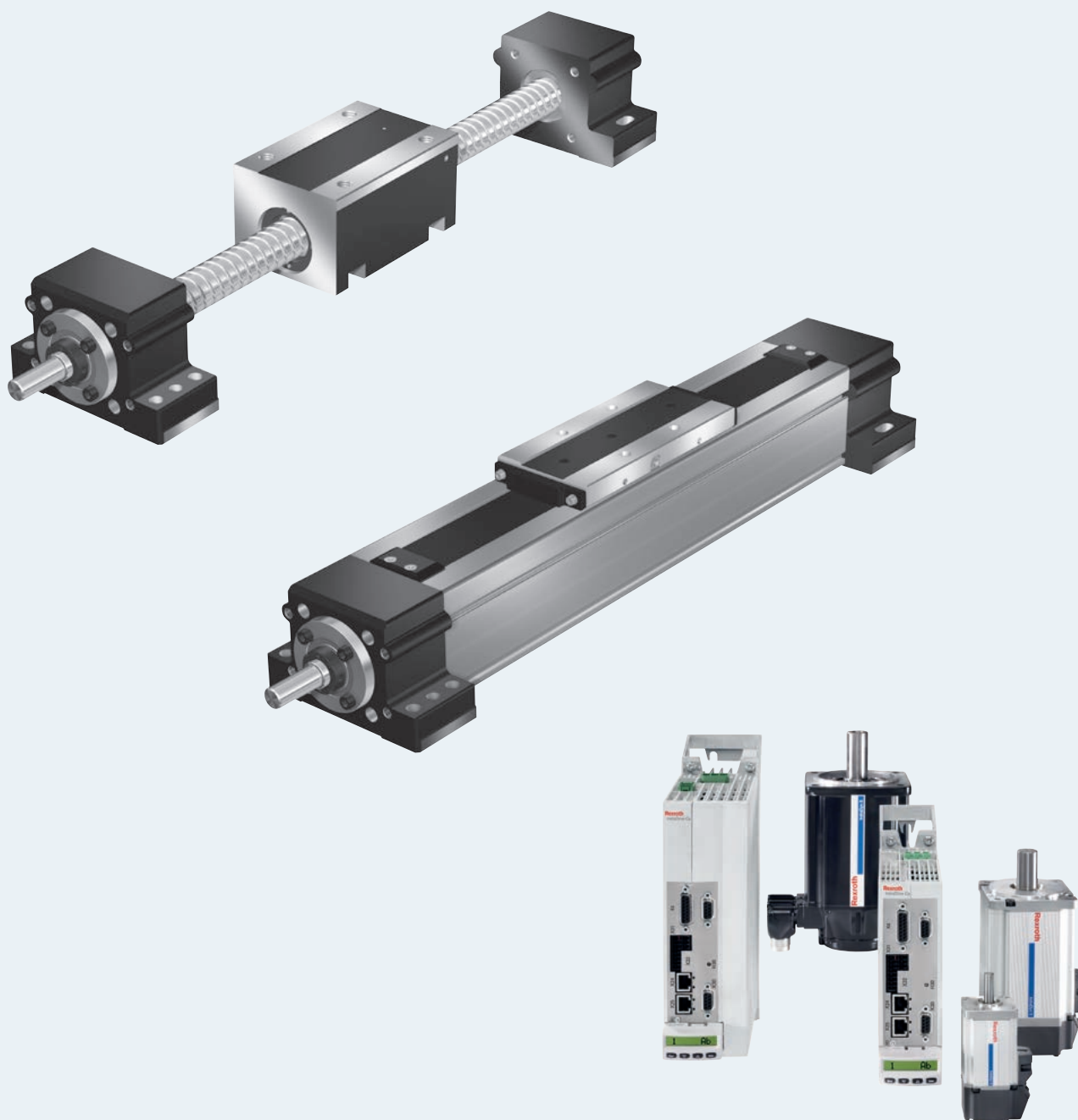


Drive Units AOK, AGK



Identification system for short product names

Short product name

Short product names are used to identify the product family, size, version and product generation of Rexroth linear motion axes.

Example	A	O	K	-	032	-	N	N	-	1
System	=	<u>D</u> rive Unit								
Format	=	<u>O</u> pen <u>C</u> losed								
Drive	=	<u>B</u> all screw drive								
Size	=	020 / <u>032</u> / 040								
Version	=	<u>S</u> tandard version								
Generation	=	Product generation <u>1</u>								

Changes/additions at a glance

Catalog structure

- New catalog number
- New short product name
- Dimension drawings revised
- “Delivery form” section added
- Technical data and drive data table layout revised
- “Calculation” section revised
- “Configuration, ordering, dimension drawings, options” section revised
- “Attachment kits for motors according to customer specification” section added
- “Motors” section added
- “AGK switch mounting arrangements/switching system” section added

Technical changes

- Range of available nuts expanded
- Range of available Nut Housings expanded
- Permissible drive torques increased
- “Switching system” section revised
- Ordering example
- Query sheet

Contents

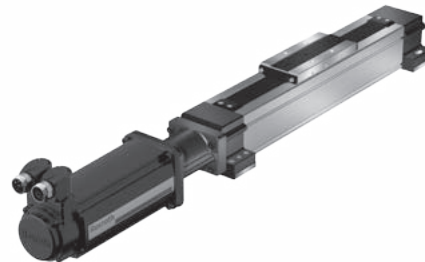
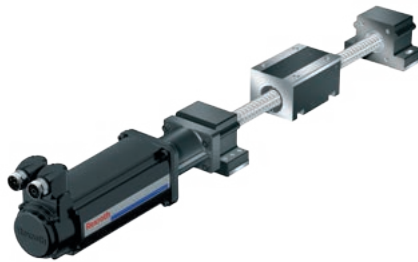
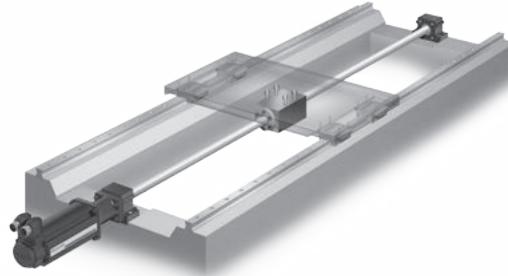
AOK/AGK product description	4	Attachments and accessories	84
Delivery form	7	Fastening	84
AOK Drive Units	8	AGK fastening instructions	84
Product description	8	AGK/AOK installation tolerances	85
Structural design	10	Attachment kits for motors according to customer specification	86
Technical data	12	Motors	88
General technical data	12	IndraDyn S - MSK servo motors	88
Drive data	12	IndraDyn S - MSM servo motors	90
See next spread for designations	13	AGK switch mounting arrangements	92
Permissible drive torque	16	Switching system	94
Permissible speed	18	Sensors	94
Calculation	20	Extensions	96
Calculation principles	20	Plugs	98
Drive dimensioning	23	Adapters	99
Calculation example	28	Distributors	100
Configuration, ordering, dimension drawings, options	32	Combination examples	104
AOK-020	32	Socket and plug	105
AOK-032	38	Service and information	106
AOK-040	44	Operating conditions	106
AGK Drive Units	50	Lubrication	107
Product description	50	Lube fittings	107
SPU product description	51	Overview	108
Structural design	52	Grease lubrication	110
Technical data	54	Liquid grease lubrication	112
General technical data	54	Oil lubrication	114
Drive data	54	Front Lube Unit (VSE)	116
Permissible drive torque	56	Parameterization (start-up)	118
Permissible speed	57	Documentation	119
Calculation	60	Inquiry/order form	122
Calculation principles	60	Further information	124
Drive dimensioning	63	Notes	126
Calculation example	68		
Configuration, ordering, dimension drawings, options	72		
AGK-020	72		
AGK-032	76		
AGK-040	80		

AOK/AGK product description

AOK and AGK Drive Units consist of Rexroth's proven ball screw drive (**BASA - BALL Screw Assembly**), which with Nut Housings and Pillow Block Units make it into a ready-to-install drive axis. When combined with an external linear guide, this Drive Unit becomes a fully functional linear motion axis for a variety of applications.

Advantages

- Each available in three sizes with freely configurable lengths up to 5600 mm
- Variable lengths and versions thanks to configuration with numerous options
- Technical data for the entire unit, e.g., maximum permissible drive torque, speed, etc.
- Nameplate with technical start-up parameters
- High positioning accuracy and repeatability due to ball screw drive with zero-backlash, pre-tensioned nut system
- When paired with Rexroth linear guides, they offer design engineers full design freedom for every application.



Drive Units are available complete with motor, controller and control system.
For more information, see the "Motors" section

Application areas

Drive Units can be used in many ways as a drive axis for linear motion and positioning tasks in the application areas and industries below.

Possible applications

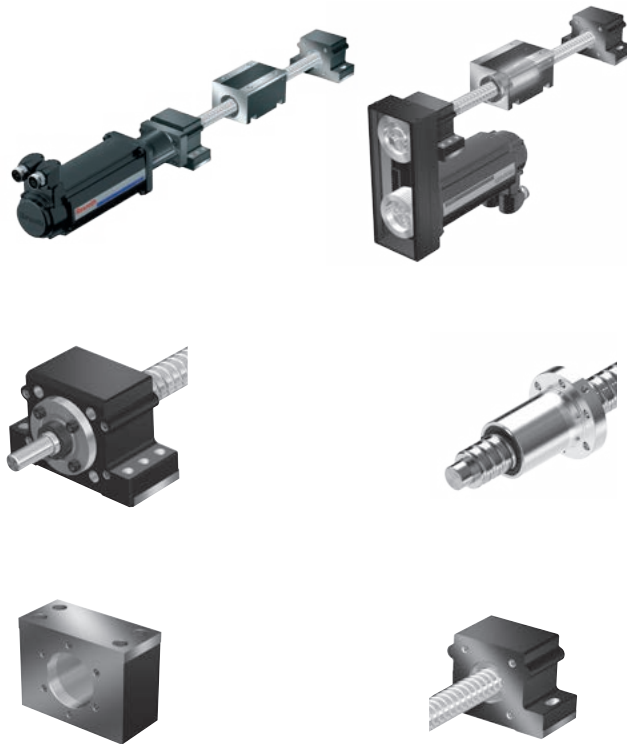
- Pick and place
- Handling systems
- Placement systems, palletizers
- Machine tool feed units
- Inspection and analysis systems
- Transfer line feed units
- Motion units

Possible industries

- Handling and assembly
- Electronics and semiconductors
- Automotive suppliers and manufacturers
- Robotics and automation
- Special-purpose machinery
- Packaging technology
- Plastics
- Textiles

AOK Drive Units, open format

- Quick Drive Unit installation and easy alignment thanks to machined reference edges on the Nut Housing and pillow block
- Available with and without floating bearings
- Motor attachment via mount and coupling or timing belt side drive
- Rexroth servo motor (MSK/MSM)



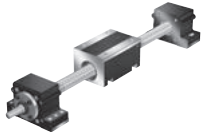
AOK Drive Units, closed format

- Rapid mounting and easy alignment of the Drive Unit due to the machined reference edge on the Pillow Block Housing
- Optimal sealing with extruded aluminum profile and steel or polyurethane sealing strip
- Traveling screw supports for maximum speeds in horizontal operation
- Motor attachment via mount and coupling or timing belt side drive
- Rexroth servo motor (MSK/MSM)



AGK with SPU screw supports

Overview

Drive Unit	Type	Format	Max. parameters	Size		
				-020	-032	-040
	AOK	open	L_{max} (mm)	3 000	4 000	5 000
			Dynamic load rating C (N)	14 300	31 700	50 000
	AGK	closed	L_{max} (mm)	3 000	5 000	5 600
			Dynamic load rating C (N)	14 300	31 700	50 000

AOK/AGK product description

Notes on applications

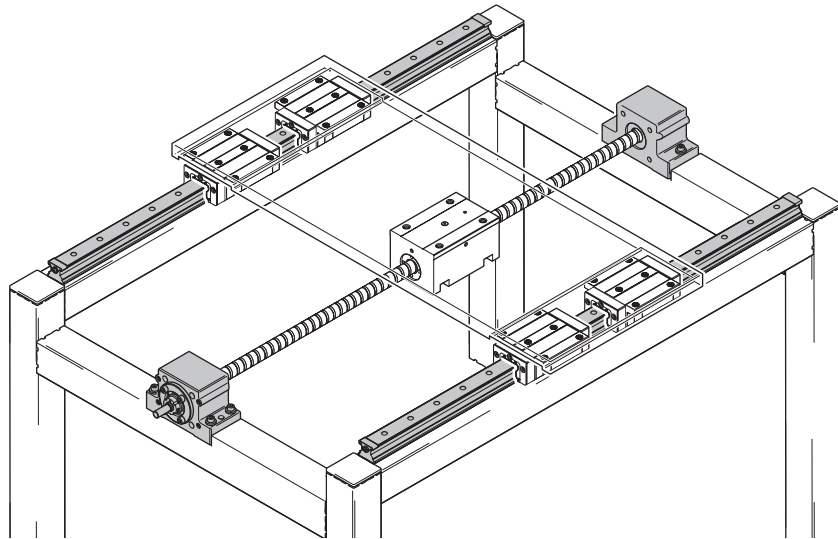
AOK and AGK Drive Units are designed for drive tasks only and can only absorb axial forces.

When using a Drive Unit, always make sure to include adequate, separate linear guides that can handle the structure being moved as well as the resulting reaction forces and torques.

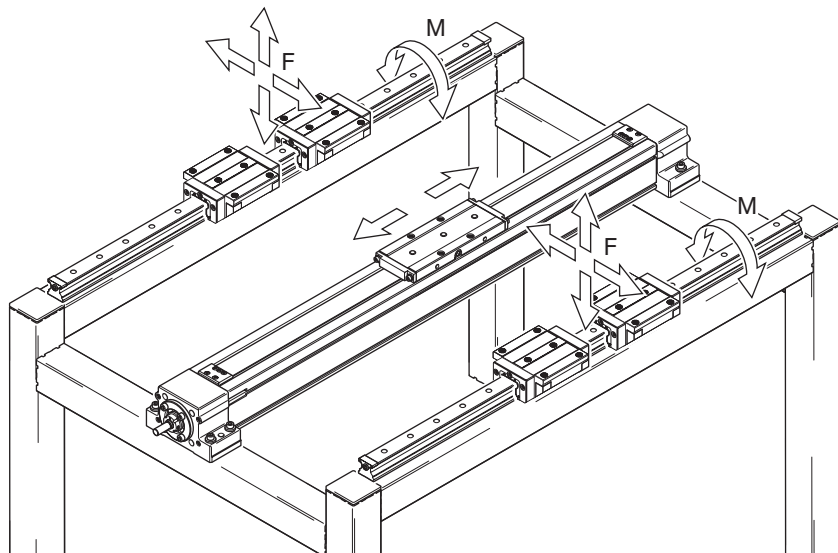
This results in a linear motion unit (e.g. table top) that can be moved automatically thanks to an AOK or AGK Drive Unit.

Examples

Example of basic motion unit structure with table top and AOK Drive Unit



In this example, two separate linear guides, each with two Runner Blocks, absorb forces and torques so that when moving the structure only axial forces act on the Drive Unit (here AGK).



 Follow the assembly instructions and installation tolerances in the “Attachments and accessories” section.

Delivery form

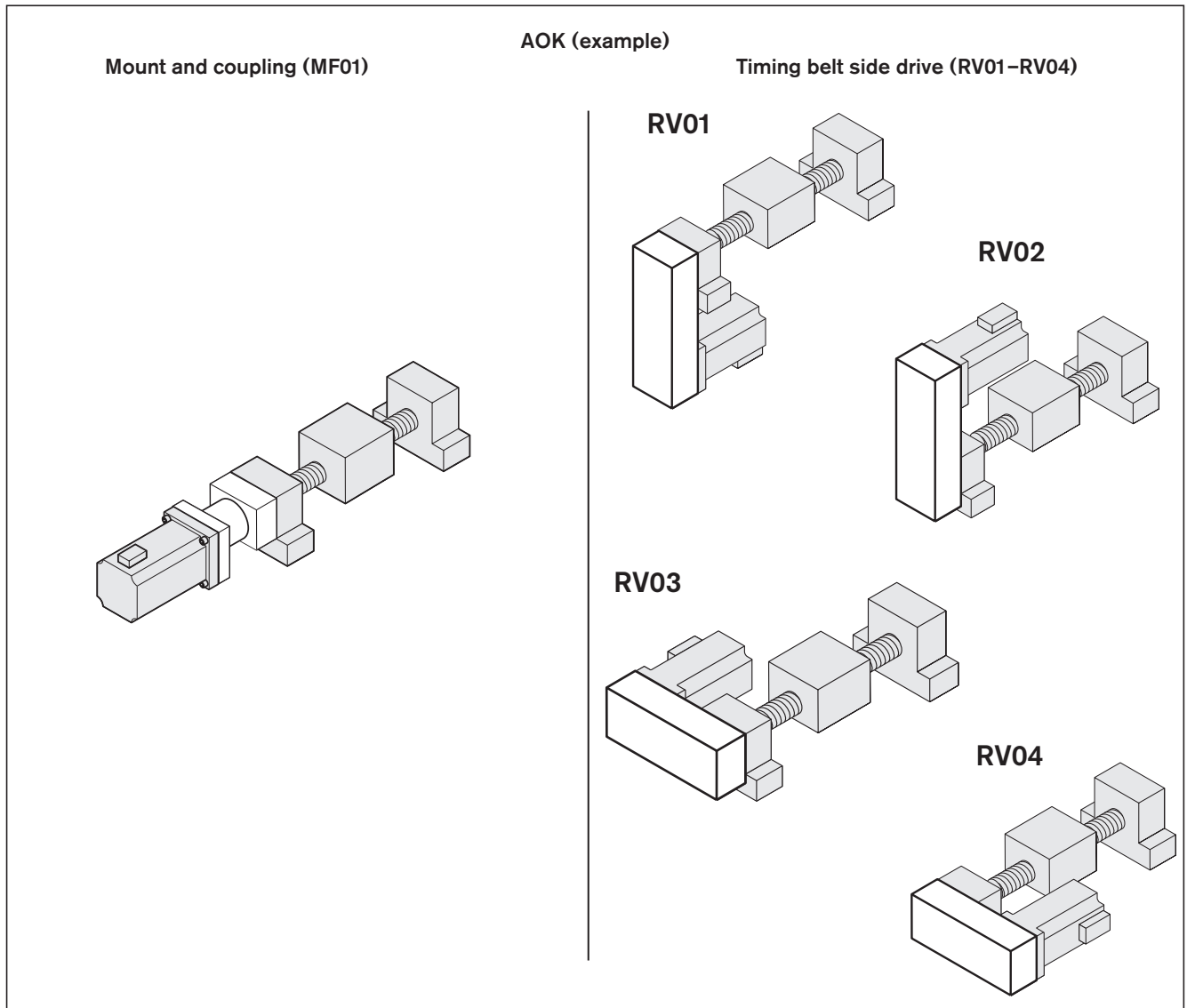
Drive Units come ready-mounted.

Motor attachment

If a combination of motor and motor attachment has been selected, then the components are attached as shown in the figure, which also shows the location of the motor connector.

Motor attachments ordered without a motor must be assembled by the customer.

All necessary instructions and parameters for professional assembly are included.



Available options

Switches and sockets with plugs are included in delivery (installation required).

Lubrication

Drive Units delivered with initial greasing.

For further information, see the "Lubrication" section.

Documentation

Each Drive Unit delivered with appropriate documentation.

8 Drive Units

AOK Drive Units

Product description

Properties

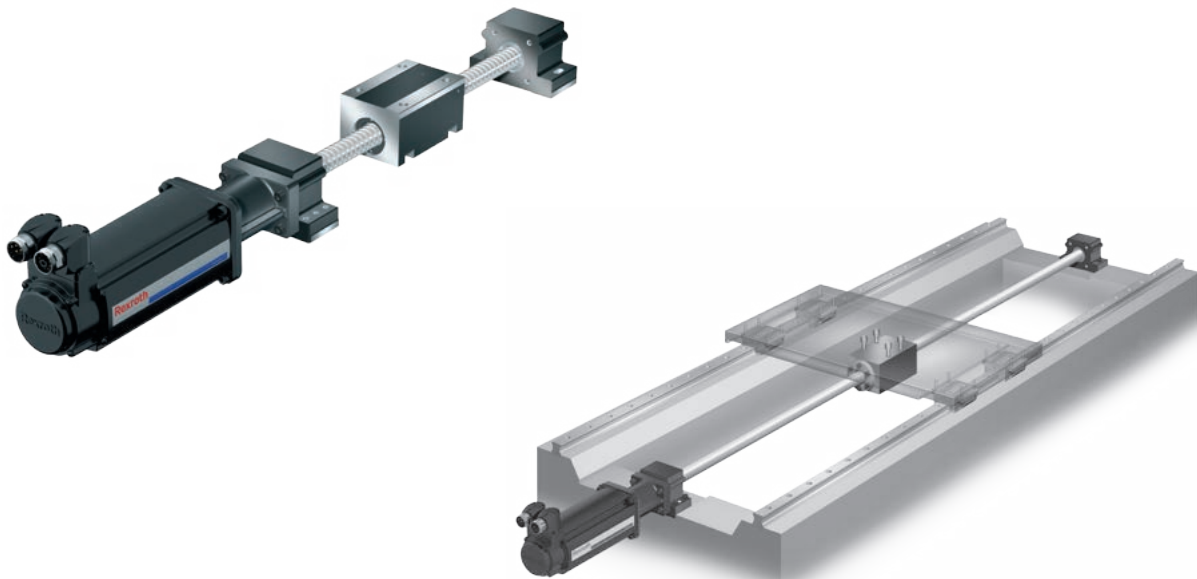
- AOK Drive Units in open format are ready-to-install drive axes consisting of a ball screw drive with nuts and pillow blocks, as well as an optional Nut Housing
- Three coordinated sizes available in any length up to $L_{\max}$
- A version with fixed and floating bearing or fixed bearing only is also available
- Driven by a precision ball screw drive in rolled design in accordance with DIN 69051
 - Screws in tolerance grade T5 or T7 available
 - Various nut versions available depending on size and lead
 - Three different preloads available (C1, C2 and C3)
- Pillow blocks available in aluminum or steel
- High linear speeds thanks to large leads with high precision over long lengths
- Nuts can be optionally selected with Front Lube Unit for longer lubrication intervals

Other highlights

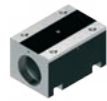
- Flexible thanks to selectable options
- Easy motor attachment via locating feature and threads
- Clearly structured technical data for the complete unit as a “linear motion system without guideway”
- Nameplate with parameters for easy start-up

Attachments

- Motor attachments with mount and coupling or via a timing belt side drive
- Attachment kits for motors according to customer specification
- Maintenance-free servo motors with selectable brake and integrated feedback



Ball screw drive component overview

Components		Short product name	Description
Version		Fixed/floating bearing	With Pillow Block Housings on fixed or floating bearing end
		Fixed bearing only	With Pillow Block Housings on fixed bearing end only
Nut		ZEM-E	Cylindrical Single Nut (only with MGA Nut Housing)
		FEM-E-S	Single Nut with flange (Rexroth mounting dimensions)
		FEP-E-S	
		FEM-E-C	Single Nut with flange (mounting dimensions similar to DIN 69051, Part 5)
Front Lube Unit		VSE	Front Lube Unit (VSE) for long-term, maintenance-free operation of the ball screw drive. (Only available in combination with nut with initial greasing).
Nut Housing		MGA	Aluminum Nut Housing, compatible with Cylindrical Single Nut ZEM-E
		MGS	Steel Nut Housing, suitable for Single Nut with flange FEM-E-S / FEP-E-S
		MGD	Steel Nut Housing, suitable for Single Nut with flange FEM-E-C

Nut preload

Preload classes	Definition
C1	Moderate preload
C2	Medium preload
C3	High preload

Precision Screw accuracy

Tolerance grade	Permissible travel deviation over 300 mm (v300p)
T5	23 µm / 300 mm
T7	52 µm / 300 mm

For further information, see the "Screw Drive" catalog.

10 Drive Units

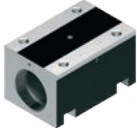
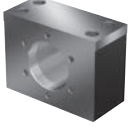
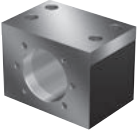
AOK Drive Units

Structural design

- 1 Ball screw drive
- 2 Pillow block on fixed bearing end (drive side)
- 3 Housing with nut
- 4 Pillow block on floating bearing end

With fixed and floating bearing

With fixed bearing only

Nut	ZEM-E 	FEM-E-S / FEP-E-S 	FEM-E-C 
can be combined with*			
Nut Housing	MGA 	MGS 	MGD 

* Only the combination options in the "Configuration and ordering" tables are valid.

Motor attachment

Attachments:

- 1 Mount and coupling
- 2 Timing belt side drive
- 3 Motor

Mount and coupling

Timing belt side drive

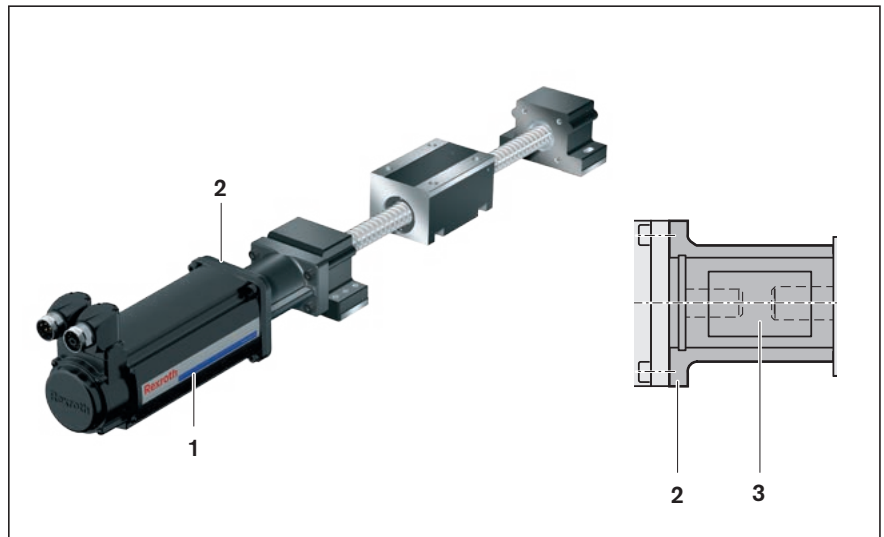
Structural design of mount and coupling

A motor can be attached to all Drive Units via mount and coupling. The mount secures the motor to the Drive Unit and serves as a closed housing for the coupling.

The coupling transmits the motor drive torque to the Drive Unit's drive shaft without distortive stresses.

Our standard couplings compensate for the system's thermal expansion.

- 1 Motor
- 2 Mount
- 3 Coupling



Structural design of timing belt side drive

All Drive Units can be attached to the motor by a timing belt side drive.

This makes the overall length shorter than when attaching the motor via mount and coupling.

The space-saving, closed pulley housing protects the belt and acts as a motor bracket.

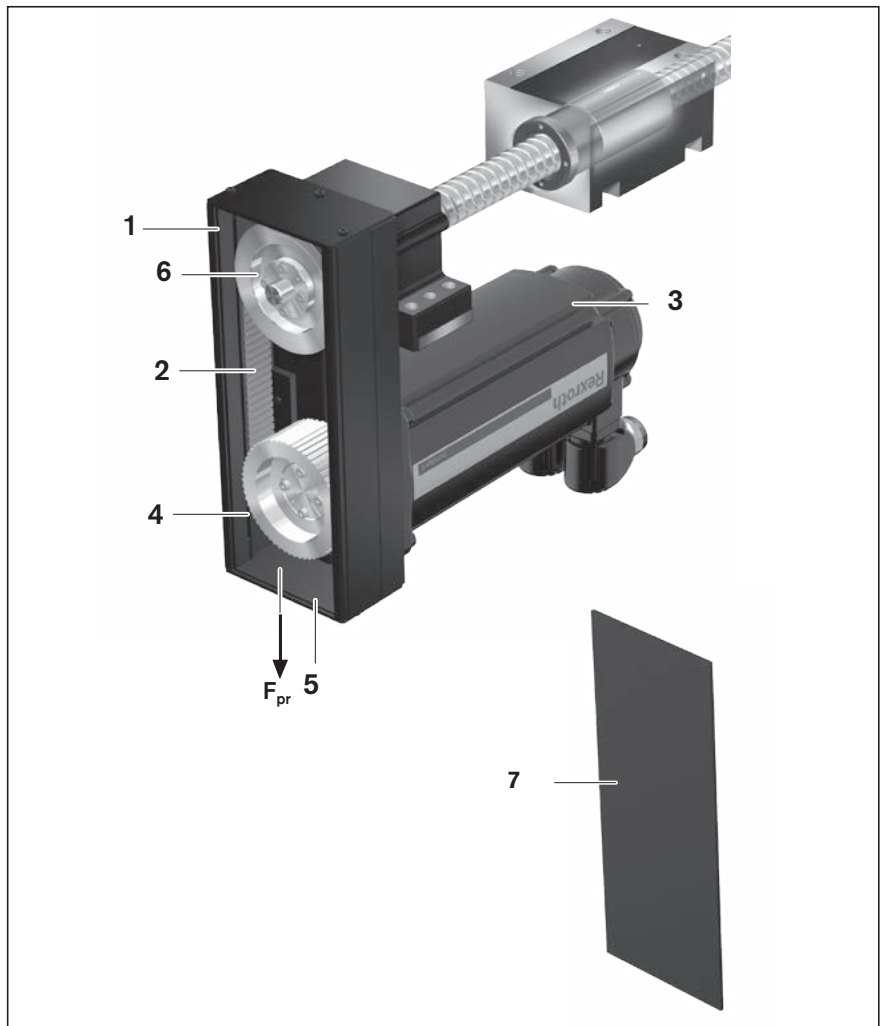
Various gear ratios are also available (depending on size):

- $i = 1$
- $i = 2$

The timing belt side drive can be installed in four directions:

- below, above (RV01 and RV02)
- left, right (RV03 and RV04)

- 1 Pulley housing made of anodized aluminum frame
- 2 Toothed belt
- 3 Motor
- 4 Pre-tensioning the belt:
Apply pre-tensioning force F_{pr} to motor (F_{pr} is provided upon delivery)
- 5 Cover
- 6 Fastening of belt pulleys with tensioning units
- 7 Timing belt side drive cover panel



12 Drive Units

AOK Drive Units

Technical data

See the "Calculation" section.

General technical data

AOK	BASA	Dynamic load rating C				Min. travel range	Max. length		Additional length		Nut length	
		ZEM-E ²⁾	FEM-E-S/ FEP-E-S ¹⁾	FEM-E-C	Fixed bearing		Fixed/ floating bearing	Fixed bearing only	Fixed/ floating bearing	Fixed bearing only	Nut FEM-E-S FEP-E-S ¹⁾	FEM-E-C
	d ₀ x P (mm)	(N)	(N)	(N)	(N)	s _{min} (mm)	L _{max} (mm)	L _{max} (mm)	L _{ad} (mm)	L _{ad} (mm)	L _c (mm)	L _c (mm)
AOK-020	20 x 5	14 300	14 300	14 300	17 000	100	3 000	750	120	70	40	40
	20 x 10	14 100	14 100	14 100							60	60
	20 x 20	13 300	9 100	13 300							57	77
	20 x 40 ¹⁾	14 000	14 000	–							57	–
AOK-032	32 x 5	21 600	21 600	21 600	26 000	150	4 000	1 500	128	74	48	48
	32 x 10	31 700	31 700	31 700							77	77
	32 x 20	19 700	13 500	19 700							64	84
	32 x 32	19 500	13 400	19 500							88	120
AOK-040	40 x 5	29 100	29 100	29 100	29 000	180	5 000	2 000	160	90	54	54
	40 x 10	50 000	50 000	50 000							70	70
	40 x 20	37 900	37 900	37 900							88	88
	40 x 40	37 000	25 500	37 000							102	142

Weight calculation

(without motor attachment, without motor)

$$m_s = k_{g \text{ fix}} + k_{g \text{ var}} \cdot L + m_{ca}$$

Drive data

AOK	BASA	Constant mass moment of inertia						
		Nut FEM-E-S FEP-E-S ¹⁾	FEM-E-C	Nut and housing ZEM-E + MGA		FEM-E-S/ FEP-E-S ¹⁾ + MGS	FEM-E-C + MGD	
	d ₀ x P (mm)	k _{J fix} (kgmm ²)	k _{J fix} (kgmm ²)	k _{J fix} (kgmm ²)	k _{J fix} (kgmm ²)	k _{J fix} (kgmm ²)	k _{J fix} (kgmm ²)	k _{J var} (kgmm ²)
AOK-020	20 x 5	15.5	15.6	16.3	16.2	16.3	0.1004	0.6333
	20 x 10	16.3	16.4	19.3	18.9	19.4	0.1004	2.5330
	20 x 20	21.4	20.3	31.6	33.4	32.3	0.1004	10.1321
	20 x 40 ¹⁾	36.0	–	73.1	83.8	–	0.1004	40.5285
AOK-032	32 x 5	129.9	129.9	131.6	131.0	131.4	0.7117	0.6333
	32 x 10	131.3	131.6	137.8	135.8	137.4	0.7117	2.5330
	32 x 20	139.9	138.6	163.6	163.8	161.6	0.7117	10.1321
	32 x 32	165.8	160.9	217.5	227.2	219.8	0.7117	25.9382
AOK-040	40 x 5	374.8	375.0	378.3	376.3	377.3	1.7827	0.6333
	40 x 10	340.7	340.4	353.4	349.8	349.6	1.6068	2.5330
	40 x 20	353.0	352.0	401.7	389.4	388.6	1.6068	10.1321
	40 x 40	482.9	425.0	597.3	733.7	571.3	1.6068	40.5285

1) Nut version FEP-E-S only available with BASA 20 x 40

2) Nut version ZEM-E only available with housing MGA

	Nut and housing length			Moved mass of system					Mass constants				
	ZEM-E + MGA	FEM-E-S/ FEP-E-S ¹⁾ + MGS	FEM-E-C + MGD	Nut		Nut and housing			Fixed/floating bearing		Fixed bearing only		$k_{g \text{ var}}$ (kg/mm)
	 L_c (mm)	 L_c (mm)	 L_c (mm)	 m_{ca} (kg)	 m_{ca} (kg)	 m_{ca} (kg)	 m_{ca} (kg)	 m_{ca} (kg)	Alumi- num	Steel	Alumi- num	Steel	
	100	52	67	0.28	0.31	1.55	1.33	1.49	3.13	7.03	1.89	3.77	0.0021
	100	60	67	0.36	0.40	1.57	1.41	1.58					
	100	78	77	0.60	0.49	1.61	1.78	1.67					
	100	63	—	0.51	—	1.42	1.69	—					
	150	63	83	0.54	0.62	3.33	2.29	2.89	4.14	9.65	2.48	4.91	0.0056
	150	77	83	0.72	0.84	3.27	2.47	3.11					
	150	75	84	1.02	0.90	3.36	3.39	3.17					
	150	114	120	1.40	1.21	3.39	3.77	3.48					
	180	75	95	0.71	1.03	6.23	3.08	4.64	6.86	14.98	4.12	7.68	0.0088
	180	80	95	1.29	1.19	6.29	4.88	4.80					
	180	88	95	1.54	1.44	6.34	5.13	5.05					
	180	151	142	3.59	2.16	6.41	9.78	5.77					

	Frictional torque		Maximum permissible acceleration	Maximum drive torque	Maximum speed				
	Fixed/floating bearing or fixed bearing only for preload class								
	C1	C2 or C3							
	M _{Rs} (Nm)	M _{Rs} (Nm)	a _{max} (m/s²)	M _p (Nm)	v _{max} (m/s)				
	0.34	0.51	39.8	See graphs	See graphs				
	0.36	0.54	50.0						
	0.35	0.51	50.0						
	0.27	—	50.0						
	0.72	1.08	17.9			See graphs	See graphs		
	0.79	1.32	30.7						
	0.71	1.04	50.0						
	0.70	1.04	50.0						
	1.19	1.80	12.2					See graphs	See graphs
	1.37	2.31	16.8						
	1.26	1.98	33.0						
	1.26	1.95	50.0						

See next spread for designations

14 Drive Units

AOK Drive Units

Technical data

See the "Calculation" section.

Drive data for motor attachment via timing belt side drive

AOK	Motor	BASA (mm) $d_o \times P$	up to L ²⁾ (mm)		M _{sd} ¹⁾ (Nm)		J _{sd} (10 ⁻⁶ kgm ²)		M _{Rsd} (Nm)	m _{sd} (kg)	F (mm)	B _t	
			Fixed/ floating bearing	Only fixed bearing	i = 1	i = 2	i = 1	i = 2				i = 1	i = 2
AOK-020	MSK 040C, MSM 041B	20 x 5	1 500	300	6.00	–	240	–	0.40	1.24	88	16 AT5	–
		20 x 10	1 900	400	7.90								
		20 x 20	2 600	600	7.94								
		20 x 40	2 200	500	7.94								
	MSK 050C	20 x 5	1 500	300	6.00	–	1 420	–	0.45	3.20	116	25 AT5	–
		20 x 10	1 900	400	7.90								
		20 x 20	2 500	600	8.70								
		20 x 40	2 100	500	8.90								
AOK-032	MSK 060C	32 x 5	2 500	600	19.10	9.55	1 400	260	0.50	3.20	116	25 AT5	32 AT5
		32 x 10	3 400	700	19.21	12.30							
		32 x 20	4 000	1 100	19.21	12.30							
		32 x 32	4 000	1 500	19.21	12.30							
AOK-040	MSK 076C	40 x 5	3 500	800	25.60	12.80	7 780	1 260	0.60	8.40	160	50 AT10	50 AT10
		40 x 10	3 000	700	51.20	25.60							
		40 x 20	3 100	700	99.30	49.65							
		40 x 40	4 400	1 100	99.30	49.65							

1) Values for M_{sd} do not factor in motor torque.

2) For greater lengths, the permissible drive torque is determined from the variable-length value M_p of the Drive Unit in accordance with the graph
 ➡ See the "Calculation principles" section.

Drive data for motor attachment via mount and coupling

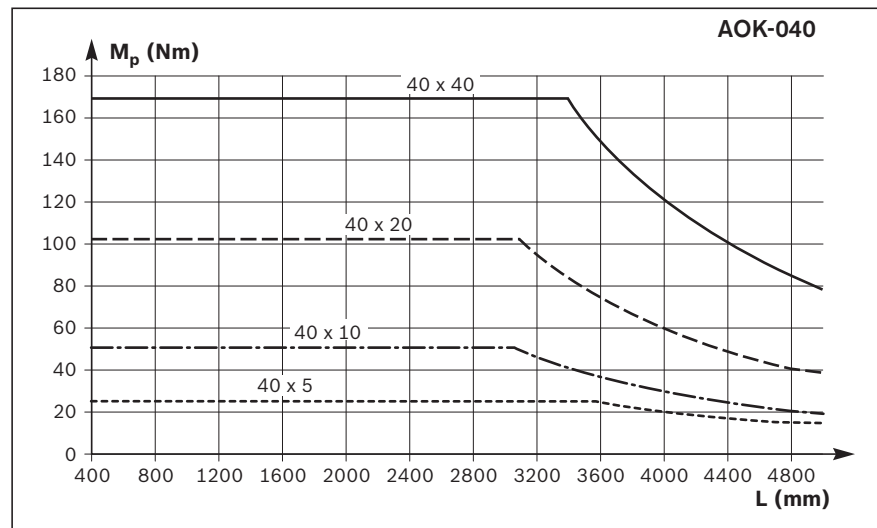
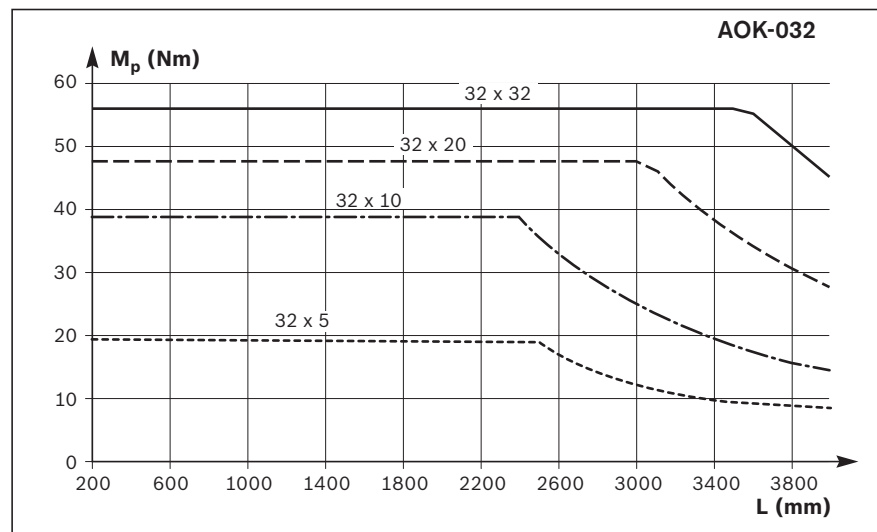
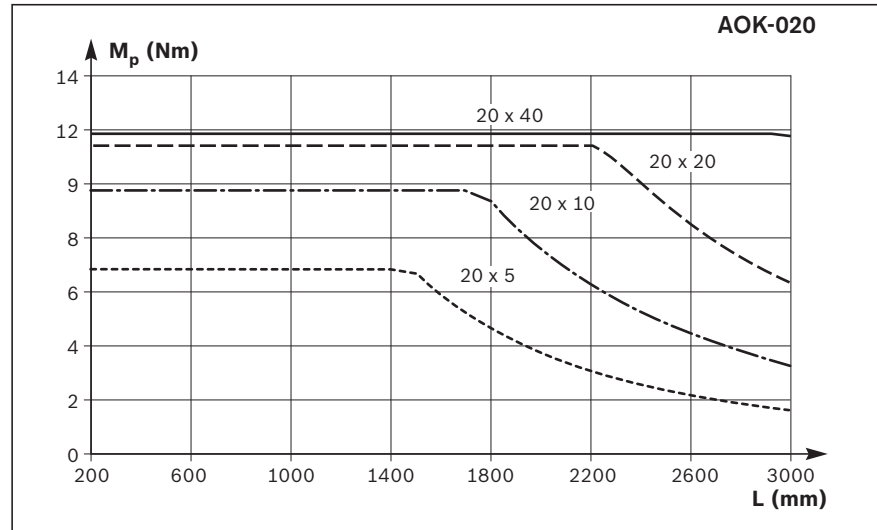
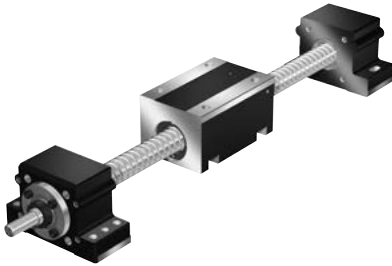
AOK	Motor	Coupling		Mount and coupling	
		M _{cN} (Nm)	J _c (10 ⁻⁶ kgm ²)	m _{fc} (kg)	
AOK-020	MSM 041B	14.5	63	0.85	
	MSK 040C	19.0	57	0.55	
	MSK 050C	50.0	200	2.00	
AOK-032	MSK 060C	50.0	200	1.80	
	MSK 076C	98.0	390	2.40	
AOK-040	MSK 076C	98.0	390	2.80	

Designations

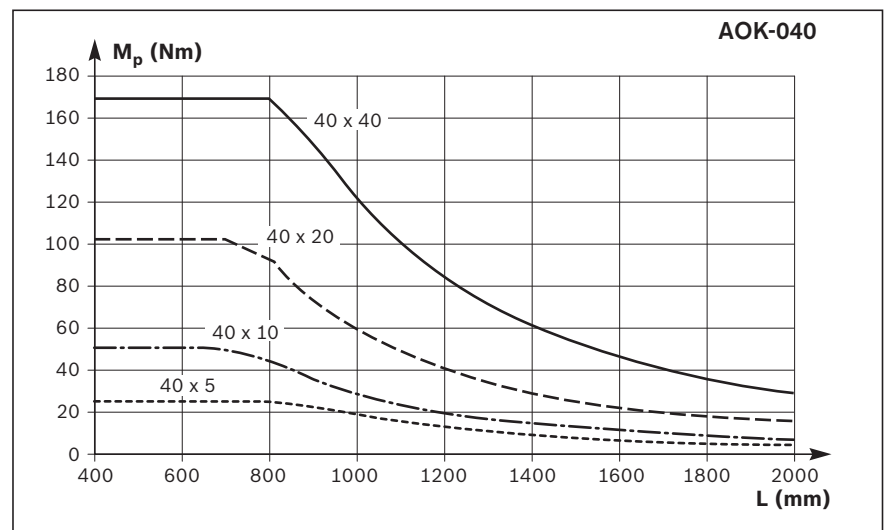
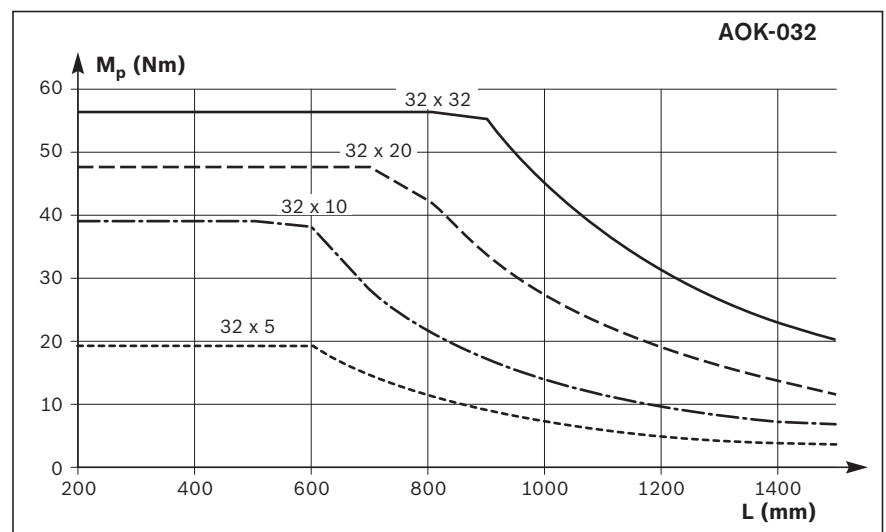
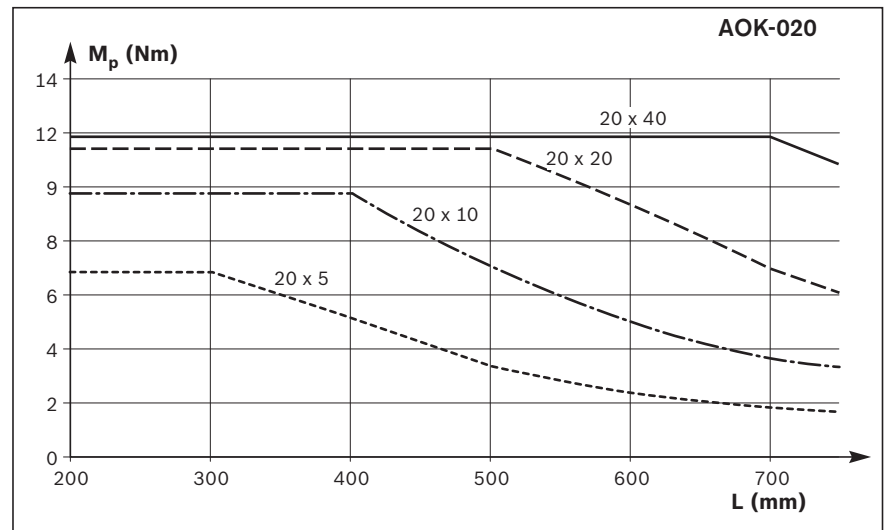
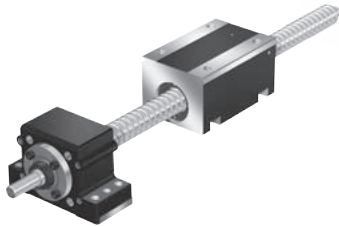
$a_{\max}$	= maximum acceleration
B_t	= belt type
C	= dynamic load rating
d_0	= nominal diameter
F	= pulley housing width
i	= timing belt side drive gear ratio
J_c	= mass moment of inertia of the coupling
J_{sd}	= reduced mass moment of inertia of timing belt side drive at motor journal
$k_{g \text{ fix}}$	= constant for fixed-length portion of the mass
$k_{g \text{ var}}$	= constant for variable-length portion of the mass
$k_{J \text{ fix}}$	= constant for fixed-length portion of mass moment of inertia
$k_{J \text{ var}}$	= constant for variable-length portion of mass moment of inertia
$k_{J \text{ m}}$	= constant for mass-specific portion of mass moment of inertia
L	= length
L_{ad}	= additional length
L_c	= nut length/nut and housing length
$L_{\max}$	= maximum length
M_p	= drive torque
M_{Rs}	= frictional torque of system
M_{cN}	= rated torque of coupling
M_{Rsd}	= frictional torque of timing belt side drive at motor journal
M_{sd}	= maximum permissible drive torque of timing belt side drive
m_{tc}	= mass of mount and coupling
m_{sd}	= mass of timing belt side drive
m_{ca}	= moved mass of system
P	= lead
$s_{\min}$	= minimum travel
$v_{\max}$	= maximum speed

Technical data

Permissible drive torque M_p
with fixed and floating bearing



Permissible drive torque M_p
with fixed bearing only



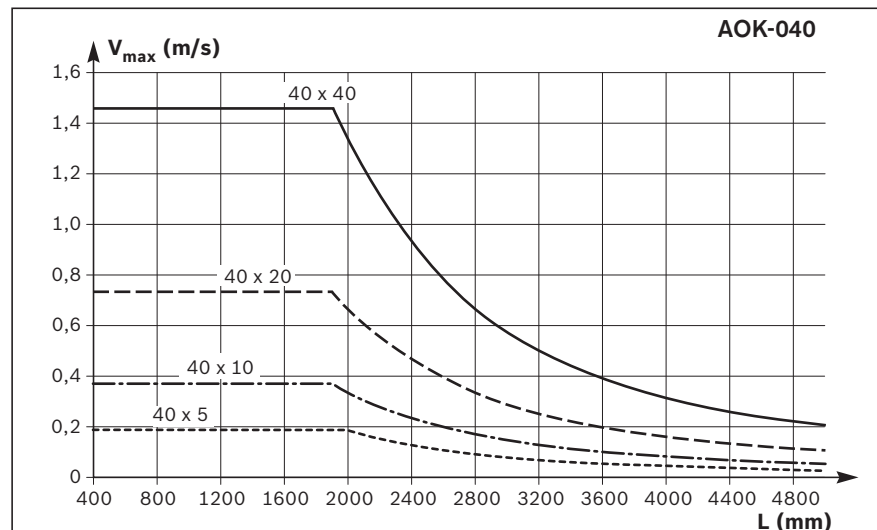
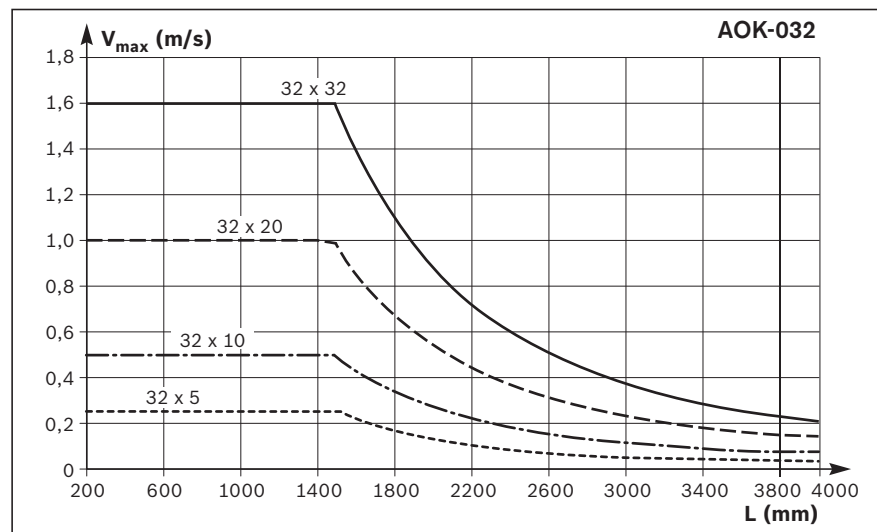
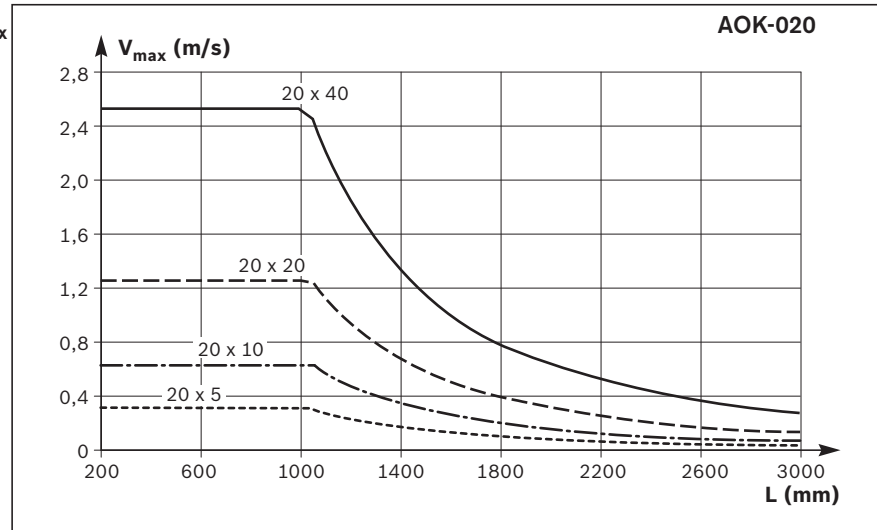
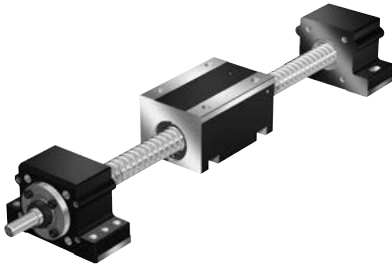
Note

The values shown for M_p apply under the following conditions:

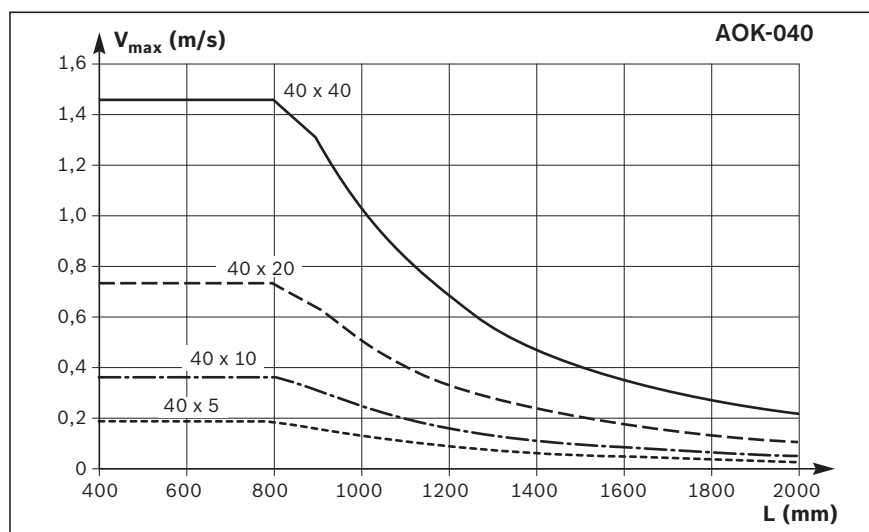
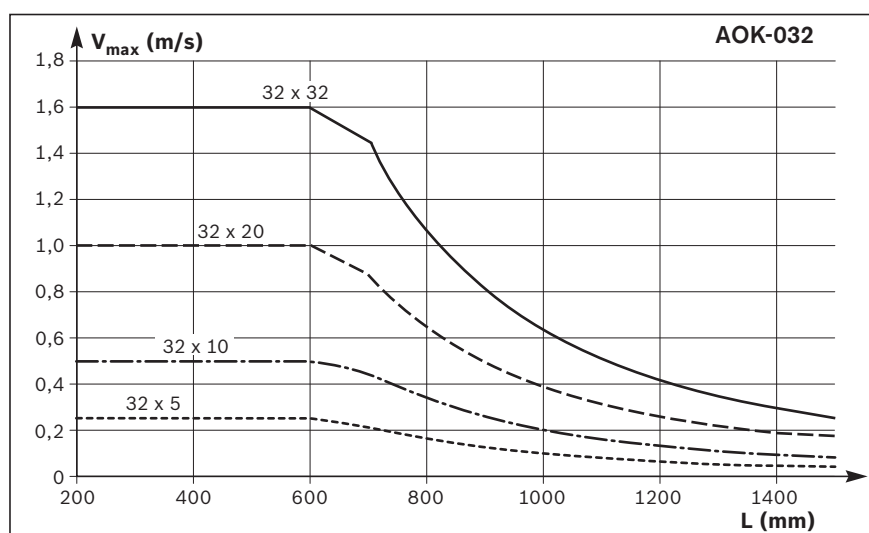
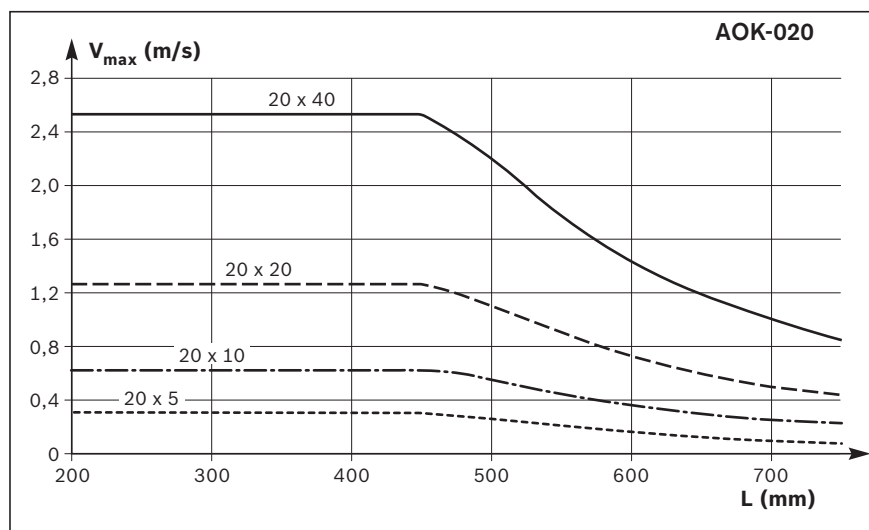
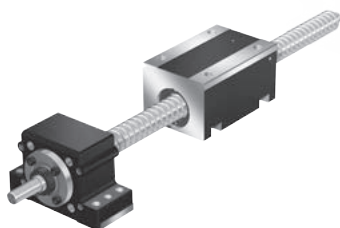
- No radial loads on screw journal

Technical data

Maximum permissible speed $v_{\max}$
with fixed and floating bearing



Maximum permissible speed $v_{\max}$
with fixed bearing only



Calculation

Calculation principles

Drive Unit service life

Service life of ball screw drive or the fixed bearing

Page 20

Page 21

Page 21

Drive dimensioning

Basic principles

Drive dimensioning based on the motor shaft as a reference point

General guide for motor selection

Calculation example

Page 23

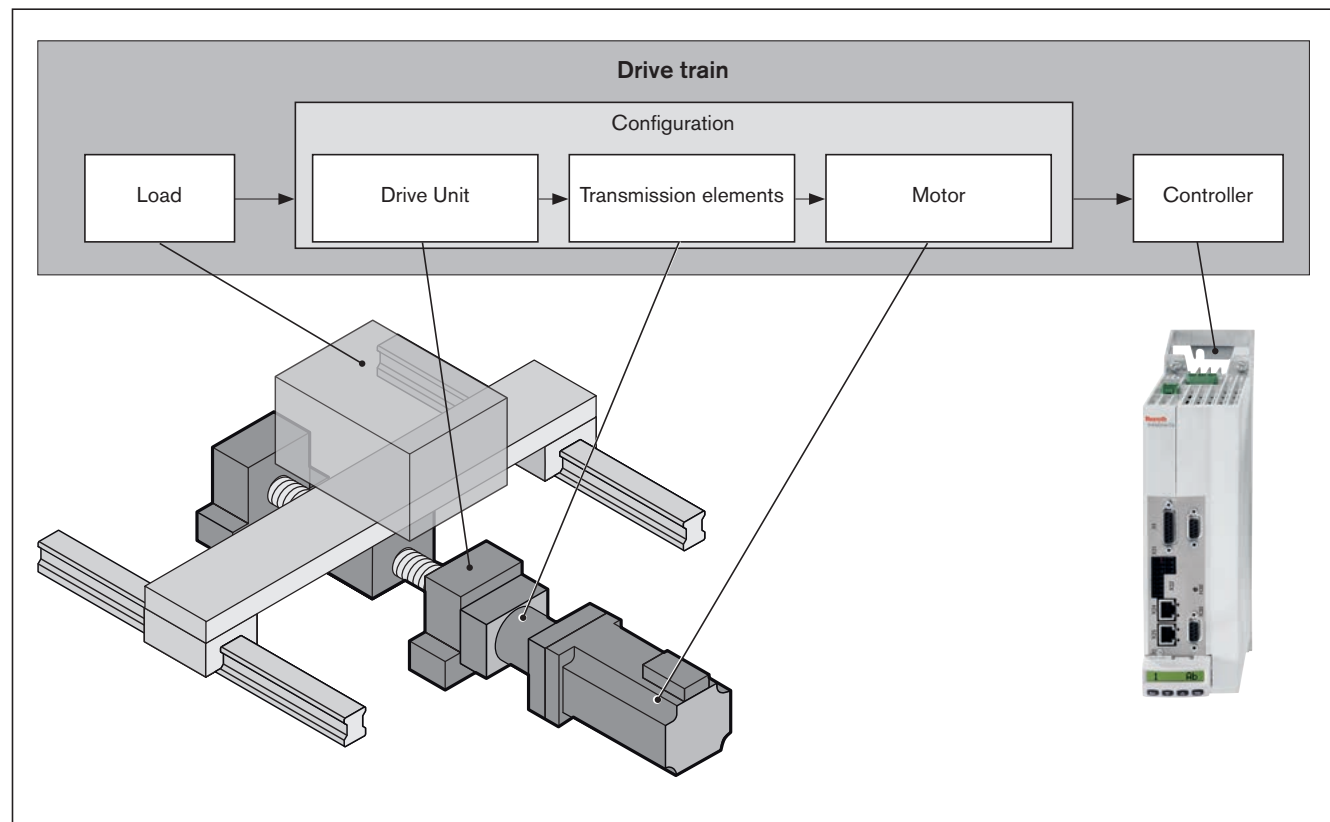
Page 23

Page 24

Page 26

Page 28

Calculation principles



Correct dimensioning and assessment for an application requires structured consideration of the entire drive train. The basic element of the drive train is the configuration comprising the Drive Unit, the transmission element (coupling or timing belt side drive) and the motor, which can be ordered in this constellation as per the catalog.

Calculation

Drive Unit service life

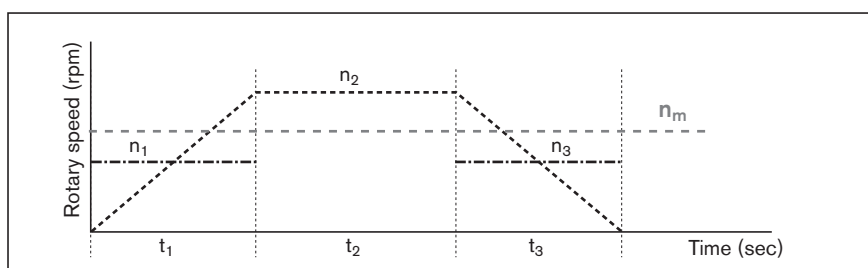
The service life of the rolling bearing points contained in a Drive Unit can be calculated using the formulas given below. In a Drive Unit with ball screw drive, the rolling bearing points that are relevant for the service life are the linear guide, the ball screw drive (nut), and the fixed bearing.

⚠ Whichever independently calculated service life is shorter, that of the ball screw drive or of the fixed bearing, is then used as the estimated service life of the Drive Unit.

Service life of the ball screw drive or the fixed bearing

If operating conditions vary (rotary speed and load), service life must be calculated using the averages F_m and n_m .

If rotary speed varies, average rotary speed n_m is calculated as follows:



$$n_m = \frac{|n_1| \cdot t_1 + |n_2| \cdot t_2 + \dots + |n_n| \cdot t_n}{t_{tot}}$$

$$t_{tot} = t_1 + t_2 + \dots + t_n$$

Rotary speed in acceleration and braking phases $n_{1...n}$:

$$n_{1...n} = \frac{n_{A1...n} + n_{E1...n}}{2}$$

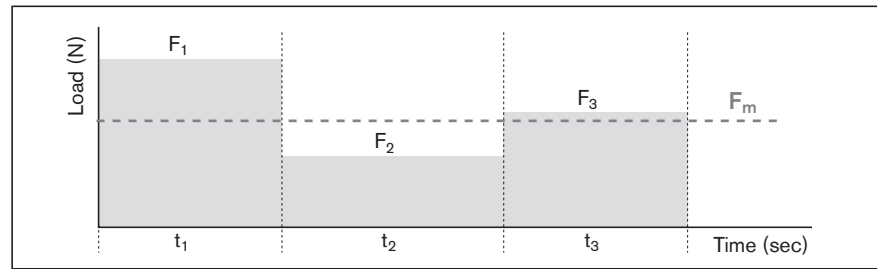
$n_1, n_2, \dots, n_n$ = rotary speed in phases 1 ... n (rpm)
 n_m = average rotary speed (rpm)
 $t_1, t_2, \dots, t_n$ = discrete time step in phases 1 ... n (sec)
 t_{tot} = sum of the discrete time steps (sec)
 n_1 = rotary speed in acceleration and braking phases
 $n_{A1...n}$ = rotary speed at start in phase 1 ... n (rpm)
 $n_{E1...n}$ = rotary speed at end in phase 1 ... n (rpm)

22 Drive Units

AOK Drive Units

Calculation

Where both the load and the rotary speed vary, the average load F_m is calculated as follows:



$$F_m = \sqrt[3]{|F_1|^3 \cdot \frac{|n_1|}{n_m} \cdot \frac{t_1}{t_{ges}} + |F_2|^3 \cdot \frac{|n_2|}{n_m} \cdot \frac{t_2}{t_{ges}} + \dots + |F_n|^3 \cdot \frac{|n_n|}{n_m} \cdot \frac{t_n}{t_{ges}}}$$

Nominal life

Nominal life in revolutions:

$$L = \left(\frac{C}{F_m} \right)^3 \cdot 10^6$$

Nominal life in hours:

$$L_h = \frac{L}{n_m \cdot 60}$$

C	=	dynamic load rating	(N)
$F_1, F_2, \dots, F_n$	=	axial load during phases 1 ... n	(N)
F_m	=	equivalent dynamic axial load	(N)
$n_1, n_2, \dots, n_n$	=	rotary speed in phases 1 ... n	(rpm)
n_m	=	average rotary speed	(rpm)
$t_1, t_2, \dots, t_n$	=	discrete time step in phases 1 ... n	(sec)
t_{tot}	=	sum of the discrete time steps	(sec)
L	=	nominal life	(—)
L_h	=	nominal life	(h)

Drive dimensioning

Basic principles

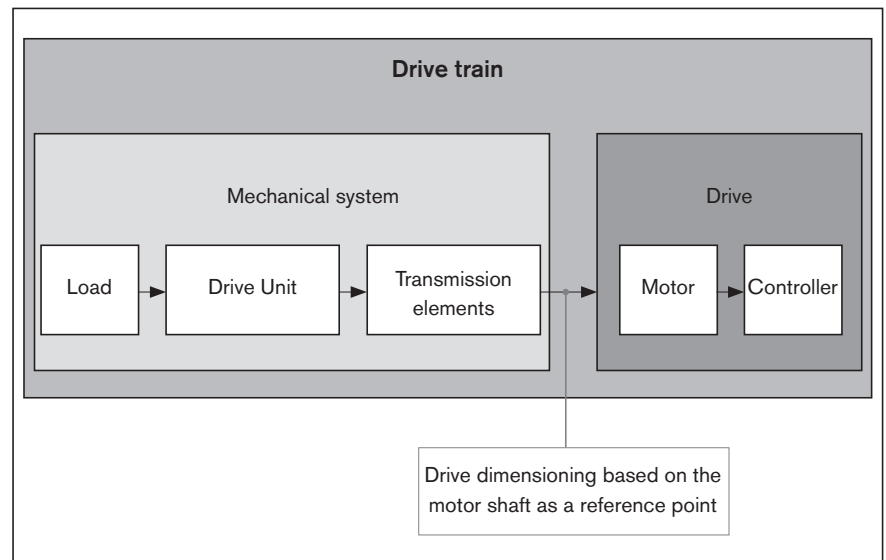
When dimensioning the drive, the drive train can be divided into the mechanical system and the drive itself.

The **mechanical system** includes the Drive Unit and transmission elements (timing belt side drive, coupling), and the load to be carried.

The electric **drive** is a motor/controller combination with corresponding performance data.

The dimensioning of the electric drive is done taking the motor shaft as a reference point.

Both basic values and limit values must be factored in when dimensioning the drive. Limit values should be observed to avoid damaging the mechanical components.



Technical data and formula symbols for the mechanical system

For each component (Drive Unit, coupling, timing belt side drive), the relevant maximum permissible values must be identified for the drive torque and travel speed, as well as the basic values for frictional torque and mass moment of inertia.

The following technical data with the associated formula symbols are used when considering the basic **mechanical system** requirements in the design calculations for dimensioning the drive. The data in the table below can be found in the "Technical data" section or they are determined using the formulas described on the following pages.

		Mechanical system			
		Load	Drive Unit	Transmission elements	
				Coupling	Timing belt side drive
Weight moment	(Nm)	$M_g^{(6)}$	—	—	—
Frictional torque	(Nm)	$M_{fs}^{(5)}$	$M_{Rs}^{(3)}$	—	$M_{Rsd}^{(3)}$
Mass moment of inertia	(kgm ²)	$J_t^{(1)}$	$J_s^{(2)}$	$J_c^{(3)}$	$J_{sd}^{(3)}$
Max. permissible speed	(m/s)	—	$v_{max}^{(4)}$	—	—
Maximum permissible drive torque	(Nm)	—	$M_p^{(4)}$	$M_{cN}^{(3)}$	$M_{sd}^{(3)}$

1) Determine the value using the appropriate formula

2) Length-dependent value, determined using the appropriate formula

3) Use the value from the table

4) Length-dependent value, to be read off the graph

5) Any additional process forces are to be taken into consideration as load moments

6) For vertical mounting position: Determine the value using the appropriate formula

Drive dimensioning

Drive dimensioning based on the motor shaft as a reference point

When dimensioning the drive, all relevant design calculation values for the mechanical components in the drive train have to be determined and be expressed in terms of or reduced to the motor shaft. For a combination of mechanical components in the drive train, this will result in one value for each of the following:

- Frictional torque M_R
- Mass moment of inertia J_{ex}
- Maximum permissible speed v_{mech} (maximum permissible rotary speed n_{mech})
- Maximum permissible drive torque M_{mech}

Determination of the values for each mechanical component in the drive train based on the motor shaft as a reference point

Frictional torque M_R

For motor attachment via mount and coupling

$$M_R = M_{Rs}$$

For motor attachment via timing belt side drive

$$M_R = M_{Rsd} + \frac{M_{Rs}}{i}$$

Mass moment of inertia J_{ex}

For motor attachment via mount and coupling

$$J_{ex} = J_s + J_t + J_c$$

For motor attachment via timing belt side drive

$$J_{ex} = J_{sd} + \frac{(J_s + J_t)}{i^2}$$

Determination of the mass moment of inertia of the Drive Unit

$$J_s = (k_{J\,fix} + k_{J\,var} \cdot L) \cdot 10^{-6}$$

Determination of the translatory mass moment of inertia of the external load

$$J_t = m_{ex} \cdot k_{J\,m} \cdot 10^{-6}$$

i	= gear ratio of timing belt side drive	(—)
J_c	= mass moment of inertia of the coupling	(kgm ²)
J_{ex}	= mass moment of inertia of mechanical system	(kgm ²)
J_s	= mass moment of inertia of the Drive Unit	(kgm ²)
J_{sd}	= mass moment of inertia of timing belt side drive at motor journal	(kgm ²)
J_t	= translatory mass moment of inertia of external load based on the Drive Unit screw journal	(kgm ²)
$k_{J\,fix}$	= constant for fixed-length portion of mass moment of inertia	(kgmm ²)
$k_{J\,m}$	= constant for mass-specific portion of mass moment of inertia	(mm ²)
$k_{J\,var}$	= constant for variable-length portion of mass moment of inertia	(kgmm)
L	= length of Drive Unit	(mm)
m_{ex}	= moved external load	(kg)
M_R	= frictional torque at motor journal	(Nm)
M_{Rs}	= frictional torque of system	(Nm)
M_{Rsd}	= frictional torque of timing belt side drive at motor journal	(Nm)

Maximum permissible speed v_{mech}

The lowest of all the values for the maximum permissible speed of all mechanical components contained in the drive train determines the maximum permissible speed of the mechanical system which has to be taken into consideration as the upper limit for the drive when dimensioning the motor. By design, the maximum permissible speed or rotary speed of a Drive Unit with ball screw drive will always be less than that of the other components in the mechanical system, such as the coupling or timing belt side drive, and therefore determines the maximum permissible speed of the mechanical system.

Maximum permissible speed

$$v_{\text{mech}} = v_{\text{max}}$$

Maximum permissible rotary speed

For motor attachment via mount and coupling

$$n_{\text{mech}} = \frac{v_{\text{mech}} \cdot 1000 \cdot 60}{P}$$

For motor attachment via timing belt side drive

$$n_{\text{mech}} = \frac{v_{\text{mech}} \cdot i \cdot 1000 \cdot 60}{P}$$

i	=	gear ratio of timing belt side drive	(—)
n_{mech}	=	maximum permissible rotary speed of mechanical system	(rpm)
P	=	screw lead	(mm)
v_{max}	=	maximum permissible speed of the Drive Unit	(m/s)
v_{mech}	=	maximum permissible speed of mechanical system	(m/s)

Maximum permissible drive torque M_{mech}

The lowest (minimum) permissible drive torque of all of the mechanical components in the drive train determines the maximum permissible drive torque of the mechanical system, which should be considered the drive limit when dimensioning the motor.

For motor attachment via mount and coupling

$$M_{\text{mech}} = \text{minimum } (M_{\text{cN}}; M_{\text{p}})$$

For motor attachment via timing belt side drive

$$M_{\text{mech}} = \text{minimum } (M_{\text{sd}}; \frac{M_{\text{p}}}{i})$$

i	=	gear ratio of timing belt side drive	(—)
M_{p}	=	maximum permissible drive torque of the Drive Unit	(Nm)
M_{cN}	=	rated torque of coupling	(Nm)
M_{sd}	=	maximum permissible drive torque of the timing belt side drive	(Nm)
M_{mech}	=	maximum permissible drive torque for mechanical system	(Nm)

⚠ When considering the complete drive train (mechanical system + motor/controller), the maximum torque of the motor can lie below the maximum value for the mechanical system (M_{mech}) and thus limit the maximum permissible drive torque of the overall drive train.

If the maximum torque of the motor lies above the upper limit for the mechanical system (M_{mech}), the maximum motor torque must be limited to the permitted value for the mechanical system.

Drive dimensioning

Motor pre-selection

The following conditions can be used as a general guide for pre-selecting the motor.

Condition 1:

The rotary speed of the motor must be greater than or equal to the rotary speed required for the mechanical system (but not exceeding the maximum permissible limit value).

$$n_{\max} \geq n_{\text{mech}}$$

$$\begin{aligned} n_{\max} &= \text{max. rotary speed of motor} && (\text{rpm}) \\ n_{\text{mech}} &= \text{maximum permissible rotary speed of the mechanical system} && (\text{rpm}) \end{aligned}$$

Condition 2:

Consideration of the ratio of mass moments of inertia of the mechanical system and the motor. The ratio of the mass moments of inertia serves as an indicator for the control performance of a motor/controller combination. The mass moment of inertia of the motor is directly related to motor size.

Ratio of mass moments of inertia

$$V = \frac{J_{\text{ex}}}{J_{\text{m}} + J_{\text{br}}}$$

For pre-selection, past experience has shown the following values will result in high control performance.

While these are not fixed limits, exceeding them will require closer evaluation of the application.

Application area	V
Handling	≤ 6.0
Processing	≤ 1.5

$$\begin{aligned} J_{\text{br}} &= \text{mass moment of inertia of motor brake} && (\text{kgm}^2) \\ J_{\text{ex}} &= \text{mass moment of inertia of mechanical system} && (\text{kgm}^2) \\ J_{\text{m}} &= \text{mass moment of inertia of motor} && (\text{kgm}^2) \\ V &= \text{ratio of mass moments of inertia of drive train and motor} && (-) \end{aligned}$$

Condition 3:

Estimation of the ratio of the static load moment to the torque of the motor at standstill. The torque ratio must be less than or equal to the empirical value of 0.6. By looking at the required motor torque levels, this estimation roughly covers the dynamic characteristics which still have to be determined by plotting an exact motion profile.

Torque ratio

$$\frac{M_{\text{stat}}}{M_0} \leq 0.6$$

Static load moment

$$M_{\text{stat}} = M_R + M_g$$

Weight moment

For vertical mounting only!

For motor attachment via mount and coupling: $i = 1$

$$M_g = \frac{P \cdot (m_{\text{ex}} + m_{\text{ca}}) \cdot g}{2000 \cdot \pi \cdot i}$$

g	= force of gravity (= 9.81)	(m/s ²)
i	= gear ratio of timing belt side drive	(—)
m_{ca}	= moved mass of carriage	(kg)
m_{ex}	= moved external load	(kg)
M_g	= weight moment at motor journal	(Nm)
M_0	= torque of the motor at standstill	(Nm)
M_R	= frictional torque at motor journal	(Nm)
M_{stat}	= static load moment	(Nm)
P	= screw lead	(mm)
π	= pi	(—)

In the section ➡ “Configuration and ordering”, users can put together standard configurations, including motor attachment and motor, for the various Drive Unit sizes by selecting the appropriate options. By checking the above conditions, it is possible to see whether a standard motor selected in a particular configuration will generally be of a suitable size for the specific application.

Precise drive dimensioning

Pre-selecting the motor according to this general guide is no substitute for the precise design calculations required for the drive with detailed consideration of torques and rotary speed levels. For precise calculation of the electric drive, including consideration of the specific motion profile, please refer to the performance data in the catalogs “IndraDrive Cs” and “IndraDrive C”.

When dimensioning the drive, the maximum permissible speed, drive torque and acceleration should not be exceeded in order to avoid damaging the mechanical system.

28 Drive Units

AOK Drive Units

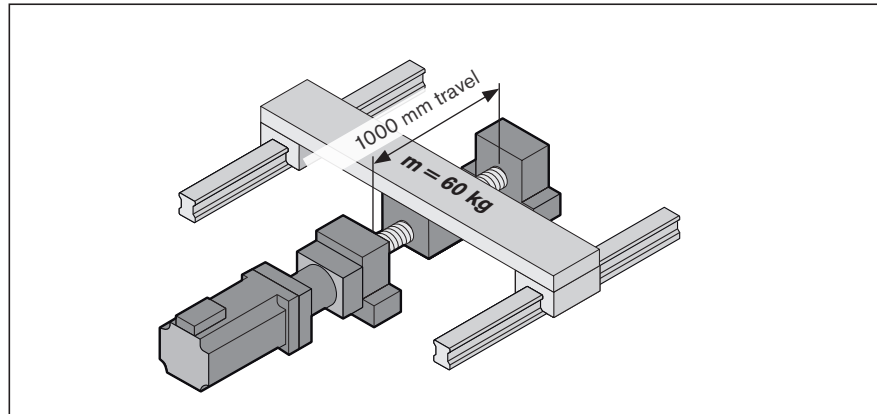
Calculation example

Starting data

An object weighing 60 kg needs to be moved horizontally 1000 mm at a max. speed of 0.6 m/s. The object travels over a separate linear guide whose frictional drag is 200 N. The following was selected based on technical data and installation space:

AOK Drive Unit-032:

- Nut version FEM-E-S with Nut Housing MGS
- Nut with preload class factor C1 (moderate preload)
- Motor attachment via timing belt side drive, $i = 2$
- Motor MSK 060C without brake



Estimating length L

(The first estimate assumes the largest possible lead and therefore length, since the permissible speed can decrease as length increases.)

$$\begin{aligned}
 L &= s_{\max} + L_{ca} + L_{ad} \\
 \text{Excess travel: } s_e &= 2 \cdot P = 2 \cdot 32 = 64 \text{ mm} \\
 \text{Max. travel: } s_{\max} &= s_{\text{eff}} + 2 \cdot s_e \\
 &= 1000 + 2 \cdot 64 = 1128 \text{ mm} \\
 \text{Length: } L &= 1128 + 114 + 128 = 1370 \text{ mm}
 \end{aligned}$$

Selecting the ball screw drive

(Better to choose the lowest lead as this is favorable in terms of resolution, braking distance, length.)

Permissible ball screw drive according to the "Permissible speed" graph at $v = 0.6 \text{ m/s}$ and $L = 1370 \text{ mm}$:

BASA 32 x 32 and BASA 32 x 20

Ball screw drive selected (smaller lead):

BASA 32 x 20

Max. permissible speed for BASA 32 x 20 from graph:

$$v_{\max} = 1.0 \text{ m/s}$$

Calculation of length L

(for selected BASA)

$$\begin{aligned}
 \text{Excess travel: } s_e &= 2 \cdot P = 2 \cdot 20 = 40 \text{ mm} \\
 \text{Max. travel: } s_{\max} &= s_{\text{eff}} + 2 \cdot s_e \\
 &= 1000 + 2 \cdot 40 = 1080 \text{ mm} \\
 \text{Length: } L &= 1080 + 114 + 128 = 1322 \text{ mm}
 \end{aligned}$$

Frictional torque M_R

(motor attachment via timing belt side drive)

$$\begin{aligned}
 M_R &= M_{Rsd} + (M_{Rs} + M_{Rad})/i \\
 \text{Separate guideway: } M_{Rad} &= (P \cdot F_R)/(2000 \cdot \pi) \\
 &= (20 \cdot 200)/(2000 \cdot \pi) \\
 &= 0.64 \text{ Nm} \\
 \text{Drive Unit: } M_{Rs} &= 0.71 \text{ Nm} \\
 \text{Timing belt side drive: } M_{Rsd} &= 0.50 \text{ Nm } (i = 2) \\
 \text{Frictional torque: } M_R &= 0.50 + (0.71 + 0.64)/2 = 1.175 \text{ Nm}
 \end{aligned}$$

Mass moment of inertia J_{ex}
(motor attachment via timing belt side drive)

$$J_{ex} = J_{sd} + \frac{(J_s + J_t)}{i^2}$$

Timing belt side drive: $J_{sd} = 260 \cdot 10^{-6} \text{ kgm}^2$

Drive Unit: $J_s = (k_{J \text{ fix}} + k_{J \text{ var}} \cdot L) \cdot 10^{-6}$

$$= (163.8 + 0.7117 \cdot 1322) \cdot 10^{-6}$$

$$= 1104.67 \cdot 10^{-6} \text{ kgm}^2$$

External load: $J_t = m_{ex} \cdot k_{Jm} \cdot 10^{-6}$

$$= 60 \cdot 10.1321 \cdot 10^{-6}$$

$$= 607.93 \cdot 10^{-6} \text{ kgm}^2$$

Moment of inertia: $J_{ex} = 260 \cdot 10^{-6} + \frac{(1104.67 \cdot 10^{-6} + 607.93 \cdot 10^{-6})}{2^2}$

$$= 688.15 \cdot 10^{-6} \text{ kgm}^2$$

Maximum permissible rotary speed n_{mech}
(motor attachment via timing belt side drive)
Limit for mechanical system

$$n_{mech} = \frac{(v_{mech} \cdot i \cdot 1000 \cdot 60)}{P}$$

Max. permissible speed: $v_{mech} = v_{max} = 1 \text{ m/s}$

Max. permissible rotary speed: $n_{mech} = \frac{(1 \cdot 2 \cdot 1000 \cdot 60)}{20}$

$$= 6000 \text{ rpm}$$

Max. rotary speed of application n_{mech}
(motor attachment via timing belt side drive)
Application limit

Speed: $v_{mech} = 0.6 \text{ m/s}$

Rotary speed: $n_{mech} = \frac{0.6 \cdot 2 \cdot 1000 \cdot 60}{20}$

$$= 3600 \text{ rpm}$$

Calculation example

Maximum permissible drive torque M_{mech}

(motor attachment via timing belt side drive) mechanical system limit

$$M_{\text{mech}} = \text{minimum} \left(M_{\text{sd}}; \frac{M_p}{i} \right)$$

Timing belt side drive: $M_{\text{sd}} = 12.3 \text{ Nm}$ (gear ratio $i = 2$ for MSK 060C)

Drive Unit: $M_p = 47 \text{ Nm}$

Drive torque: $M_{\text{mech}} = \text{minimum} \left(12.3; \frac{47}{2} \right)$

$$= \text{minimum} (12.3; 23.5)$$

$$= 12.3 \text{ Nm}$$

Checking motor preselection

Selected motor:

MSK 060C without brake

Condition 1:

Rotary speed: $n_{\text{max}} \geq n_{\text{mech}}$

$$6000 \geq 3600 \text{ condition met – motor selection OK}$$

Condition 2:

Mass moment of inertia ratio: $V = \frac{J_{\text{ex}}}{J_m + J_{\text{br}}}$

Motor inertia: $J_m = 800 \cdot 10^{-6} \text{ kgm}^2$

Brake inertia: $J_{\text{br}} = 0 \cdot 10^{-6} \text{ kgm}^2$ (without brake)

Mass moment of inertia ratio: $V = \frac{688.15 \cdot 10^{-6}}{(800 \cdot 10^{-6} + 0 \cdot 10^{-6})}$

$$= 0.86$$

Condition for handling: $V \leq 6$

$$0.86 \leq 6 \text{ condition fulfilled – motor selection OK}$$

Condition 3:

Torque ratio: $\frac{M_{\text{stat}}}{M_0} \leq 0.6$

Static load moment: $M_{\text{stat}} = M_R + M_g$ (horizontal mounting $M_g = 0$)

$$= 1.175 \text{ Nm}$$

Torque of the motor

at standstill $M_0 = 8 \text{ Nm}$

Torque ratio: $\frac{1.175}{8} = 0.15$

$$0.15 \leq 0.6 \text{ condition met – motor selection OK}$$

All three conditions met ➡ Selected motor is suitable for the application.

Result

AOK-032 Drive Unit

Length:	L	$=$	1322 mm
Max. travel	$s_{\max}$	$=$	1080 mm
Carriage length:	L_{ca}	$=$	114 mm
Ball screw drive:	Nominal diameter:	d_0	$=$ 32 mm
	Lead:	P	$=$ 20 mm

Motor attachment via timing belt side drive, gear ratio $i = 2$

Pre-selected motor: MSK 060C without brake

The motor-controller combination should always be considered for precise dimensioning of the electric drive, since the performance data (e.g., max. useful speed and max. torque) will depend on the controller used.

When doing this, the following data must be considered.

Frictional torque:	M_R	$=$	1.175 Nm
Mass moment of inertia:	J_{ex}	$=$	$688.15 \cdot 10^{-6} \text{ kgm}^2$
Speed:	v_{mech}	$=$	0.6 m/s ($n_{\text{mech}} = 3600 \text{ rpm}$)
Drive torque limit:	M_{mech}	$=$	12.3 Nm
⇒ Motor torque should be limited to 12.3 Nm on the drive side.			
Acceleration limit:	$a_{\max}$	$=$	50 m/s ²
Speed limit value:	$v_{\max}$	$=$	1 m/s ($n_{\text{mech}} = 6000 \text{ rpm}$)

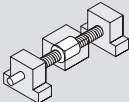
Besides the preferred type MSK 060C, other motors with identical connection dimensions can be adapted while taking care not to exceed the limits.

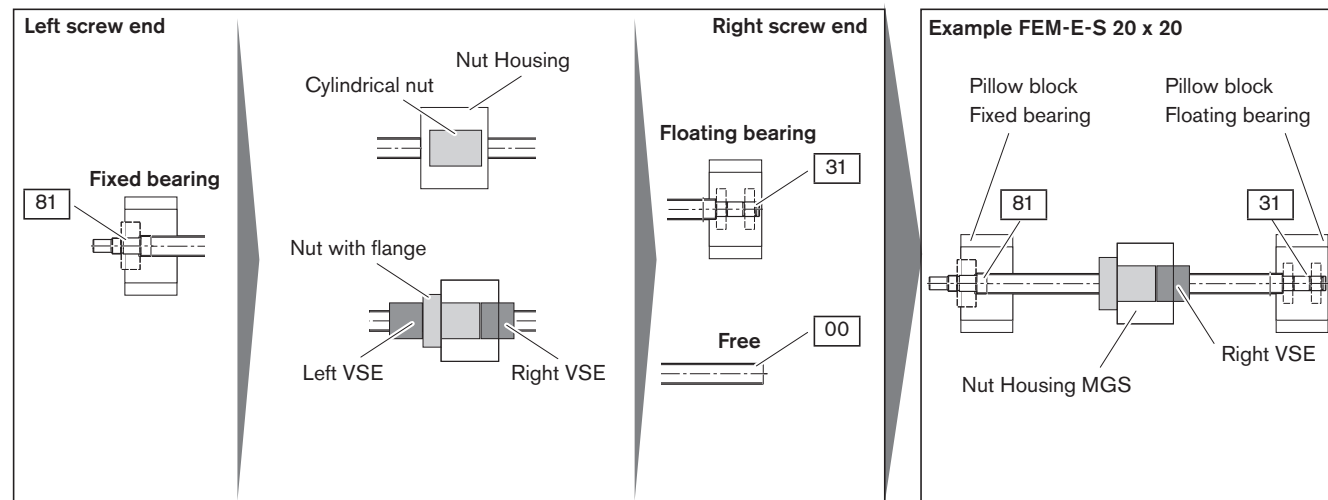
32 Drive Units

AOK Drive Units

AOK-020

Configuration and ordering

Short product name, length: AOK-020-NN-1, ... mm	Drive BASA															
		nut	Size				Tolerance grade		Standard seal	Lubrication			Preload class			
			d ₀ x P							Initial greasing	Left VSE	Right VSE	C1 (moderate)	C2 (medium)		C3 (high)
			20 x 5	20 x 10	20 x 20	20 x 40										
Fixed and floating bearing 	ZEM-E 	01	04	02	–	T5	T7	1	1	–	–	3	6	2		
		–	–	–	03											
	FEM-E-S 	11	–	–	–	T5	T7	1	1	2	3	3	6	2		
		–	13	–	–					–	–					
		–	–	12	–					2	3					
	FEP-E-S 	–	–	–	33	T5	T7	1	1	–	–	3	6	2		
	FEM-E-C 	21	–	–	–	T5	T7	1	1	2	3	3	6	2		
		–	23	–	–					–	–					
		–	–	22	–					2	3					
	Version with fixed bearing only 	ZEM-E 	06	09	07	–	T5	T7	1	1	–	–	3	6	2	
–			–	–	08											
FEM-E-S 		16	–	–	–	T5	T7	1	1	2	–	3	6	2		
		–	18	–	–					–	–					
		–	–	17	–					2	–					
FEP-E-S 		–	–	–	38	T5	T7	1	1	–	–	3	6	2		
FEM-E-C 		26	–	–	–	T5	T7	1	1	2	–	3	6	2		
		–	28	–	–					–	–					
		–	–	27	–					2	–					



	Screw ends		Pillow block		Nut Housing			Motor attachment				Motor		Documentation								
	Left	Right	Aluminum	Steel	with-out	with	Type	Version	Gear ratio	Attachment kit 1)	for motor	without with brake		Standard report	Measurement report							
	81	31	02	12	-	01	MGA	without mount	OF01					01	03 Lead deviation							
					-	02				-	00	-	00									
	81	31	02	12	00	11	MGS	with mount	MF01	-	06	MSM 041B ²⁾	110	111								
					00	14					02	MSK 040C ²⁾	86	87								
					00	12					07	MSK 050C ²⁾	88	89								
	81	31	02	12	00	21	MGD	with timing belt side drive	RV01	RV02	i = 1	32	MSM 041B ²⁾	110		111						
					00	11													30	MSK 040C ²⁾	86	87
					00	14																
					00	12																
	81	00	01	11	-	01	MGA															
					-	12																
	81	00	01	11	00	11	MGS															
					00	14																
					00	12																
	81	00	01	11	00	13																
					00	21	MGD															
					00	23																
					00	12																

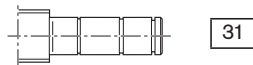
Screw ends

Free end



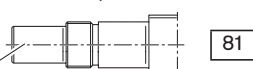
00

Floating bearing end



31

Fixed bearing end (motor attachment)



81

Screw journal for motor attachment

- 1) Attachment kit available without motor (when ordering: enter "00" for motor)
- 2) Recommended motor (motor data and type designation ➡ "Motors")

Ordering example: See "Service and information/ordering example"

Length calculation

$$L = s_{\max} + L_c + L_{ad}$$

Effective stroke

$$s_{\text{eff}} = s_{\max} - 2 \cdot s_e$$

d_0 = nominal diameter
 P = lead
 VSE = Front Lube Unit
 s_e = excess travel
 $s_{\max}$ = max. travel
 s_{eff} = effective stroke
 L = length
 L_c = nut length/nut and housing length
 L_{ad} = additional length (see "Technical data" section)

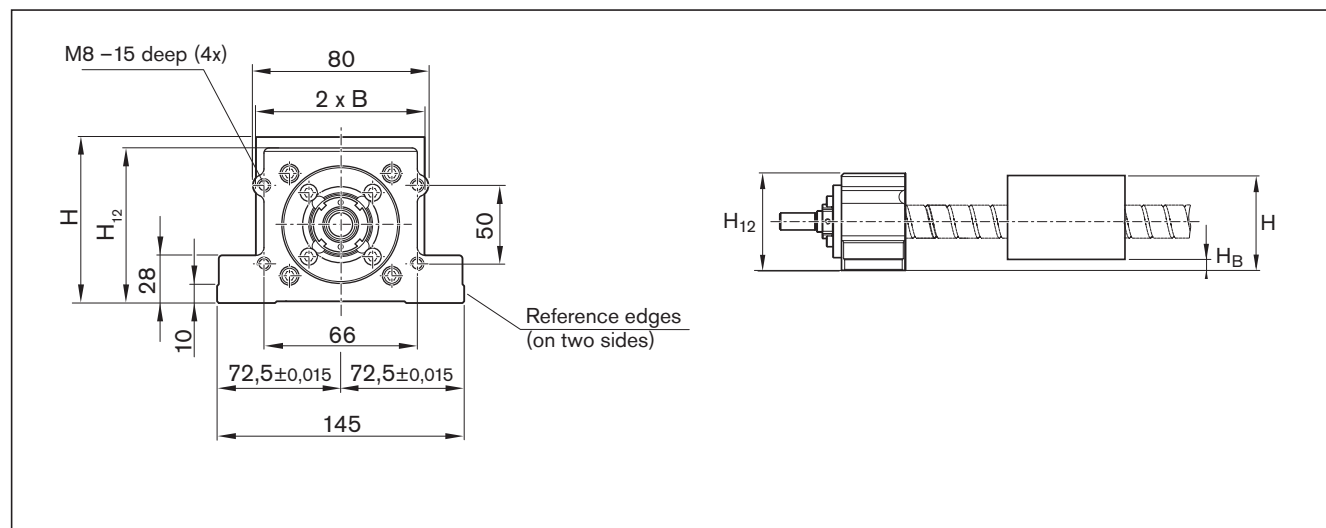
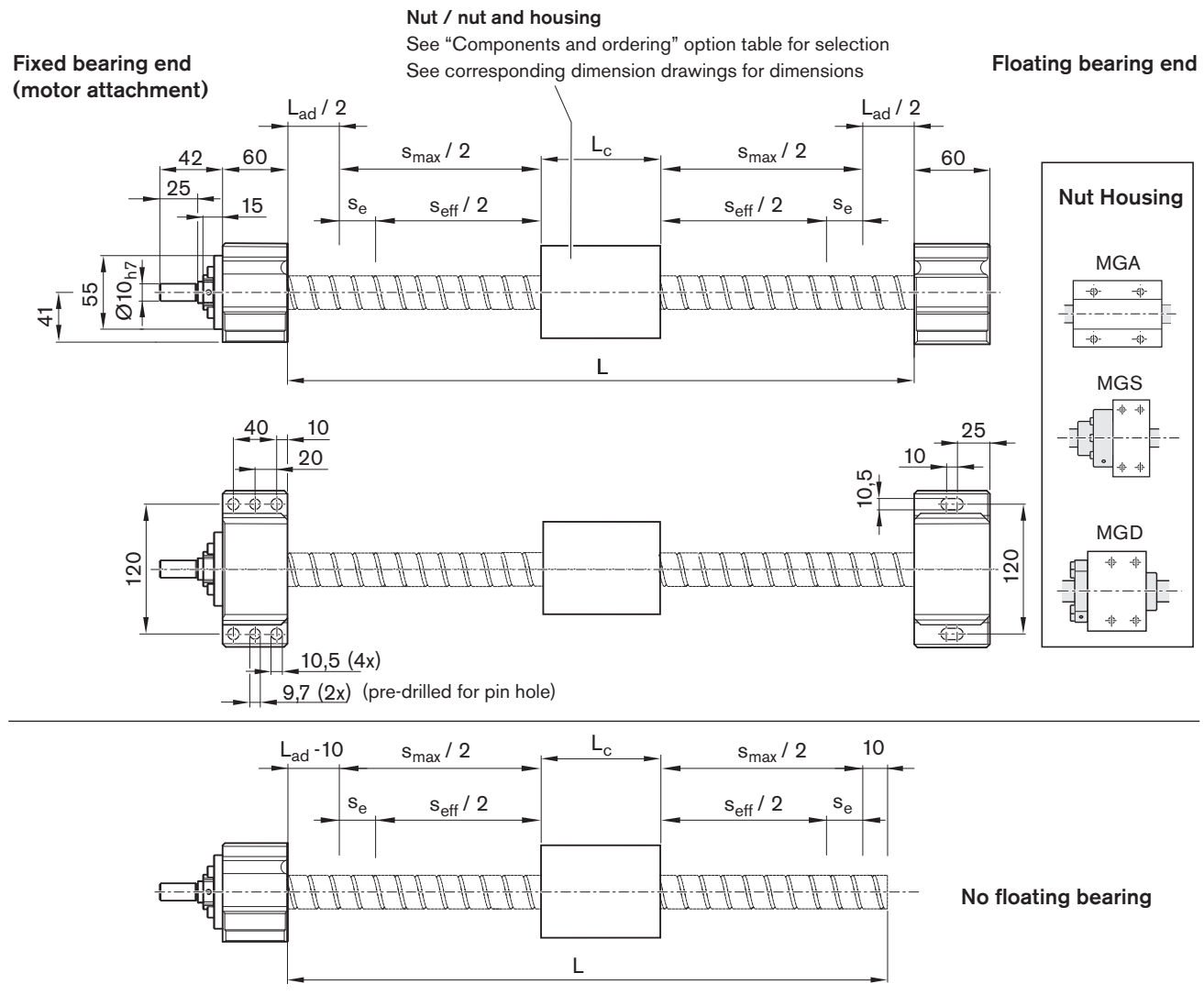
See ordering example for sample length calculation.

AOK-020

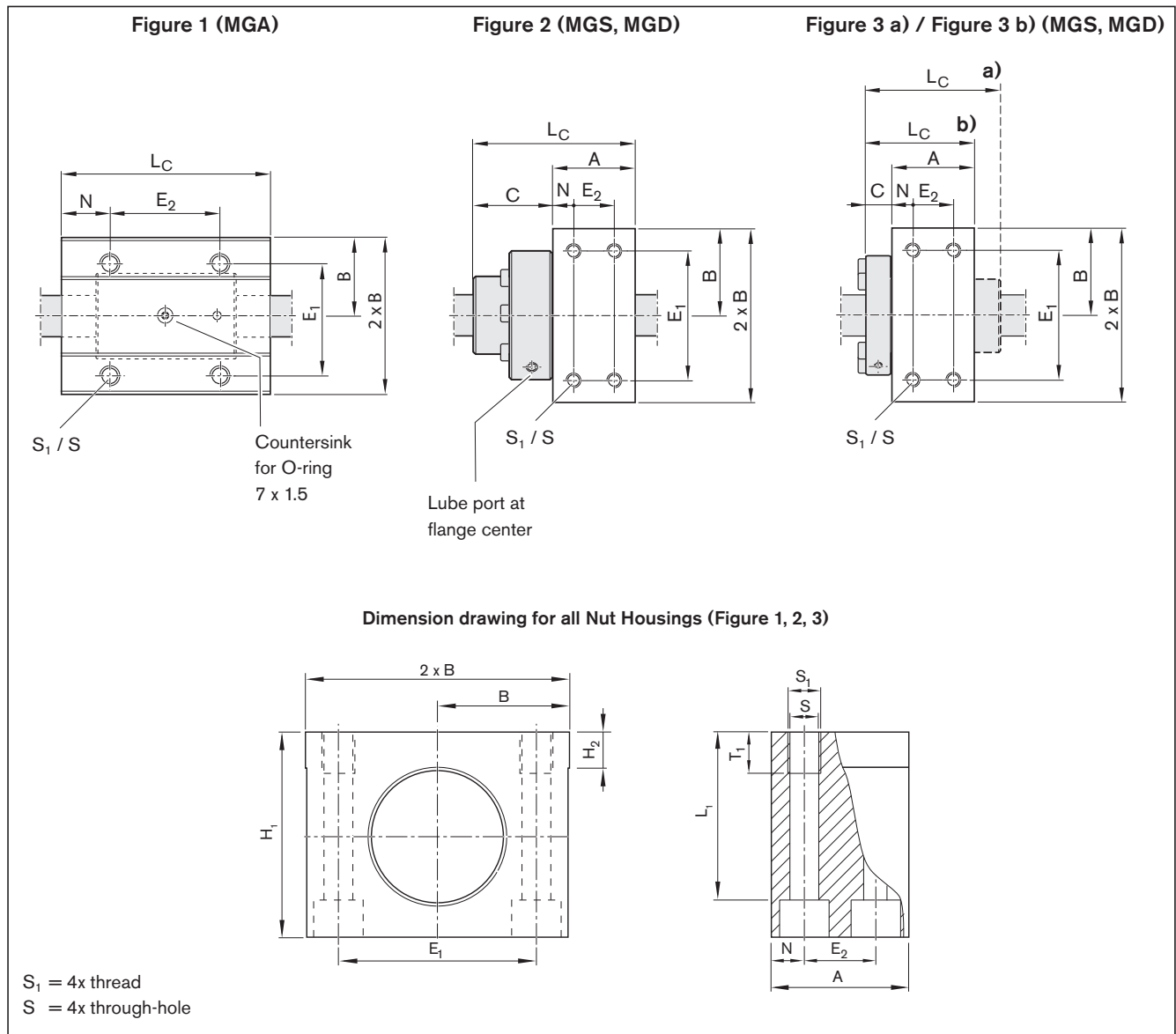
Dimensional drawings

All dimensions in mm. Drawings not to scale.

Straightness and flatness tolerance in accordance with DIN EN 12020-02



Nut and housing dimension drawings



AOK-020 d ₀ x P	Nut	Nut Housing	Fig- ure	Dimensions (mm)																			
				A	B ±0.01	C	E ₁	E ₂	H	H ₁	H ₂	H ₁₂ ±0.15	H _B	L _C	L ₁	N	S ₁	S	T ₁				
20 x 5	ZEM-E	MGA	1	—	37.5	—	55	60	85	62	10	81	10	100	51	20	M10	8.6	15				
	FEM-E-S	MGS	3 b)	40	37.5	12	56±0.1	20±0.1	73				11	52		10	M10	8.4					
	FEM-E-C	MGD	3 b)	55	37.5	12	55±0.1	23±0.1	69				13	67		22	M10	8.4					
20 x 10	ZEM-E	MGA	1	—	37.5	—	55	60	85	62			10	81	10	100	51	20		M10	8.6		
	FEM-E-S	MGS	3 a)	40	37.5	12	56±0.1	20±0.1	73						11	60		10		M10	8.4		
	FEM-E-C	MGD	3 b)	55	37.5	12	55±0.1	23±0.1	69						13	67		22		M10	8.4		
20 x 20	ZEM-E	MGA	1	—	37.5	—	55	60	85	65					10	81	10	100		54	20	M10	8.6
	FEM-E-S	MGS	2	40	42.5	38	63±0.1	20±0.1	75								10	78			10	M10	8.4
	FEM-E-C	MGD	3 a)	55	37.5	12	55±0.1	23±0.1	69								13	77			22	M10	8.4
20 x 40	ZEM-E	MGA	1	—	37.5	—	55	60	85	65	10	81					10	100		54	20	M10	8.6
	FEP-E-S	MGS	2	40	42.5	23	63±0.1	20±0.1	75								10	63			10	M10	8.4

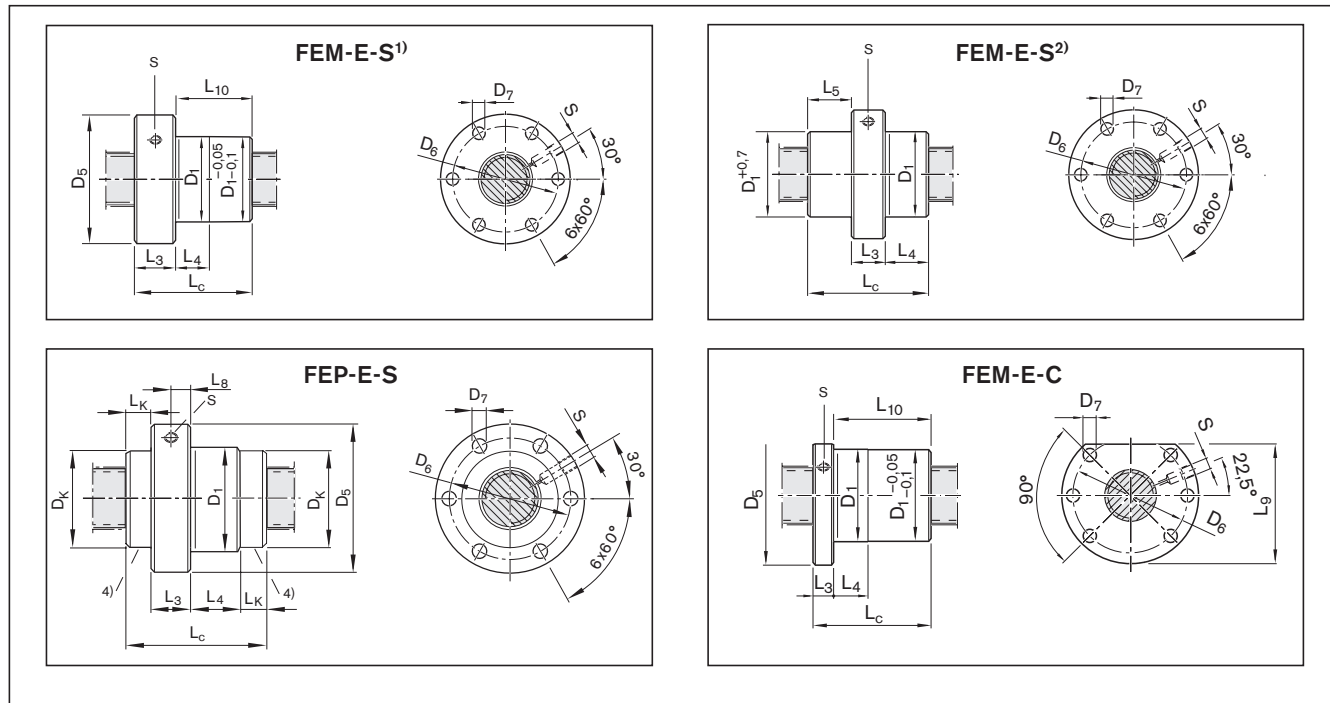
L_{ad} = additional length (see "Technical data" section)

36 Drive Units

AOK Drive Units

AOK-020

Nut dimension drawings

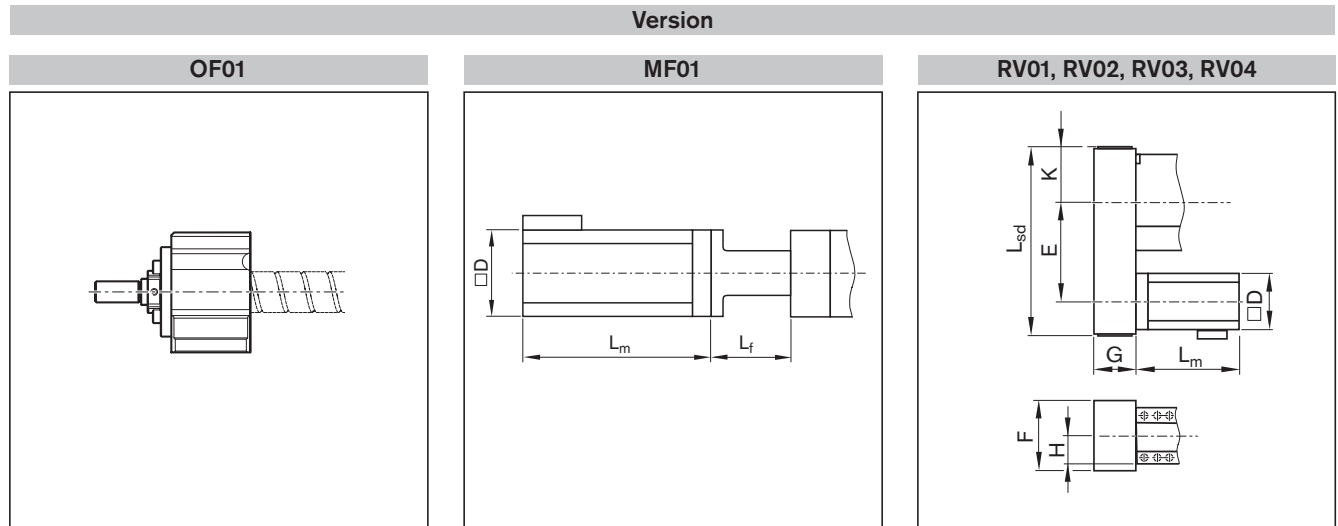


AOK-020 d ₀ x P	Nut	Dimensions (mm)														S ³⁾
		D ₁ (g6)	D ₅	D ₆	D ₇	D _K	L _C	L ₃	L ₄	L ₅	L ₈	L ₉	L ₁₀	L _K		
20 x 5	FEM-E-S ¹⁾	33	58	45	6.6	–	40	12	10.0	–	–	–	28	–	M6	
	FEM-E-C	36	58	47	6.6	–	40	12	10.0	–	–	51	28	–	M6	
20 x 10	FEM-E-S ¹⁾	33	58	45	6.6	–	60	12	16.0	18.5	–	–	48	–	M6	
	FEM-E-C	36	58	47	6.6	–	60	12	16.0	–	–	51	48	–	M6	
20 x 20	FEM-E-S ²⁾	38	63	50	6.6	–	57	20	18.5	18.5	–	–	–	–	M6	
	FEM-E-C	36	58	47	6.6	–	77	12	25.0	–	–	51	65	–	M6	
20 x 40	FEP-E-S	38	63	50	6.6	37.5	57 ^{±0.5}	12	23.0	–	8	–	–	11	M6	

3) Lube hole (S) (in flange center on FEM-E-S, FEM-E-C); lube port machining: flat surface $L_3 \leq 15$ mm, countersink $L_3 > 15$ mm;

4) Plastic recirculation cap

Motor attachment dimension drawings



Version	Motor	Dimensions (mm)									
		D	E i = 1	F	G	H	K	L _f	L _m without brake	with brake	L _{sd} i = 1
RV01, RV02, RV03, RV04	MSM 041B	80	122.5	88	51	41	47.5	–	112.0	149.0	231
	MSK 040C	82	122.5	88	51	41	47.5	–	185.5	215.5	231
	MSK 050C	100	155	116	66	41	56	–	203.0	233.0	287
MF01	MSM 041B	80	–	–	–	–	–	90	112.0	149.0	–
	MSK 040C	82	–	–	–	–	–	90	185.5	215.5	–
	MSK 050C	98	–	–	–	–	–	115	203.0	233.0	–

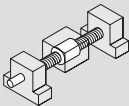
See "Motors" section for more information and dimensions

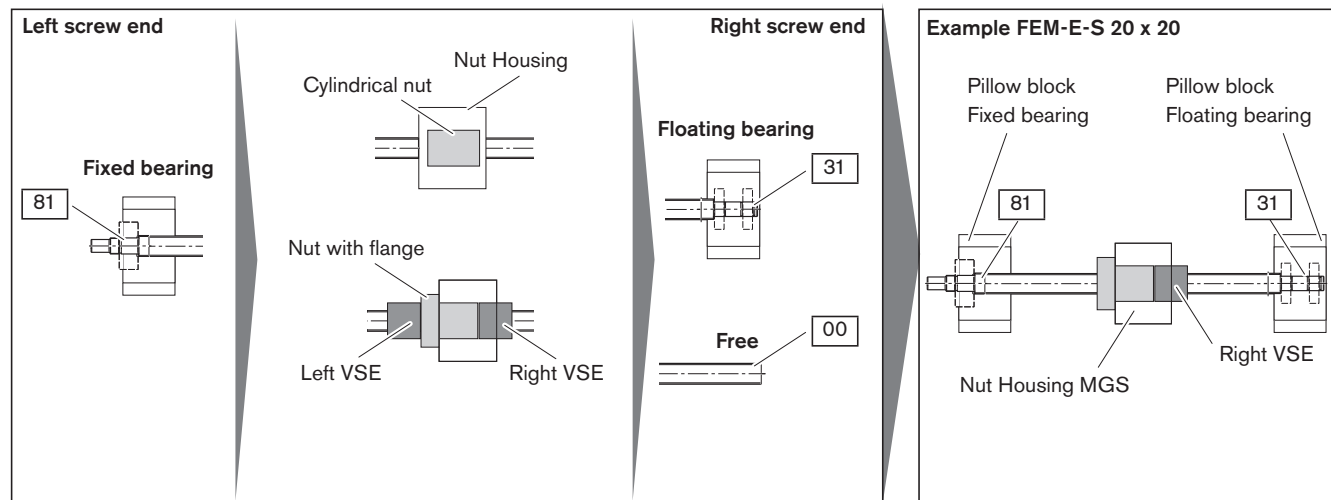
38 Drive Units

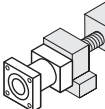
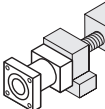
AOK Drive Units

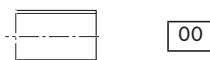
AOK-032

Configuration and ordering

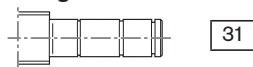
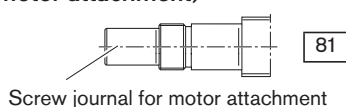
Short product name, length: AOK-032-NN-1, mm	Drive BASA															
		nut	Size				Tolerance grade		Standard seal	Lubrication			Preload class			
			d ₀ x P							Initial greasing	Left VSE	Right VSE	C1 (moderate)	C2 (medium)		C3 (high)
			32 x 5	32 x 10	32 x 20	32 x 32										
Fixed and floating bearing 	ZEM-E 	01	02	03	04	T5	T7	1	1	–	–	3	6	2		
	FEM-E-S 	11	–	–	–	T5	T7	1	1	2	3	3	6	2		
		–	12	–	–											
		–	–	13	–											
		–	–	–	14											
	FEM-E-C 	21	–	–	–	T5	T7	1	1	2	3	3	6	2		
		–	22	–	–											
		–	–	23	–											
		–	–	–	24											
	Version with fixed bearing only 	ZEM-E 	06	07	08	09	T5	T7	1	1	–	–	3	6	2	
		FEM-E-S 	16	–	–	–	T5	T7	1	1	2	–	3	6	2	
–			17	–	–											
–			–	18	–											
–			–	–	19											
FEM-E-C 		26	–	–	–	T5	T7	1	1	2	–	3	6	2		
		–	27	–	–											
				28												
		–	–	–	29											



Screw ends		Pillow block		Nut Housing		Motor attachment				Motor		Documentation								
				without	with	Version	Gear ratio	Attachment kit ¹⁾	for motor	without brake	with	Standard report	Measurement report							
Left	Right	Aluminum	Steel	Type																
81	31	02	12	—	01	MGA 	without mount 	OF01	—	00	—	00	01	03 Lead deviation						
81	31	02	12	00	11	MGS 		with mount 	MF01	—	03	MSK 60C ²⁾			90	91				
				00	13															
				00	12															
				00	14															
81	31	02	12	00	21	MGD 	with mount 	MF01	—	02	MSK 76C ²⁾	92			93					
				00	22															
				00	23															
				00	24															
81	00	01	11	—	01	MGA 	with timing belt side drive    	RV01 RV02 RV03 RV04	i = 1	23	MSK 60C ²⁾	90			91					
81	00	01	11	00	11	MGS 										i = 2	24	MSK 60C ²⁾	90	91
				00	13															
				00	12															
				00	14															
81	00	01	11	00	21	MGD 				i = 2	24	MSK 60C ²⁾			90	91				
				00	22															
				00	23															
				00	24															

01
03
Lead deviationScrew ends
Free end

Floating bearing end

Fixed bearing end
(motor attachment)

- 1) Attachment kit available without motor (when ordering: enter "00" for motor)
- 2) Recommended motor (motor data and type designation ➡ "Motors")

Ordering example: See "Service and information/ordering example"

Length calculation

$$L = s_{\max} + L_c + L_{\text{ad}}$$

Effective stroke

$$s_{\text{eff}} = s_{\max} - 2 \cdot s_e$$

d_0 = nominal diameter
 P = lead
 VSE = Front Lube Unit
 s_e = excess travel
 $s_{\max}$ = max. travel
 s_{eff} = effective stroke
 L = length
 L_c = nut length/nut and housing length
 L_{ad} = additional length (see "Technical data" section)

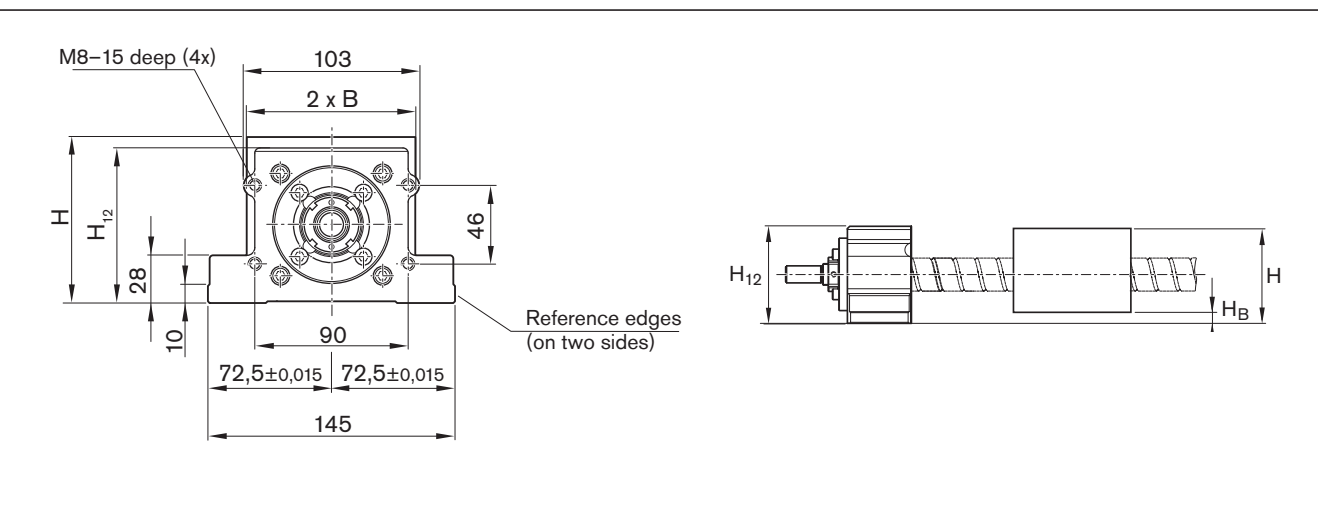
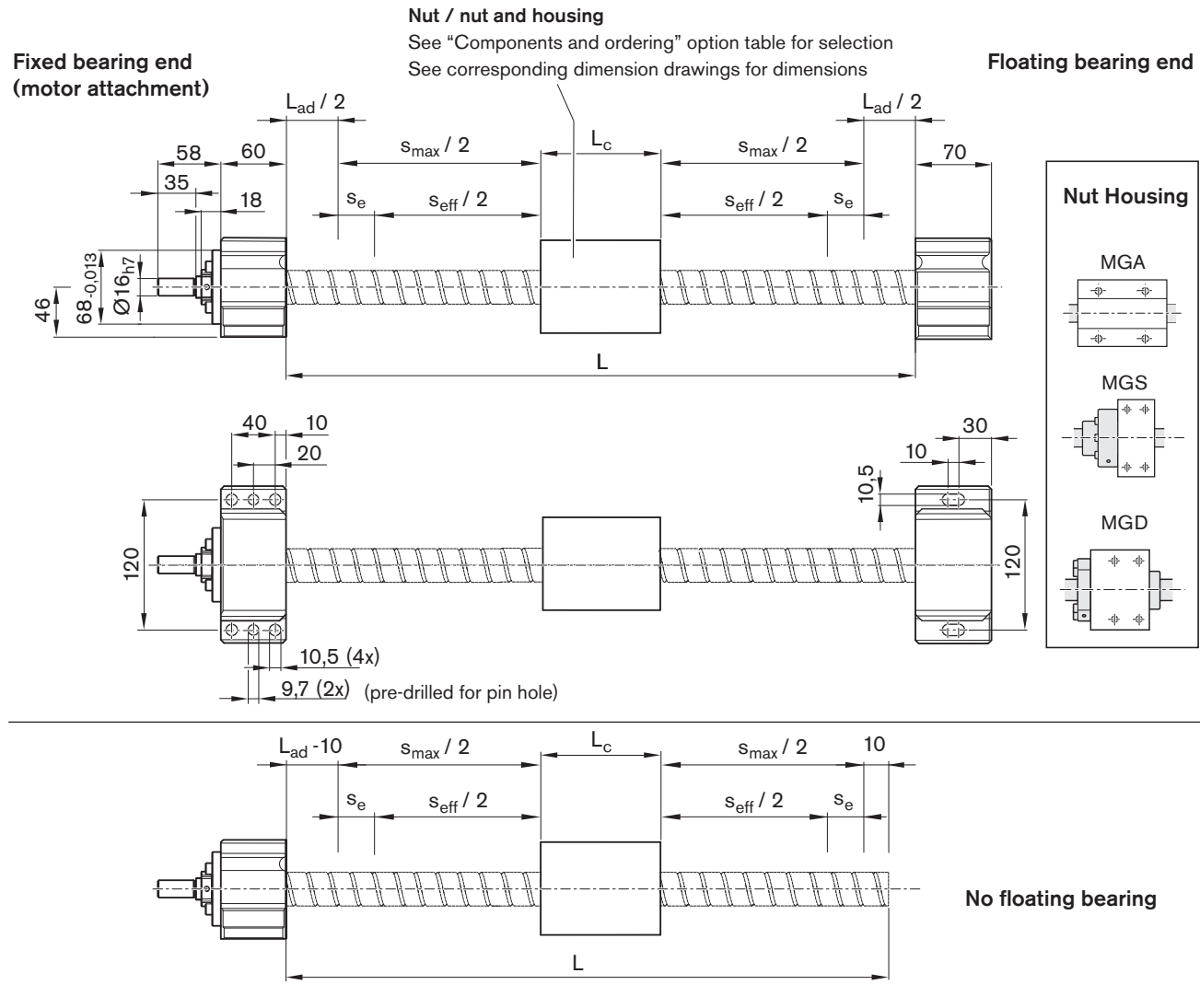
See ordering example for sample length calculation.

AOK-032

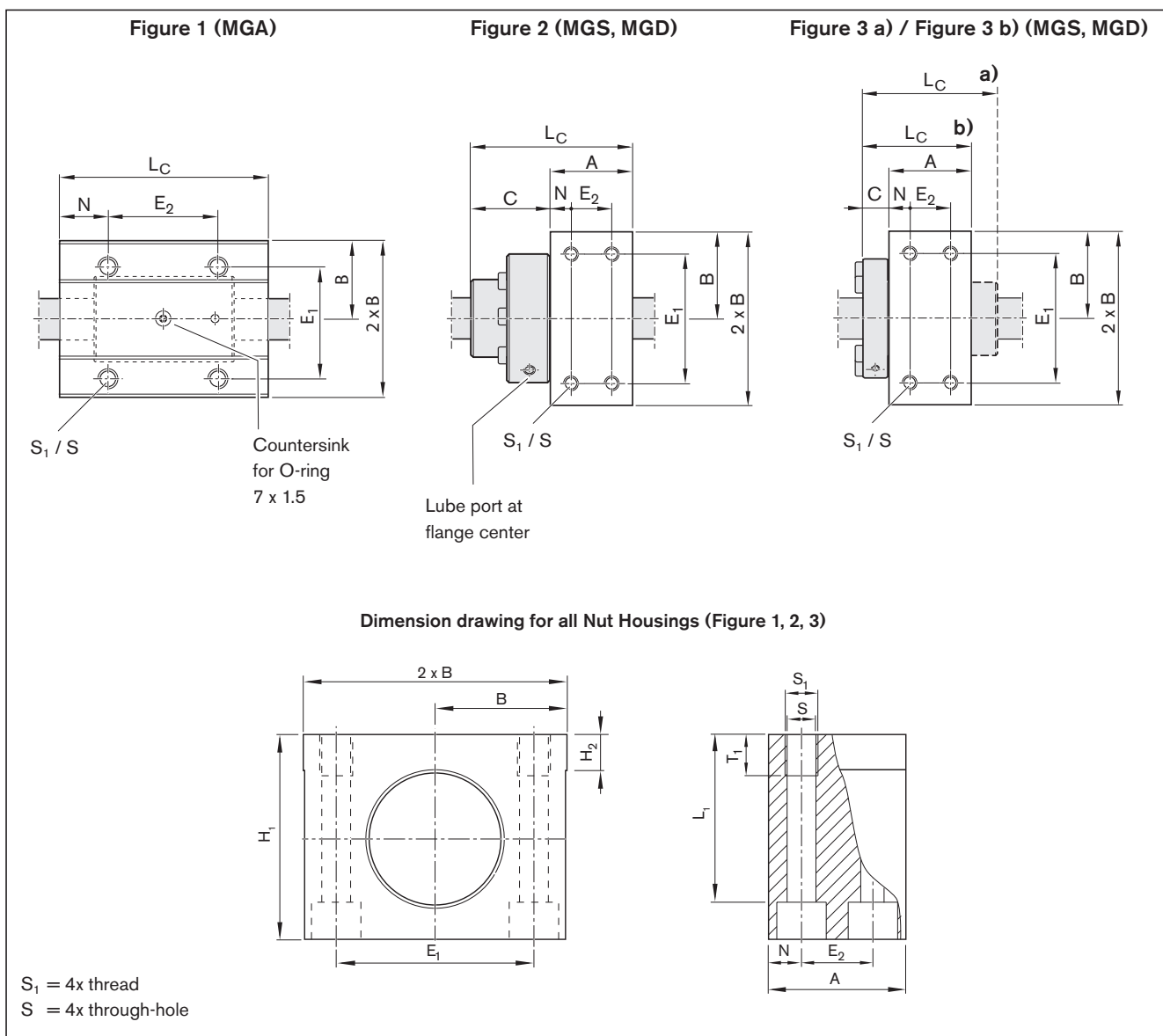
Dimensional drawings

All dimensions in mm. Drawings not to scale.

Straightness and flatness tolerance in accordance with DIN EN 12020-02



Nut and housing dimension drawings



AOK-032 d ₀ x P	Nut	Nut Housing	Fig- ure	Dimensions (mm)															
				A	B ±0.01	C	E ₁	E ₂	H	H ₁	H ₂	H ₁₂ ±0.15	H _B	L _C	L ₁	N	S ₁	S	T ₁
32 x 5	ZEM-E	MGA	1	—	50	—	75	100	95	75	10	91	15	150	61	25	M12	10.5	18
	FEM-E-S	MGS	3 b)	50	47.5	13	72 ^{±0.1}	26 ^{±0.1}	84				9	63		12	M12	10.5	15
	FEM-E-C	MGD	3 b)	70	50	13	75 ^{±0.1}	30 ^{±0.1}	81				11	83		27	M16	13.0	20
32 x 10	ZEM-E	MGA	1	—	50	—	75	100	95	75	10	91	15	150	61	25	M12	10.5	18
	FEM-E-S	MGS	3 a)	50	47.5	13	72 ^{±0.1}	26 ^{±0.1}	84				9	77		15	M12	10.5	15
	FEM-E-C	MGD	3 b)	70	50	13	75 ^{±0.1}	30 ^{±0.1}	81				11	83		27	M16	13.0	20
32 x 20	ZEM-E	MGA	1	—	50	—	75	100	95	82	12	91	15	150	64	25	M12	10.5	18
	FEM-E-S	MGS	3 b)	60	52.5	15	82 ^{±0.1}	30 ^{±0.1}	88				6	75		15	M16	13.0	20
	FEM-E-C	MGD	3 a)	70	50	13	75 ^{±0.1}	30 ^{±0.1}	81				11	84		27	M16	13.0	20
32 x 32	ZEM-E	MGA	1	—	50	—	75	100	95	82	12	91	15	150	64	25	M12	10.5	18
	FEM-E-S	MGS	2	60	52.5	54	82 ^{±0.1}	30 ^{±0.1}	88				6	114		15	M16	13.0	20
	FEM-E-C	MGD	3 a)	70	50	13	75 ^{±0.1}	30 ^{±0.1}	81				11	120		27	M16	13.0	20

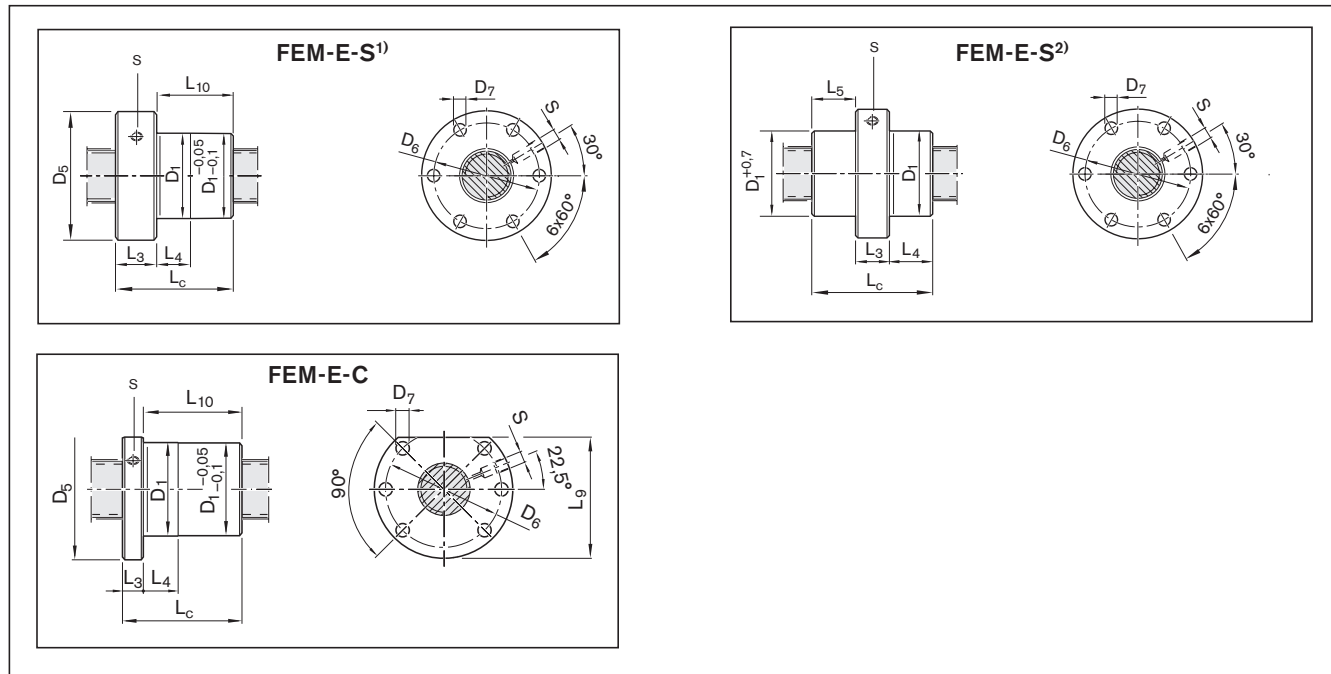
L_{ad} = additional length (see "Technical data" section)

42 Drive Units

AOK Drive Units

AOK-032

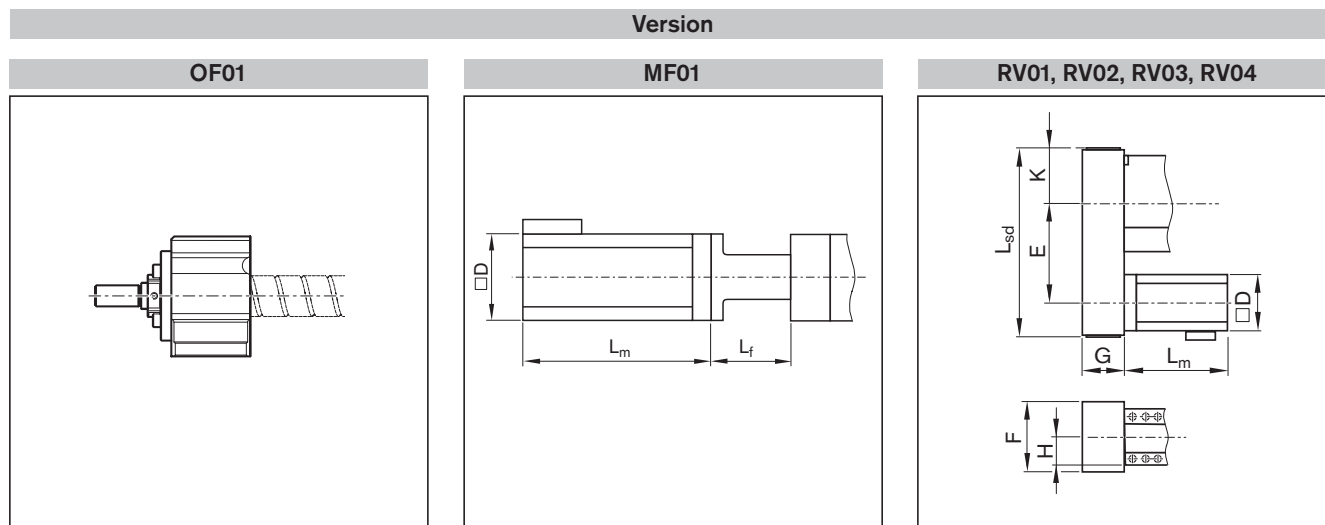
Nut dimension drawings



AOK-032 $d_o \times P$	Nut	(mm)										
		D_1 (g6)	D_5	D_6	D_7	L_C	L_3	L_4	L_5	L_9	L_{10}	$S^3)$
32 x 5	FEM-E-S¹)	48	73	60	6.6	48	13	10	–	–	35	M6
	FEM-E-C	50	80	65	9.0	48	13	10	–	71	35	M6
32 x 10	FEM-E-S¹)	48	73	60	6.6	77	13	16	–	–	64	M6
	FEM-E-C	50	80	65	9.0	77	13	16	–	71	64	M6
32 x 20	FEM-E-S¹)	56	80	60	6.6	64	15	25	–	–	49	M6
	FEM-E-C	50	80	65	9.0	84	13	25	–	71	71	M6
32 x 32	FEM-E-S²)	56	80	60	6.6	88	20	34	34	–	–	M6
	FEM-E-C	50	80	65	9.0	120	13	40	–	71	107	M6

3) Lube hole (S) (in flange center on FEM-E-S, FEM-E-C); lube port machining: flat surface $L_3 \leq 15$ mm, countersink $L_3 > 15$ mm;

Motor attachment dimension drawings



Version	Motor	Dimensions (mm)											
		D	E	i = 1	i = 2	F	G	H	K	L _f	L _m	L _{sd}	
RV01, RV02, RV03, RV04	MSK 060C	116	165	162	116	66	46	59	–	–	226.0	259.0	300
	MSK 076C	140	–	–	–	–	–	–	–	125	226.0	259.0	–
MF01	MSK 060C	116	–	–	–	–	–	–	–	–	–	–	–
	MSK 076C	140	–	–	–	–	–	–	–	–	–	–	–

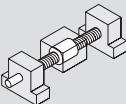
See "Motors" section for more information and dimensions

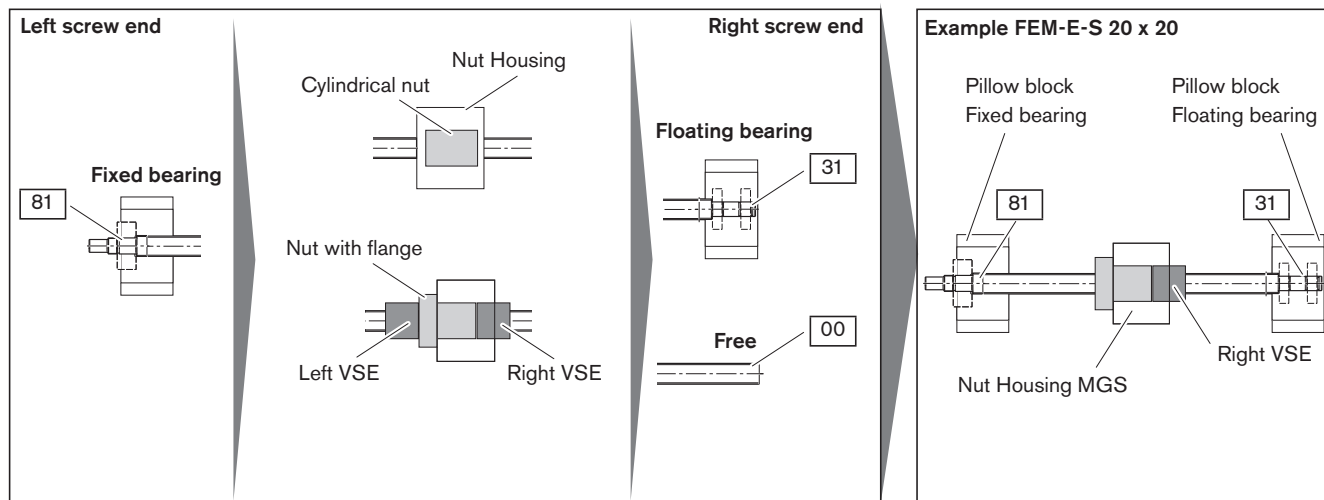
44 Drive Units

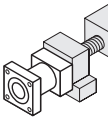
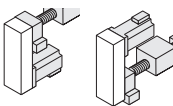
AOK Drive Units

AOK-040

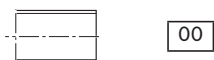
Configuration and ordering

Short product name, length: AOK-040-NN-1, mm	Drive BASA															
		nut	Size				Tolerance grade		Seal	Lubrication			Preload class			
			d ₀ x P							Initial greasing	Left VSE	Right VSE	C1 (moderate)	C2 (medium)		C3 (high)
			40 x 5	40 x 10	40 x 20	40 x 40										
Fixed and floating bearing 	ZEM-E 	01	02	03	04	T5	T7	1	1	–	–	3	6	2		
	FEM-E-S 	11	–	–	–	T5	T7	1	1	2	3	3	6	2		
		–	–	13	–											
		–	–	–	14											
	FEM-E-C 	21	–	–	–	T5	T7	1	1	2	3	3	6	2		
		–	22	–	–											
		–	–	23	–											
		–	–	–	24											
	Version with fixed bearing only 	ZEM-E 	06	07	08	09	T5	T7	1	1	–	–	3	6	2	
		FEM-E-S 	16	–	–	–	T5	T7	1	1	2	–	3	6	2	
–			17	–	–											
–			–	18	–											
FEM-E-C 		26	–	–	–	T5	T7	1	1	2	–	3	6	2		
		–	27	–	–											
		–	–	28	–											
		–	–	–	29											



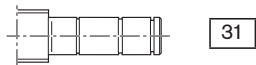
Screw ends		Pillow block		Nut Housing			Motor attachment				Motor		Documentation							
				without	with	Type	Version	Gear ratio	Attachment kit 1)	for motor	without brake	with	Standard report	Measurement report						
Left	Right	Aluminum	Steel																	
81	31	02	12	–	01	MGA 	without mount OF01 	–	00	–	00	01	03 Lead deviation							
81	31	02	12	00	11	MGS 	with mount MF01 	–	02	MSK 076C ²⁾	92			93						
				00	12															
				00	14															
				00	13															
81	31	02	12	00	21	MGD 														
				00	22															
				00	23															
				00	24															
81	00	01	11	–	01	MGA 	with timing belt side drive RV01 RV02 	i = 1	23	MSK 076C ²⁾	92			93						
81	00	01	11	00	11	MGS 														
				00	12															
				00	14															
				00	13															
81	00	01	11	00	21	MGD 														
				00	22															
				00	23															
				00	24															
				00	21															
				00	22															
				00	23															
				00	24															
				00	21															
				00	22															
				00	23															
				00	24															

Screw ends Free end



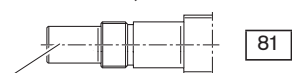
00

Floating bearing end



31

Fixed bearing end (motor attachment)



81

Screw journal for motor attachment

- 1) Attachment kit available without motor (when ordering: enter "00" for motor)
- 2) Recommended motor (motor data and type designation ➡ "Motors")

Ordering example: See "Service and information/ordering example"

Length calculation

$$L = s_{\max} + L_c + L_{ad}$$

Effective stroke

$$s_{\text{eff}} = s_{\max} - 2 \cdot s_e$$

d_0 = nominal diameter
 P = lead
 VSE = Front Lube Unit
 s_e = excess travel
 $s_{\max}$ = max. travel
 s_{eff} = effective stroke
 L = length
 L_c = nut length/nut and housing length
 L_{ad} = additional length (see "Technical data" section)

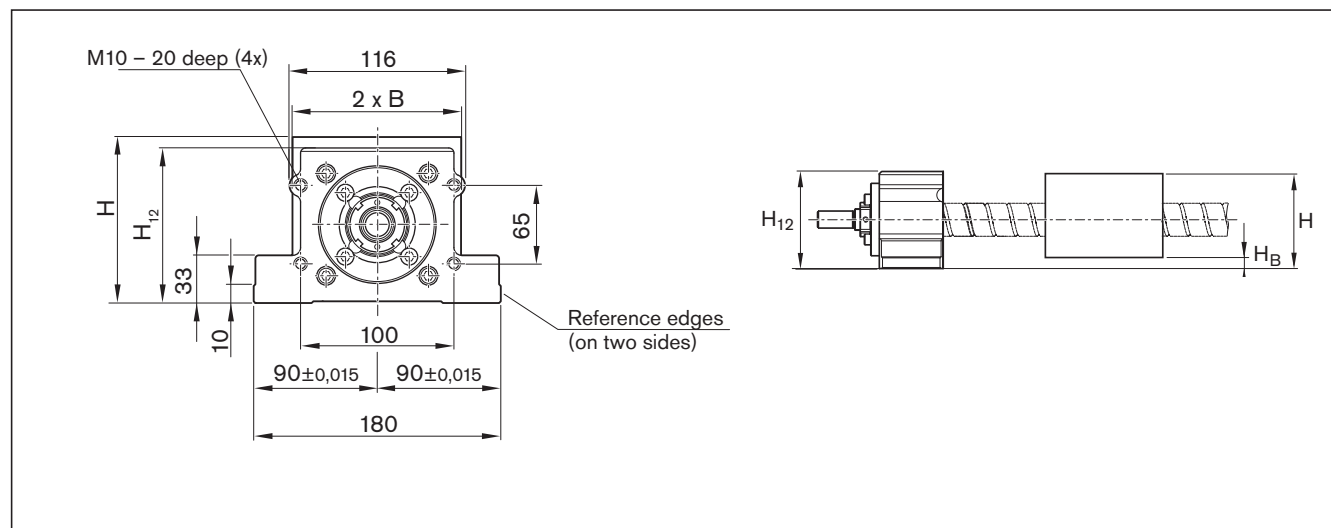
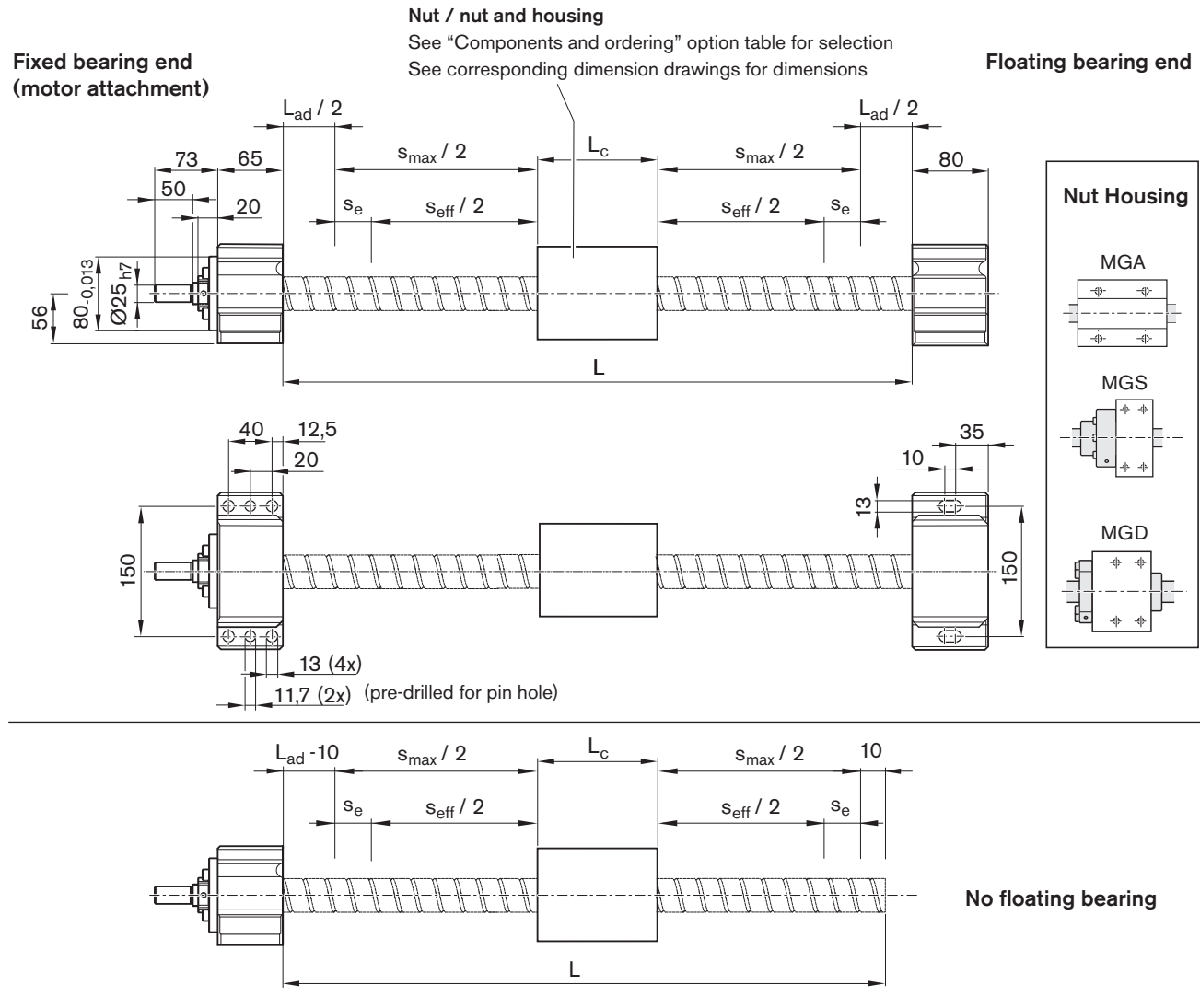
See ordering example for sample length calculation.

AOK-040

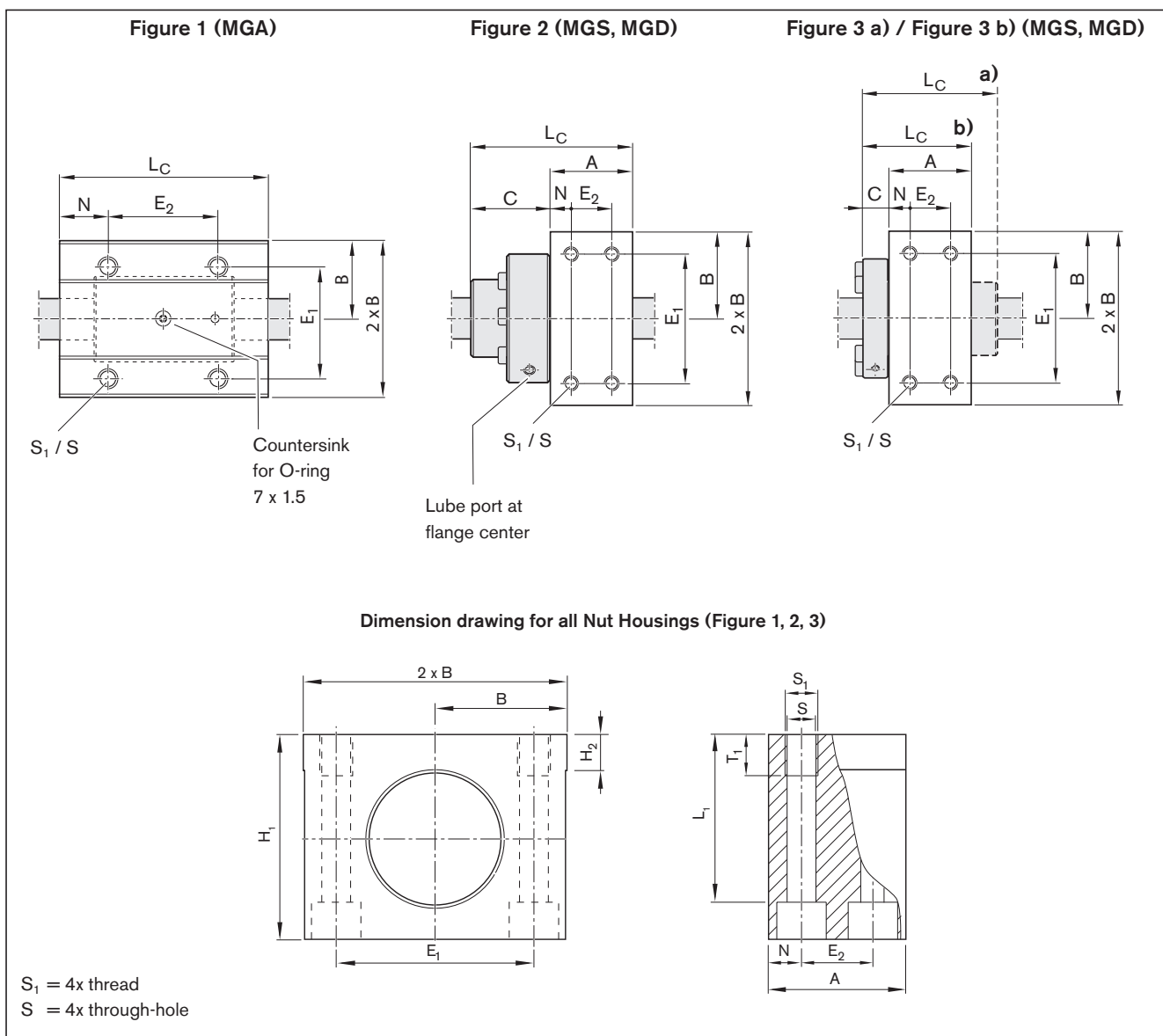
Dimensional drawings

All dimensions in mm. Drawings not to scale.

Straightness and flatness tolerance in accordance with DIN EN 12020-02



Nut and housing dimension drawings



AOK-040 d _o x P	Nut	Nut Housing	Fig- ure	Dimensions (mm)							H ₂	H ₁₂ ±0.15	H _B	L _C	L _I	N	S _I	S	T _I
A	B ±0.01	C	E _I	E ₂	H	H _I													
40 x 5	ZEM-E	MGA	1	–	60	–	90	120	115	82	12	111	10	180	64	30	M16	14.5	24
	FEM-E-S	MGS	3 b)	60	52.5	13	82±0.1	30±0.1	98				16	75		15	M16	13.0	20
	FEM-E-C	MGD	3 b)	80	60	13	90±0.1	35±0.1	98				14	95		31	M18	15.0	25
40 x 10	ZEM-E	MGA	1	–	60	–	90	120	115	98			10	180	79	30	M16	14.5	24
	FEM-E-S	MGS	3 b)	65	60	13	93±0.1	35±0.1	106				8	80		15	M18	15.0	25
	FEM-E-C	MGD	3 b)	80	60	13	90±0.1	35±0.1	98				14	95		31	M18	15.0	25
40 x 20	ZEM-E	MGA	1	–	60	–	90	120	115	98			10	180	79	30	M16	14.5	24
	FEM-E-S	MGS	3 a)	65	60	15	93±0.1	35±0.1	106				8	88		15	M18	15.0	25
	FEM-E-C	MGD	3 b)	80	60	13	90±0.1	35±0.1	98				14	95		31	M18	15.0	25
40 x 40	ZEM-E	MGA	1	–	60	–	90	120	115	113			10	180	92	30	M16	14.5	24
	FEM-E-S	MGS	2	80	70	54	108±0.1	46±0.1	114				1	151		17	M20	17.0	30
	FEM-E-C	MGD	3 a)	80	60	13	90±0.1	35±0.1	98				14	142		31	M18	15.0	25

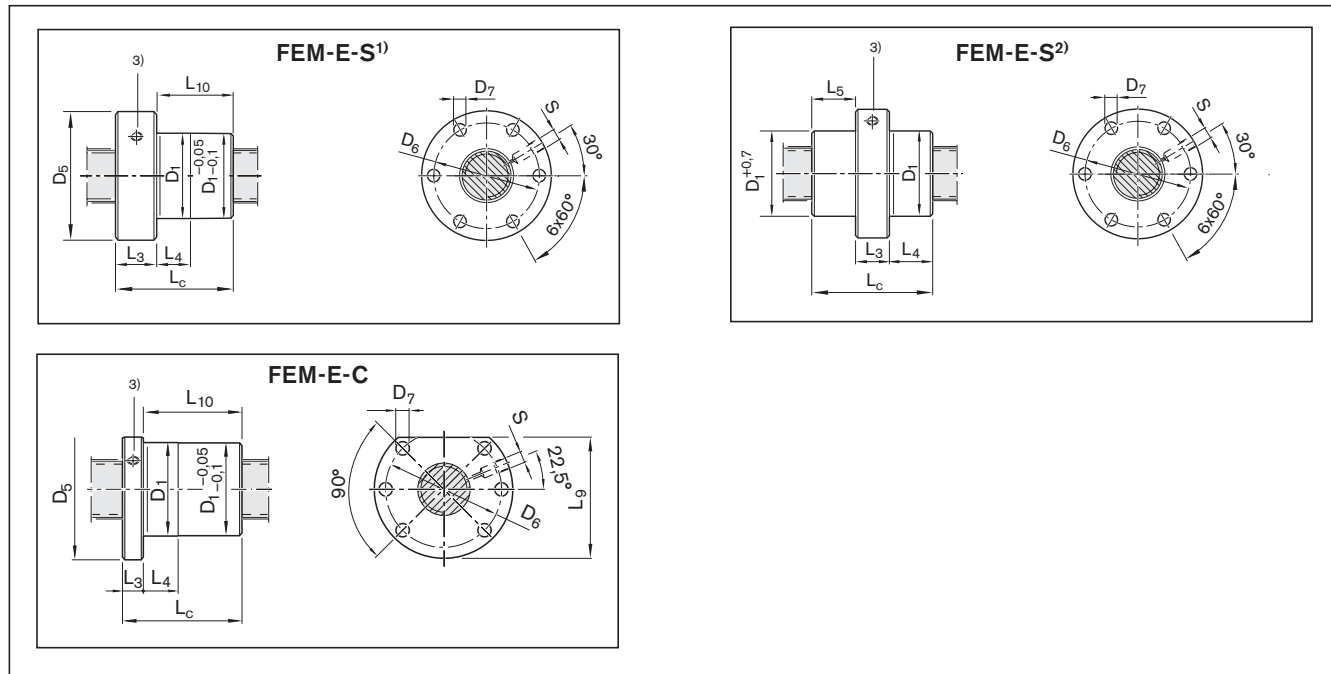
L_{ad} = additional length (see "Technical data" section)

48 Drive Units

AOK Drive Units

AOK-040

Nut dimension drawings

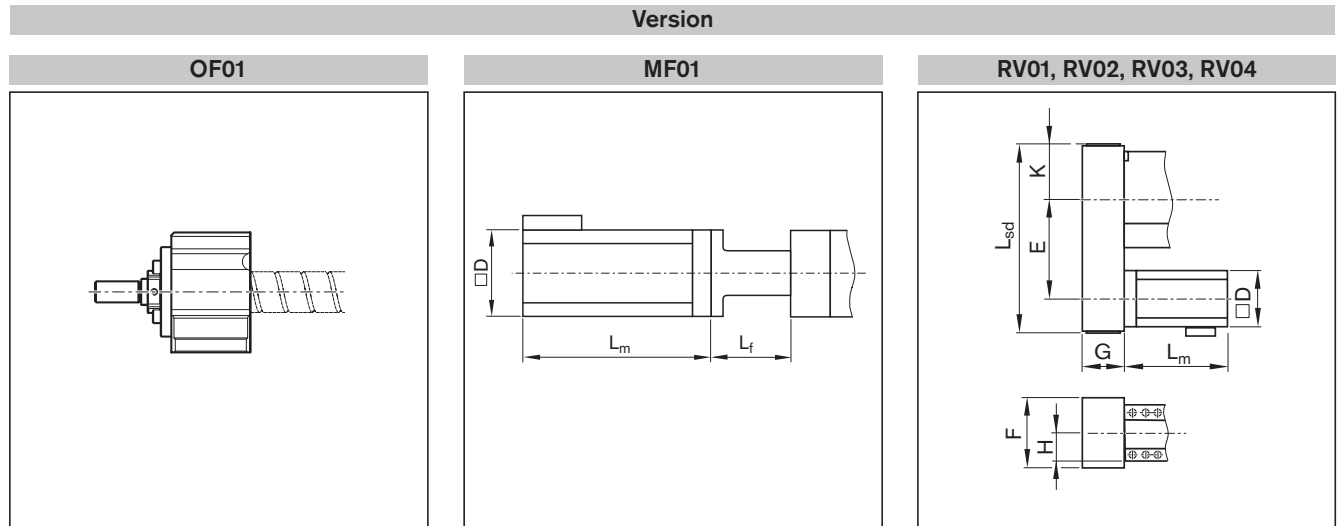


AOK-040 $d_o \times P$	Nut	(mm)										
		D_1 (g6)	D_5	D_6	D_7	L_C	L_3	L_4	L_5	L_9	L_{10}	$S^{3)}$
40 x 5	FEM-E-S¹)	56	80	68	6.6	54	15	10	–	–	39	M8x1
	FEM-E-C	63	93	78	9.0	54	15	10	–	81.5	39	M8x1
40 x 10	FEM-E-S¹)	63	95	78	9.0	70	15	16	–	–	55	M8x1
	FEM-E-C	63	93	78	9.0	70	15	16	–	81.5	55	M8x1
40 x 20	FEM-E-S¹)	63	95	78	9.0	88	15	25	–	–	73	M8x1
	FEM-E-C	63	93	78	9.0	88	15	25	–	81.5	73	M8x1
40 x 40	FEM-E-S²)	72	110	90	11.0	102	40	31	31	–	–	M8x1
	FEM-E-C	63	93	78	9.0	142	15	45	–	81.5	127	M8x1

3) Lube hole (S) (in flange center on FEM-E-S, FEM-E-C)

Lube port machining: flat surface $L_3 \leq 15$ mm, countersink $L_3 > 15$ mm;

Motor attachment dimension drawings



Version	Motor	Dimensions (mm)												
		D	E		F	G	H	K	L _f	L _m		L _{sd}	i	
			i = 1	i = 2						without brake	with brake		i = 1	i = 2
RV01, RV02, RV03, RV04	MSK 076C	140	240	238	160	90	56	77	–	292.5	292.5	409	409	
MF01	MSK 076C	140	–	–	–	–	–	–	140	292.5	292.5	–	–	

See "Motors" section for more information and dimensions

Product description

Properties

- AGK Drive Units in closed format are ready-to-install drive axes consisting of ball screw drive, Nut Housings and pillow blocks, as well as a protective aluminum profile with cover strip as an enclosure
- Three coordinated sizes available in any length up to L_{max}
- The BASA is optimally protected by the protective profile with steel or polyurethane sealing strip
- Driven by zero-backlash, pre-tensioned, precision ball screw drive in rolled design, in accordance with DIN 69051 in tolerance grade T5 or T7
- High linear speeds thanks to large leads with high precision over long lengths
- Optional traveling screw supports to use in horizontal mounting positions for max. speeds over longer lengths

Other highlights

- Flexible thanks to selectable options
- Easy motor attachment via locating feature and threads
- Clearly structured technical data for the complete unit as "Linear motion axes without guideway"
- Nameplate with parameters for easy start-up

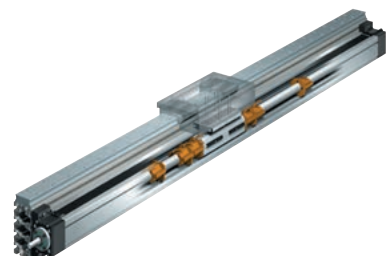
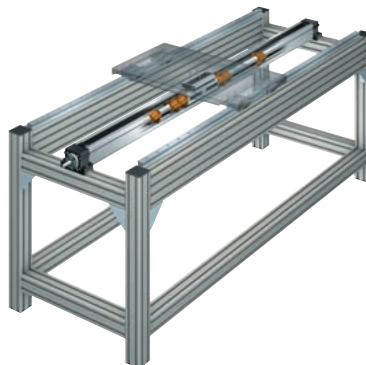
Attachments

- Motor attachments with mount and coupling or via a timing belt side drive
- Attachment kits for motors according to customer specification
- Maintenance-free servo motors with selectable brake and integrated feedback
- Switches (magnetic sensor), switch activation without additional switching lug
- Socket and plug

Application examples



The table is supported symmetrically on two rail guides with four Runner Blocks. The Nut Housing of the ball screw drive is located at the top.



Depending on the application requirements, the Nut Housing can also be on the side instead of the top.

SPU product description

Patented screw support (SPU)

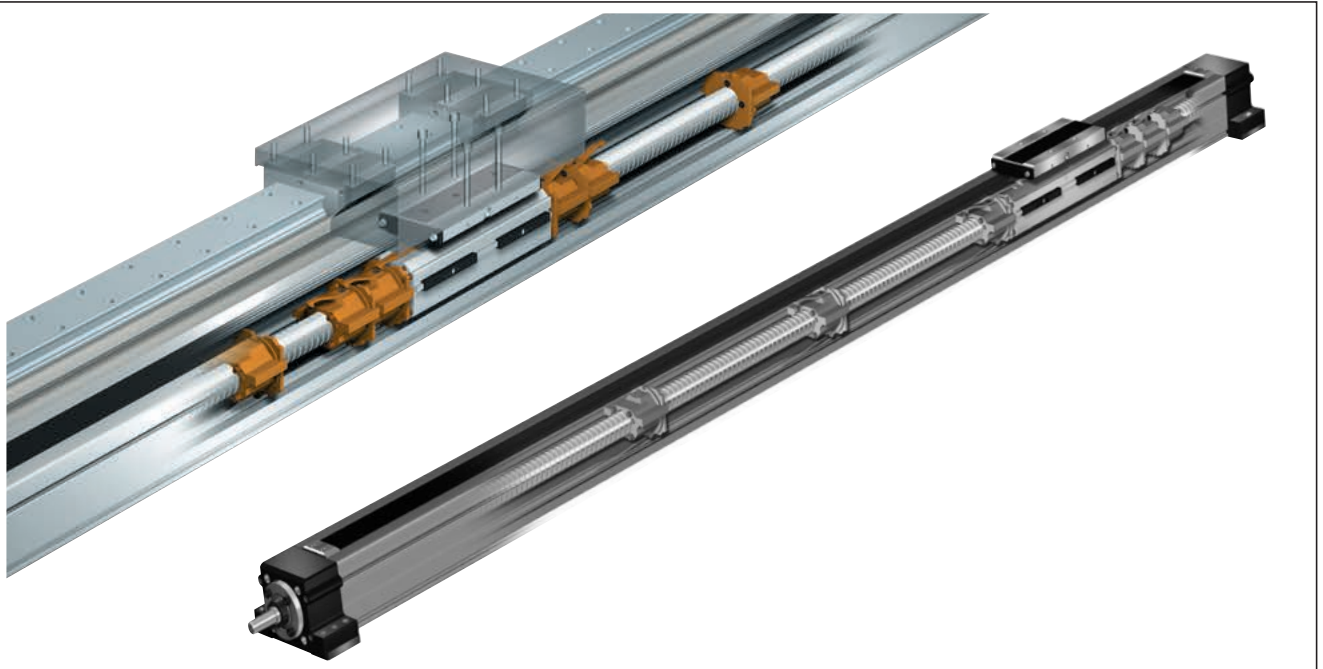
The screw support SPU provides the following benefits:

- Screw supports can be selected as a standard option
- Max. speed over long lengths
- Guideway of the screw supports in protective profile
- Elastomer buffer provides cushioning between carriage and screw support
- Maintenance-free screw supports
- Covered screw supports

Screw support designed for horizontal operation only.

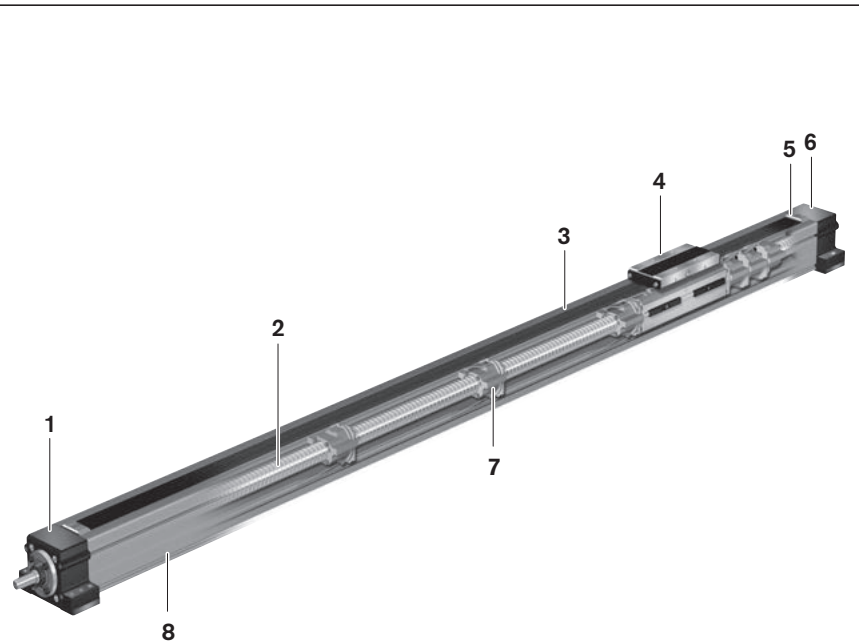
As the length of screw-driven Linear Motion Axes increases, the distance between screw supports increases. As the unsupported length increases, undesirable screw oscillation causes the resonance range to be reached more quickly, reducing rotary speed/max. permissible speed accordingly.

The traveling screw supports are located at defined support points to reduce the length of screw that is unsupported. The result is consistently high speeds over long lengths.



Structural design

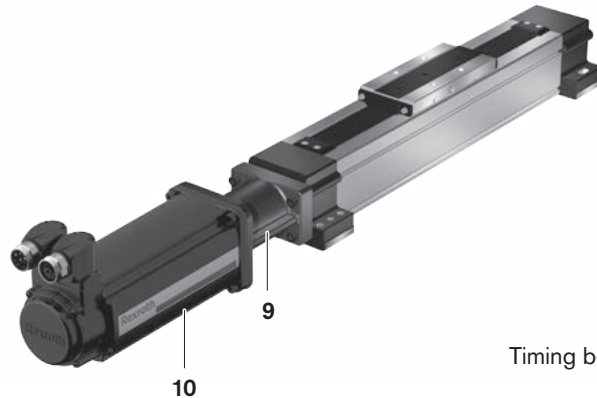
- 1 Pillow block (fixed bearing)
- 2 Ball screw drive with zero-backlash Cylindrical Single Nut
- 3 Steel or plastic sealing strip
- 4 Nut Housing
- 5 Strip fixing
- 6 Pillow block (floating bearing)
- 7 Screw support (SPU)
- 8 Protective profile



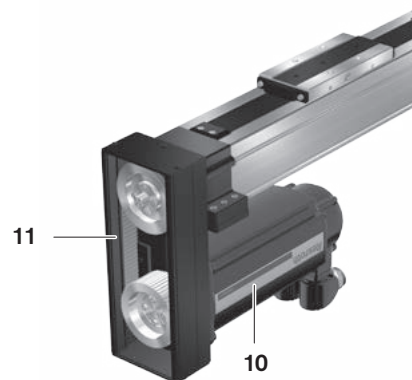
Motor attachment

- 9 Mount and coupling
- 10 Servo motor
- 11 Timing belt side drive

Mount and coupling



Timing belt side drive



Structural design of mount and coupling

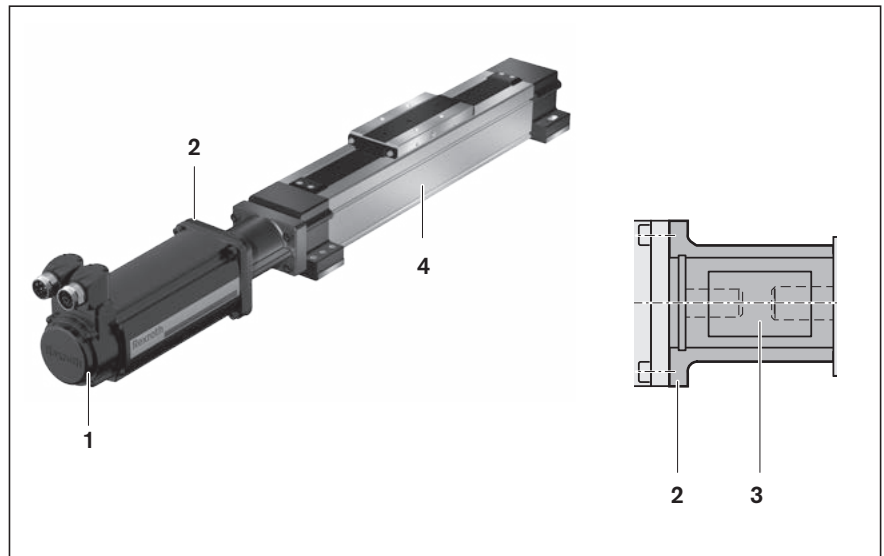
A motor can be attached to all Drive Units via mount and coupling.

The mount secures the motor to the Drive Unit and serves as a closed housing for the coupling.

The coupling transmits the motor drive torque to the Drive Unit's drive shaft without distortive stresses.

Our standard couplings compensate for the system's thermal expansion.

- 1 Motor
- 2 Mount
- 3 Coupling
- 4 Drive Unit



Structural design of timing belt side drive

All Drive Units can be attached to the motor by a timing belt side drive.

This makes the overall length shorter than when attaching the motor via mount and coupling.

The space-saving, closed pulley housing protects the belt and acts as a motor bracket.

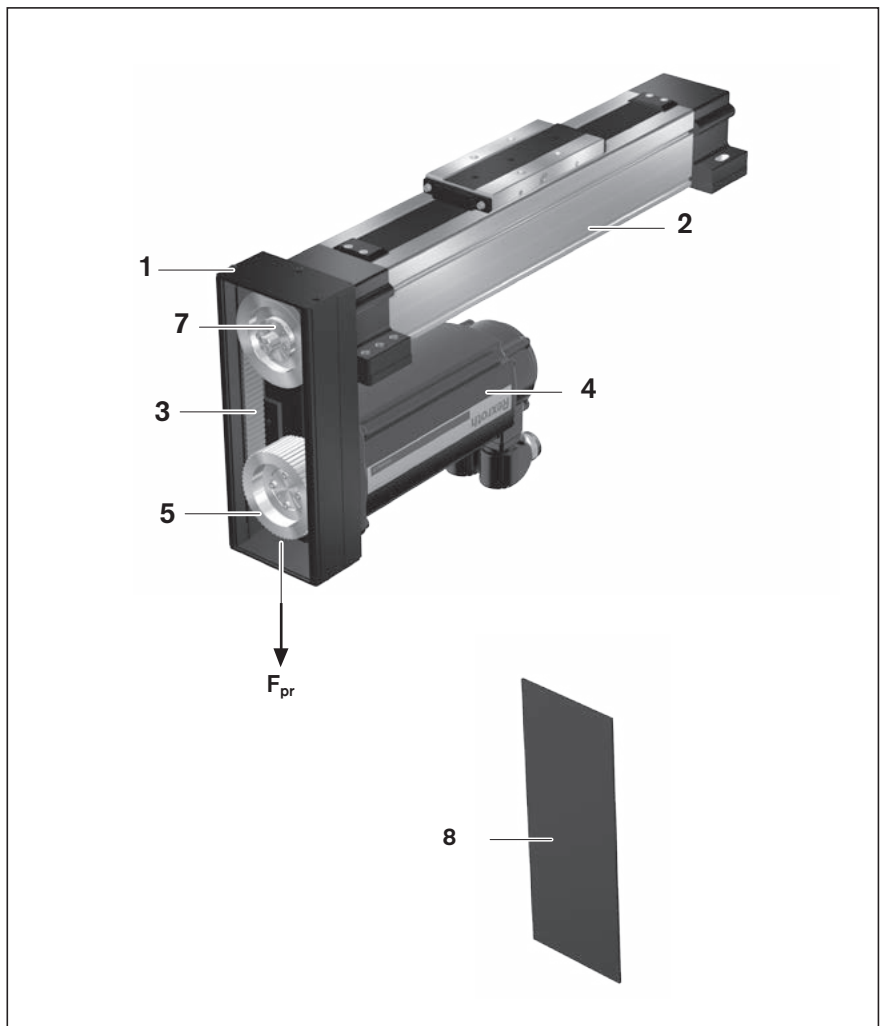
Various gear ratios are also available (depending on size):

- $i = 1$
- $i = 2$

The timing belt side drive can be installed in four directions:

- below, above (RV01 and RV02)
- left, right (RV03 and RV04)

- 1 Pulley housing made of anodized aluminum frame
- 2 Drive Unit
- 3 Toothed belt
- 4 Motor
- 5 Pre-tensioning the belt: Apply pre-tensioning force F_{pr} to motor (F_{pr} is provided upon delivery)
- 6 Cover
- 7 Fastening of belt pulleys with tensioning units
- 8 Cover panel



54 Drive Units

AGK Drive Units

Technical data

See the "Calculation" section.

General technical data

AGK	BASA	Dynamic characteristic values Dynamic load rating C		Min. travel range	Max. length	Additional length				Nut Housing length	Moved mass of system	Mass constants	
		Nut	Fixed bearing			with number of SPU							
						$d_0 \times P$ (mm)	(N)	(N)	s_{min} (mm)			L_{max} (mm)	without
AGK-020	20 x 5	14300	17000	100	3000	86	201	326	451	204	2.50	3.50	0.0062
	20 x 10	14100											
	20 x 20	13300											
	20 x 40	14000											
AGK-032	32 x 5	21600	26000	150	5000	86	201	326	451	204	3.50	4.70	0.0099
	32 x 10	31700											
	32 x 20	19700											
	32 x 32	19500											
AGK-040	40 x 5	29100	29000	180	5600	86	201	326	451	264	6.60	7.70	0.0160
	40 x 10	50000											
	40 x 20	37900											
	40 x 40	37000											

Calculation of the mass of the linear motion system
(without motor attachment, without motor)

$$m_s = k_{g \text{ fix}} + k_{g \text{ var}} \cdot L + m_{ca}$$

Drive data

AGK	BASA	Constant mass moment of inertia			Frictional torque				Max. permissible acceleration	Maximum permissible drive torque	Max. speed		
		$d_0 \times P$ (mm)	$k_{J \text{ fix}}$ (kgmm ²)	$k_{J \text{ var}}$ (kgmm)	$k_{J \text{ m}}$ (mm ²)	with number of SPU							
						without	1	2				3	
					M_{Rs} (Nm)				a_{max} (m/s ²)	M_P (Nm)	v_{max} (m/s)		
AGK-020	20 x 5	16.9	0.1004	0.633	0.55	0.6	0.6	0.7	39.8	See graphs	See graphs		
	20 x 10	21.7	0.1004	2.533	0.55	0.6	0.7	0.7	50.0				
	20 x 20	40.7	0.1004	10.132	0.60	0.7	0.8	0.9	50.0				
	20 x 40	116.7	0.1004	40.5285	0.70	0.9	1.1	1.3	50.0				
AGK-032	32 x 5	131.7	0.7117	0.633	0.9	0.9	1.0	1.0	17.9				
	32 x 10	138.4	0.7117	2.533	1.0	1.1	1.1	1.2	30.7				
	32 x 20	165.0	0.6668	10.132	1.1	1.2	1.3	1.5	50.0				
	32 x 32	220.3	0.6668	25.938	1.2	1.4	1.6	1.8	50.0				
AGK-040	40 x 5	378.5	1.783	0.633	1.5	1.5	1.6	1.6	12.2				
	40 x 10	354.1	1.607	2.533	1.5	1.6	1.7	1.8	16.8				
	40 x 20	404.3	1.607	10.132	1.6	1.8	1.9	2.1	33.0				
	40 x 40	604.9	1.607	40.528	1.8	2.1	2.5	2.8	50.0				

See graphs

See graphs

Drive data for motor attachment via timing belt side drive

AGK	Motor	BASA (mm) $d_0 \times P$	up to $L^{2)}$ (mm)	$M_{sd}^{1)}$ (Nm)		J_{sd} (10^{-6} kgm^2)		M_{Rsd} (Nm)	m_{sd} (kg)	F (mm)	B_t	
				i = 1	i = 2	i = 1	i = 2				i = 1	i = 2
AGK-020	MSK 040C, MSM 041B	20 x 5	1600	6.00	–	240	–	0.40	1.24	88	16 AT5	–
		20 x 10	2000	7.90								
		20 x 20	2700	7.94								
		20 x 40	3000	7.94								
	MSK 050C	20 x 5	1600	6.00	–	1420	–	0.45	3.20	116	25 AT5	–
		20 x 10	2000	7.90								
		20 x 20	2600	8.70								
		20 x 40	3000	8.90								
AGK-032	MSK 060C	32 x 5	2500	19.10	9.55	1400	260	0.50	3.20	116	25 AT5	32 AT5
		32 x 10	3000	19.21	12.30							
		32 x 20	4200	19.21	12.30							
		32 x 32	5000	19.21	12.30							
AGK-040	MSK 076C	40 x 5	3600	25.60	12.80	7780	1260	0.60	8.40	160	50 AT10	50 AT10
		40 x 10	3100	51.20	25.60							
		40 x 20	3100	99.30	49.65							
		40 x 40	4400	99.30	49.65							

1) Values for M_{sd} do not factor in motor torque.

2) For greater lengths, the permissible drive torque is determined from the variable-length value M_p of the Drive Unit in accordance with the graph
 ➡ See the "Calculation principles" section.

Drive data for motor attachment via mount and coupling

AGK	Motor Type	Coupling	M_{cN} (Nm)	J_c (10^{-6} kgm^2)	Mount and coupling m_{fc} (kg)
AGK-020	MSM 041B		14.5	63	0.85
	MSK 040C		19.0	57	0.55
	MSK 050C		50.0	200	2.00
AGK-032	MSK 060C		50.0	200	1.80
	MSK 076C		98.0	390	2.40
AGK-040	MSK 076C		98.0	390	2.80

a_{max} = maximum acceleration

C = dynamic load rating

d_0 = nominal diameter

$k_{g \text{ fix}}$ = constant for fixed-length portion of the mass

$k_{g \text{ var}}$ = constant for variable-length portion of the mass

$k_{J \text{ fix}}$ = constant for fixed-length portion of mass moment of inertia

$k_{J \text{ var}}$ = constant for variable-length portion of mass moment of inertia

$k_{J \text{ m}}$ = constant for mass-specific portion of mass moment of inertia

L = length

L_{ad} = additional length

L_c = Nut Housing length

L_{max} = maximum length

m_{ca} = moved mass of system

P = lead

s_{min} = minimum travel

SPU = screw support

M_p = drive torque

M_{Rs} = frictional torque of system

v_{max} = maximum speed

B_t = belt type

i = timing belt side drive gear ratio

J_c = mass moment of inertia of the coupling

J_{sd} = reduced mass moment of inertia of timing belt side drive at motor journal

M_{cN} = rated torque of coupling

m_{fc} = mass of mount and coupling

M_{Rsd} = frictional torque of timing belt side drive at motor journal

M_{sd} = maximum permissible drive torque of timing belt side drive

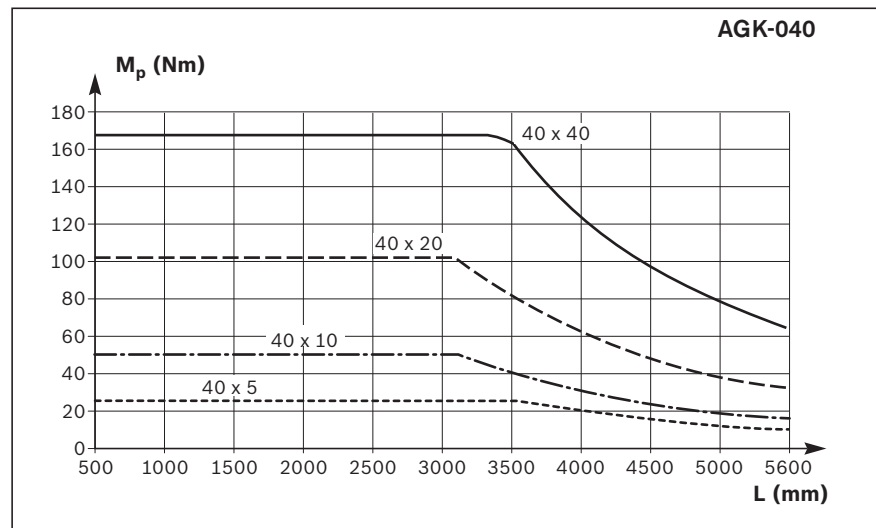
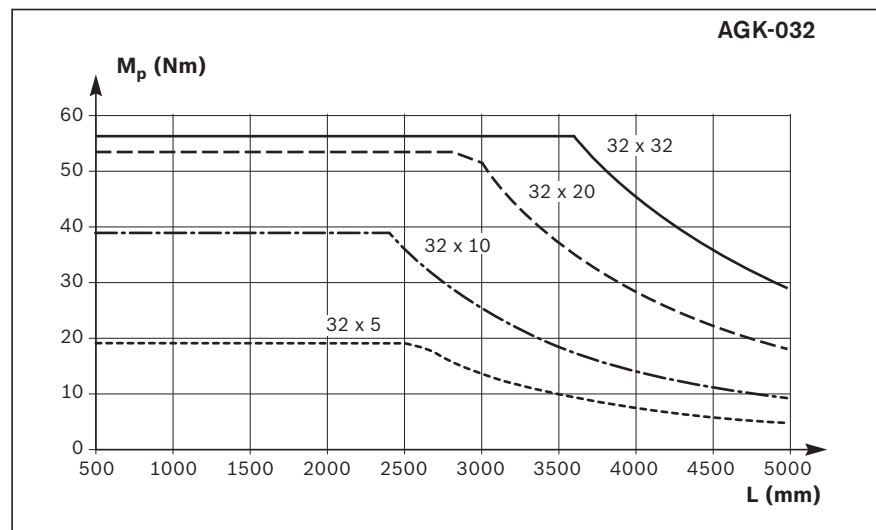
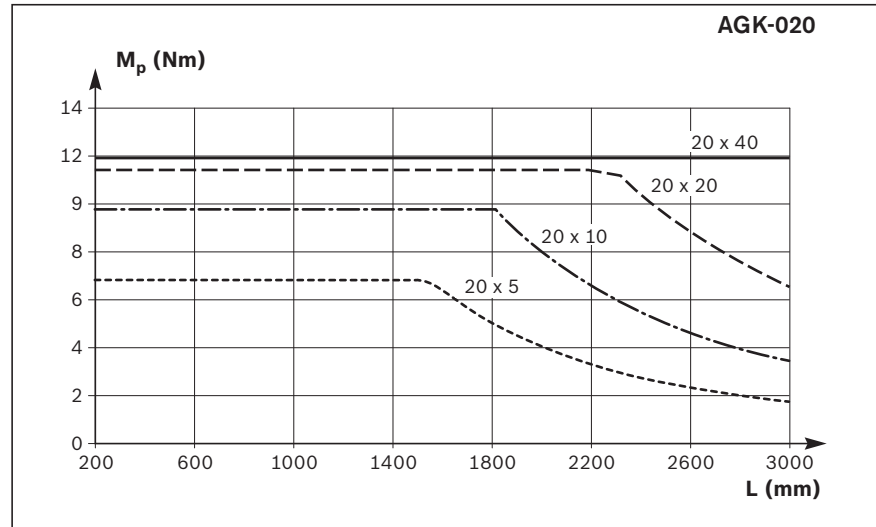
m_{sd} = mass of timing belt side drive

Technical data

Permissible drive torque M_p

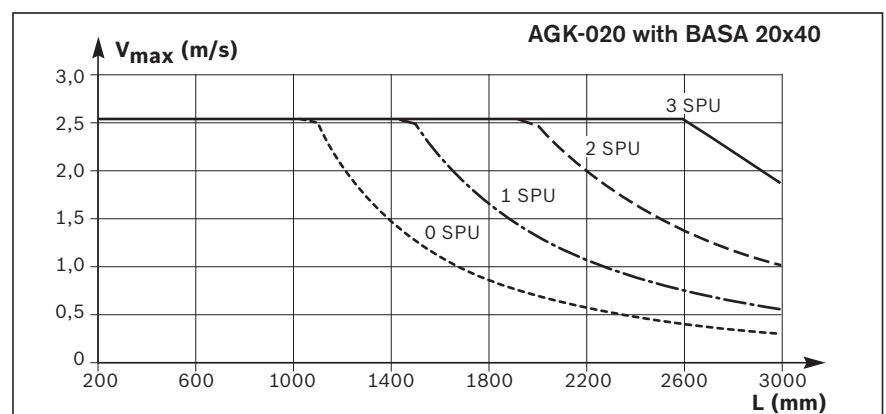
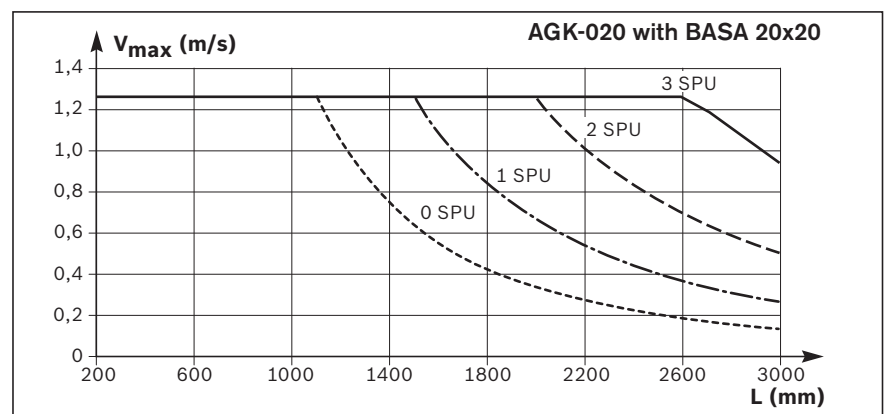
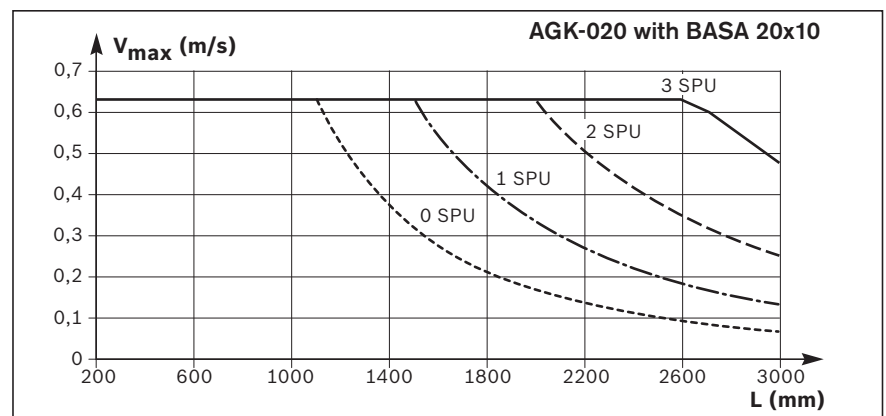
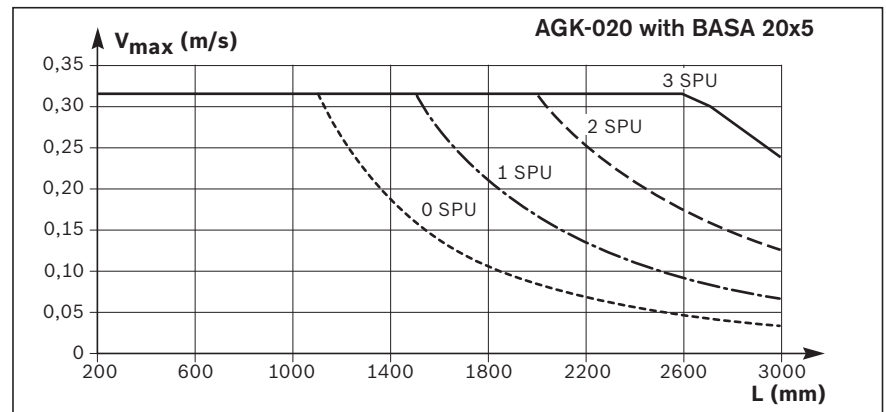
The values shown for M_p apply under the following conditions:

- No radial loads on screw journal



Permissible speed $v_{\max}$

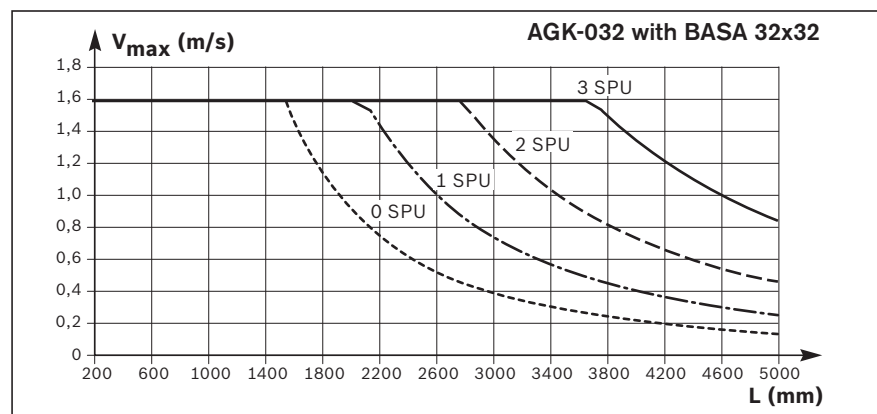
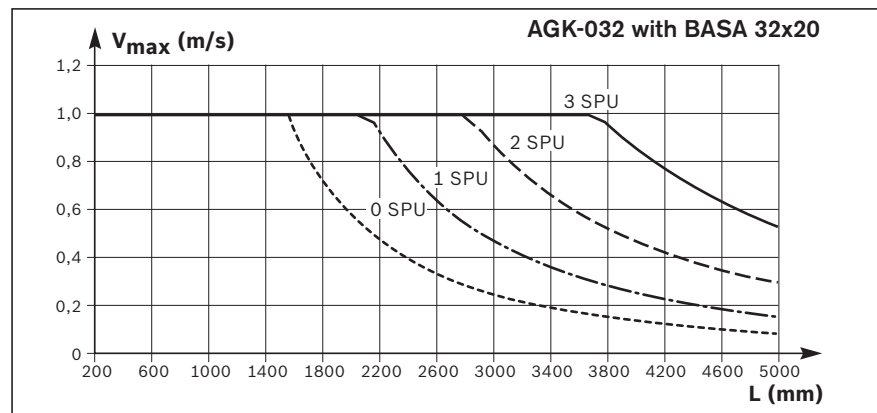
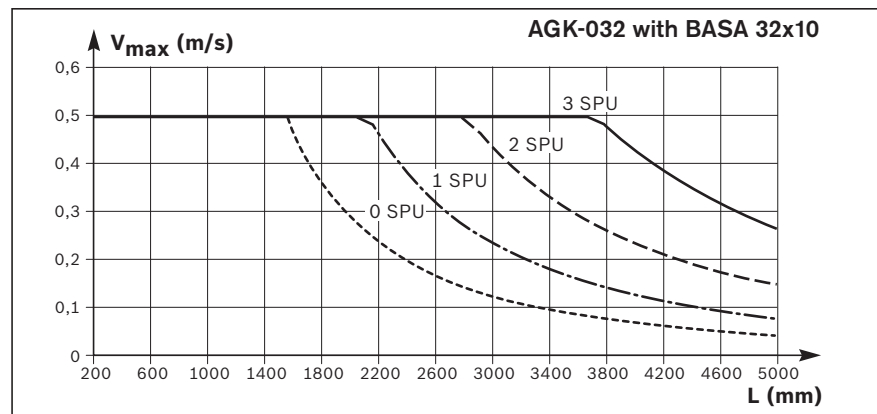
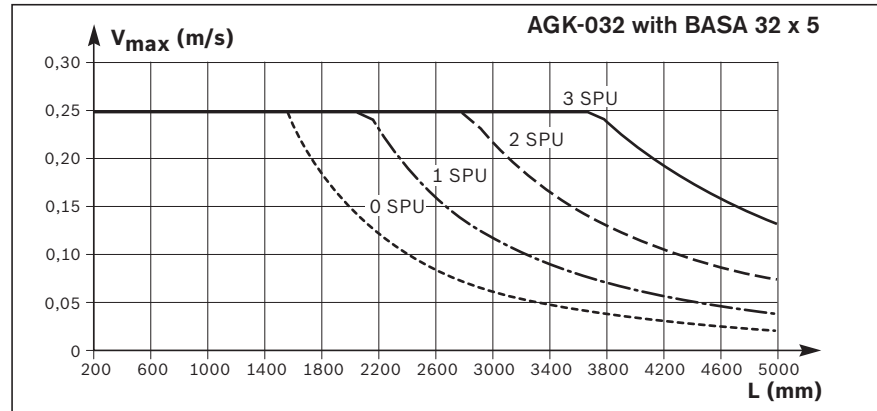
SPU = screw support



Technical data

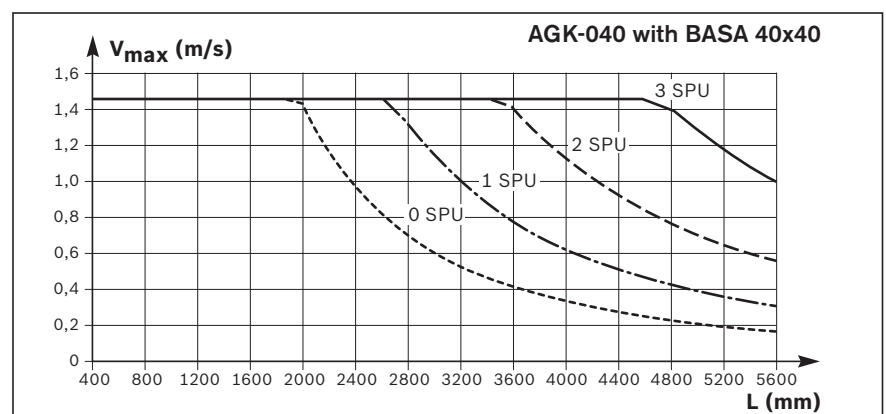
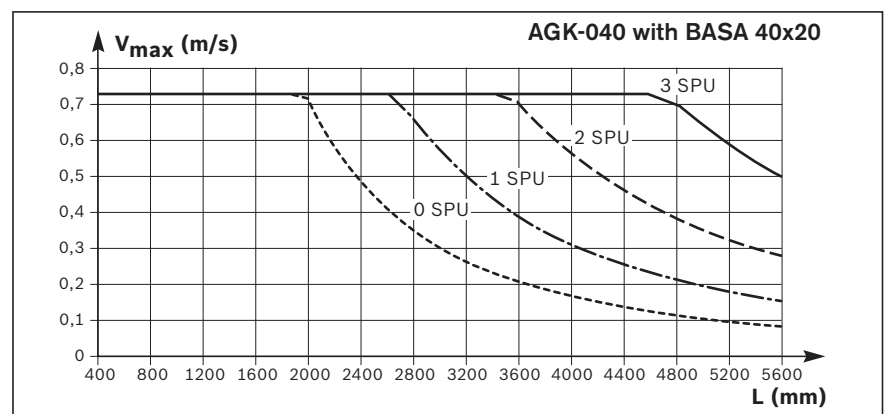
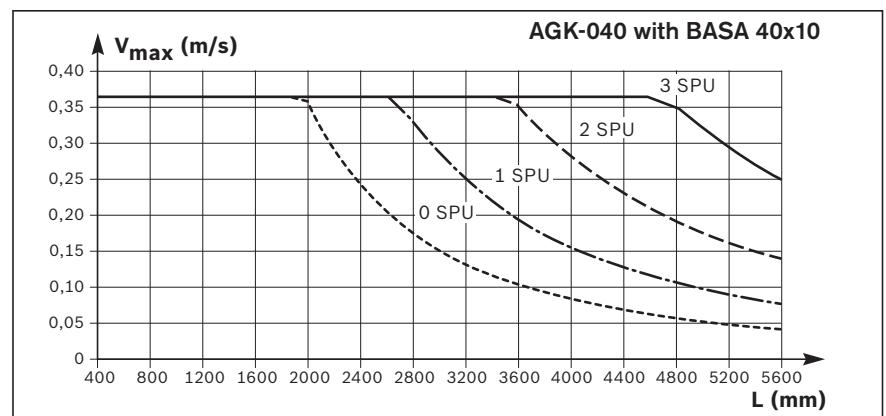
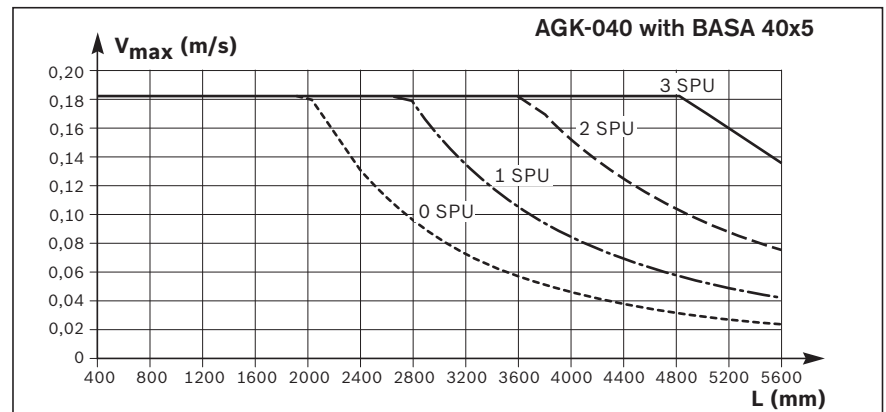
Permissible speed v_{max}

SPU = screw support



Permissible speed v_{max}

SPU = screw support



Calculation

Calculation principles

Drive Unit service life

Ball screw drive/fixed bearing service life

Page 60

Page 61

Page 61

Drive dimensioning

Basic principles

Drive dimensioning based on the motor shaft as a reference point

General guide for motor selection

Calculation example

Page 63

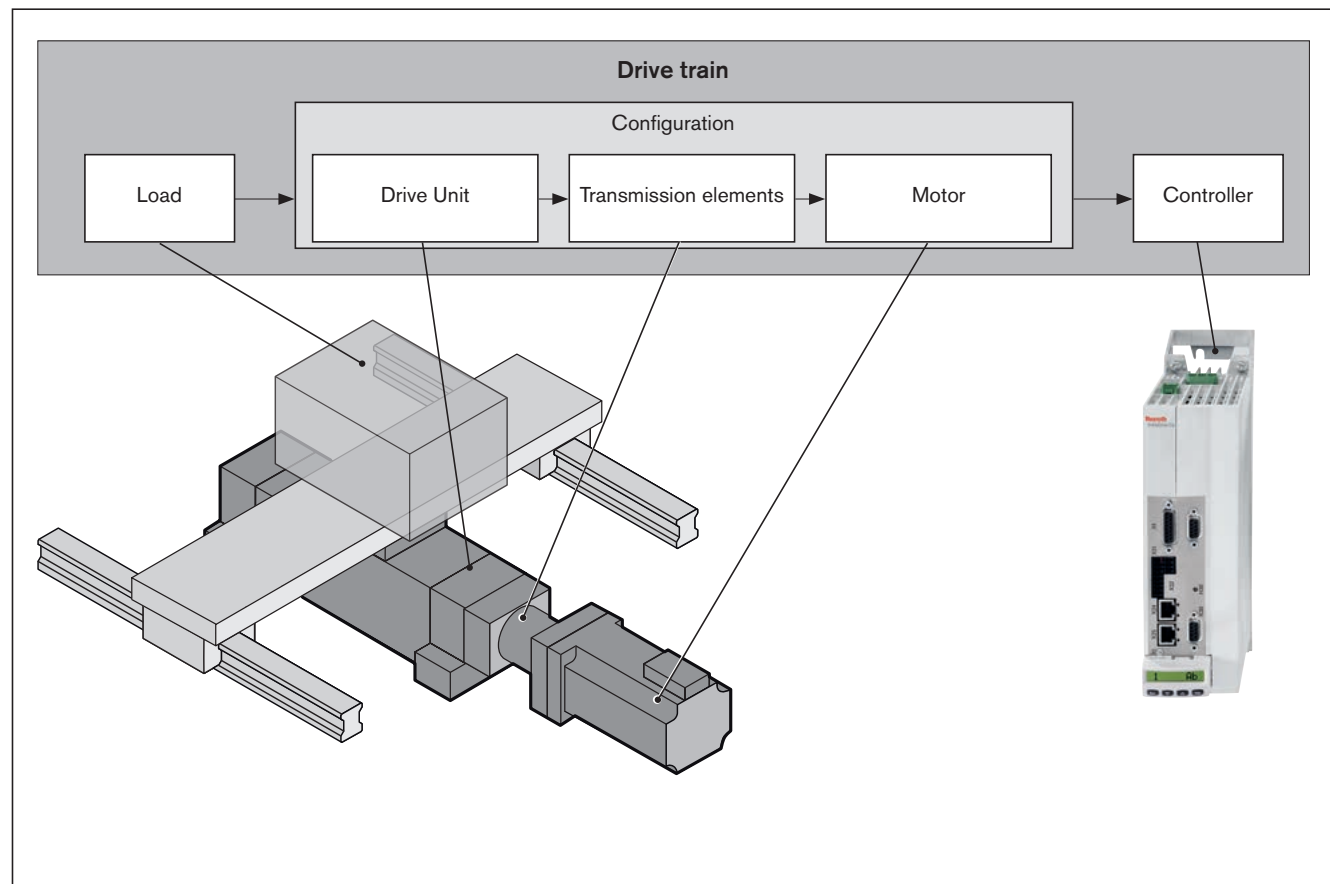
Page 63

Page 64

Page 64

Page 68

Calculation principles



Correct dimensioning and assessment for an application requires structured consideration of the entire drive train. The basic element of the drive train is the configuration, consisting of the Drive Unit, the transmission element (coupling or timing belt side drive) and the motor, that can be ordered from the catalog.

Drive Unit service life

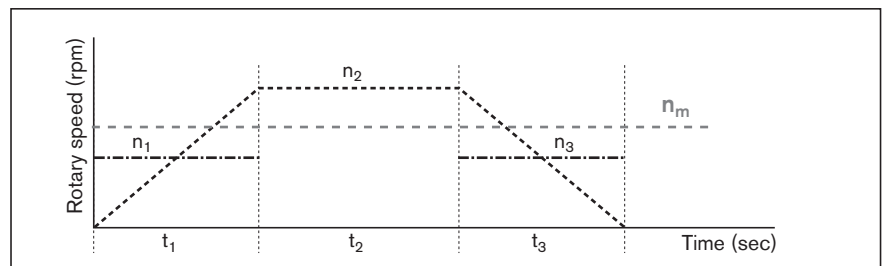
The service life of the rolling bearing points contained in a Drive Unit can be calculated using the formulas given below. In a Drive Unit with ball screw drive, the rolling bearing points that are relevant for the service life are the linear guide, the ball screw drive (nut), and the fixed bearing.

⚠ Whichever independently calculated service life is shorter, that of the ball screw drive or of the fixed bearing, is then used as the estimated service life of the Drive Unit.

Service life of the ball screw drive or the fixed bearing

If operating conditions vary (rotary speed and load), service life must be calculated using the averages F_m and n_m .

If rotary speed varies, average rotary speed n_m is calculated as follows:



$$n_m = \frac{|n_1| \cdot t_1 + |n_2| \cdot t_2 + \dots + |n_n| \cdot t_n}{t_{tot}}$$

$$t_{tot} = t_1 + t_2 + \dots + t_n$$

$$n_{1 \dots n} = \frac{n_{A1 \dots n} + n_{E1 \dots n}}{2}$$

$n_1, n_2, \dots, n_n$ = rotary speed in phases 1 ... n (rpm)

n_m = average rotary speed (rpm)

$t_1, t_2, \dots, t_n$ = discrete time step in phases 1 ... n (sec)

t_{tot} = sum of the discrete time steps (sec)

n_1 = rotary speed in acceleration and braking phases

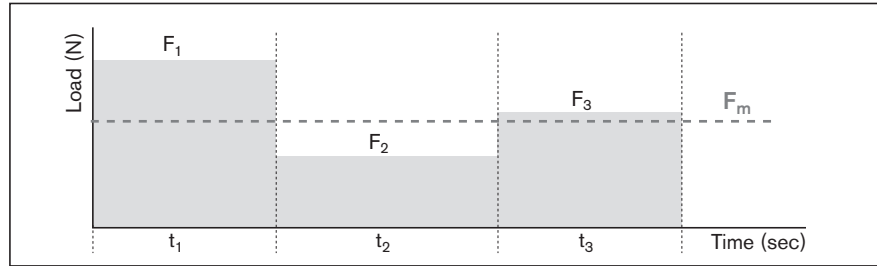
$n_{A1 \dots n}$ = rotary speed at start in phase 1 ... n (rpm)

$n_{E1 \dots n}$ = rotary speed at end in phase 1 ... n (rpm)

Rotary speed in acceleration and braking phases $n_{1 \dots n}$:

Calculation

Where both the load and the rotary speed vary, the average load F_m is calculated as follows:



$$F_m = \sqrt[3]{|F_1|^3 \cdot \frac{|n_1|}{n_m} \cdot \frac{t_1}{t_{ges}} + |F_2|^3 \cdot \frac{|n_2|}{n_m} \cdot \frac{t_2}{t_{ges}} + \dots + |F_n|^3 \cdot \frac{|n_n|}{n_m} \cdot \frac{t_n}{t_{ges}}}$$

Nominal life

Nominal life in revolutions:

$$L = \left(\frac{C}{F_m} \right)^3 \cdot 10^6$$

Nominal life in hours:

$$L_h = \frac{L}{n_m \cdot 60}$$

C	=	dynamic load rating	(N)
$F_1, F_2, \dots, F_n$	=	axial load during phases 1 ... n	(N)
F_m	=	equivalent dynamic axial load	(N)
$n_1, n_2, \dots, n_n$	=	rotary speed in phases 1 ... n	(rpm)
n_m	=	average rotary speed	(rpm)
$t_1, t_2, \dots, t_n$	=	discrete time step in phases 1 ... n	(sec)
t_{tot}	=	sum of the discrete time steps	(sec)
L	=	nominal life	(—)
L_h	=	nominal life	(h)

Drive dimensioning

Basic principles

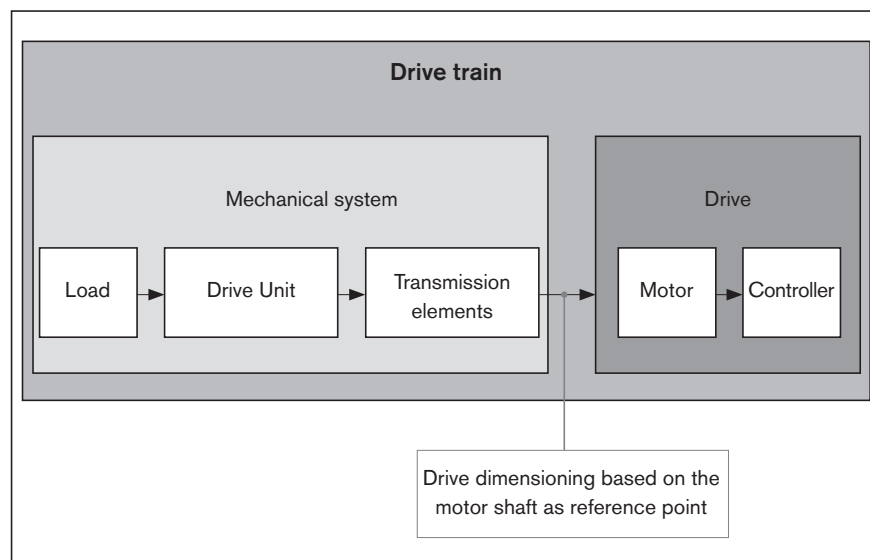
When dimensioning the drive, the drive train can be divided into the mechanical system and the drive itself.

The **mechanical system** includes the Drive Unit and transmission elements (timing belt side drive, coupling), and the load to be carried.

The electric **drive** is a motor/controller combination with corresponding performance data.

The dimensioning of the electric drive is done taking the motor shaft as a reference point.

Both basic values and limit values must be factored in when dimensioning the drive. Limit values should be observed to avoid damaging the mechanical components.



Technical data and formula symbols for the mechanical system

For each component (Drive Unit, coupling, timing belt side drive), the relevant maximum permissible values must be identified for the drive torque and travel speed, as well as the basic values for frictional torque and mass moment of inertia.

The following technical data with the associated formula symbols are used when considering the basic **mechanical system** requirements in the design calculations for dimensioning the drive. The data in the table below can be found in the "Technical data" section or they are determined using the formulas described on the following pages.

		Mechanical system			
		Load	Drive Unit	Transmission elements	
				Coupling	Timing belt side drive
Weight moment	(Nm)	$M_g^{(6)}$	—	—	—
Frictional torque	(Nm)	— ⁽⁵⁾	$M_{Rs}^{(3)}$	—	$M_{Rsd}^{(3)}$
Mass moment of inertia	(kgm ²)	$J_l^{(1)}$	$J_s^{(2)}$	$J_c^{(3)}$	$J_{sd}^{(3)}$
Max. permissible speed	(m/s)	—	$v_{max}^{(4)}$	—	—
Maximum permissible drive torque	(Nm)	—	$M_p^{(4)}$	$M_{cN}^{(3)}$	$M_{sd}^{(3)}$

- 1) Determine the value using the appropriate formula
- 2) Length-dependent value, determined using the appropriate formula
- 3) Use the value from the table
- 4) Length-dependent value, to be read off the graph
- 5) Any additional process forces are to be taken into consideration as load moments
- 6) For vertical mounting position: Determine the value using the appropriate formula

Drive dimensioning

Drive dimensioning based on the motor shaft as a reference point

When dimensioning the drive, all relevant design calculation values for the mechanical components in the drive train have to be determined and be expressed in terms of or reduced to the motor shaft. For a combination of mechanical components in the drive train, this will result in one value for each of the following:

- Frictional torque M_R
- Mass moment of inertia J_{ex}
- Maximum permissible speed v_{mech} (maximum permissible rotary speed n_{mech})
- Maximum permissible drive torque M_{mech}

Determination of the values for each mechanical component in the drive train based on the motor shaft as a reference point

Frictional torque M_R

For motor attachment via mount and coupling

$$M_R = M_{Rs}$$

For motor attachment via timing belt side drive

$$M_R = M_{Rsd} + \frac{M_{Rs}}{i}$$

Mass moment of inertia J_{ex}

For motor attachment via mount and coupling

$$J_{ex} = J_s + J_t + J_c$$

For motor attachment via timing belt side drive

$$J_{ex} = J_{sd} + \frac{(J_s + J_t)}{i^2}$$

Determination of the mass moment of inertia of the Drive Unit

$$J_s = (k_{J\text{ fix}} + k_{J\text{ var}} \cdot L) \cdot 10^{-6}$$

Determination of the translatory mass moment of inertia of the external load

$$J_t = m_{ex} \cdot k_{Jm} \cdot 10^{-6}$$

i	= gear ratio of timing belt side drive	(—)
J_c	= mass moment of inertia of the coupling	(kgm ²)
J_{ex}	= mass moment of inertia of mechanical system	(kgm ²)
J_s	= mass moment of inertia of the Drive Unit	(kgm ²)
J_{sd}	= mass moment of inertia of timing belt side drive at motor journal	(kgm ²)
J_t	= translatory mass moment of inertia of external load based on the Drive Unit screw journal	(kgm ²)
$k_{J\text{ fix}}$	= constant for fixed-length portion of mass moment of inertia	(kgmm ²)
k_{Jm}	= constant for mass-specific portion of mass moment of inertia	(mm ²)
$k_{J\text{ var}}$	= constant for variable-length portion of mass moment of inertia	(kgmm)
L	= length of Drive Unit	(mm)
m_{ex}	= moved external load	(kg)
M_R	= frictional torque at motor journal	(Nm)
M_{Rs}	= frictional torque of system	(Nm)
M_{Rsd}	= frictional torque of timing belt side drive at motor journal	(Nm)

Maximum permissible speed v_{mech}

The lowest of all the values for the maximum permissible speed of all mechanical components contained in the drive train determines the maximum permissible speed of the mechanical system which has to be taken into consideration as the upper limit for the drive when dimensioning the motor. By design, the maximum permissible speed or rotary speed of the Drive Unit with ball screw drive will always be less than that of the other components in the mechanical system, such as the coupling or timing belt side drive, meaning it is the maximum permissible speed of the mechanical system.

Maximum permissible speed

$$v_{\text{mech}} = v_{\text{max}}$$

Maximum permissible rotary speed

For motor attachment via
mount and coupling

$$n_{\text{mech}} = \frac{v_{\text{mech}} \cdot 1000 \cdot 60}{P}$$

For motor attachment via
timing belt side drive

$$n_{\text{mech}} = \frac{v_{\text{mech}} \cdot i \cdot 1000 \cdot 60}{P}$$

i	=	gear ratio of timing belt side drive	(—)
n_{mech}	=	maximum permissible rotary speed of mechanical system	(rpm)
P	=	screw lead	(mm)
v_{max}	=	maximum permissible speed of the Drive Unit	(m/s)
v_{mech}	=	maximum permissible speed of mechanical system	(m/s)

Maximum permissible drive torque M_{mech}

The lowest (minimum) permissible drive torque of all of the mechanical components in the drive train determines the maximum permissible drive torque of the mechanical system, which should be considered the drive limit when dimensioning the motor.

For motor attachment via
mount and coupling

$$M_{\text{mech}} = \text{minimum } (M_{\text{cN}}; M_{\text{p}})$$

For motor attachment via
timing belt side drive

$$M_{\text{mech}} = \text{minimum } (M_{\text{sd}}; \frac{M_{\text{p}}}{i})$$

i	=	gear ratio of timing belt side drive	(—)
M_{p}	=	maximum permissible drive torque of the Drive Unit	(Nm)
M_{cN}	=	rated torque of coupling	(Nm)
M_{sd}	=	maximum permissible drive torque of the timing belt side drive	(Nm)
M_{mech}	=	maximum permissible drive torque for mechanical system	(Nm)

⚠ When considering the complete drive train (mechanical system + motor/controller), the maximum torque of the motor can lie below the maximum value for the mechanical system (M_{mech}) and thus limit the maximum permissible drive torque of the overall drive train.

If the maximum torque of the motor lies above the upper limit for the mechanical system (M_{mech}), the maximum motor torque must be limited to the permitted value for the mechanical system.

Drive dimensioning

Motor pre-selection

The following conditions can be used as a general guide for pre-selecting the motor.

Condition 1:

The rotary speed of the motor must be greater than or equal to the rotary speed required for the mechanical system (but not exceeding the maximum permissible limit value).

$$n_{\max} \geq n_{\text{mech}}$$

$$\begin{aligned} n_{\max} &= \text{max. rotary speed of motor} && (\text{rpm}) \\ n_{\text{mech}} &= \text{maximum permissible rotary speed of the mechanical system} && (\text{rpm}) \end{aligned}$$

Condition 2:

Consideration of the ratio of mass moments of inertia of the mechanical system and the motor. The ratio of the mass moments of inertia serves as an indicator for the control performance of a motor/controller combination. The mass moment of inertia of the motor is directly related to motor size.

Ratio of mass moments of inertia

$$V = \frac{J_{\text{ex}}}{J_{\text{m}} + J_{\text{br}}}$$

For pre-selection, past experience has shown the following values will result in high control performance.

These are not rigid limits, but values exceeding them will require closer consideration of the specific application.

Application area	V
Handling	≤ 6.0
Processing	≤ 1.5

$$\begin{aligned} J_{\text{br}} &= \text{mass moment of inertia of motor brake} && (\text{kgm}^2) \\ J_{\text{ex}} &= \text{mass moment of inertia of mechanical system} && (\text{kgm}^2) \\ J_{\text{m}} &= \text{mass moment of inertia of motor} && (\text{kgm}^2) \\ V &= \text{ratio of mass moments of inertia of drive train and motor} && (-) \end{aligned}$$

Condition 3:

Estimation of the ratio of the static load moment to the torque of the motor at standstill. The torque ratio must be less than or equal to the empirical value of 0.6. By looking at the required motor torque levels, this estimation roughly covers the dynamic characteristics which still have to be determined by plotting an exact motion profile.

Torque ratio

$$\frac{M_{\text{stat}}}{M_0} \leq 0.6$$

Static load moment

$$M_{\text{stat}} = M_R + M_g$$

Weight moment

For vertical mounting only!

For motor attachment via mount and coupling: $i = 1$

$$M_g = \frac{P \cdot (m_{\text{ex}} + m_{\text{ca}}) \cdot g}{2000 \cdot \pi \cdot i}$$

g	= force of gravity (= 9.81)	(m/s ²)
i	= gear ratio of timing belt side drive	(—)
m_{ca}	= moved mass of carriage	(kg)
m_{ex}	= moved external load	(kg)
M_g	= weight moment at motor journal	(Nm)
M_0	= torque of the motor at standstill	(Nm)
M_R	= frictional torque at motor journal	(Nm)
M_{stat}	= static load moment	(Nm)
P	= screw lead	(mm)
π	= pi	(—)

In the section ➡ “Configuration and ordering”, users can put together standard configurations, including motor attachment and motor, for the various Drive Unit sizes by selecting the appropriate options. By checking the above conditions, it is possible to see whether a standard motor selected in a particular configuration will generally be of a suitable size for the specific application.

Precise drive dimensioning

Pre-selecting the motor according to this general guide is no substitute for the precise design calculations required for the drive with detailed consideration of torques and rotary speed levels. For precise calculation of the electric drive, including consideration of the specific motion profile, please refer to the performance data in the catalogs “IndraDrive Cs” and “IndraDrive C”.

When dimensioning the drive, the maximum permissible speed, drive torque and acceleration should not be exceeded in order to avoid damaging the mechanical system.

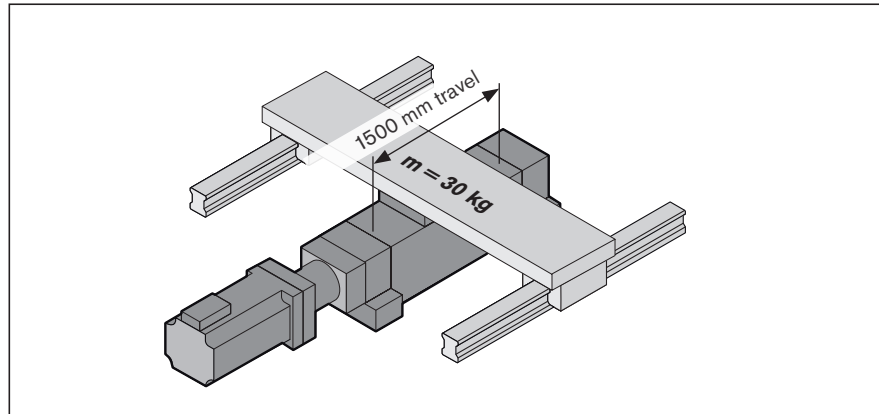
Calculation example

Starting data

An object weighing 30 kg needs to be moved horizontally 1500 mm at a max. speed of 0.3 m/s. The object travels over a separate linear guide whose frictional drag is 100 N. The following was selected based on technical data and installation space:

AOK-020 Drive Unit:

- motor attachment via mount and coupling
- with motor MSK 040C without brake



Estimating length L

(The first estimate assumes the largest possible lead and therefore length, since the permissible speed can decrease as length increases.)

$$\begin{aligned}
 L &= s_{\max} + L_{ca} + L_{ad} \\
 \text{Excess travel: } s_e &= 2 \cdot P = 2 \cdot 40 = 80 \text{ mm} \\
 \text{Max. travel: } s_{\max} &= s_{\text{eff}} + 2 \cdot s_e \\
 &= 1500 + 2 \cdot 80 = 1660 \text{ mm} \\
 \text{Length: } L &= 1660 + 204 + 86 = 1950 \text{ mm}
 \end{aligned}$$

Selecting the ball screw drive

(Better to choose the lowest lead as this is favorable in terms of resolution, braking distance, length.)

Permissible ball screw drives according to “Permissible speed” graph given $v = 0.3 \text{ m/s}$ and $L = 1950 \text{ mm}$:

BASA 20 x 40 and BASA 20 x 20

Ball screw drive selected (smaller lead):

BASA 20 x 20

Maximum permissible speed for BASA 20 x 20 from graph:

$$v_{\max} = 0.4 \text{ m/s}$$

Calculation of length L

(for selected BASA)

$$\begin{aligned}
 \text{Excess travel: } s_e &= 2 \cdot P = 2 \cdot 20 = 40 \text{ mm} \\
 \text{Max. travel: } s_{\max} &= s_{\text{eff}} + 2 \cdot s_e \\
 &= 1500 + 2 \cdot 40 = 1580 \text{ mm} \\
 \text{Length: } L &= 1580 + 204 + 86 = 1870 \text{ mm}
 \end{aligned}$$

Frictional torque M_R

(motor attachment via mount and coupling)

$$\begin{aligned}
 M_R &= M_{Rs} + M_{Rad} \\
 \text{Separate guideway: } M_{Rad} &= (P \cdot F_R) / (2000 \cdot \pi) \\
 &= (20 \cdot 100) / (2000 \cdot \pi) \\
 &= 0.32 \text{ Nm} \\
 \text{Drive Unit: } M_{Rs} &= 0.60 \text{ Nm} \\
 \text{Frictional torque: } M_R &= 0.60 + 0.32 = 0.92 \text{ Nm}
 \end{aligned}$$

Mass moment of inertia J_{ex}

(motor attachment via mount and coupling)

$$\begin{aligned}
 J_{ex} &= J_s + J_t + J_c \\
 \text{Coupling: } J_c &= 57 \cdot 10^{-6} \text{ kgm}^2 \\
 \text{Drive Unit: } J_s &= (k_{J \text{ fix}} + k_{J \text{ var}} \cdot L) \cdot 10^{-6} \\
 &= (40.7 + 0.1004 \cdot 1870) \cdot 10^{-6} \\
 &= 228.45 \cdot 10^{-6} \text{ kgm}^2 \\
 \text{External load: } J_t &= m_{ex} \cdot k_{Jm} \cdot 10^{-6} \\
 &= 30 \cdot 10.1321 \cdot 10^{-6} \\
 &= 303.96 \cdot 10^{-6} \text{ kgm}^2 \\
 \text{Moment of inertia: } J_{ex} &= 228.45 \cdot 10^{-6} + 303.96 \cdot 10^{-6} + 57 \cdot 10^{-6} \\
 &= 589.41 \cdot 10^{-6} \text{ kgm}^2
 \end{aligned}$$

Maximum permissible rotary speed n_{mech}

(motor attachment via mount and coupling)

Limit for mechanical system

$$\begin{aligned}
 n_{mech} &= \frac{(v_{mech} \cdot 1000 \cdot 60)}{P} \\
 \text{Max. permissible speed: } v_{mech} &= v_{max} = 0.4 \text{ m/s} \\
 \text{Max. permissible rotary speed: } n_{mech} &= \frac{(0.4 \cdot 1000 \cdot 60)}{20} \\
 &= 1200 \text{ rpm}
 \end{aligned}$$

Max. rotary speed of application n_{mech}

(motor attachment via mount and coupling)

Application limit

$$\begin{aligned}
 \text{Speed: } v_{mech} &= 0.3 \text{ m/s} \\
 \text{Rotary speed: } n_{mech} &= \frac{0.3 \cdot 1000 \cdot 60}{20} \\
 &= 900 \text{ rpm}
 \end{aligned}$$

Calculation example

Maximum permissible drive torque M_{mech}

(motor attachment via mount and coupling)
Limit for mechanical system

$$M_{\text{mech}} = \text{minimum } (M_{\text{cN}}; M_{\text{p}})$$

Coupling: $M_{\text{cN}} = 19 \text{ Nm (for MSK 040C)}$

Drive Unit: $M_{\text{p}} = 11.5 \text{ Nm}$

Drive torque: $M_{\text{mech}} = \text{minimum } (19; 11.5)$
 $= 11.5 \text{ Nm}$

Checking motor preselection

Selected motor:
MSK 040C without brake

Condition 1:

Rotary speed: $n_{\text{max}} \geq n_{\text{mech}}$
 $6000 \geq 900 \text{ condition met – motor selection OK}$

Condition 2:

Mass moment of inertia ratio: $V = \frac{J_{\text{ex}}}{J_{\text{m}} + J_{\text{br}}}$

Motor inertia: $J_{\text{m}} = 140 \cdot 10^{-6} \text{ kgm}^2$

Brake inertia: $J_{\text{br}} = 0 \cdot 10^{-6} \text{ kgm}^2 \text{ (without brake)}$

Mass moment of inertia ratio: $V = \frac{589.41 \cdot 10^{-6}}{(140 \cdot 10^{-6} + 0 \cdot 10^{-6})}$
 $= 4.21$

Condition for handling: $V \leq 6$
 $4.21 \leq 6 \text{ condition met – motor selection OK}$

Condition 3:

Torque ratio: $\frac{M_{\text{stat}}}{M_0} \leq 0.6$

Static load moment: $M_{\text{stat}} = M_{\text{R}} + M_{\text{g}} \text{ (horizontal mounting } M_{\text{g}} = 0)$
 $= 0.92 \text{ Nm}$

Torque of the motor at standstill: $M_0 = 2.7 \text{ Nm}$

Torque ratio: $\frac{0.92}{2.7} = 0.34$
 $0.34 \leq 0.6 \text{ condition met – motor selection OK}$

All three conditions met $\Rightarrow$ Selected motor is suitable for the application.

Result

AOK-020 Drive Unit

Length:	L	$=$	1870 mm
Max. travel	$s_{\max}$	$=$	1580 mm
Carriage length:	L_c	$=$	204 mm
Ball screw drive:	Nominal diameter:	d_0	$=$ 20 mm
	Lead:	P	$=$ 20 mm

Motor attachment via mount and coupling

Pre-selected motor: MSK 040C without brake

The motor-controller combination should always be considered for precise dimensioning of the electric drive, since the performance data (e.g., max. useful speed and max. torque) will depend on the controller used.

When doing this, the following data must be considered.

Frictional torque:	M_R	$=$	0.92 Nm
Mass moment of inertia:	J_{ex}	$=$	$589.41 \cdot 10^{-6} \text{ kgm}^2$
Speed:	v_{mech}	$=$	0.3 m/s ($n_{\text{mech}} = 900 \text{ rpm}$)
Drive torque limit:	M_{mech}	$=$	11.5 Nm
➡ Motor torque should be limited to 11.5 Nm on the drive side.			
Acceleration limit:	$a_{\max}$	$=$	50 m/s ²
Limit value for speed:	$v_{\max}$	$=$	0.4 m/s ($n_{\text{mech}} = 1200 \text{ rpm}$)

Besides the preferred type MSK 040C, other motors with identical connection dimensions can be adapted while taking care not to exceed the calculated limit values.

AGK-020

Configuration and ordering

Short product name, length AGK-020-NN-1, mm	Drive BASA											Pillow block	Nut Housing without SPU	Nut Housing with SPU			Nut Housing Mounting orientation		
		Nut	BASA size d ₀ x P				Seal	Lubrication	Preload class	Screw ends			Aluminum		Number of SPU per side ³⁾				
			20 x 5	20 x 10	20 x 20	20 x 40				Tolerance grade	Standard				Initial greasing	C1 (mod- erate)			Left (fixed bearing)
		01	04	02	03	T5 T7	1	1	3	81	31	02	01	21	22	23	 MR01 Left  MR02 Top  MR03 Right		

Ordering example: See “Request/order”

BASA = ball screw drive

d₀ = nominal diameter BASA (mm)

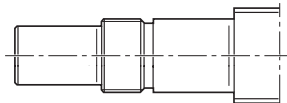
P = lead (mm)

SPU = screw support

Screw ends:

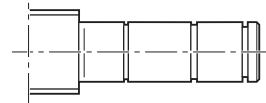
Fixed bearing end (left)

81



Floating bearing end (right)

31



Nut Housing
Mounting orientation



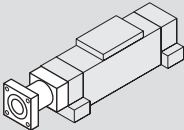
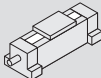
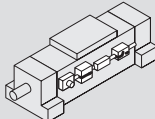
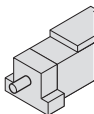
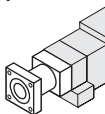
MR01
left



MR02
top



MR03
right

Motor attachment				Motor		Cover		Switch/ socket-plug	Documentation															
																								
Version		Gear ratio	Attachment kit ¹⁾	for motor	without	with	Steel	PU	Standard report	Measurement report														
					Brake																			
without mount	OF01		00	—	00		01	02	<table><tr><td>Without switch</td><td rowspan="2">00</td></tr><tr><td>Without socket-plug</td></tr><tr><td colspan="2">Magnetic sensor</td></tr><tr><td>REED sensor</td><td>21</td></tr><tr><td>Hall sensor</td><td>22</td></tr><tr><td>PNP NC</td><td></td></tr><tr><td>Socket-plug</td><td>17</td></tr></table>	Without switch	00	Without socket-plug	Magnetic sensor		REED sensor	21	Hall sensor	22	PNP NC		Socket-plug	17	01	02 Frictional torque 03 Lead deviation
	Without switch	00																						
	Without socket-plug																							
	Magnetic sensor																							
	REED sensor	21																						
	Hall sensor	22																						
	PNP NC																							
	Socket-plug	17																						
	MF01			06	MSM 041B ²⁾	140				141														
				02	MSK 040C ²⁾	86				87														
				07	MSK 050C ²⁾	88				89														
	RV01	RV02				32				MSM 041B ²⁾	140	141												
30						MSK 040C ²⁾	86	87																
23						MSK 050C ²⁾	88	89																
RV03						RV04																		

1) Attachment kit available without motor (when ordering: enter "00" for motor)

2) Recommended motor (motor data and type designation ➡ "Motors")

3) SPU always have the same number on each side of the Nut Housing example: 3 SPUs
(Option 13) mean a total 6 SPUs (3 left and 3 right)

Length calculation

$$L = s_{\max} + L_c + L_{ad}$$

Effective stroke

$$s_{\text{eff}} = s_{\max} - 2 \cdot s_e$$

s_e = excess travel
 $s_{\max}$ = maximum travel
 s_{eff} = effective stroke
 L = length
 L_c = Nut Housing length
 L_{ad} = additional length (see "Technical data" section)

AGK-020

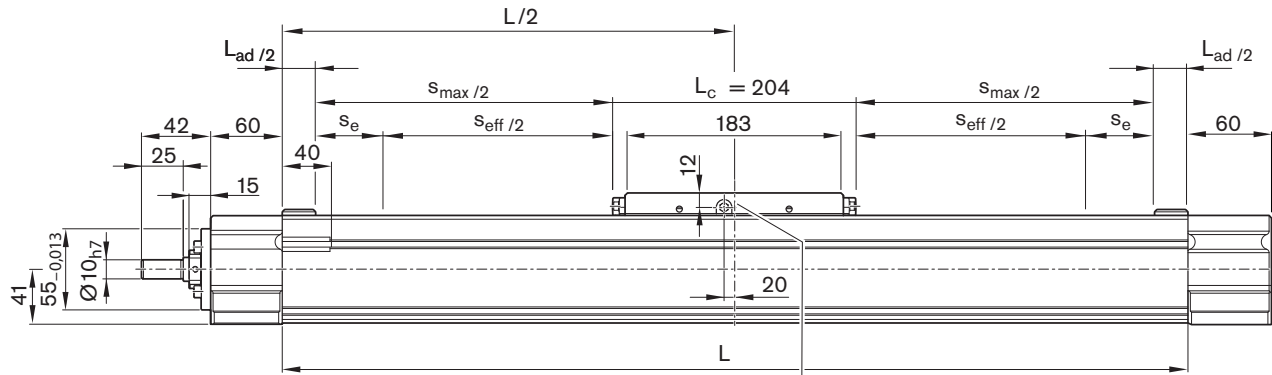
Dimensional drawings

All dimensions in mm. Drawings not to scale.

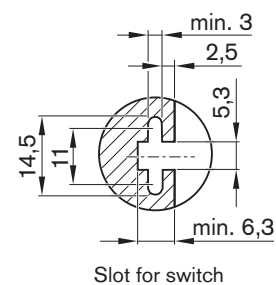
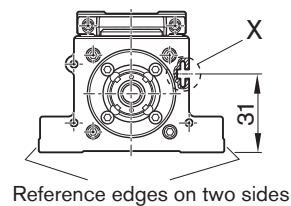
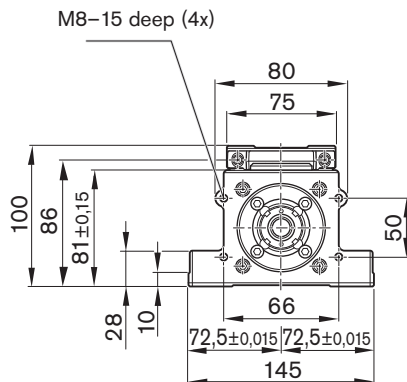
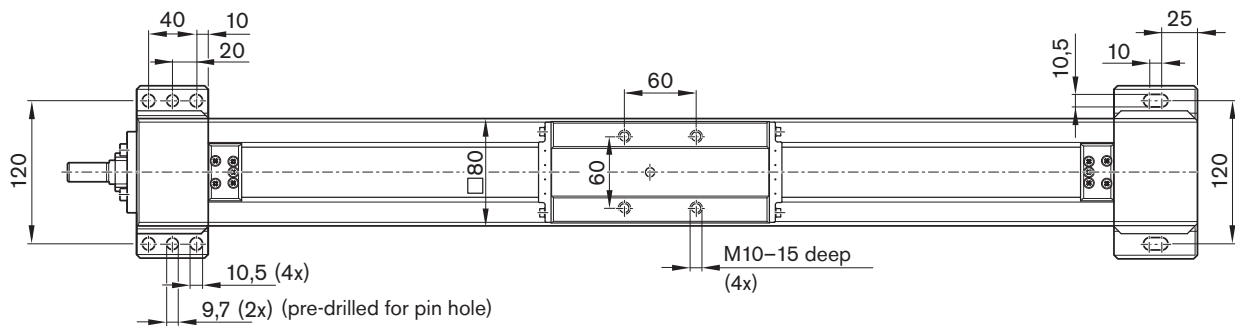
Straightness and flatness tolerance in accordance with DIN EN 12020-02

Fixed bearing end

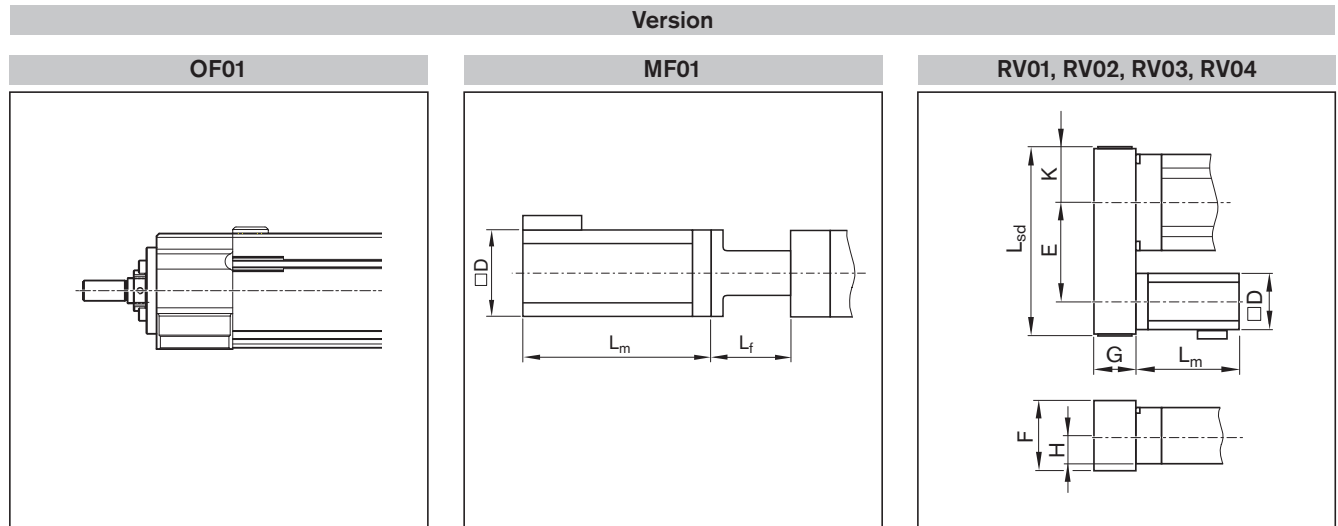
Floating bearing end



Lubrication hole on both sides of Nut Housing.
DIN 3405-A M6 funnel-type lube nipple



Motor attachment dimension drawings



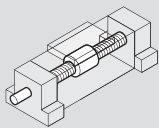
Version	Motor	Dimensions (mm)									
		D	E i = 1	F	G	H	K	L _f	L _m without brake	L _m with brake	L _{sd} i = 1
RV01, RV02, RV03, RV04	MSM 041B	80	122.5	88	51	41	47.5	–	112.0	149.0	231
	MSK 040C	82	122.5	88	51	41	47.5	–	185.5	215.5	231
	MSK 050C	100	155	116	66	41	56	–	203.0	233.0	287
MF01	MSM 041B	80	–	–	–	–	–	90	112.0	149.0	–
	MSK 040C	82	–	–	–	–	–	90	185.5	215.5	–
	MSK 050C	98	–	–	–	–	–	115	203.0	233.0	–

See "Motors" section for more information and dimensions

L_{ad} = additional length (see "Technical data" section)

AGK-032

Configuration and ordering

Short product name, length AGK-032-NN-1, mm	Drive BASA								Screw ends		Pillow block	Nut Housing without SPU 	Nut Housing with SPU			Nut Housing Mounting orientation							
		Nut	BASA size d ₀ x P				Seal	Lubrication					Preload class	Number of SPU per side ³⁾									
			32 x 5	32 x 10	32 x 20	32 x 32			Tolerance grade	Standard				Initial greasing	C1 (moderate)			Left (fixed bearing)	Right (floating bearing)	Aluminum	1	2	3
		01	02	03	04	T5 T7	1	1	3	81	31	02	01	11	12	13	 MR01 Left  MR02 Top  MR03 Right						

Ordering example: See "Request/order"

BASA = Ball screw drive

d₀ = nominal diameter BASA (mm)

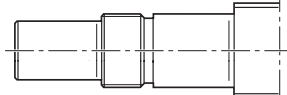
P = lead (mm)

SPU = screw support

Screw ends:

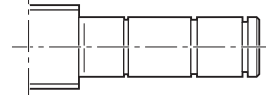
Fixed bearing end (left)

81

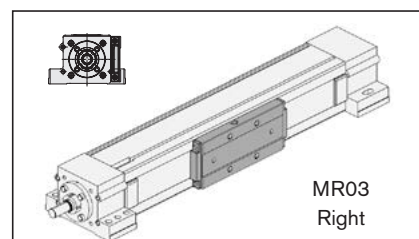
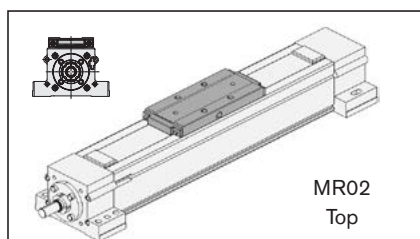
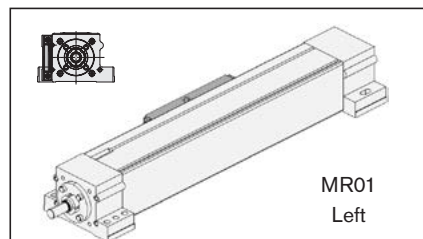


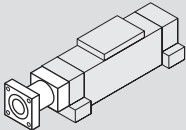
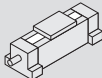
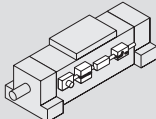
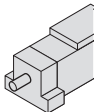
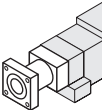
Floating bearing end (right)

31



Nut Housing
Mounting orientation



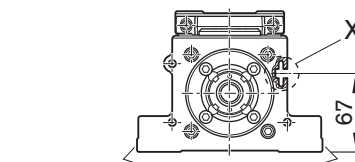
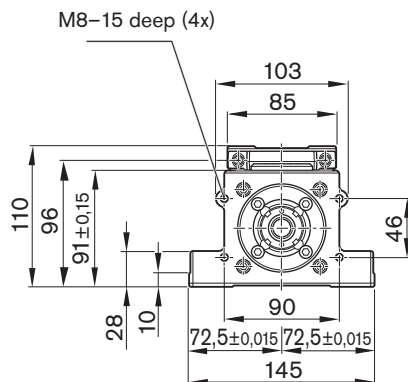
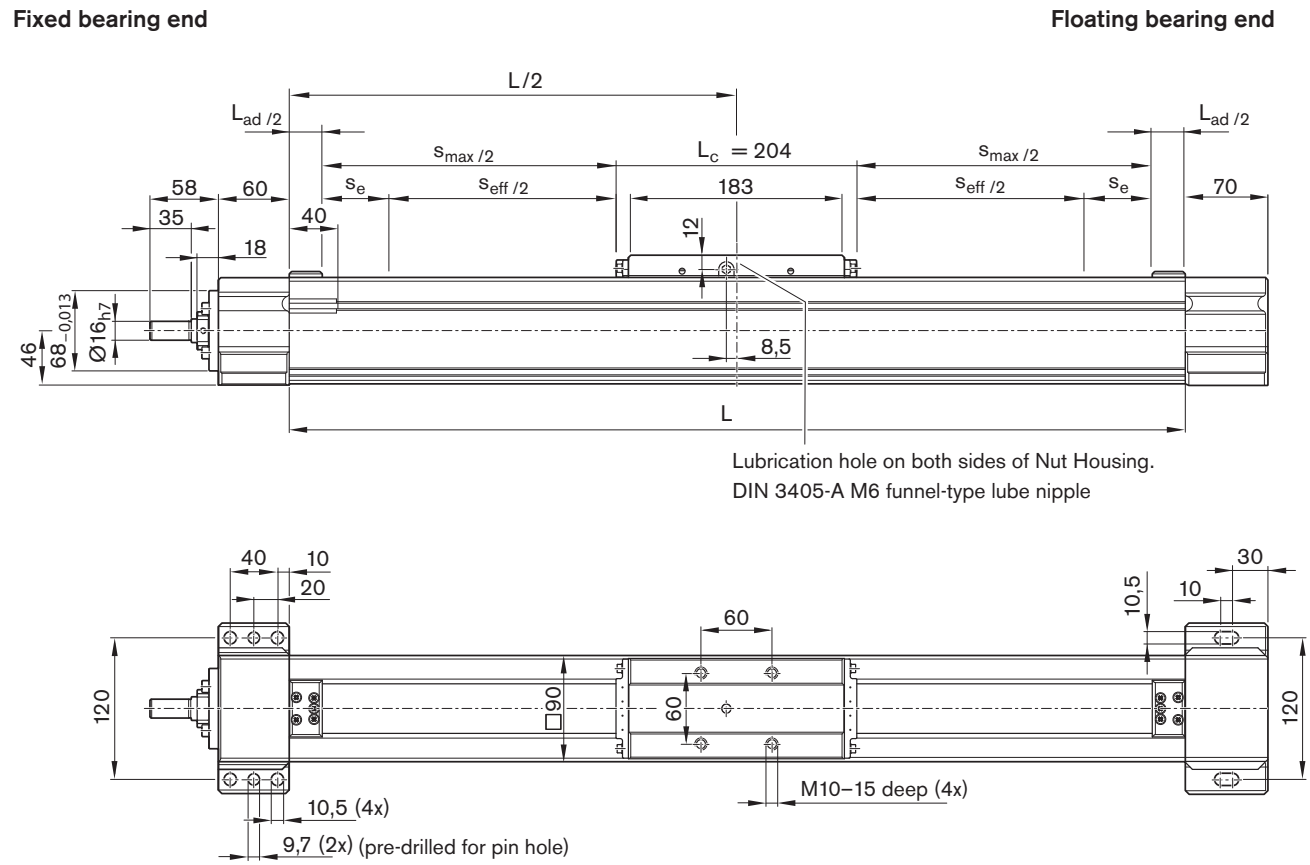
Motor attachment				Motor		Cover		Switch/socket-plug		Documentation													
																							
Version				for motor	without	with	Steel	PU															
					Brake																		
Gear ratio				Attachment kit ¹⁾						Standard report	Measurement report												
	without mount	OF01			00	-	00	01	02	<table><tr><td>Without switch</td><td rowspan="2">00</td></tr><tr><td>Without socket-plug</td></tr><tr><td colspan="2">Magnetic sensor</td></tr><tr><td>REED sensor</td><td>21</td></tr><tr><td>Hall sensor</td><td rowspan="2">22</td></tr><tr><td>PNP NC</td></tr><tr><td>Socket-plug</td><td>17</td></tr></table>		Without switch	00	Without socket-plug	Magnetic sensor		REED sensor	21	Hall sensor	22	PNP NC	Socket-plug	17
		Without switch	00																				
	Without socket-plug																						
	Magnetic sensor																						
	REED sensor	21																					
	Hall sensor	22																					
	PNP NC																						
	Socket-plug	17																					
	with mount	MF01			03	MSK 060C ²⁾	90					91											
					02	MSK 076C ²⁾	92					93											
	with timing belt side drive	RV01		i = 1	23	MSK 060C ²⁾	90					91											
RV02																							
	RV03		i = 2	24	MSK 060C ²⁾	90	91																
	RV04																						

AGK-032

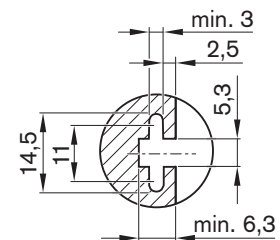
Dimensional drawings

All dimensions in mm. Drawings not to scale.

Straightness and flatness tolerance in accordance with DIN EN 12020-02

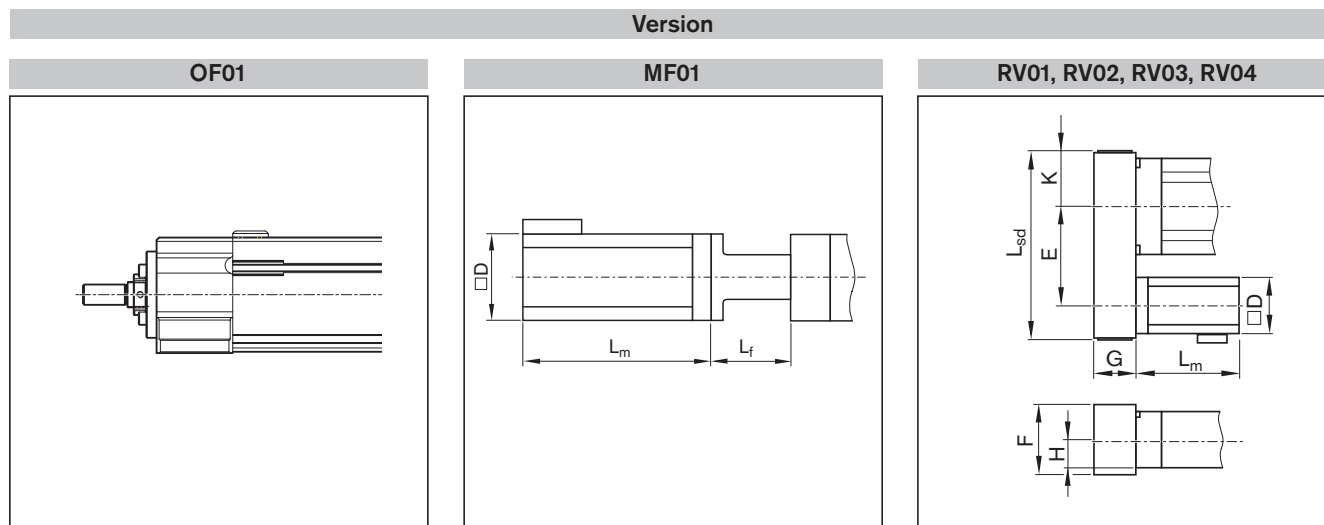


Reference edges on two sides



Slot for switch

Motor attachment dimension drawings



Version	Motor	Dimensions (mm)											
		D	E		F	G	H	K	L _f	L _m	L _{sd}	i = 1	i = 2
			i = 1	i = 2						without brake			
RV01, RV02, RV03, RV04	MSK 060C	116	165	162	116	66	46	59	–	226.0	259.0	300	300
MF01	MSK 060C	116	–	–	–	–	–	–	125	226.0	259.0	–	–
	MSK 076C	140	–	–	–	–	–	–	133	292.5	292.5	–	–

See "Motors" section for more information and dimensions

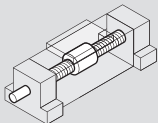
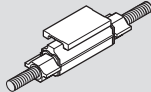
L_{ad} = additional length (see "Technical data" section)

80 Drive Units

AGK Drive Units

AGK-040

Configuration and ordering

Short product name, length AGK-040-NN-1, mm	Drive BASA								Screw ends		Pillow block	Nut Housing without SPU 	Nut Housing with SPU			Nut Housing Mounting orientation										
		Nut	BASA size d ₀ x P				Seal	Lubrication					Preload class	Number of SPU per side ³⁾												
			40 x 5	40 x 10	40 x 20	40 x 40								Tolerance grade	1			Initial greasing	C1 (mod- erate)	Left (fixed bearing)	Right (floating bearing)	Aluminum		1		
																								2	3	
	ZEM-E 	01				T5 T7	1	1	3	81	31	02	01	11	12	13	 MR01 left									
																	 MR02 top									
		02	03	04		T5 T7	1	1	3	81	31	02	01	21	22	23	 MR03 right									

Ordering example: See "Request/order"

BASA = Ball screw drive

 d_0 = nominal diameter BASA (mm)

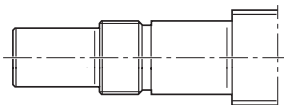
P = lead (mm)

SPU = screw support

Screw ends:

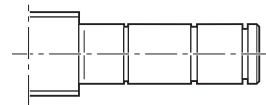
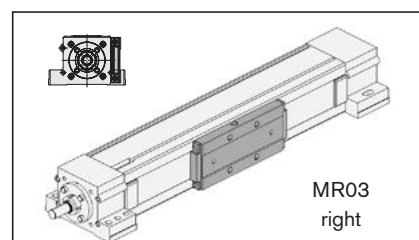
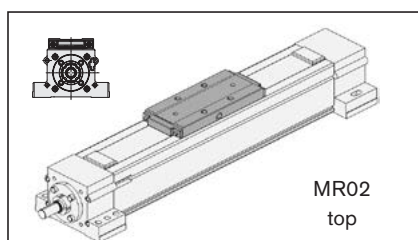
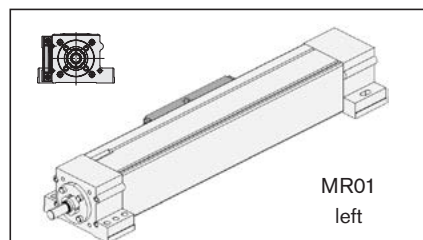
Fixed bearing end (left)

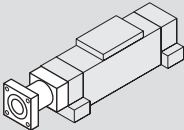
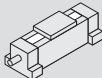
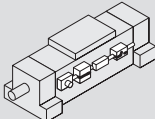
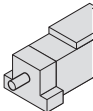
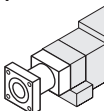
81



Floating bearing end (right)

31


Nut Housing
Mounting orientation


Motor attachment				Motor		Cover		Switch/socket-plug		Documentation		
												
Version				for motor		without with Brake		Steel PU				
Gear ratio				Attachment kit ¹⁾						Standard report		
										Measurement report		
	without mount	OF01			00	—		00		01	02 Frictional torque 03 Lead deviation	
		MF01			02	MSK 076C ²⁾		92	93			
	with timing belt side drive	RV01		i = 1	23	MSK 076C ²⁾		92	93			
		RV02										
		RV03		i = 2	24	MSK 076C ²⁾		92	93			
		RV04										

AGK-040

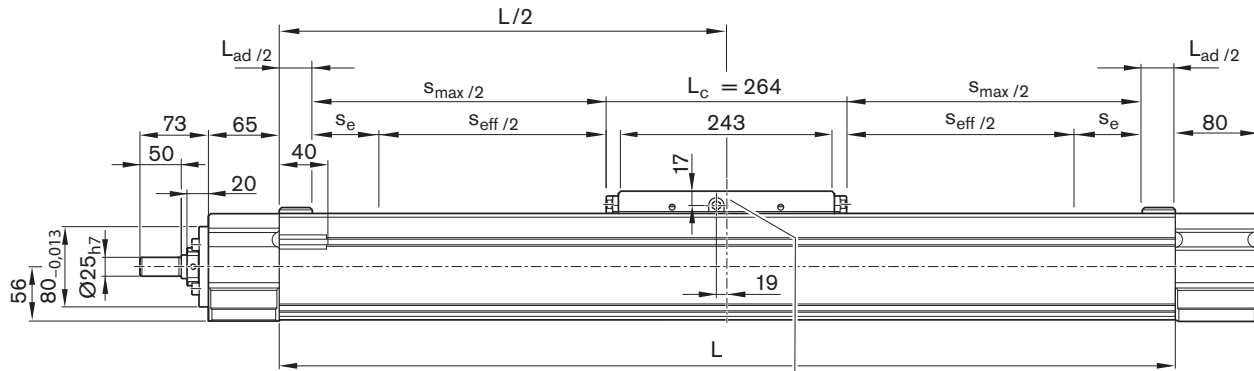
Dimensional drawings

All dimensions in mm. Drawings not to scale.

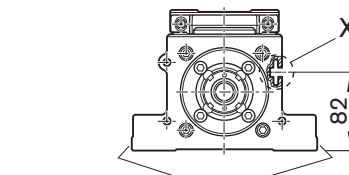
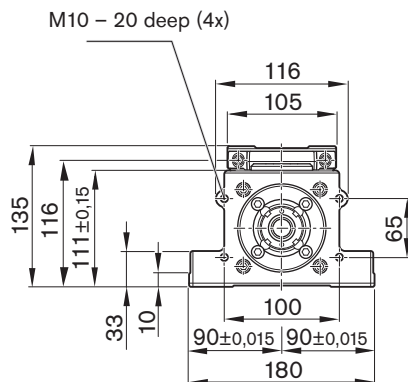
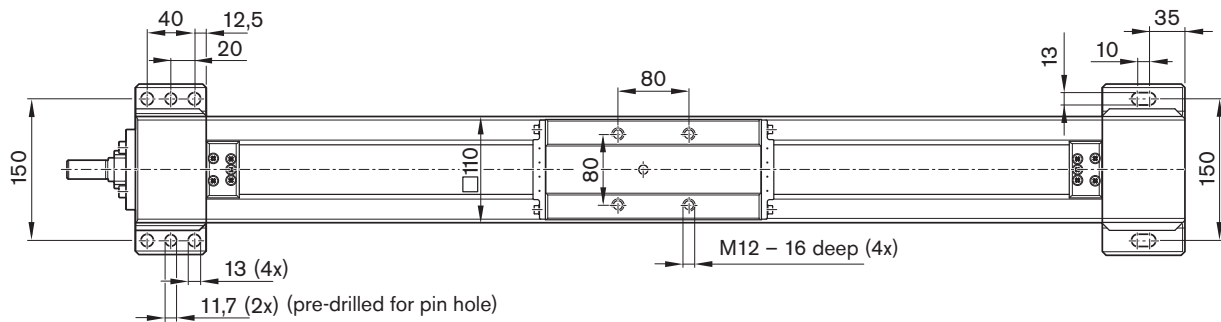
Straightness and flatness tolerance in accordance with DIN EN 12020-02

Fixed bearing end

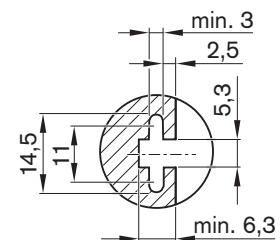
Floating bearing end



Lubrication hole on both sides of Nut Housing.
DIN 3405-A M6 funnel-type lube nipple

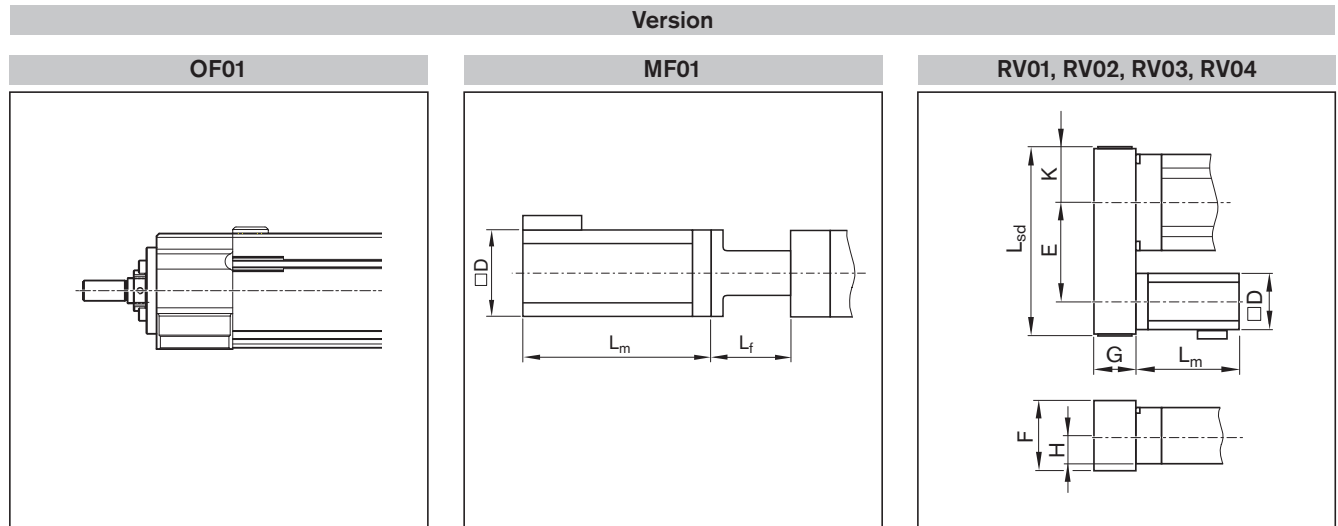


Reference edges on two sides



Slot for switch

Motor attachment dimension drawings



Version	Motor	Dimensions (mm)												
		D	E	i = 1	i = 2	F	G	H	K	L _f	L _m without brake	L _m with brake	L _{sd} i = 1	i = 2
RV01, RV02, RV03, RV04	MSK 076C	140	240	238	160	90	56	77	–	292.5	292.5	409	409	
MF01	MSK 076C	140	–	–	–	–	–	–	140	292.5	292.5	–	–	

See "Motors" section for more information and dimensions

L_{ad} = additional length (see "Technical data" section)

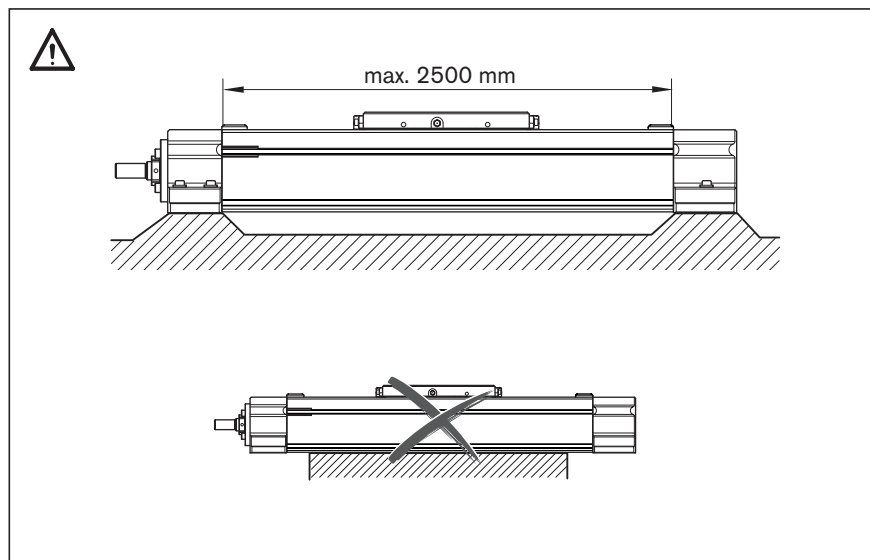
AGK fastening instructions

Fastening Drive Unit to customer-built attachment

Drive Unit fastening points

 Fasten Drive Unit to both pillow blocks only. The protective profile is not a load-bearing part and cannot transmit any forces.

For more information on fastening see "Instructions for AGK Drive Unit" R310D4 3372



Provide supports for the protective profile

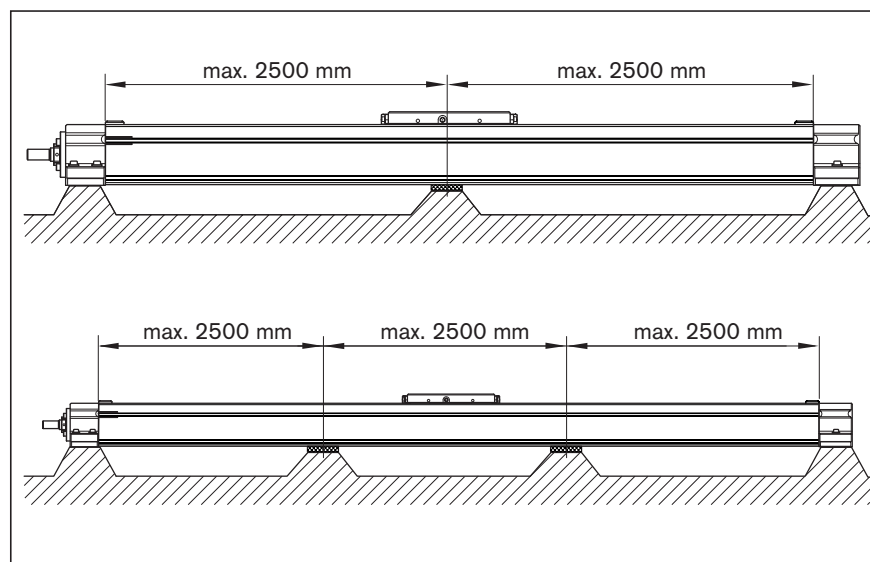
The protective profile may sag under its own weight.

This is why supports should be installed for the protective profile over open lengths of more than 2500 mm.

- Spacing between the support points: max. 2500 mm
- The mounting bases for the protective profile supports and the pillow blocks should be on the same level.

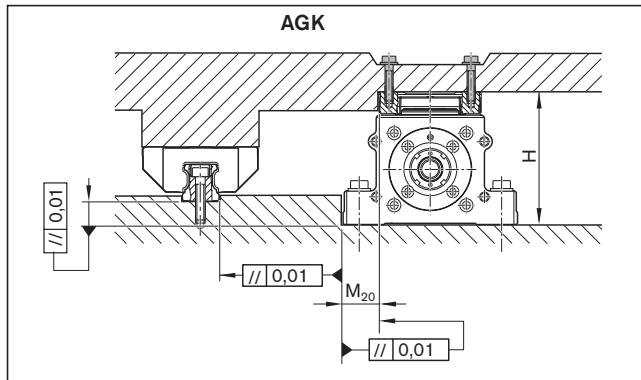
When the Drive Unit is in operation, the protective profile lifts as the drive carriage passes over it, then sinks back down onto the supporting surface.

Provide cushioning material on the surfaces of the protective profile supports, e.g., foam rubber pads.

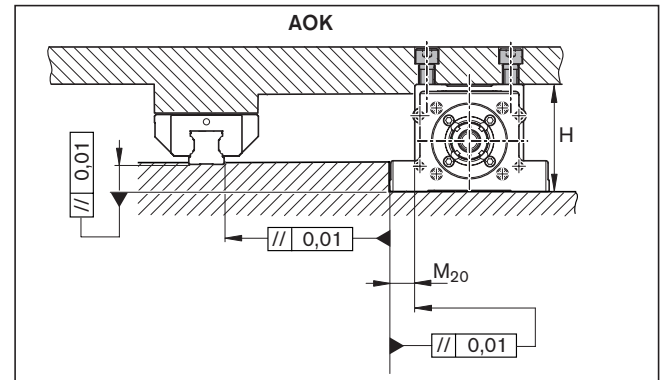


AGK/AOK installation tolerances

Parallelism of customer-built attachments, pillow blocks and rail guides



	Dimensions (mm)	
	H ± 0.01	M ₂₀ ± 0.01
AGK-020	100	35.0
AGK-032	110	30.0
AGK-040	135	37.5



AOK-020 d ₀ x P	Nut	Nut Housing	Dimensions (mm)	
			H ± 0.01	M ₂₀ ± 0.01
20 x 5	ZEM-E	MGA	85	35
	FEM-E-S	MGS	73	35
	FEM-E-C	MGD	69	35
20 x 10	ZEM-E	MGA	85	35
	FEM-E-S	MGS	73	35
	FEM-E-C	MGD	73	35
20 x 20	ZEM-E	MGA	85	35
	FEM-E-S	MGS	75	30
	FEM-E-C	MGD	69	35
20 x 40	ZEM-E	MGA	85	35
	FEP-E-S	MGS	75	30

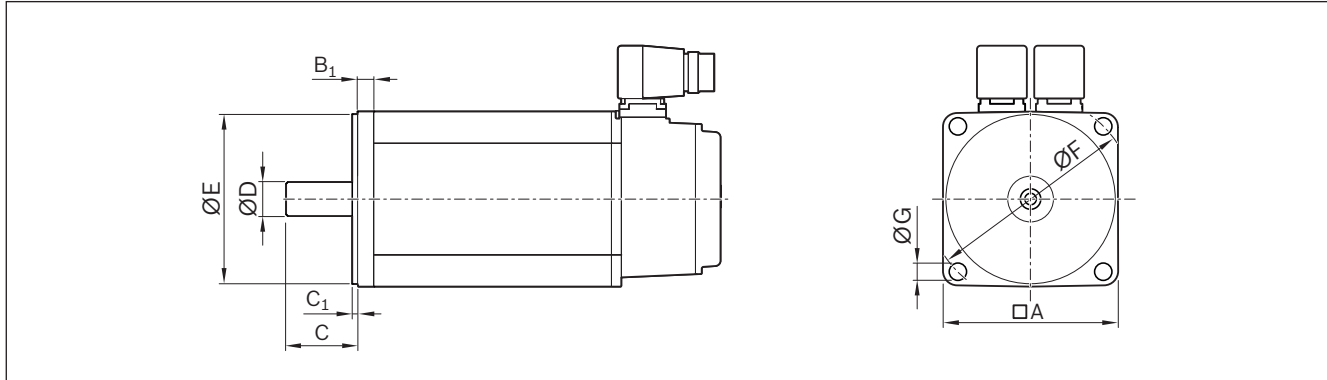
AOK-032 d ₀ x P	Nut	Nut Housing	Dimensions (mm)	
			H ± 0.01	M ₂₀ ± 0.01
32 x 5	ZEM-E	MGA	95	22.5
	FEM-E-S	MGS	84	25
	FEM-E-C	MGD	81	22.5
32 x 10	ZEM-E	MGA	95	22.5
	FEM-E-S	MGS	84	25
	FEM-E-C	MGD	81	22.5
32 x 20	ZEM-E	MGA	95	22.5
	FEM-E-S	MGS	88	20
	FEM-E-C	MGD	81	22.5
32 x 40	ZEM-E	MGA	95	22.5
	FEP-E-S	MGS	88	20
	FEM-E-C	MGD	81	22.5

AOK-040 d ₀ x P	Nut	Nut Housing	Dimensions (mm)	
			H ± 0.01	M ₂₀ ± 0.01
40 x 5	ZEM-E	MGA	115	30
	FEM-E-S	MGS	98	37.5
	FEM-E-C	MGD	98	30
40 x 10	ZEM-E	MGA	115	30
	FEM-E-S	MGS	106	30
	FEM-E-C	MGD	98	30
40 x 20	ZEM-E	MGA	115	30
	FEM-E-S	MGS	106	30
	FEM-E-C	MGD	98	30
40 x 40	ZEM-E	MGA	115	30
	FEP-E-S	MGS	114	20
	FEM-E-C	MGD	98	30

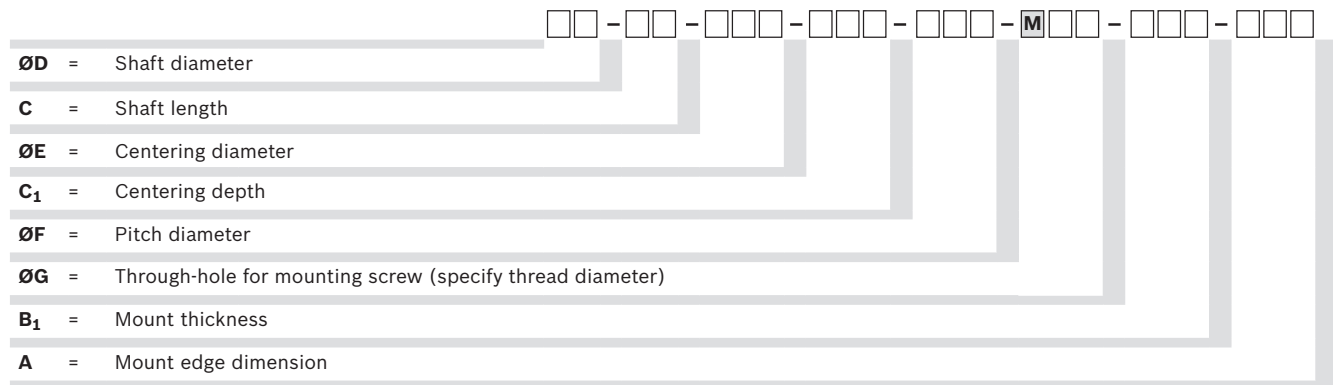
Attachment kits for motors according to customer specification

The motor of a linear motion system with ball screw drive is attached by either an attachment kit with mount and coupling (MF) or a timing belt side drive (RV).

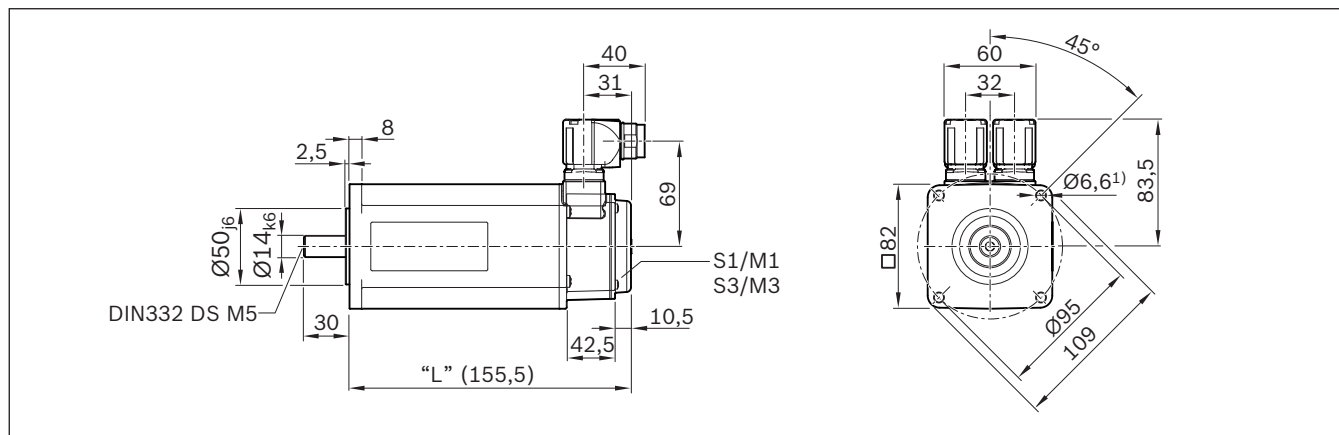
The available combinations are shown in the “Configuration and ordering” selection tables for each size. In addition to attachment kits for Rexroth motors, attachment kits for motors according to customer specification are also available. In order to determine the appropriate attachment kit, the connection geometry of the motor is crucial. Characteristics required to clearly determine motor geometry are shown below.



The dimensions queried result in a unique “motor geometry code”:



Example illustration of servo motor IndraDyn S Type MSK040C

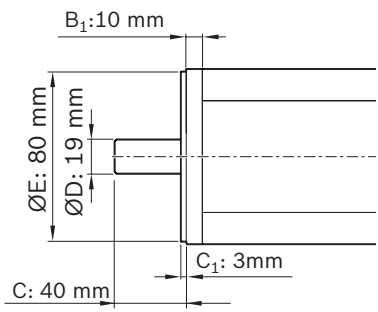


1 4 - 3 0 - 0 5 0 - 2 . 5 - 0 9 5 - M 0 6 - 0 0 8 - 0 8 2

¹⁾ The through-hole Ø 6.6 mm results in the type designation M06 for the geometry motor code (M6 fastening screw nominal thread).

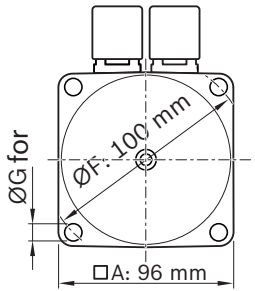
Attachment kits for motors according to customer specification can be configured using the online configurator in the eShop. To do this, select the “Attachment kits for motors according to customer specification” option.

Enter motor geometry in the input dialog box. The dimensions can be entered directly or by using a drop-down menu.



Ø G for: ▼

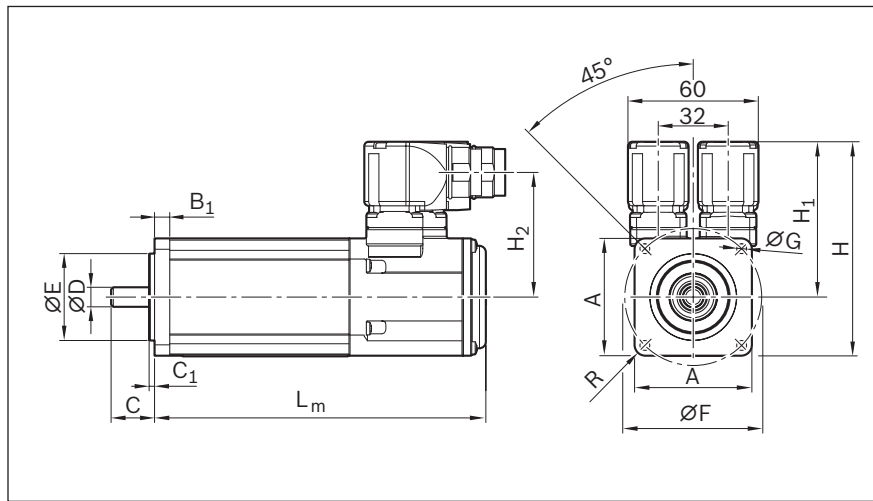
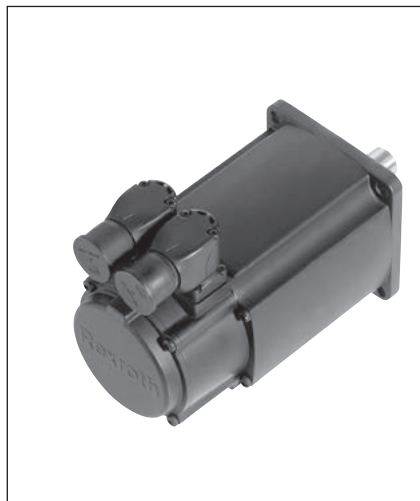
- M3
- M4
- M5
- M6
- M8
- M10
- M12
- M16
- M20



88 Drive Units

Attachments and Accessories

IndraDyn S - MSK servo motors



Motor schematic

Motor	Dimensions (mm)													
	A	B ₁	C	C ₁	ØD k6	ØE j6	ØF	ØG	H	H ₁	H ₂	L _m		R
												without holding brake	with holding brake	
MSK 040C-0600	82	8.0	30	2.5	14	50	95	6.6	124.5	83.5	69.0	185.5	215.5	R8
MSK 050C-0600	98	9.0	40	3.0	19	95	115	9.0	134.5	85.5	71.0	203.0	233.0	R8
MSK 060C-0600	116	9.5	50	3.0	24	95	130	9.0	156.5	98.5	84.0	226.0	259.0	R9
MSK 076C-0450	140	14.0	50	4.0	24	110	165	11.0	180.0	110.0	95.6	292.5	292.5	R12

Motor data

Motor	n _{max} (rpm)	M ₀ (Nm)	M _{max} (Nm)	M _{br} (Nm)	J _m (kgm ²)	J _{br} (kgm ²)	m _m (kg)	m _{br} (kg)
MSK 040C-0600	7 500	2.7	8.1	4	0.000140	0.000023	3.6	0.3
MSK 050C-0600	6 000	5.0	15.0	5	0.000330	0.000107	5.4	0.7
MSK 060C-0600	6 000	8.0	24.0	10	0.000800	0.000059	8.4	0.8
MSK 076C-0450	5 000	12.0	43.5	11	0.004300	0.000360	13.8	1.1

J_{br} = holding brake mass moment of inertia

J_m = motor mass moment of inertia

L_m = motor length

M₀ = torque at standstill

M_{br} = holding torque of holding brake when switched off

M_{max} = max. motor torque

m_m = motor mass

m_{br} = holding brake mass

n_{max} = max. rotary speed

Option number ¹⁾	Motor	Part number	Version		Type designation
			Holding brake		
			Without	With	
86	MSK040C-0600	R911306060	X		MSK040C-0600-NN-M1-UG0-NNNN
87		R911306061		X	MSK040C-0600-NN-M1-UG1-NNNN
88	MSK050C-0600	R911298354	X		MSK050C-0600-NN-M1-UG0-NNNN
89		R911298355		X	MSK050C-0600-NN-M1-UG1-NNNN
90	MSK060C-0600	R911306052	X		MSK060C-0600-NN-M1-UG0-NNNN
91		R911306053		X	MSK060C-0600-NN-M1-UG1-NNNN
92	MSK076C-0450	R911318098	X		MSK076C-0450-NN-M1-UG0-NNNN
93		R911315713		X	MSK076C-0450-NN-M1-UG1-NNNN

¹⁾ From "Configuration and ordering" table

Version

- ▶ Plain shaft with shaft seal
- ▶ Multi-turn absolute encoder M1 (Hiperface)

- ▶ Cooling system: natural convection
- ▶ IP65 rating (housing)
- ▶ With or without holding brake

Note

Motors are available with controllers and control systems. See the Rexroth Drive Technology catalog for other motor types and more information on motors, controllers and control systems.

Rexroth Medienverzeichnis

Kategorien		
▶ Elektrische Antriebe und Steuerungen	▶ Allgemeines	▶ IndraDrive
▶ Industriehydraulik	▶ Antriebstechnik	▶ IndraDrive Cs
▶ Mobilhydraulik	▶ Automatisierungssysteme	▶ IndraDrive Mi
▶ Linear- und Montagetechnik	▶ Einpresssysteme	▶ IndraDrive ML
▶ Systeme	▶ Engineering	▶ IndraDrive Fc
▶ Training	▶ Schraubsysteme	▶ Frequency Converter EFC 3600
▶ Gesamtunternehmen	▶ Steuerungskomponenten	▶ Frequency Converter EFC 3610/5610
▶ Branchen	▶ Widerstandsschweißen	▶ Frequency Converter VFC 3610/5610
▶ Guss		▶ Frequency Converter Fe
▶ Service		▶ Frequency Converter Fv
▶ Länder		

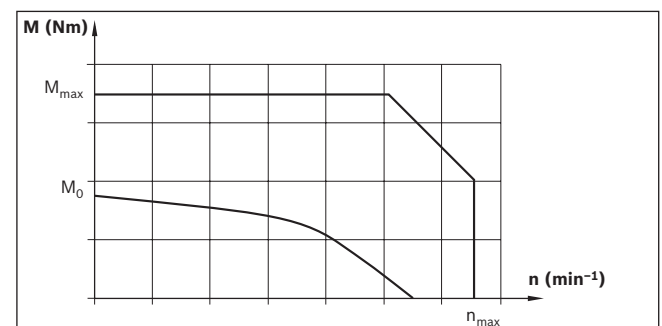
Recommended motor/controller combination



Motor	Controller
MSK 040C-0600	HCS 01.1E-W0008
MSK 040C-0600	HCS 01.1E-W0018
MSK 050C-0600	
MSK 050C-0600	HCS 01.1E-W0028
MSK 060C-0600	
MSK 060C-0600	HCS 01.1E-W0054
MSK 076C-0450	

Torque/speed characteristic

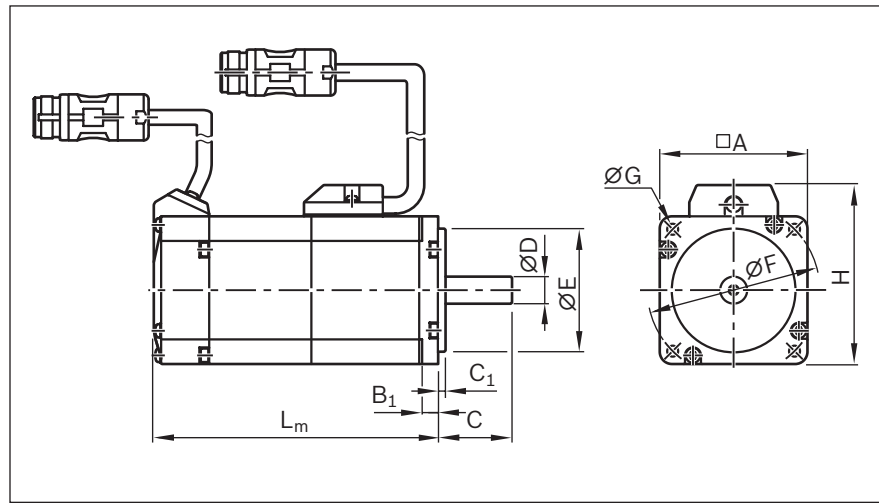
(schematic)



90 Drive Units

Attachments and Accessories

IndraDyn S - MSM servo motors



Motor schematic

Motor	Dimensions (mm)										
	A	B ₁	C	C ₁	ØD h6	ØE h7	ØF	ØG	H	without holding brake	L _m with holding brake
MSM 041B-0300	80	8.0	35	3	19	70	90	6.0	93	112.0	149.0

Motor data

Motor	n _{max} (rpm)	M ₀ (Nm)	M _{max} (Nm)	M _{br} (Nm)	J _m (kgm ²)	J _{br} (kgm ²)	m _m (kg)	m _{br} (kg)
MSM 041B-0300	4 500	2.40	7.10	2.45	0.0000870	0.0000075	2.30	0.80

J_{br} = holding brake mass moment of inertia

J_m = motor mass moment of inertia

L_m = motor length

M₀ = torque at standstill

M_{br} = holding torque of holding brake when switched off

M_{max} = max. motor torque

m_m = motor mass

m_{br} = holding brake mass

n_{max} = max. rotary speed

Option number ¹⁾	Motor	Part number	Version		Type designation
			Holding brake		
			Without	With	
140	MSM 041B-0300	R911344217	X		MSM 041B-0300-NN-M5-MH0
141		R911344218		X	MSM 041B-0300-NN-M5-MH1

¹⁾ From "Configuration and ordering" table

Versions:

- ▶ Plain shaft without shaft seal
- ▶ Multiturn absolute encoder M5 (20 bit, absolute encoder function only available with backup battery)
- ▶ Cooling system: natural convection
- ▶ Protection class IP54 (shaft IP40)
- ▶ With or without holding brake
- ▶ Metal round connector M17

Note

Motors are available with controllers and control systems. See the Rexroth Drive Technology catalog for other motor types and more information on motors, controllers and control systems.

Rexroth Medienverzeichnis

Kategorien		
▶ Elektrische Antriebe und Steuerungen	▶ Allgemeines	▶ IndraDrive
▶ Industriehydraulik	▶ Antriebstechnik	▶ IndraDrive Cs
▶ Mobilhydraulik	▶ Automatisierungssysteme	▶ IndraDrive Mi
▶ Linear- und Montagetechnik	▶ Einpresssysteme	▶ IndraDrive ML
▶ Systeme	▶ Engineering	▶ IndraDrive Fc
▶ Training	▶ Schraubsysteme	▶ Frequency Converter EFC 3600
▶ Gesamtunternehmen	▶ Steuerungskomponenten	▶ Frequency Converter EFC 3610/5610
▶ Branchen	▶ Widerstandsschweißen	▶ Frequency Converter VFC 3610/5610
▶ Guss		▶ Frequency Converter Fe
▶ Service		▶ Frequency Converter Fv
▶ Länder		

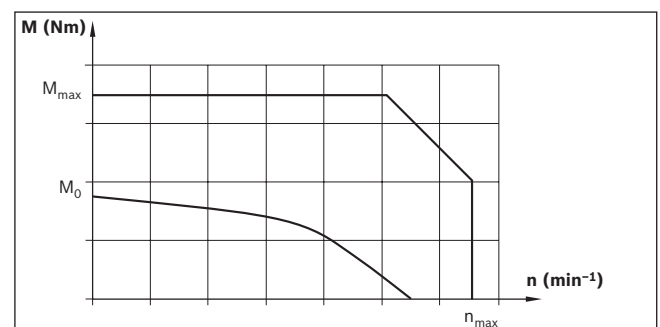
Recommended motor/controller combination



Motor	Controller
MSM 041B-0300	HCS 01.1E-W0013

Torque/speed characteristic

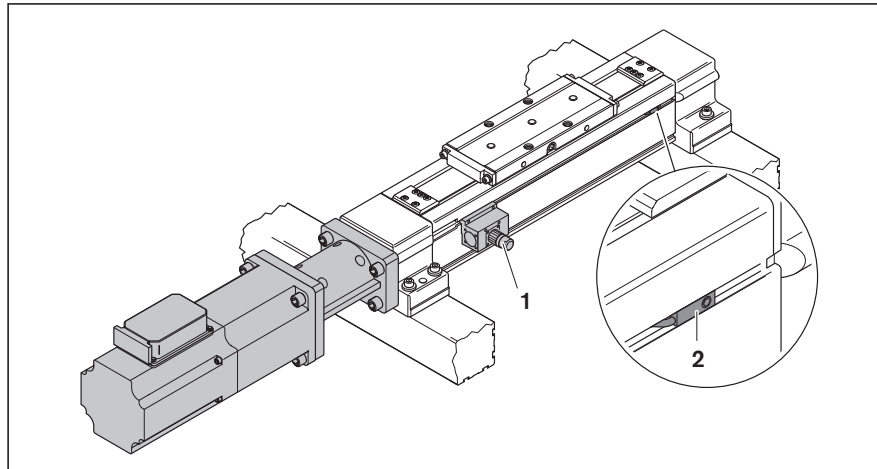
(schematic)



AGK switch mounting arrangements

Switching system overview

- 1 Socket and plug
- 2 Magnetic field sensor



Switch mounting arrangements

- 1 Switch (magnetic field sensor) with potted cable
- 2 Set screw for securing
- 3 Cable

The switch activator is a magnet integrated in the Nut Housing (no switching angle required).

The switching positions can be freely configured via the stroke.

Version

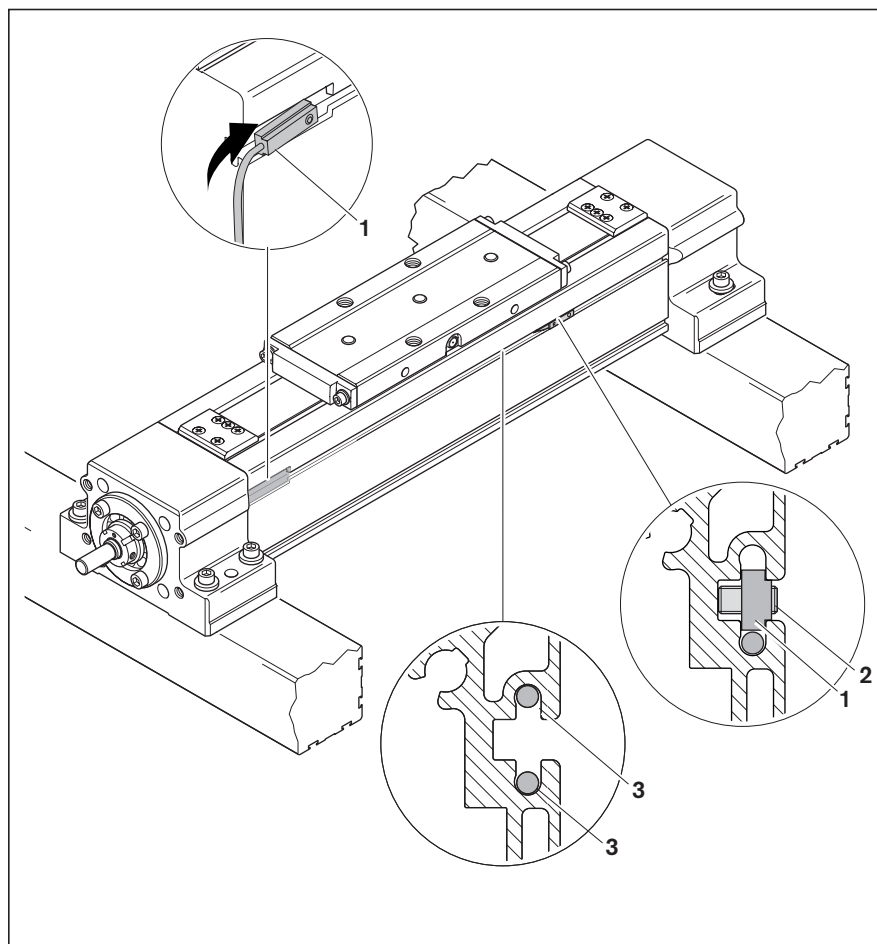
- Hall sensor (PNP NC) or
- REED sensor (changeover)

See "Sensors" section for technical data

Notes for mounting

- Insert sensor (1) with set screw (2) facing outward into upper T-slot of housing.
- Set switching point and secure sensor with set screw (2).
- Press the signal cable (3) into the upper or lower cable run of the T-slot to secure it.

See instructions for more specific information on installation and switching positions.



Socket-plug mounting arrangements

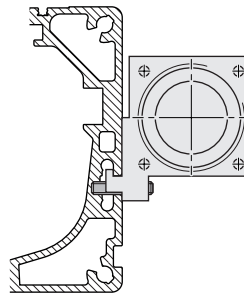
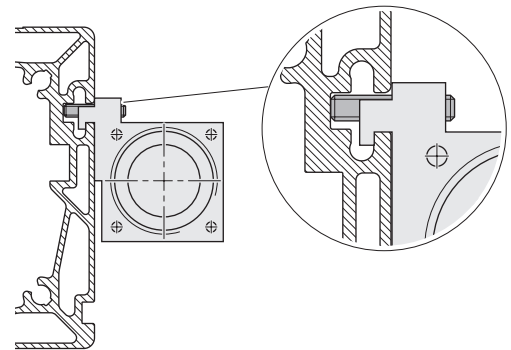
Mounting orientation

Various socket and plug arrangements are possible depending on requirements. See "Sockets and plugs" section for technical data.



Securing socket to AGK protective profile

- AGK-020:
Attach socket in lower T-slot of protective profile and secure with two set screws.
- AGK-032, AGK-040:
Attach socket to upper T-slot of protective profile and secure with two set screws.

AGK-020

AGK-032, AGK-040


Switches and attachments

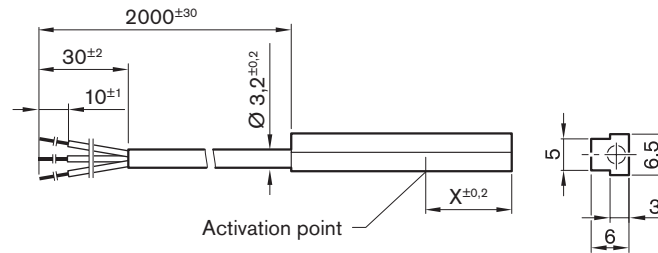
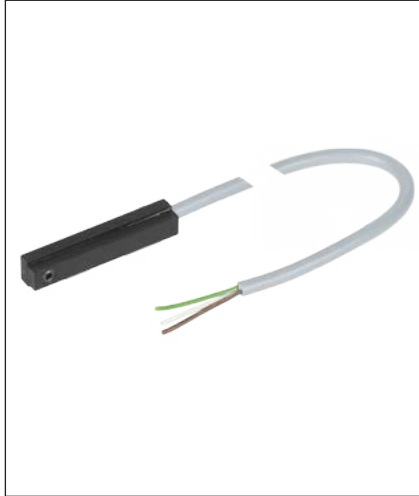
Description	Switching function		Option number ¹⁾	Part number
Socket-plug	—		17	R117500153
Magnetic sensor	REED	Changeover contact (NC: C+NC; NO:C+NO)	21	R347600903
	Hall	PNP/normally closed (NC)	22	R347601003
	Hall	PNP/normally open (NO)	nv ²⁾	R347601203
	Hall	NPN/normally closed (NC)	nv ²⁾	R347601303
	Hall	NPN/normally open (NO)	nv ²⁾	R347601403

¹⁾ From "Configuration and ordering" table

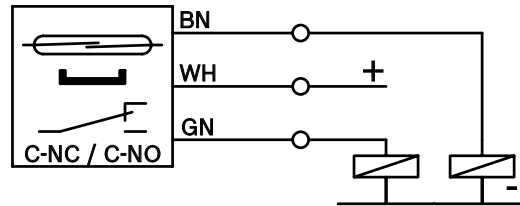
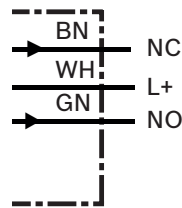
²⁾ Option not available. Switch only available as accessory with part number

Sensors

Magnetic sensor with free cable end

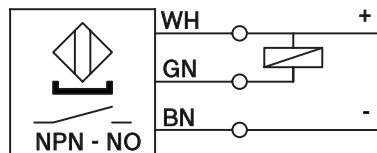
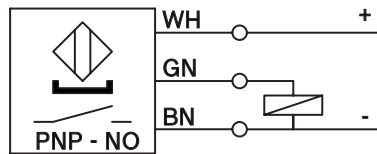
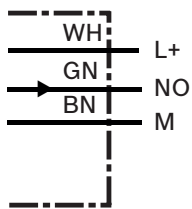


R347600903



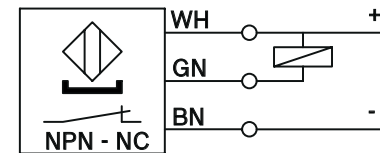
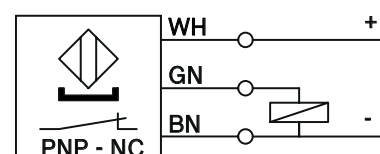
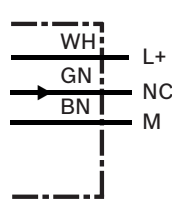
R347601203

R347601403



R347601003

R347601303



Part number R347600903

Use	Reference, limit switch
Part number	R347600903
Designation	R12212
Functional principle	Magnetic
Operating voltage	max. 30 V DC
Load current	500 mA
Switching function	REED/changeover contact (NC: C+NC, NO: C+NO)
Activation point (dimension "X")	9 mm

Part number R347601003 / R347601203 / R347601403 / R347601303

Use	Limit switch	Reference switch	Limit switch	Reference switch
Part number	R347601003	R347601203	R347601303	R347601403
Designation	H14118	H15637	H15638	H15080
Functional principle	Magnetic			
Operating voltage	3.8 - 30 V DC			
Load current	≤ 20 mA			
Switching function	Hall PNP/normally closed (NC)	Hall PNP/normally open (NO)	Hall NPN/normally closed (NC)	Hall NPN/normally open (NO)
Activation point, dimension "X"	13.65 mm			

Technical data for R347600903/R347601003/R347601203/R347601403/R347601303

Connection type	Cable 2.0 m, 3-pin
Galvanized connection ends	4
Function indicator	—
Short-circuit protection	—
Reverse polarity protection	—
Switch-on suppression	—
Switching frequency	2.5 kHz
Pulse delay (Off delay)	—
Max. permissible approach speed	2 m/s
Suitable for drag chains*	—
Torsion-resistant*	—
Weld spark-resistant*	—
Cable cross-section*	3x 0.14 mm ²
Cable diameter D	3.2 ± 0.20 mm
Static bending radius*	—
Dynamic bending radius*	—
Bending cycles*	—
Max. permissible linear speed*	—
Max. permissible acceleration*	—
Ambient temperature	−40 °C to +85 °C
Protection rating	IP66
MTTFd (acc. to EN ISO 13849-1)	—
Certifications and approvals**	—

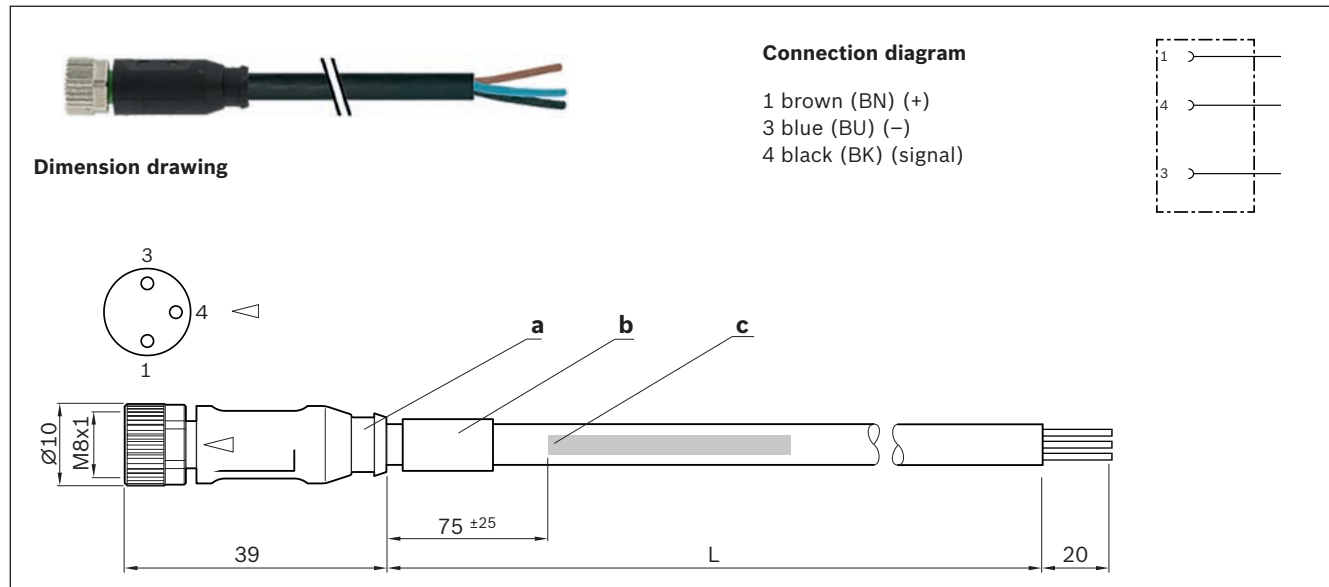
* Technical data only for built-in sensor connection cable.

Extension cables are available for even more performance, e.g., for use in a power cable chain (see below).

** No  certificate is required to introduce these products to the Chinese market.

Extensions

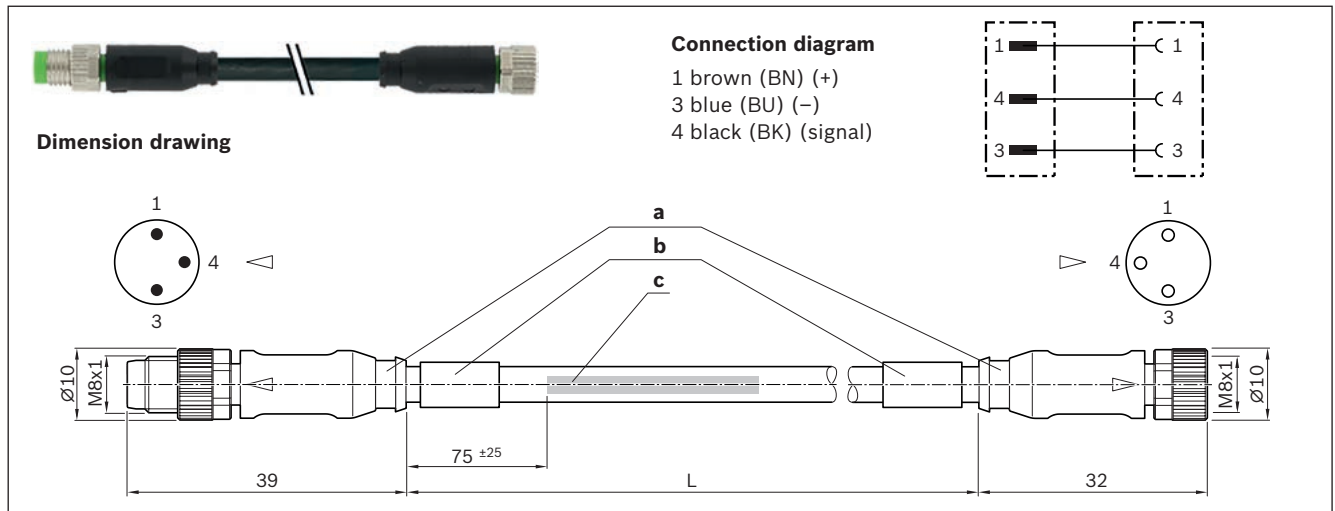
Pre-assembled on one side



Part numbers

Use	Extension cable		
Part number	R911344602	R911344619	R911344620
Designation	7000-08041-6500500	7000-08041-6501000	7000-08041-6501500
Length (L)	5.0 m	10.0 m	15.0 m
1st connection type	Straight plug, M8x1, 3-pin		
2nd connection type	free cable end		

Pre-assembled on two sides



Part numbers

Use	Extension cable				
Part number	R911344621	R911344622	R911344623	R911344624	R911344625
Designation	7000-88001-6500050	7000-88001-6500100	7000-88001-6500200	7000-88001-6500500	7000-88001-6501000
Length (L)	0.5 m	1.0 m	2.0 m	5.0 m	10.0 m
1st connection type	M8x1 3-pole straight female connector				
2nd connection type	Straight plug, M8x1, 3-pin				

Technical data for extensions pre-assembled on one or two sides

Function indicator	—
Operating voltage indicator	—
Operating voltage	10–30 V DC
Type of cable	PUR black
Suitable for drag chains	✓
Torsion-resistant	✓
Weld spark-resistant	✓
Cable cross-section	3 x 0.25 mm ²
Cable diameter D	4.1 ± 0.2 mm
Static bending radius	≥ 5xD
Dynamic bending radius	≥ 10xD
Bending cycles	> 10 mil.
Max. permissible linear speed	3.3 m/s over 5 m (typ.) to 5 m/s over 0.9 m
Max. permissible acceleration	≤ 30 m/s ²
Ambient temperature when secured	-40 °C to +85 °C
Ambient temperature when loose	-25 °C to +85 °C
Protection rating	IP68
Certifications and approvals	    

a) Contour for 6.5 mm corrugated tube (inner diameter)

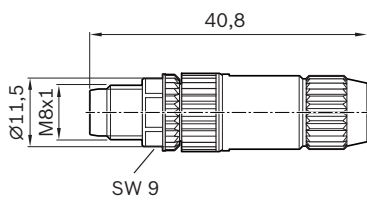
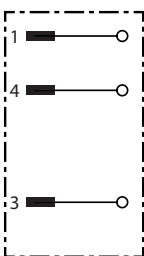
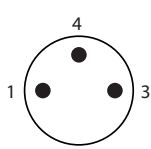
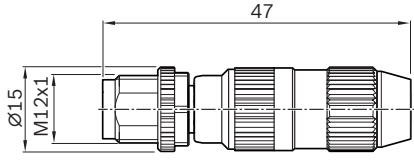
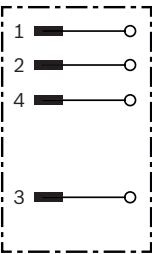
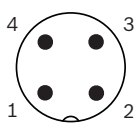
b) Cable grommet

c) Cable label in accordance with labeling regulation

98 Drive Units

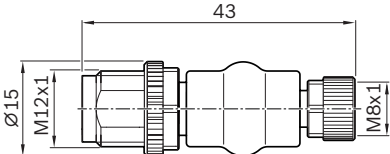
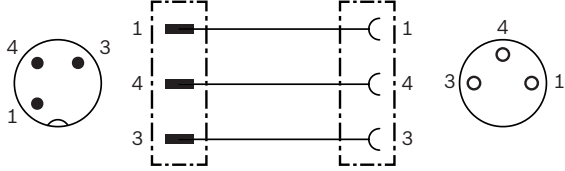
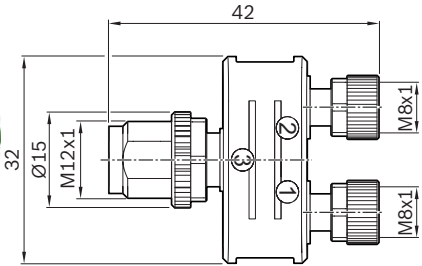
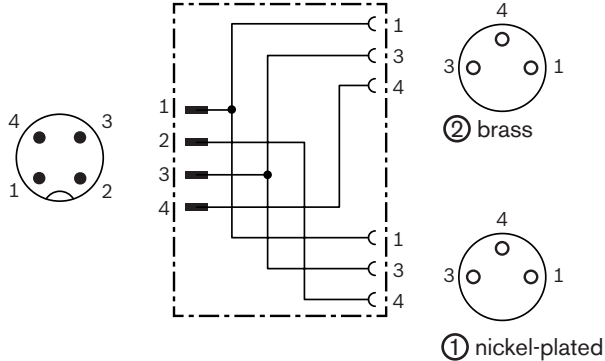
Attachments and Accessories

Plugs

	Dimension drawing	Connection diagram	Connector side view
 R901388333			
 R901388352			

Part numbers / technical data		
Use	Single plug	
Part number	R901388333	R901388352
Designation	7000-08331-0000000	7000-12491-0000000
Version	straight	
Operating current per contact	max. 4 A	
Operating voltage	Max. 32 V AC/DC	
Connection type	Straight plug, M8x1, 3-pin, IDC, self-locking screw	Straight plug, M12x1, 4-pin, IDC, self-locking screw
Function indicator	-	
Operating voltage indicator	-	
Connection cross-section	0.14...0.34 mm ²	
Ambient temperature	-25 °C to +85 °C	
Protection rating	IP67 (plugged in & screwed down)	
Certifications and approvals	  	

Adapters

	Dimension drawing	Connection diagram
 R911344591		
 R911344592		

Part numbers / technical data

Use	Adapter	Adapter or distributor
Part number	R911344591	R911344592
Designation	7000-42201-0000000	7000-41211-0000000
Version	straight for 1 sensor	straight, for 1 - 2 sensors
Operating current per contact	max. 4 A	
Operating voltage	max. 32 V AC/DC	
1st connection type	Straight female connector, M8x1, 3-pin, IDC, self-locking screw thread	2 X straight female connectors, M8x1, 3-pin, IDC, self-locking screw thread
2nd connection type	Straight plug, M12x1, 3-pin, IDC, self-locking screw thread	Straight plug, M12x1, 4-pin, IDC, self-locking screw thread
Function indicator	-	
Operating voltage indicator	-	
Connection cross-section	-	
Ambient temperature	-25 °C to +85 °C	
Protection rating	IP67 (plugged in & screwed down)	
Certifications and approvals		  

100 Drive Units

Attachments and Accessories

Passive distributors



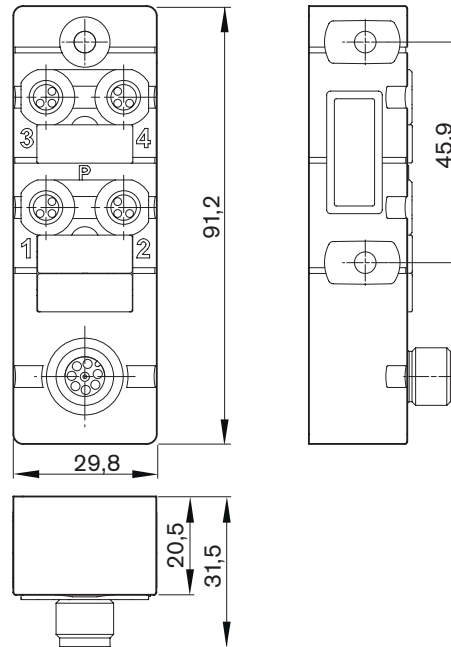
R901425737



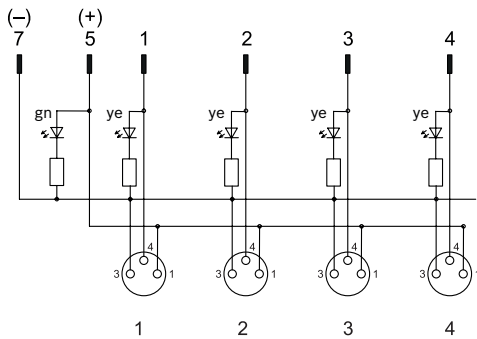
R901429917



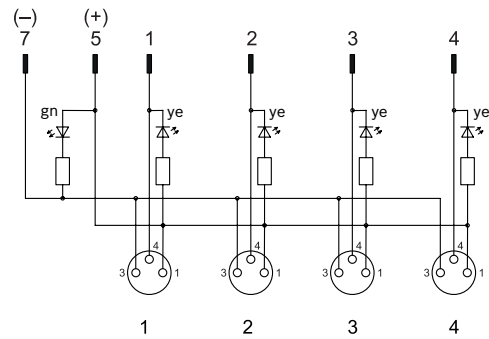
R911344592



R901425737



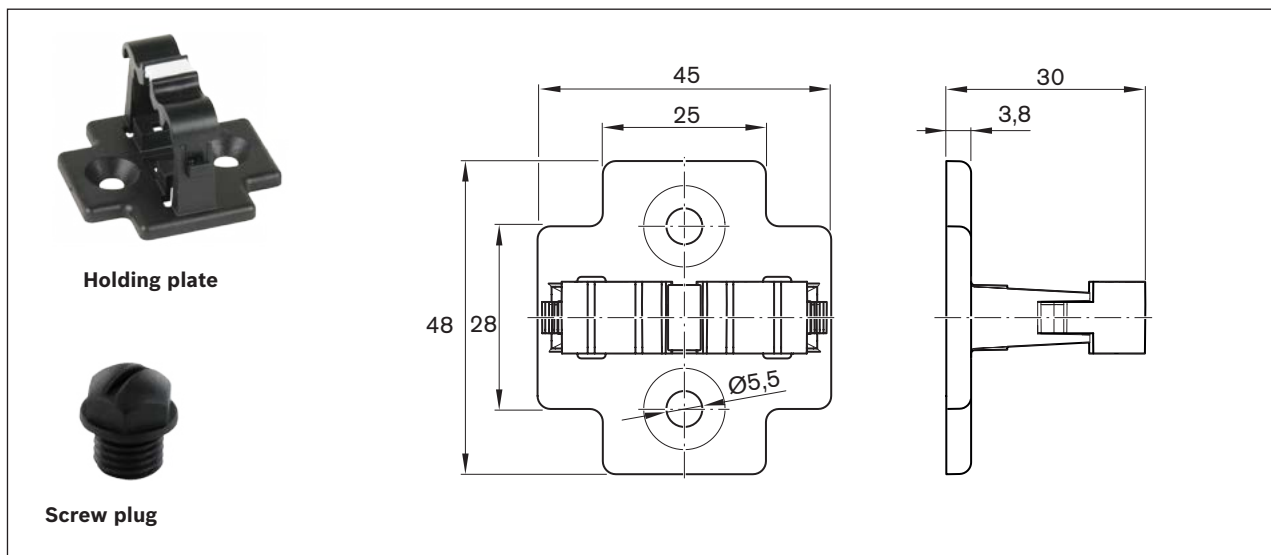
R901429917



Part numbers / technical data

Use	Passive distributor		
Part number	R901425737	R901429917	R911344592
Designation	8000-84070-0000000	8000-84071-0000000	
Version	Straight, for 1 - 4 sensors		
Operating current per contact	max. 2 A		
Operating voltage	24 V DC		
Switching logic	PNP	NPN	
1st connection type	4x straight female connector, M8x1, 3-pin, IDC, self-locking screw thread		
2nd connection type	Straight plug, M12x1, 8-pin, IDC, self-locking screw thread		
Function indicator	✓		
Operating voltage indicator	✓		
Connection cross-section	-		
Ambient temperature	-20° to +70 °C		
Protection rating	IP67 (plugged in & screwed down)		
Certifications and approvals			

See the adapter for technical data and drawing

Accessories for passive distributors

Part numbers / technical data

Use	For passive distributor R911344592	For passive distributors R901425737/R901429917
Holding plate	R913047341	–
Designation	7000-99061-0000000	–
Set	1 pc.	–
Screw plug	–	R913047322
Designation	–	3858627
Set	–	10 pcs.

102 Drive Units

Attachments and Accessories

Extensions for passive distributors

R911371982



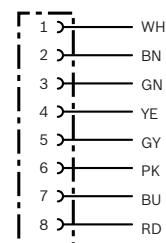
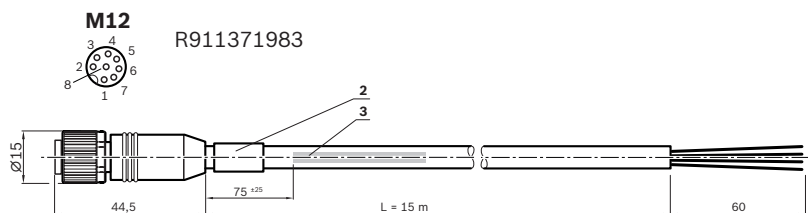
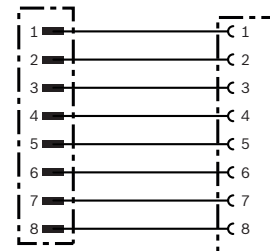
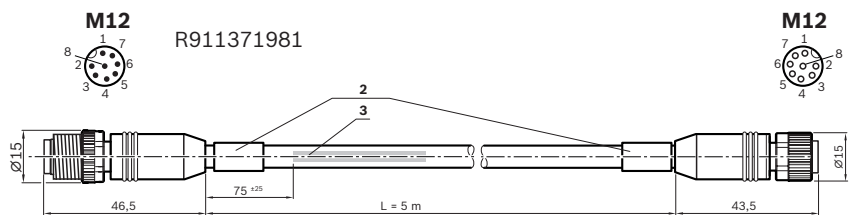
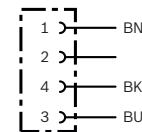
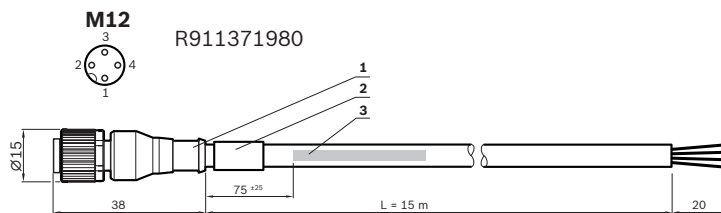
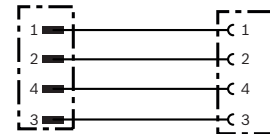
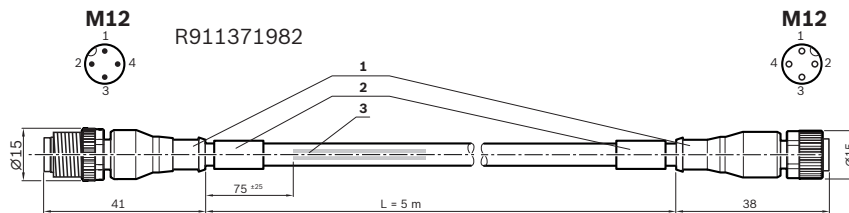
R911371981



R911371980



R911371983

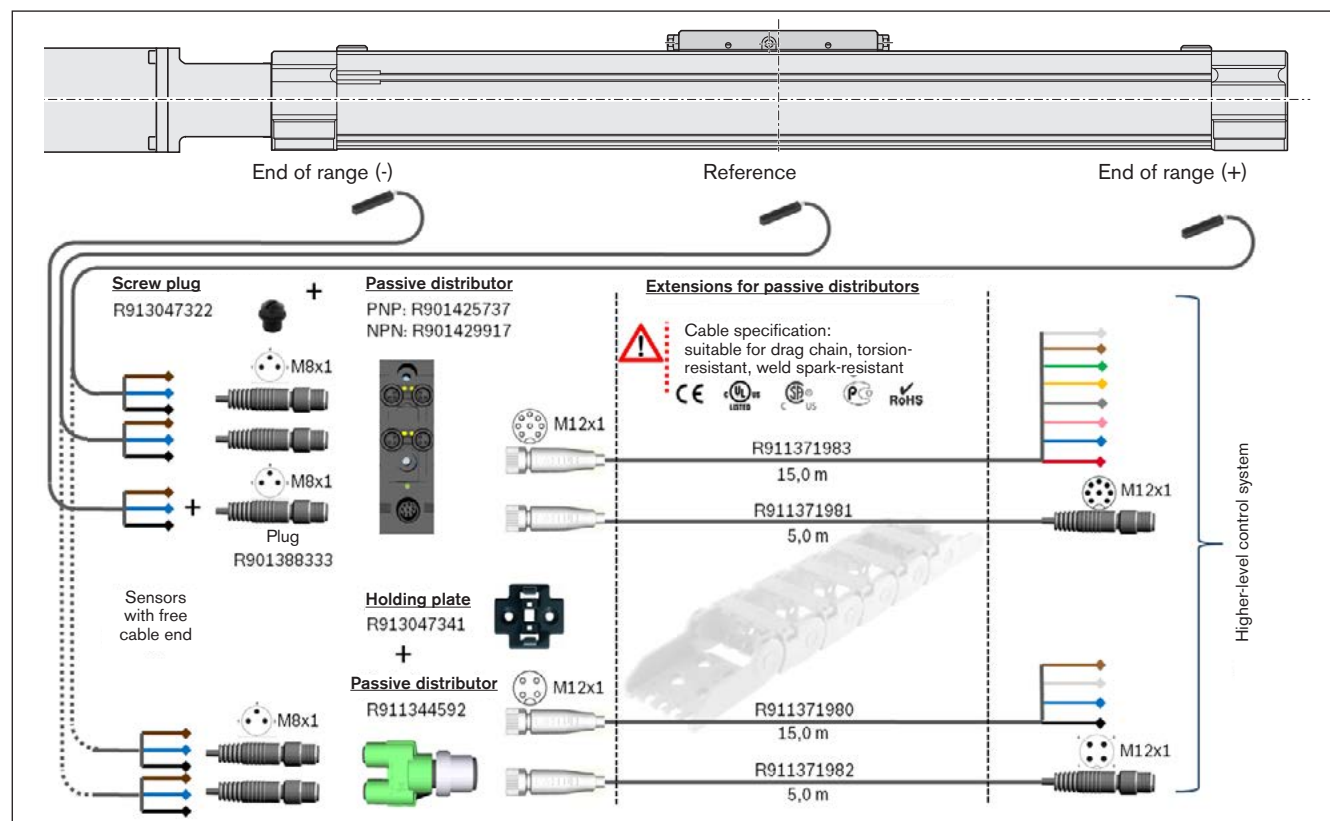
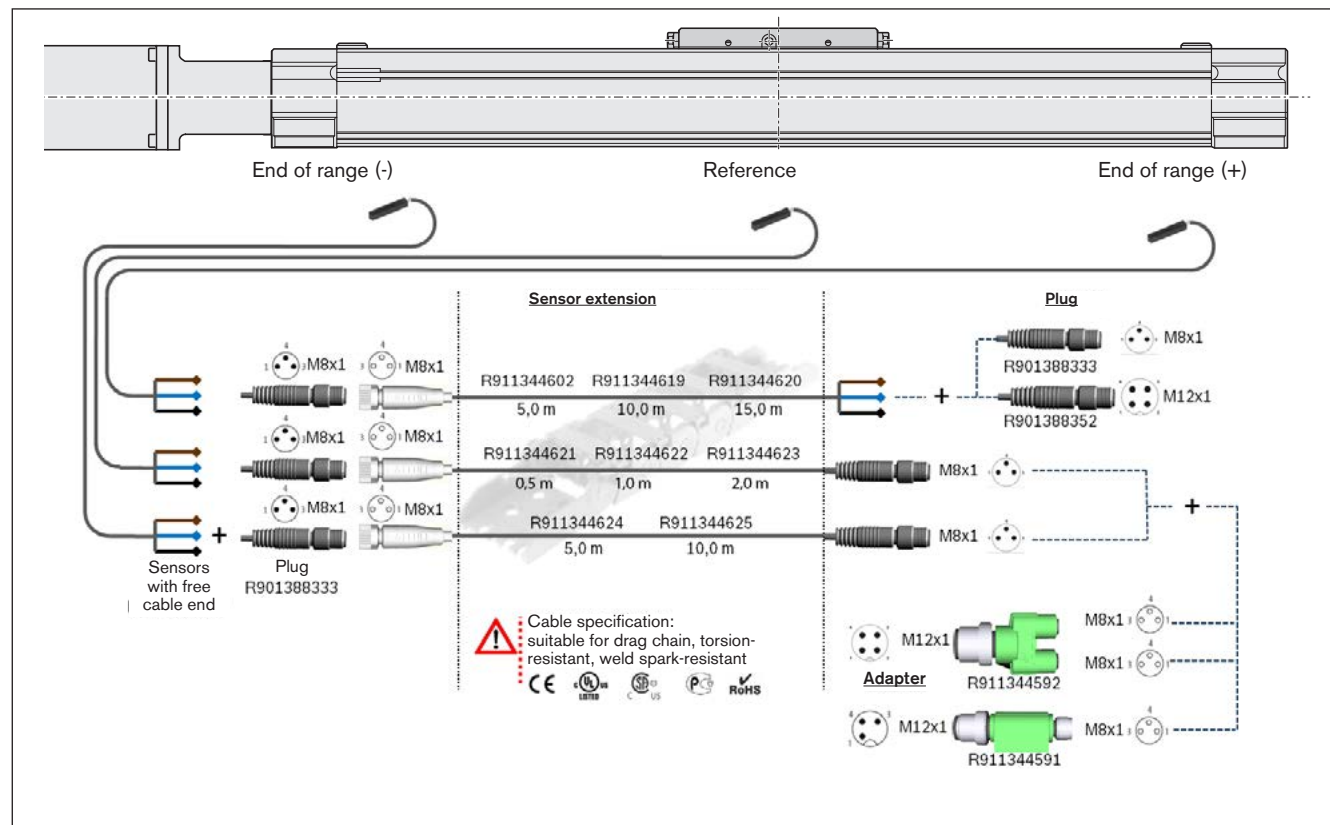


- 1) Contour for 10 mm corrugated tube (inner diameter)
- 2) Cable grommet
- 3) Label in accordance with ordering regulation 7000-08001

Part numbers / technical data

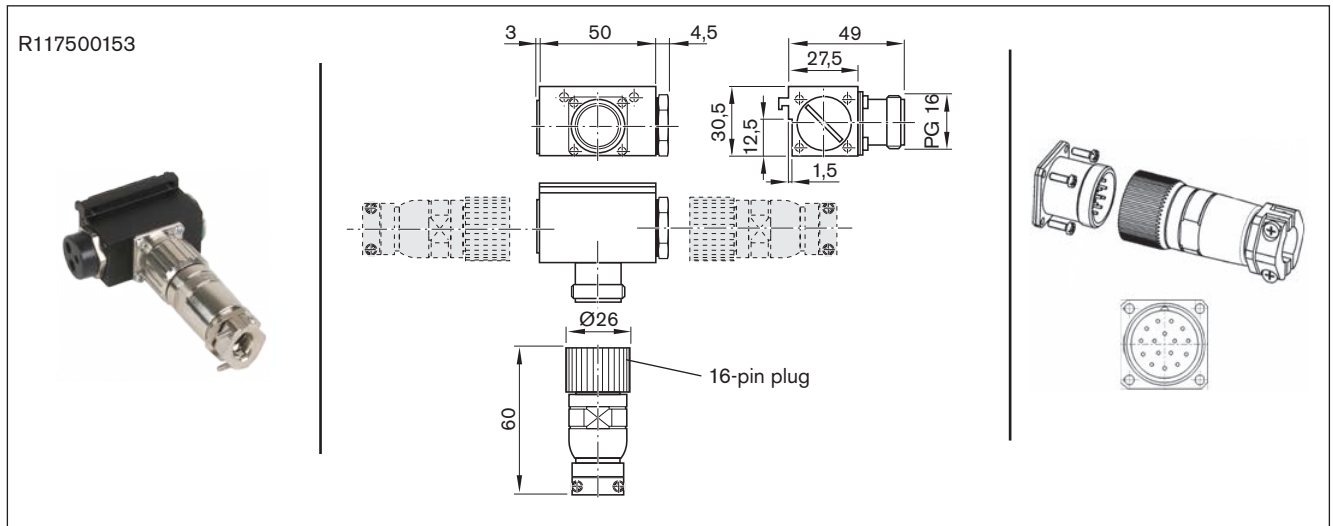
Use	Extension cable for passive distributor R911344592		Extension cable for passive distributors R901425737/R901429917	
Part number	R911371982	R911371980	R911371981	R911371983
Designation	7000-40021-6540500	7000-12221-6541500	7000-48001-3770500	7000-17041-3771500
Length	5.0 m	15.0 m	5.0 m	15.0 m
1st connection type	Straight female connector, M12x1, 4-pin		Straight female connector, M12x1, 8-pin	
2nd connection type	Straight plug, M12x1, 4-pin	Free cable end	Straight plug, M12x1, 8-pin	Free cable end
Function indicator	-			
Operating voltage indicator	-			
Type of cable	PUR black		PUR gray	
Operating voltage	30 V AC/DC			
Operating current per contact	max. 4 A per contact		max. 2 A per contact	
Suitable for drag chains	✓			
Torsion-resistant	✓			
Weld spark-resistant	✓			
Cable cross-section	4x 0.34 mm ²		8x 0.34 mm ²	
Cable diameter D	4.7 +/- 0.2 mm		6.2 +/- 0.3 mm	
Static bending radius	≧ 5 x D			
Dynamic bending radius	≧ 10 x D			
Bending cycles	> 10 mil.			
Max. permissible linear speed	3.3 m/s - at 5m travel range (type) up to 5 m/s at 0.9m travel range			
Max. permissible acceleration	≤ 30 m/s ²			
Ambient temperature when secured	-40 °C to +80 °C (90° max. 10000 h)			
Ambient temperature when loose	-25 °C to +80 °C (90° max. 10000 h)			
Protection rating	IP67 (plugged in & screwed down)			
Certifications and approvals	    			

Combination examples



Socket and plug

Attach the socket on the side with the magnetic switches. Socket and plug are not pre-wired. The variable sliding attachment allows switching positions to be optimized during start-up. The plug can be installed in three directions.



Use	Socket and plug
Part number	R117500153
Designation	for AGK-020 -032 -040
Version	angled, for suspension in the lateral slot of the linear motion system
Operating current per contact	max. 8 A
Operating voltage	150 V AC/DC
1st connection type	Straight plug, 16-pin, soldered connection
2nd connection type	Coupling / flange socket, 16-pin, soldered connection
Housing cable bushing	1 seal with bore 2x5.5 mm, 1x3.5 mm hole 1 adaptable seal, max. 14 mm diameter incl. cap and dummy plug
Cable bushing, plug	Gland with pull relief
Connection cross-section	0.14...1 mm
Cable diameter	10...14 mm
Ambient temperature	-20 °C to +125 °C
Protection rating	—
Certifications and approvals	—

Operating conditions

Normal operating conditions

Ambient temperature with Rexroth servo motor	0 °C ... 40 °C, loss of performance above 40 °C
Ambient temperature for mechanical system (without dropping below dew point)	-10 °C ... 60 °C
Travel $s_{\min}^{1)}$	See "Technical data" tables
Contamination	not permissible

1) Minimum travel to ensure a reliable lubrication distribution.

Required and supplementary documentation

For further instructions and information, please refer to the documentation for this product.

You can find PDF files of these documents on the Internet at www.boschrexroth.com/mediadirectory

We would also be happy to send you the documents you want.

If you are unsure about using this product, please contact Bosch Rexroth.

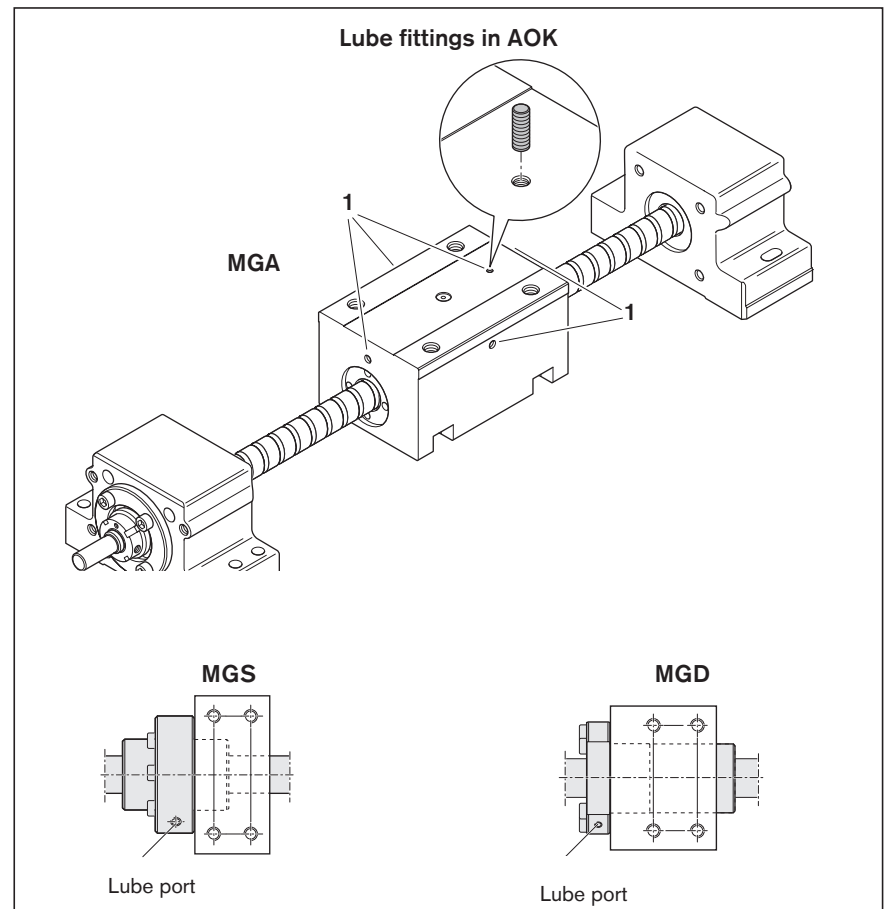
Lubrication

Lube fittings

AOK

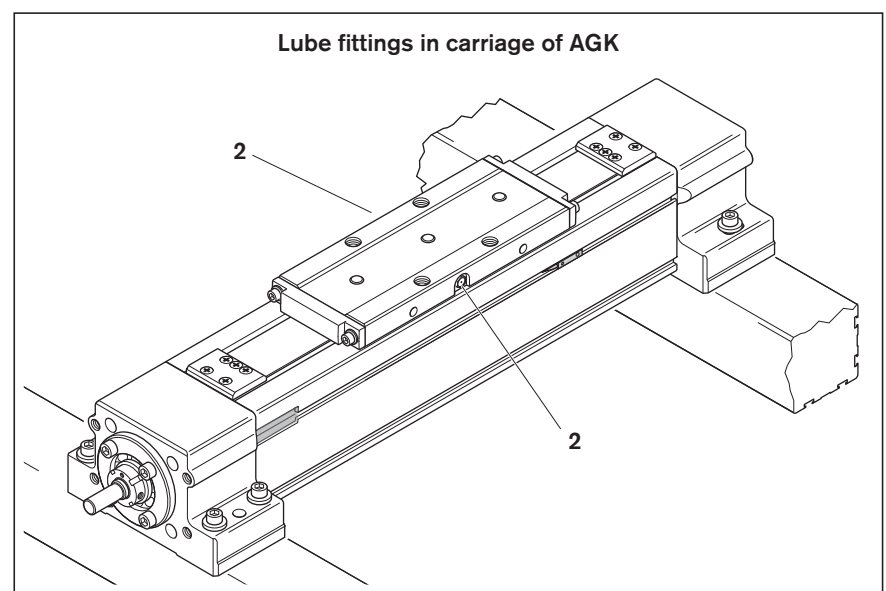
Housing MGA has one lube fitting (1) on each side.
Lubrication through one of the five lube fittings is adequate.

The nuts in all other version are lubricated.
See dimensional drawings for location of lube port.



AGK

The carriage has one funnel-type lube nipple (2) on each side.
Lubrication through only one of the two lube nipples is sufficient.



Lubrication

Overview

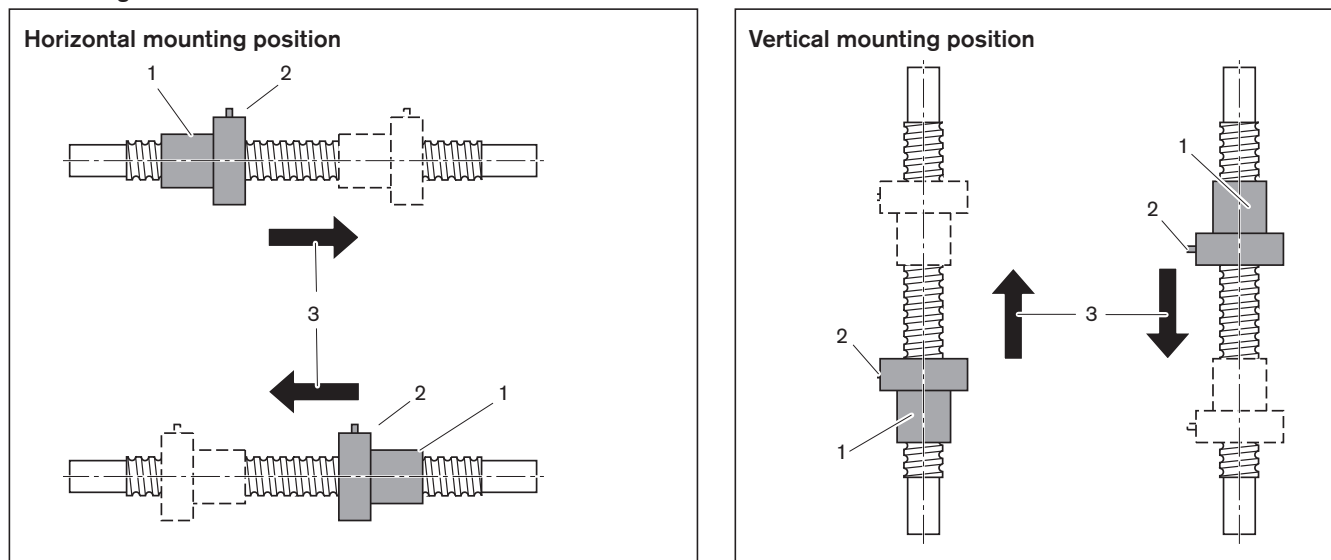
The ball screw drives in the Drive Units come with initial greasing standard. Basic lubrication with Dynalub 510 grease lubricant (see "Grease lubrication" section for lubricant properties)

The following lubrication procedures are generally acceptable for relubrication and are also described in separate sections.

- **Grease lubrication**
with grease guns or progressive lubrication systems
- **Liquid grease lubrication**
with single-line piston distributor systems
- **Oil lubrication**
with single-line piston distributor systems

Follow the positioning and travel instructions in the figure below when relubricating the ball screw drive nuts regardless of which of the above lubrication procedures is used.

Positioning and travel instructions



- 1 Position of the nut during lubricating procedure
- 2 Mount with lube port (if installed horizontally, the port should be as close to the top as possible)
- 3 Direction of travel after lubrication. Travel $\geq s_{min}$ (see "Technical data" tables).

Basic information on lubrication intervals:

The lubrication intervals in the following sections are based on a load ratio of F_m/C . The load ratio describes the quotient of average load F_m and dynamic load rating C (see "Calculation" section).

Lubrication intervals depend on load and are calculated in revolutions based on the characteristic curve graph for the type of lubrication. Revolutions can be converted into km depending on lead.

Lubrication intervals are constant up to a load ratio of 0.2, so they can also be taken directly from the relubrication quantities and intervals tables. For higher load ratios, lubrication intervals have to be determined accordingly. Due to aging, relubrication should occur no less than every two years, even under normal operating conditions, regardless of application-specific lubrication intervals.

Notes:

Attention: Do not use lubricants with solid particles (e.g., graphite or MoS₂ additives).

If other lubricants are used than specified in the following sections, they may cause reduced relubrication intervals, loss of short-stroke and load-carrying performance, and chemical reactions between plastics, lubricants and anti-corrosion agents.

For strokes less than or equal to travel S_{min} (as per "Technical data" tables), executing a longer stroke ("lubricating stroke") according to positioning and travel instructions and reducing lubrication intervals are recommended.

Short-stroke:

A short stroke is when the stroke is less than $S_{min}/2$

Effect of short stroke on service life:	Short strokes increase the number of time a rolling load passes over each point in the load zone, which reduces service life.
---	---

Effect of short stroke on lubrication:	Short strokes mean the ball does not make a full turn in the nut. This makes it impossible for an adequate grease film to form, which can result in premature wear.
--	--

Please contact one of our regional centers for short-stroke applications, since their effects on service life and lubrication require separate assessment.

You can find your local contact person at: www.boschrexroth.com/contact

Please contact us for applications in extreme conditions (e.g., heavy contamination, vibrations, shocks, corrosive media, etc.), since a separate assessment is necessary and a custom lubrication recommendation may be required.

Lubrication

Grease lubrication

With grease guns or progressive lubrication systems

Grease lubricant: We recommend using Dynalub 510 with the following properties:

- NLGI grade 2 lithium-based high-performance grease in accordance with DIN 51818 (KP2K-20 according to DIN 51825)
- Good water resistance
- Corrosion protection
- Temperature range: –20 °C to +80 °C

You can download product and safety data sheets from our website at www.boschrexroth.com.

When using progressive lubrication systems, make sure all the lines and distributors (including the connection to the BASA nut) are filled before relubricating.

Grease lubrication			
Size	BASA	Maintenance lubrication quantity	Maintenance lubrication interval
	d ₀ xP	ZEM-E/FEM-E-S/FEP-E-S/FEM-E-C (cm ³)	Based on load ratio F _m /C ≤ 0.2 (km)
AOK-020 AGK-020	20x5	1.0	250
	20x10	1.5	500
	20x20	2.4	1 000
	20x40	1.8	2 000
AOK-032 AGK-032	32x5	2.2	250
	32x10	3.1	500
	32x20	3.6	1 000
	32x32	5.5	1 600
AOK-040 AGK-040	40x5	3.0	250
	40x10	6.7	500
	40x20	8.7	1 000
	40x40	14.3	2 000

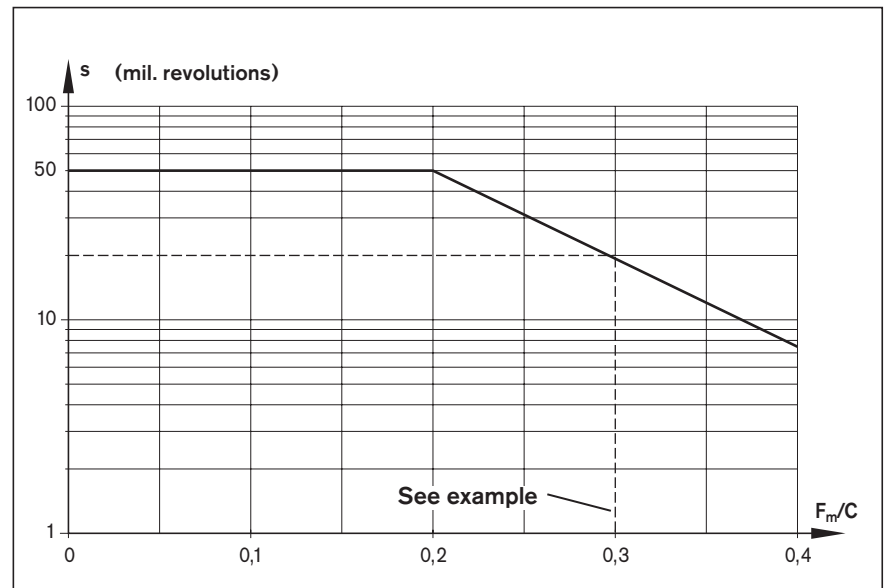
The load ratio F_m/C is the quotient of the average load F_m and the dynamic load rating C (see "Calculation").

Graph for determining load-based lubrication intervals for grease lubrication using grease guns or progressive lubrication systems

This applies to the following conditions:

- Dynalub 510 grease or, alternatively, Castrol Longtime PD 2, Elkalub GLS 135/N2 grease lubricant
- No exposure to media
- Ambient temperature: $T = 20$ to $30\text{ }^{\circ}\text{C}$

s = lubrication interval in millions of revolutions (10^6 revolutions)
 C = dynamic load rating (N)
 F_m = average load (N)
 d_0 = nominal diameter (mm)



Conversion of lubrication interval s from millions of revolutions to kilometers:

$$s \text{ in kilometers} = \frac{s \text{ in millions (of revs)} \cdot \text{lead } P \text{ (mm)}}{10^6}$$

Example:

AOK-032, BASA 32x20

From application: Load ratio $F_m/C = 0.3$

Taken from graph, with $P = 20$ mm

and $F_m/C = 0.3$: $20 \cdot 10^6$ revs

$$s \text{ in kilometers} = \frac{20 \cdot 10^6 \text{ (revs)} \cdot 20 \text{ (mm)}}{10^6} = 400 \text{ km}$$

112 Drive Units

Service and Information

Lubrication

Liquid grease lubrication

With single-line piston distributor systems

Grease lubricant

We recommend using Dynalub 520 with the following properties:

- Lithium-based, high-performance grease of NLGI grade 00 in accordance with DIN 51818 (GP00K-20 in accordance with DIN 51826)
- Good water resistance
- Corrosion protection
- Temperature range: –20 to +80 °C

You can download product and safety data sheets from our website at www.boschrexroth.com.

When using single-line distributor systems, always make sure all lines and the piston distributors (including the connection to the BASA nut) are filled before relubricating.

The pulse count that is needed for this is the integer quotient of the relubrication quantity according to the table and the piston distributor size. Make sure the piston distributor size is at least 0.03 cm³. The lubricating cycle time is then the result of dividing the lubrication interval by the determined pulse count.

Liquid grease lubrication			
Size	BASA	Maintenance lubrication quantity	Maintenance lubrication interval
	d ₀ xP	ZEM-E/FEM-E-S/FEP-E-S/FEM-E-C (cm ³³)	Based on load ratio $F_m/C \leq 0.2$ (km)
AOK-020 AGK-020	20x5	1.0	188
	20x10	1.5	375
	20x20	2.4	750
	20x40	1.8	1 500
AOK-032 AGK-032	32x5	2.2	188
	32x10	3.1	375
	32x20	3.6	750
	32x32	5.5	1 200
AOK-040 AGK-040	40x5	3.0	188
	40x10	6.7	375
	40x20	8.7	750
	40x40	14.3	1 500

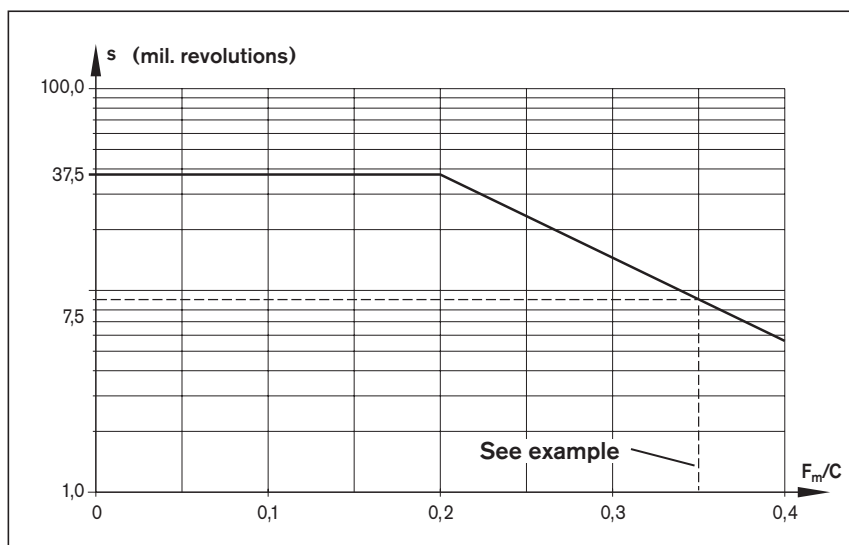
The load ratio F_m/C is the quotient of the average load F_m and the dynamic load rating C (see "Calculation").

Graph for determining load-based lubrication intervals for liquid grease lubrication using single-line piston distributor systems

This applies to the following conditions:

- Dynalub 520 grease or, alternatively, Castrol Longtime PD 00, Elkalub GLS 135/N00 grease lubricant
- No exposure to media
- Ambient temperature: $T = 20$ to $30\text{ }^{\circ}\text{C}$

s = lubrication interval in millions of revolutions (10^6 revolutions)
 C = dynamic load rating (N)
 F_m = average load (N)
 d_0 = nominal diameter (mm)



Conversion of lubrication interval s from millions of revolutions to kilometers:

$$s \text{ in kilometers} = \frac{s \text{ in millions (of revs)} \cdot \text{lead } P \text{ (mm)}}{10^6}$$

Example:

AOK-032, BASA 32x10

From application: Load ratio $F_m/C = 0.35$

Taken from graph, with $P = 10$ mm and

$F_m/C = 0.35$: $10 \cdot 10^6$ revs

$$s \text{ in kilometers} = \frac{10 \cdot 10^6 \text{ (revs)} \cdot 20 \text{ (mm)}}{10^6} = 100 \text{ km}$$

Note:

We recommend using piston distributors from SKF. These should be installed as close as possible to the lube port of the nut. Long lines and small line diameters should be avoided, and the lines should be laid on an upward slant.

If other consumers are connected to the single-line lubrication system, the weakest link in the chain determines the lubrication cycle time.

Pumping or storage tanks for the lubricant should be fitted either with a stirrer or a follower piston to guarantee the flow of lubricant (to avoid funneling in the tank).

Lubrication

Oil lubrication

With single-line piston distributor systems

Lubricant oil

We recommend using Shell Tonna S 220, which has the following properties:

- Special demulsifying oil CLP or CGLP as per DIN 51517-3 for machine bed tracks and tool guides
- A blend of highly refined mineral oils and additives
- Can be used even when mixed with significant quantities of metalworking fluids

When using single-line distributor systems, always make sure all lines and the piston distributors (including the connection to the BASA nut) are filled before relubricating.

The pulse count that is needed for this is the integer quotient of the relubrication quantity according to the table and the piston distributor size. Make sure the piston distributor size is at least 0.03 cm³. The lubricating cycle time is then the result of dividing the lubrication interval by the determined pulse count.

Oil lubrication				
		Maintenance lubrication quantity	Maintenance lubrication interval	
Size	BASA	ZEM-E/FEM-E-S/FEP-E-S/FEM-E-C	Based on load ratio $F_m/C \leq 0.2$	Time
	d ₀ xP	(cm ³)	(km)	(h)
AOK-020 AGK-020	20x5	0.06	5	10
	20x10	0.06	10	
	20x20	0.06	20	
	20x40	0.06	40	
AOK-032 AGK-032	32x5	0.06	5	
	32x10	0.06	10	
	32x20	0.06	20	
	32x32	0.06	32	
AOK-040 AGK-040	40x5	0.40	5	
	40x10	0.40	10	
	40x20	0.40	20	
	40x40	0.40	40	

The load ratio F_m/C is the quotient of the average load F_m and the dynamic load rating C (see "Calculation").

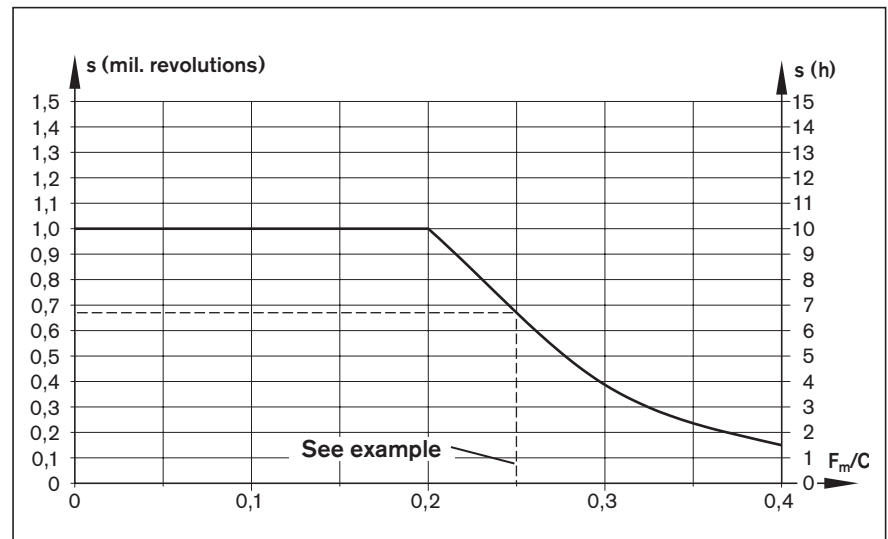
The lubrication interval s is defined either by millions of revolutions or operating time in km or hours. The value reached first defines the lubricating interval.

Graph for determining load-based lubrication intervals for oil lubrication using single-line piston distributor systems.

This applies to the following conditions:

- Lubricant oil is Shell Tonna S 220
- No exposure to media
- Ambient temperature:
T = 20 to 30 °C

s = lubrication interval
C = dynamic load rating (N)
 F_m = average load (N)
 d_0 = nominal diameter (mm)



Conversion of lubrication interval s from millions of revolutions to kilometers:

$$s \text{ in kilometers} = \frac{s \text{ in millions (of revs)} \cdot \text{lead } P \text{ (mm)}}{10^6}$$

Example:

AOK-020, BASA 20x20

From application: Load ratio $F_m/C = 0.25$

Taken from graph, with $P = 20$ mm and

$F_m/C = 0.25$: $0.65 \cdot 10^6$ revs

$$s \text{ in kilometers} = \frac{0.65 \cdot 10^6 \text{ (revs)} \cdot 20 \text{ (mm)}}{10^6} = 13 \text{ km}$$

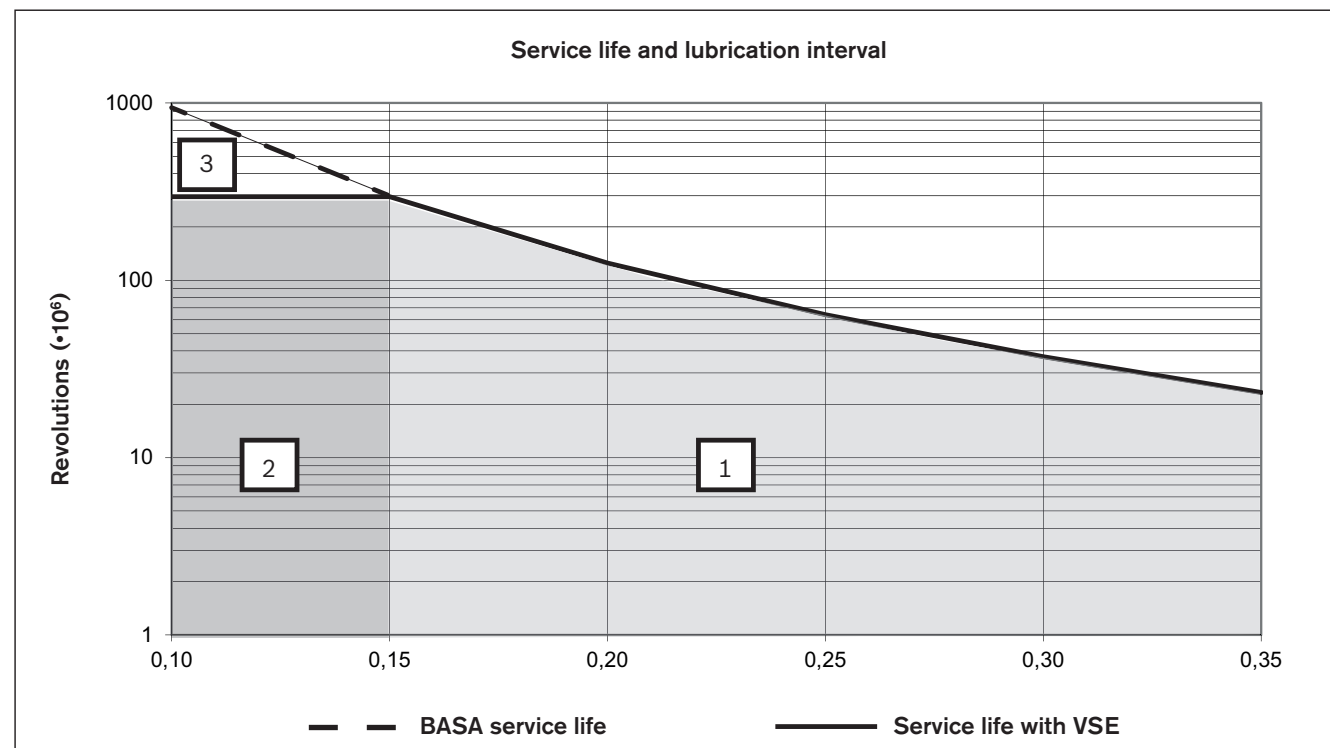
Note:

We recommend using piston distributors from SKF. These should be installed as close as possible to the lube port of the nut. Long lines and small line diameters should be avoided, and the lines should be laid on an upward slant. If other consumers are connected to the single-line lubrication system, the weakest link in the chain determines the lubrication cycle time.

Lubrication

Front Lube Unit (VSE)

If a VSE is selected (not available with all versions), it comes ready-mounted with a pre-greased nut for excellent travel performance without relubricating. The VSE is designed to ensure long-term, maintenance-free operation of the ball screw drive. The effective life of a Rexroth VSE is the same as the theoretical service life curve of the ball screw drive for travel up to 300 mil. revolutions without relubrication.



- 1

Lifelong lubrication:
 For load ratios of $0.15 \leq F_m/C \leq 0.35$ (graph area 1), the readable revolutions correspond to the theoretical service life of the BASA and the effective life of the VSE. This means the BASA is lubricated for life.
- 2

Maintenance-free up to 300×10^6 revolutions:
 For load ratios $F_m/C < 0.15$ (graph area 2), the ball screw drive is maintenance-free up to 300 mil. revolutions. The VSE will continue to lubricate past the interval up to this limit.
- 3

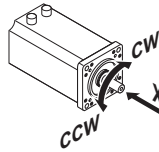
Relubrication required:
 After 300 mil. revolutions (graph area 3), the nut should be relubricated as usual. The VSE does not have to be removed, however it will no longer continue to lubricate past the interval.

Parameterization (start-up)

The nameplate contains reference information on the production of the linear motion system as well as technical start-up parameters.

4	1	2	3	5	6							
Rexroth MNR: R12345678 TYP: AGK-110-NN-1 CS: 1005135076 20 07						Bosch Rexroth AG D-97419 Schweinfurt Made in Germany		FD: 483		7210		
						s_{max} (mm)	u (mm/U)	v_{max} (m/s)	a_{max} (m/s ²)	$M1_{max}$ (Nm)	d	i
						540	10	0,77	50	13,51	cw	1
7	8	9	10	11	12	13						

- 1 Part number
- 2 Type designation
- 3 Size
- 4 Customer information
- 5 Date of manufacture
- 6 Manufacturing location
- 7 s_{max} = max. travel range (mm)
- 8 u = lead constant without gears (mm/rev)
- 9 v_{max} = max. speed without gears (m/s)
- 10 a_{max} = max. acceleration without gear (m/s²)
- 11 $M1_{max}$ = max. drive torque at motor journal (Nm)
- 12 d = direction of rotation of the motor for travel in positive direction
cw = clockwise
ccw = counterclockwise



- 13 i = gear ratio

Documentation

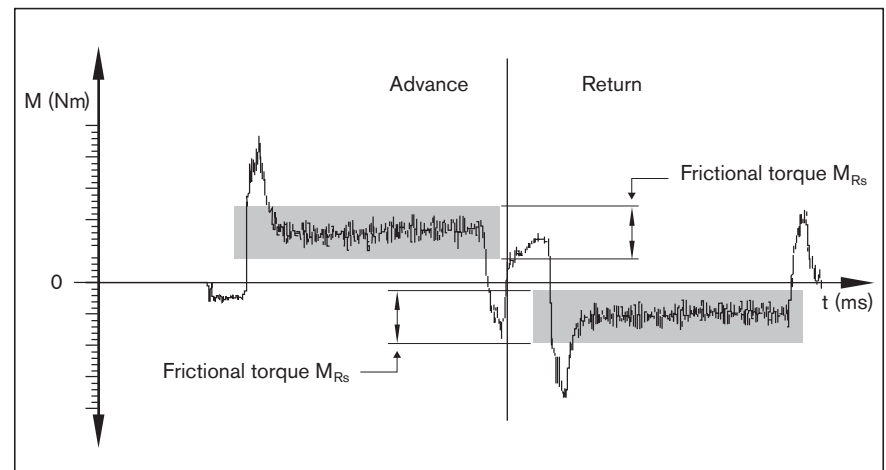
Standard report Option 01

The standard report contains:

- Confirmation of proper mechanical and electrical function
- Confirmation of version as per order confirmation
- Technical delivery information as per nameplate

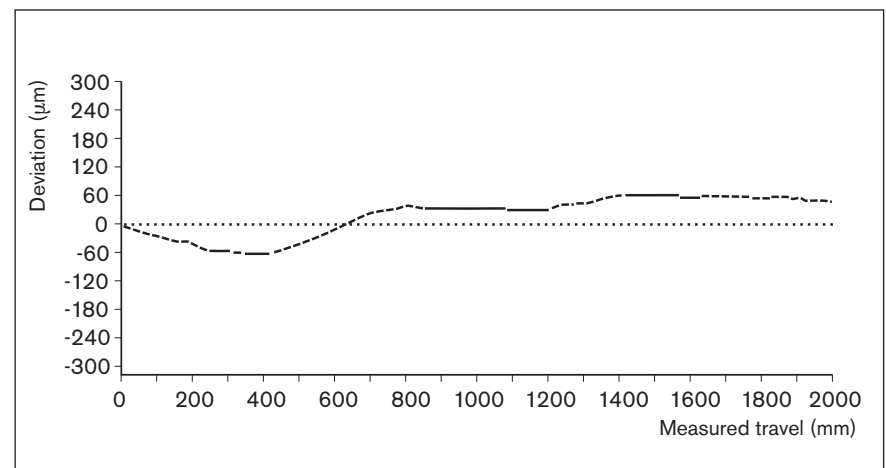
Frictional torque measurement for entire system (for AGK) Option 02 (includes Option 01)

Frictional torque is measured over the entire travel range.



Lead deviation of the ball screw drive Option 03 (includes Option 01)

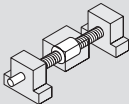
A table containing the measurement report is included in addition to the graph (see figure).



120 Drive Units

Service and Information

AOK-032

Short product name, length: AOK-032-NN-1, ... mm	Drive BASA														
		nut	Size d ₀ x P				Tolerance grade		Standard seal	Lubrication			Preload class		
			32 x 5	32 x 10	32 x 20	32 x 32				Initial greasing	Left VSE	Right VSE	C1 (moderate)	C2 (medium)	C3 (high)
Fixed and floating bearing 															
		01	02	03	04	T5	T7	1	1	–	–	3	6	2	
		11	–	–	–	T5	T7	1	1	2	3	3	6	2	
		–	12	–	–										
		–	–	13	–										
		–	–	–	14										
		21	–	–	–	T5	T7	1	1	2	3	3	6	2	
		–	22	–	–										
		–	–	23	–										
		–	–	–	24										
	Version with fixed bearing only	ZEM-E	06	07	08	09	T5	T7	1	1	–	–	3	6	2

■ = Selection area mark after version is chosen

□ = Selected option to be entered under "Request/order" in the order form at the end of the catalog

AOK length calculation

$$L = s_{\max} + L_c + L_{ad}$$

$$s_{\max} = s_{\text{eff}} + 2 \cdot s_e$$

Max. travel: $s_{\max} = 1000$ mmDrive: BASA 32x10 (d₀ x P)Nut length/nut and housing length $L_c = 77$ mmAdditional length: $L_{ad} = 128$ mm

$$L = 1000 + 77 + 128$$

$$L = 1205 \text{ mm}$$

d₀ = screw diameter (mm)

P = lead (mm)

L_c = nut length/nut and housing length (mm)

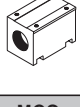
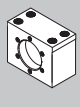
Excess travel:

Excess travel must be greater than braking distance.

Acceleration travel can be used as a guideline value for braking distance.

Also see "Drive dimensioning calculation example"

AGK length calculation: same as for AOK Drive Unit, except: L_c = length of nut with housing

	Screw ends		Pillow block		Nut Housing		Motor attachment				Motor		Documentation	
	Left	Right	Aluminum	Steel	without	with	Version	Gear ratio	Attachment kit ¹⁾	for motor	without brake	with brake	Standard report	Measurement report
	81	31	02	12	—	01	 MGA	without mount	OF01	—	00	—	00	
	81	31	02	12	00	11	 MGS	with mount	MF01	—	03	MSK 60C ²⁾	90	91
					00	13								
					00	12								
					00	14								
					00	21								
	81	31	02	12	00	22	 MGD							
					00	23								
					00	24								
	81	00	01	11	—	01	MGA						01	03 Lead deviation

Type code: AOK-032-NN-1, 1205 mm/12/T7/1/1/3/81/31/02/13/MF01/03/91/01

Ordering data	Option	Explanation
Drive Unit (short product name)	AOK-032-NN-1, 1205 mm	Open Drive Unit (AOK-032), length = 1205 mm
Basic version		Version with fixed and floating bearing
Ball screw drive	12	BASA 32x10 with Single Nut with flange FEM-E-S
Tolerance grade	T7	Tolerance grade T7
Seal	1	Standard seal
Lubrication	1	Preserved and with initial greasing
Preload class C1	3	Moderate preload
Left screw end type	81	Type 81
Right screw end type	31	Type 31
Pillow block	02	Fixed and floating bearing (Al)
Nut Housing	13	MGS (32x10)
Version	MF01	Mount/coupling for motor attachment as per MF01 illustration
Motor attachment	03	Mount/coupling for motor MSK 060C
Motor	91	Motor MSK 060C with brake
Documentation	01	Standard final testing

The order code for the AGK Drive Unit has the same format as the AOK Drive Unit

122 Drive Units

Service and Information

Inquiry/order form

Find your local contact person here:

www.boschrexroth.com/contact

Ordering example for Rexroth AOK Drive Units

Ordering data	Option	Explanation
Drive Unit (short product name)	AOK-032-NN-1, 1000 mm	Open Drive Unit (AOK-032), length = 1000 mm
Basic version		Version with fixed and floating bearing
Ball screw drive	12	BASA 32x10 with single nut with flange FEM-E-S
Tolerance grade	T7	Tolerance grade T7
Seal	1	Standard seal
Lubrication	1	Preserved and with initial greasing
Preload class	3	C1 (moderate preload)
Left screw end type	81	Type 81
Right screw end type	31	Type 31
Pillow block	02	Fixed and floating bearing (AI)
Nut Housing	13	MGs (32x10)
Version	MF01	Mount/coupling for motor attachment as per MF01 illustration
Motor attachment	03	Mount/coupling for motor MSK 060C
Motor	91	Motor MSK 060C with brake
Documentation	01	Standard final testing

To be completed by customer: Inquiry ☐ / Order ☐Drive Unit
(short product name): _____, length _____ mm

Ball screw drive	=	☐
Tolerance grade	=	☐ T ☐
Seal	=	☐
Lubrication	=	☐
Preload	=	☐
Left screw end type	=	☐
Right screw end type	=	☐
Pillow block	=	☐
Nut Housing	=	☐
Version	=	☐ ☐ ☐
Motor attachment	=	☐
Motor geometry code ¹⁾	=	☐ ☐ - ☐ ☐ - ☐ ☐ ☐ - ☐ ☐ ☐ - ☐ ☐ ☐ - ☐ ☐ ☐ - ☐ ☐ ☐ - ☐ ☐ ☐ - ☐ ☐ ☐
Motor	=	☐ ☐
Documentation	=	☐ ☐

1) Only required for attachment kits for motors according to customer specification, see page 86.

Quantity _____ Acceptance of: _____ pcs., _____ per month, _____ per year, per order, or _____

Comments: _____

From

Company: _____

Address: _____

Responsible person: _____

Department: _____

Telephone: _____

Fax: _____

Ordering example for Rexroth AGK Drive Units

Ordering data	Option	Explanation
Drive Unit (short product name)	AGK-032-NN-1, 1000 mm	Drive Unit AGK-032, length = 1000 mm, closed format
Ball screw drive	01	BASA 32x10 with Cylindrical Single Nut ZEM-E
Tolerance grade	T5	Tolerance grade T5
Seal	1	Standard seal
Lubrication	1	Preserved and with initial greasing
Preload class	3	C1 (moderate preload)
Left screw end type	81	Type 81
Right screw end type	31	Type 31
Pillow block	02	Fixed and floating bearing (Al)
Nut Housing	01	Nut Housing without SPU (screw supports)
Nut Housing mounting orientation	MR02	Top
Version	RV04	With timing belt side drive on right as per RV04 illustration
Motor attachment	23	Timing belt side drive $i = 1$ for motor MSK 060C
Motor	90	Motor MSK 060C without brake
Cover	01	Protective profile and steel strip
Switch 1	21	REED sensor (delivered as separate part)
Switch 2	21	REED sensor (delivered as separate part)
Switch 3	22	HALL sensor, PNP NC (delivered as separate part)
Socket-plug	17	Socket-plug (delivered as separate part)
Documentation	01	Standard final testing

To be completed by customer: Inquiry ☐ / Order ☐

Drive Unit
(short product name): _____, length _____ mm

Ball screw drive	=	
Tolerance grade	=	T
Seal	=	
Lubrication	=	
Preload	=	
Left screw end type	=	
Right screw end type	=	
Pillow block	=	
Nut Housing	=	
Nut Housing mounting orientation	=	MR
Version	=	
Motor attachment	=	
Motor geometry code ¹⁾	=	L - - - - - - -
Motor	=	
Cover	=	
Switch 1	=	
Switch 2	=	
Switch 3	=	
Socket-plug	=	
Documentation	=	

1) Only required for attachment kits for motors according to customer specification, see page 86.

Quantity Acceptance of: _____ pcs., _____ per month, _____ per year, per order, or _____
Comments: _____

From

Company: _____
 Address: _____

Responsible person: _____
 Department: _____
 Telephone: _____
 Fax: _____

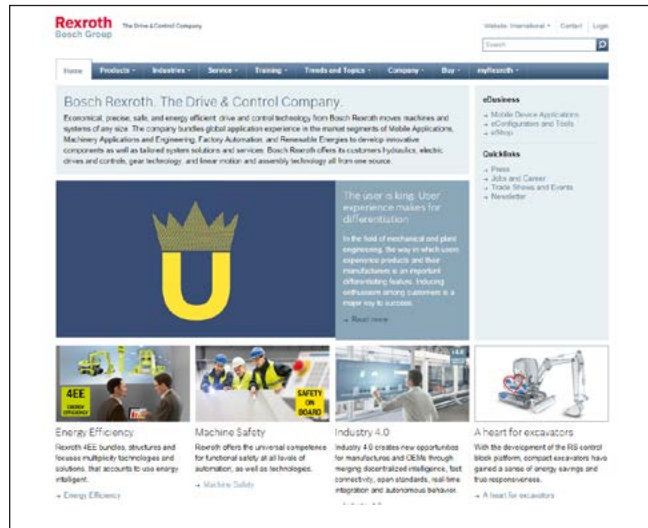
124 Drive Units

Service and Information

Further information

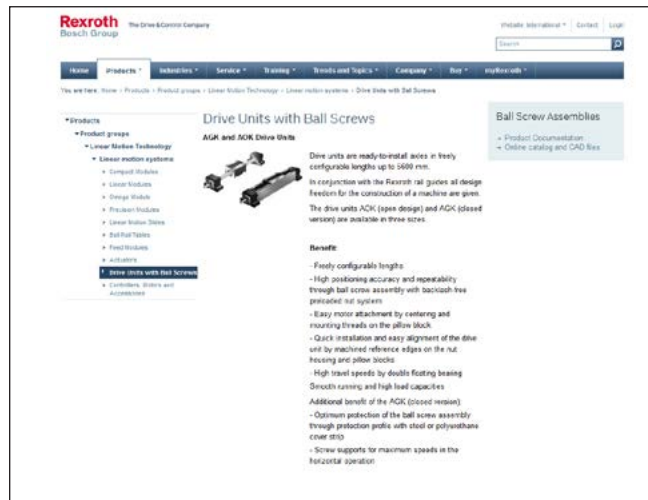
Bosch Rexroth homepage:

<http://www.boschrexroth.com>



Drive Unit product information:

<https://www.boschrexroth.com/de/de/produkte/produktgruppen/lineartechnik/linearsysteme/antriebseinheiten-mit-kugelgewindetrieben/index>



Notes

Bosch Rexroth AG

Ernst-Sachs-Straße 100
97424 Schweinfurt, Germany
Tel. +49 9721 937-0
Fax +49 9721 937-275
www.boschrexroth.com

Find your local contact person here:

www.boschrexroth.com/contact