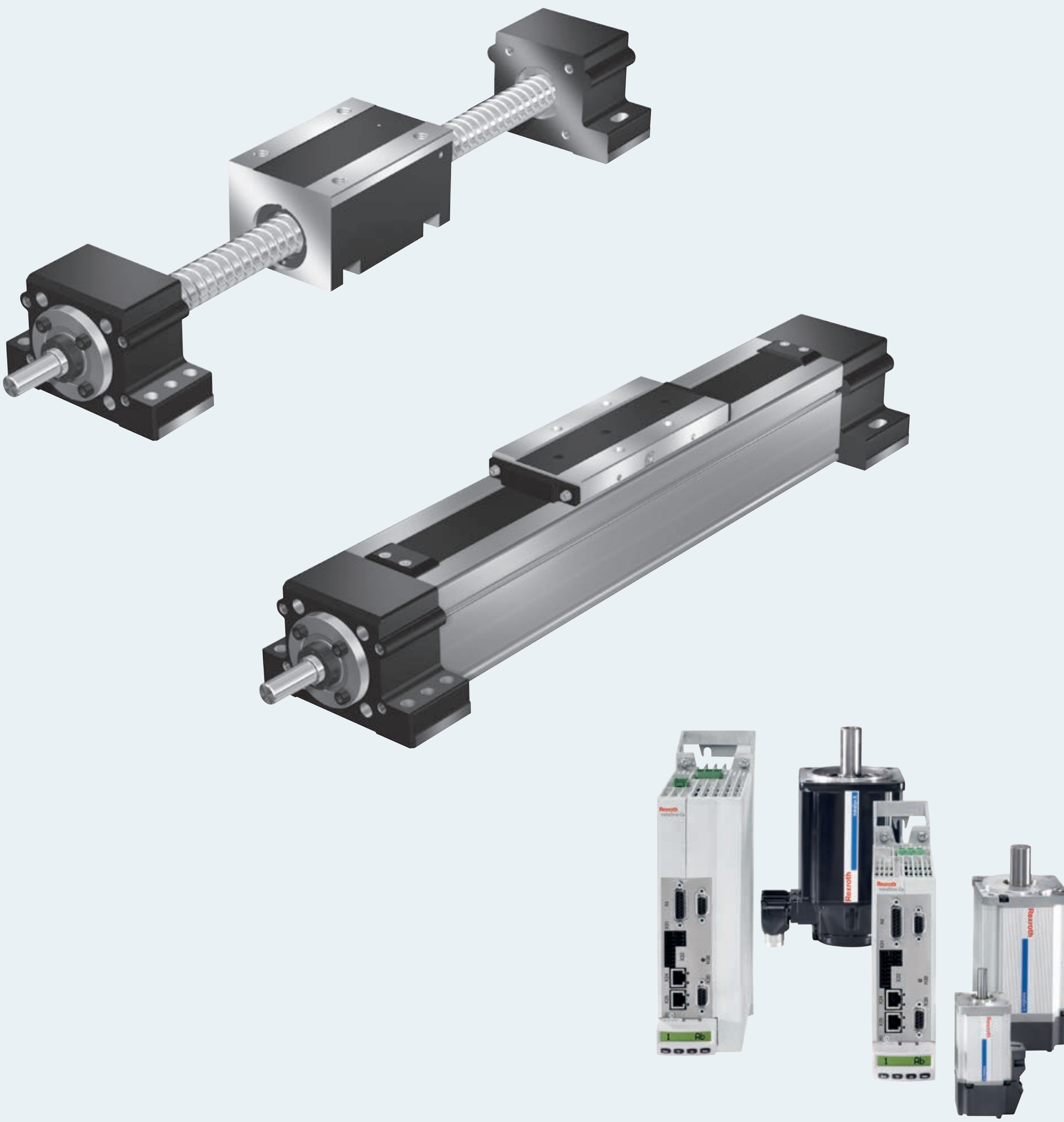
The Drive & Control Company

Rexroth
Bosch Group

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	=	**D**rive Unit									
Format	=	**O**pen **C**losed									
Drive	=	**B**all screw drive									
Size	=	020 / **032** / 040									
Version	=	**S**tandard version									
Generation	=	Product generation **1**									

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

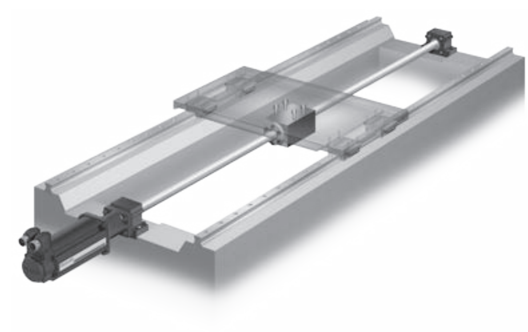
Contents

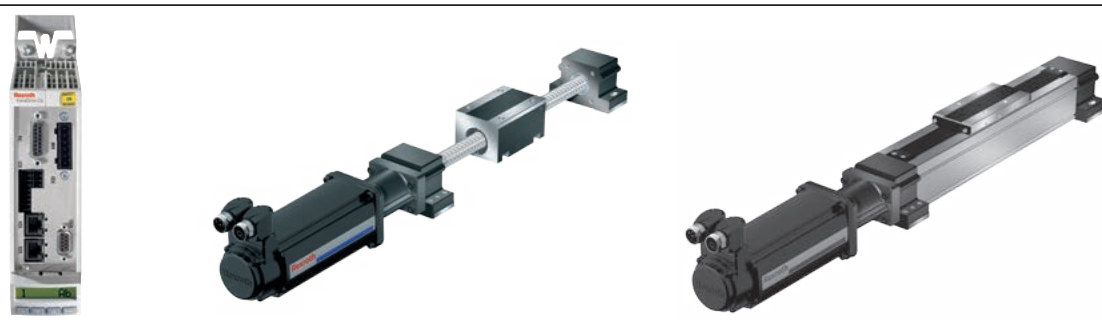
AOK/AGK product description

AOK and AGK Drive Units consist of Rexroth's proven ball screw drive (**BASA** - **BA**ll **S**crew **A**ssembly), 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

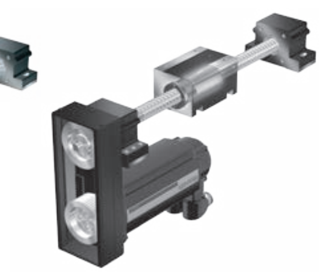
- Pick and place
- Handling systems
- Placement systems, palletizers
- Machine tool feed units
- Inspection and analysis systems
- Transfer line feed units
- Motion units

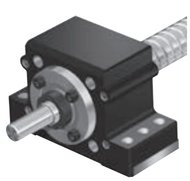
Possible industries

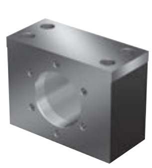
- Handling and assembly
- Electronics and semiconductors
- Automotive suppliers and manufacturers
- Robotics and automation
- Special-purpose machinery
- Packaging technology
- Plastics
- Textiles

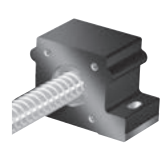
AOK Drive Units, open format

- 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)



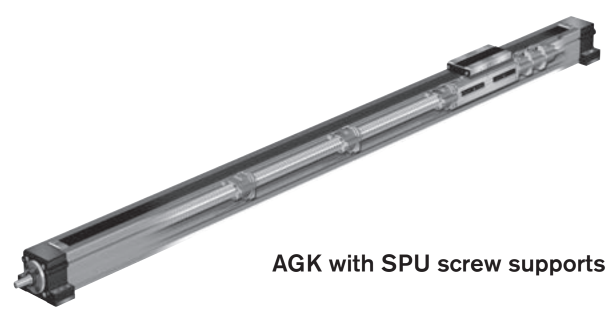






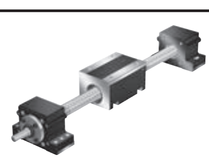
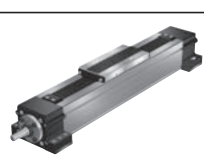
AOK Drive Units, closed format

- 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

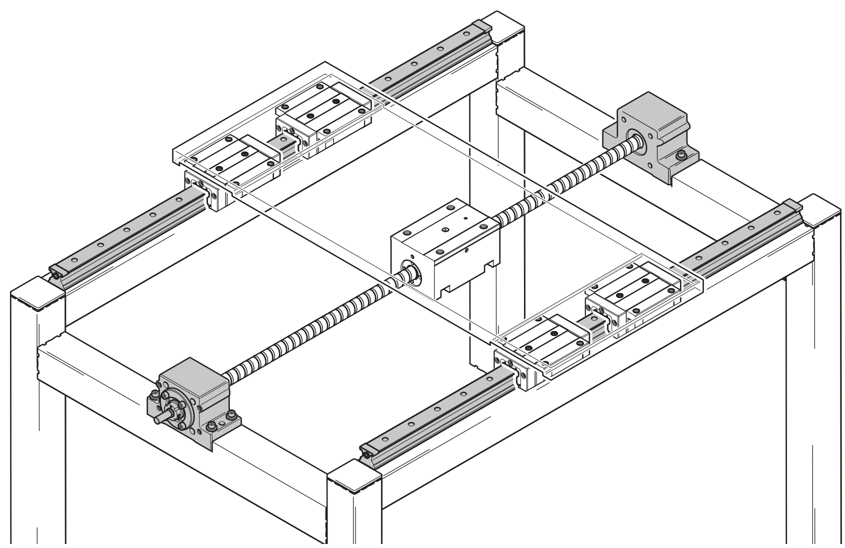
AOK/AGK product description

Notes on applications

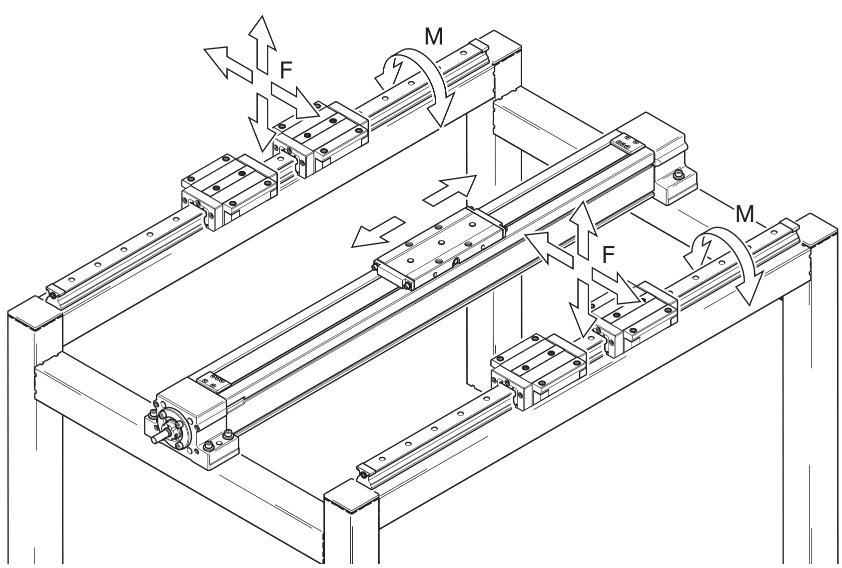
AOK and AGK Drive Units are designed for drive tasks only and can only absorb axial forces.
When using a Drive Unit, always make sure to include adequate, separate linear guides that can handle the structure being moved as well as the resulting reaction forces and torques.
This results in a linear motion 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

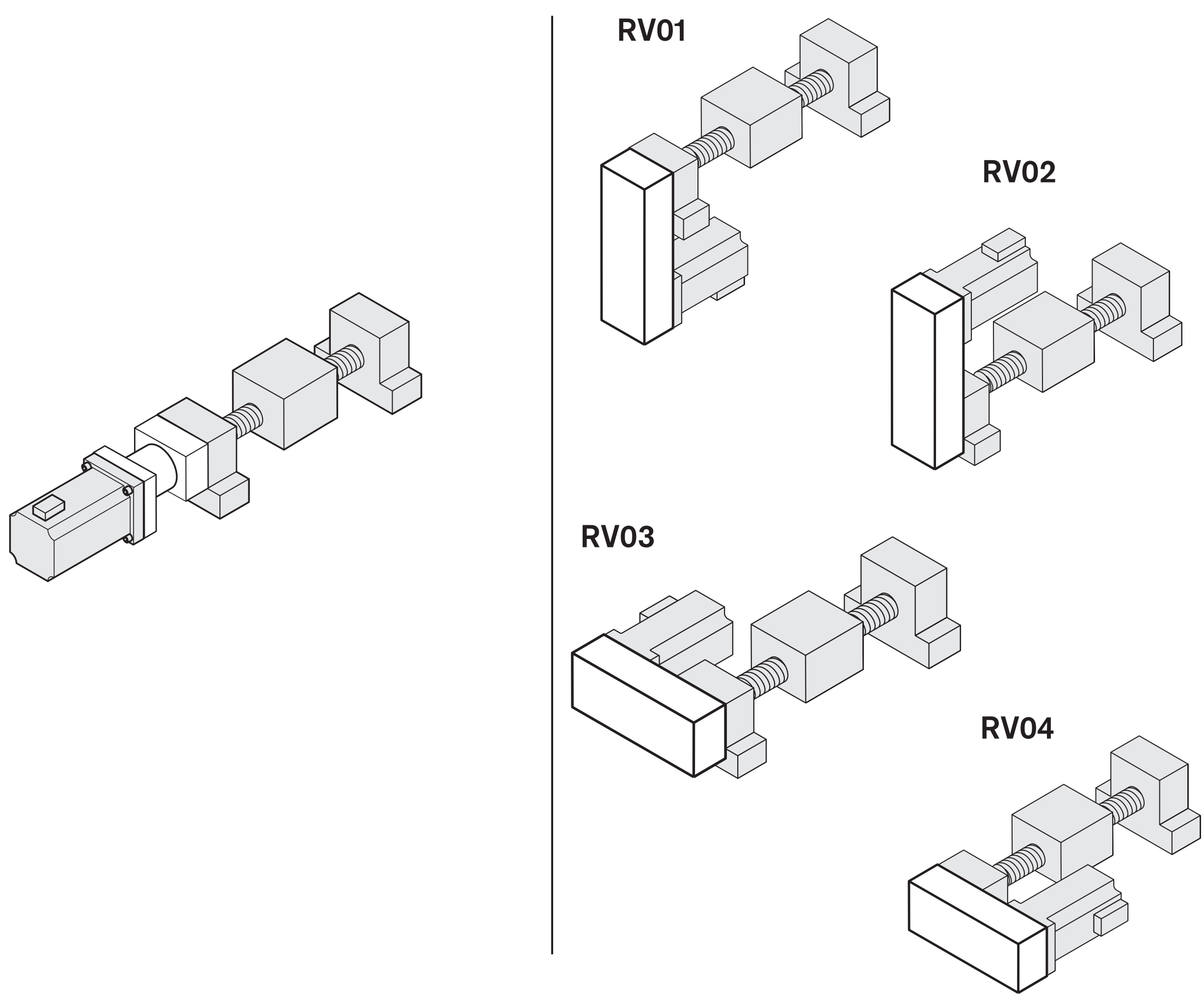
Drive Units come ready-mounted.

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.

AOK (example)

Mount and coupling (MF01) | **Timing belt side drive (RV01–RV04)**



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.

Product description

Properties

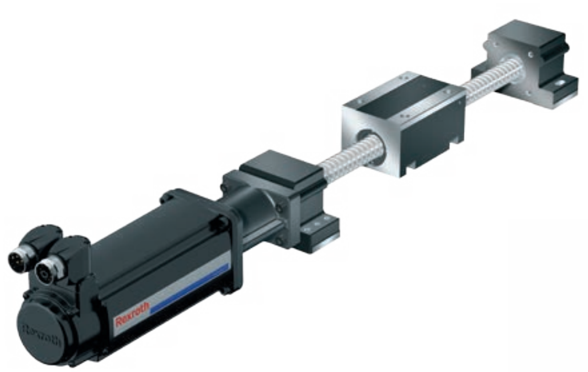
- AOK Drive Units in open format are ready-to-install drive axes consisting of a ball screw drive with nuts and pillow blocks, as well as an optional Nut Housing
- Three coordinated sizes available in any length up to L_{max}
- A version with fixed and floating bearing or fixed bearing only is also available
- 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

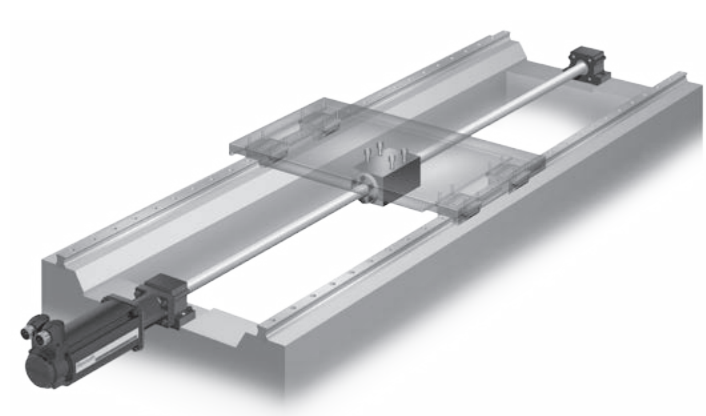
Other highlights

- 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

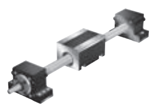
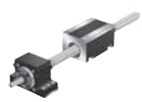
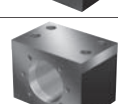
Attachments

- 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

For further information, see the “Screw Drive” catalog.

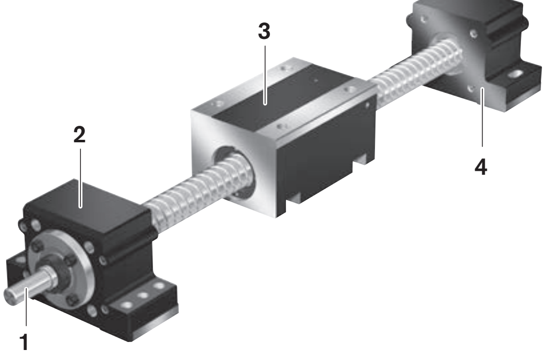
Precision Screw accuracy

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

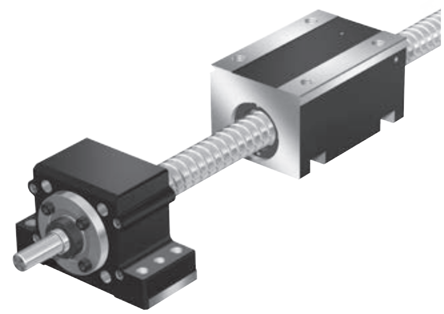
Structural design

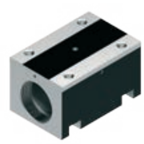
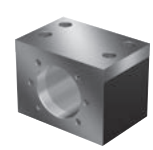
1 Ball screw drive
2 Pillow block on fixed bearing end (drive side)
3 Housing with nut
4 Pillow block on floating bearing end

With fixed and floating bearing



With fixed bearing only



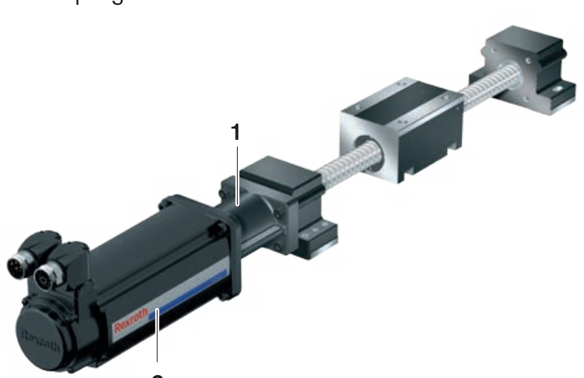
Nut	ZEM-E	FEM-E-S / FEP-E-S	FEM-E-C
		 	
can be combined with*			
Nut Housing	MGA	MGS	MGD
			

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

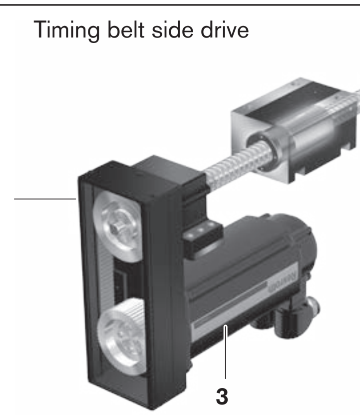
Motor attachment

Attachments:
1 Mount and coupling
2 Timing belt side drive
3 Motor

Mount and coupling



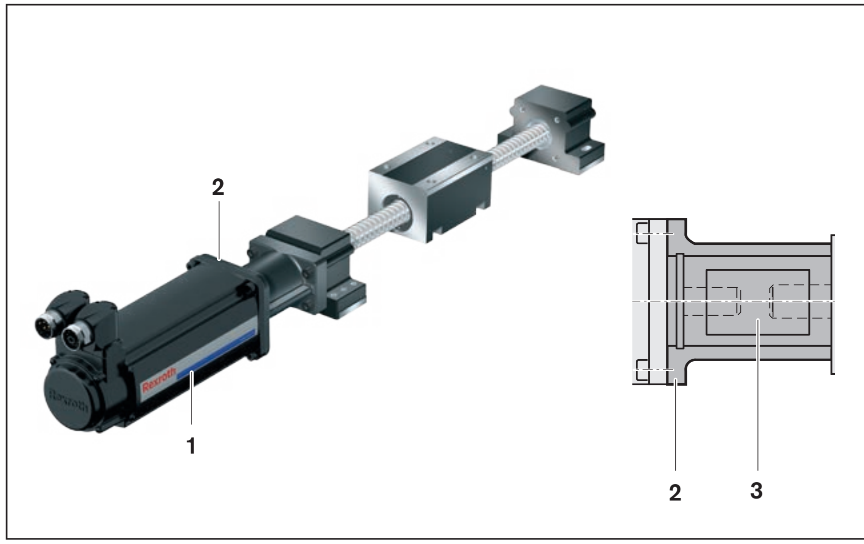
Timing belt side drive



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.

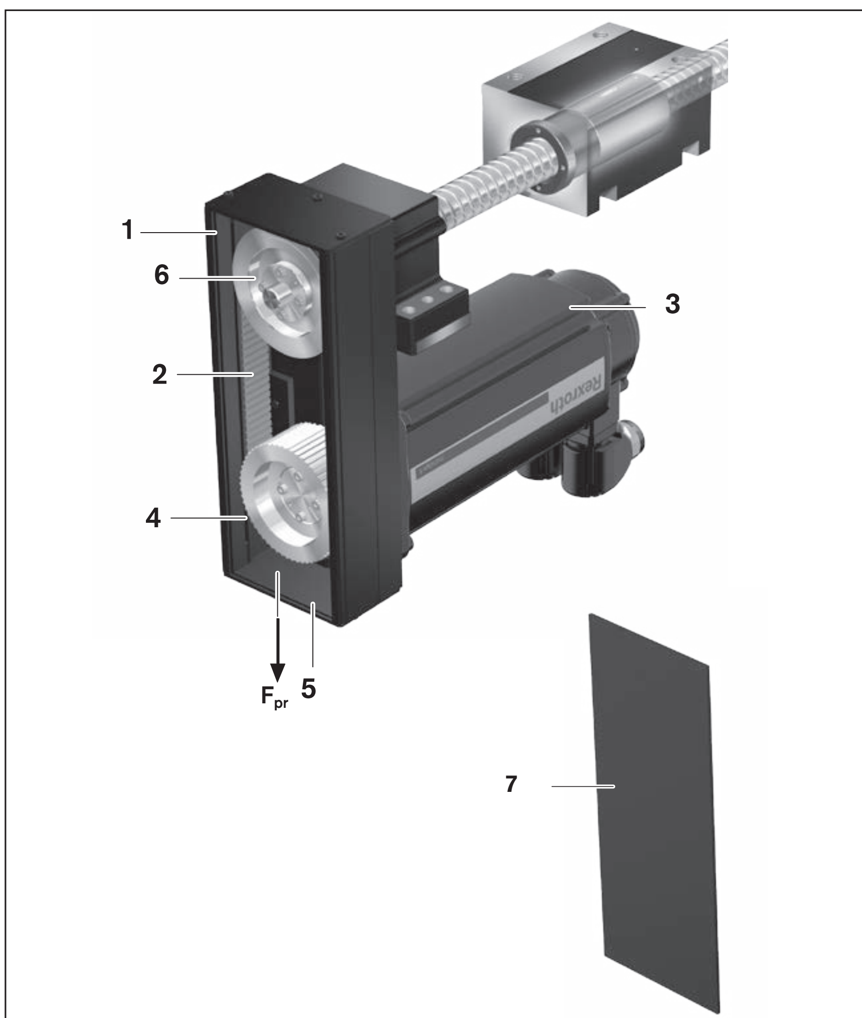
1 Motor
2 Mount
3 Coupling



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



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 bear-ing		Fixed/ floating bear-ing	Fixed bearing only	Fixed/ floating bear-ing	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

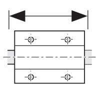
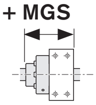
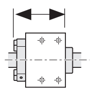
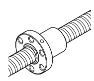
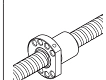
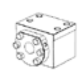
Weight calculation
(without motor attachment, without motor)

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

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)	$k_{J\ fix}$ ($kgmm^2$)	$k_{J\ fix}$ ($kgmm^2$)	$k_{J\ fix}$ ($kgmm^2$)	$k_{J\ fix}$ ($kgmm^2$)	$k_{J\ fix}$ ($kgmm^2$)	$k_{J\ var}$ (kgmm)	$k_{J\ m}$ (mm^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				
				Nut		Nut and housing			Fixed/floating bearing		Fixed bearing only		
	ZEM-E + MGA	FEM-E-S/ FEP-E-S[1] + MGS	FEM-E-C + MGD	FEM-E-S FEP-E-S[1]	FEM-E-C	ZEM-E + MGA	FEM-E-S/ FEP-E-S[1] + MGS	FEM-E-C + MGD	Alumi-num	Steel	Alumi-num	Steel	
													
	L_c (mm)	L_c (mm)	L_c (mm)	m_{ca} (kg)	m_{ca} (kg)	m_{ca} (kg)	m_{ca} (kg)	m_{ca} (kg)	$k_{g\ fix}$ (kg)	$k_{g\ fix}$ (kg)	$k_{g\ fix}$ (kg)	$k_{g\ fix}$ (kg)	$k_{g\ var}$ (kg/mm)
	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		
	0.79	1.32	30.7		
	0.71	1.04	50.0		
	0.70	1.04	50.0		
	1.19	1.80	12.2		
	1.37	2.31	16.8		
	1.26	1.98	33.0		
	1.26	1.95	50.0		

See next spread for designations

Technical data

See the “Calculation” section.

Drive data for motor attachment via timing belt side drive

AOK	Motor	BASA (mm) d_0 x P	up to L[2)] (mm) Fixed/ floating bearing	Only fixed bearing	M_{sd}[1)] (Nm) i = 1	i = 2	J_{sd} (10^{-6} kgm²) i = 1	i = 2	M_{Rsd} (Nm)	m_{sd} (kg)	F (mm)	B_t 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

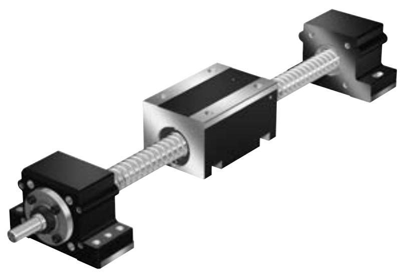
AOK	Motor	Coupling M_{cN} (Nm)	J_c (10^{-6} kgm²)	Mount and coupling m_{fc} (kg)
AOK-020	MSM 041B	14.5	63	0.85
	MSK 040C	19.0	57	0.55
	MSK 050C	50.0	200	2.00
AOK-032	MSK 060C	50.0	200	1.80
	MSK 076C	98.0	390	2.40
AOK-040	MSK 076C	98.0	390	2.80

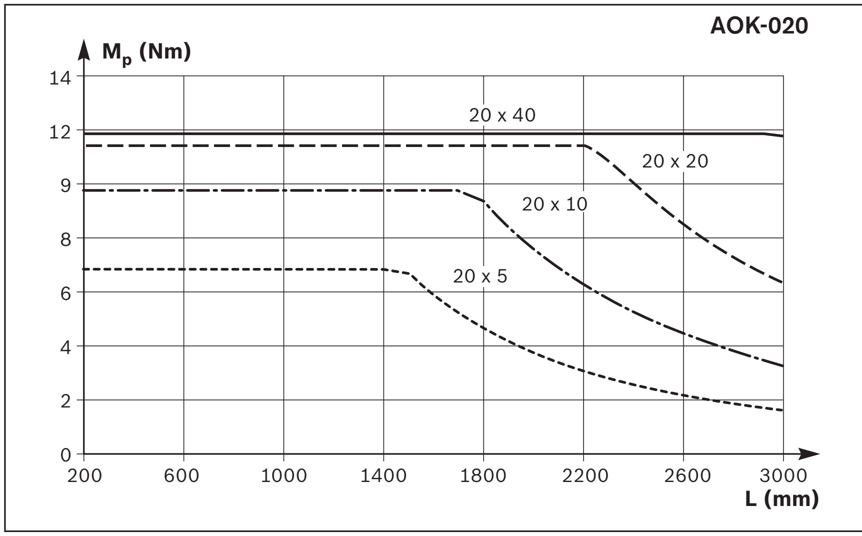
Designations

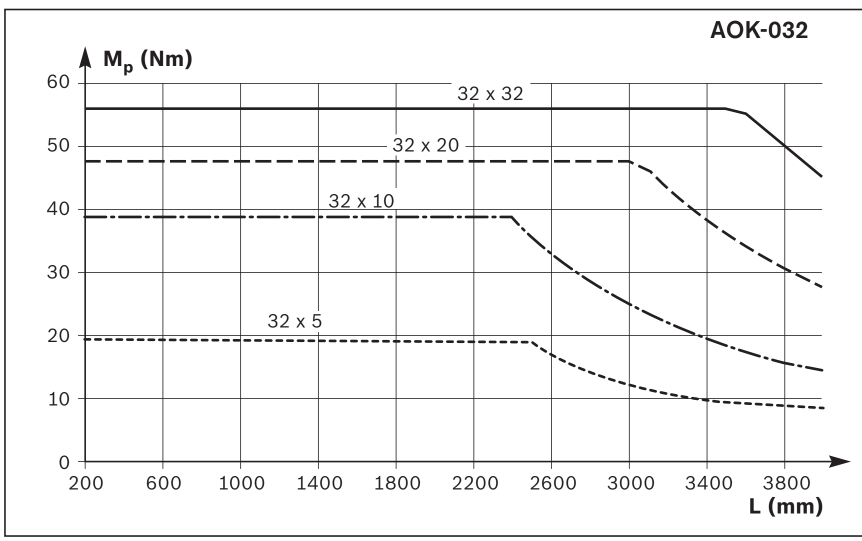
a_{max} = maximum acceleration
B_t = belt type
C = dynamic load rating
d_0 = nominal diameter
F = pulley housing width
i = timing belt side drive gear ratio
J_c = mass moment of inertia of the coupling
J_{sd} = reduced mass moment of inertia of timing belt side drive at motor journal
$k_{g\ fix}$ = constant for fixed-length portion of the mass
$k_{g\ var}$ = constant for variable-length portion of the mass
$k_{J\ fix}$ = constant for fixed-length portion of mass moment of inertia
$k_{J\ var}$ = constant for variable-length portion of mass moment of inertia
$k_{J\ m}$ = 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_{fc} = 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

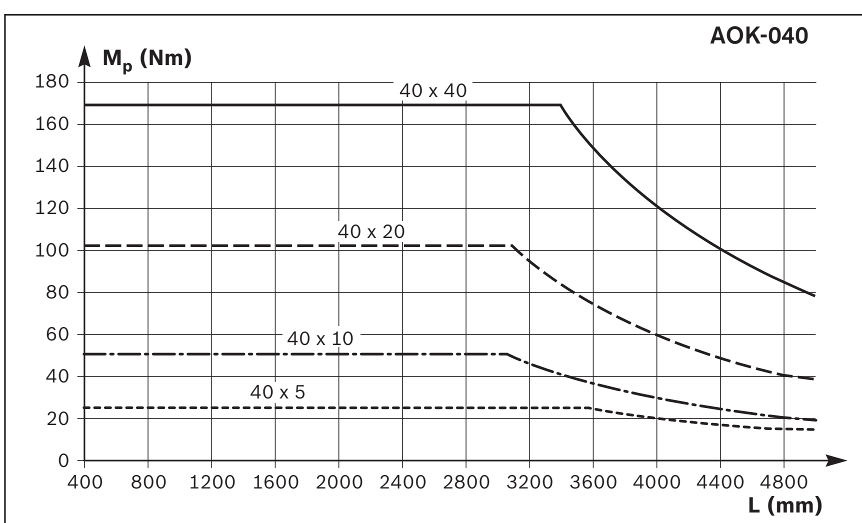
Technical data

Permissible drive torque M_P with fixed and floating bearing

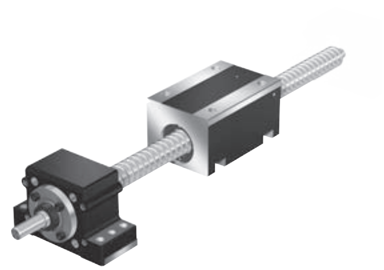


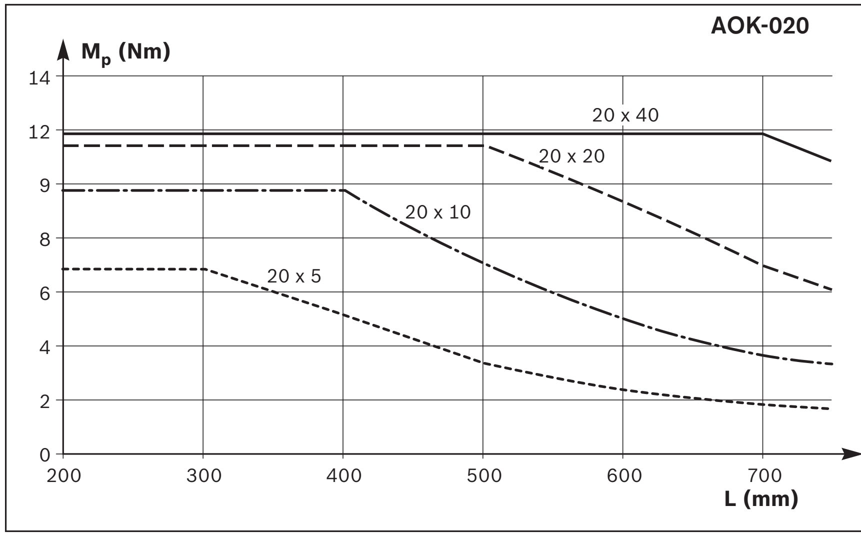


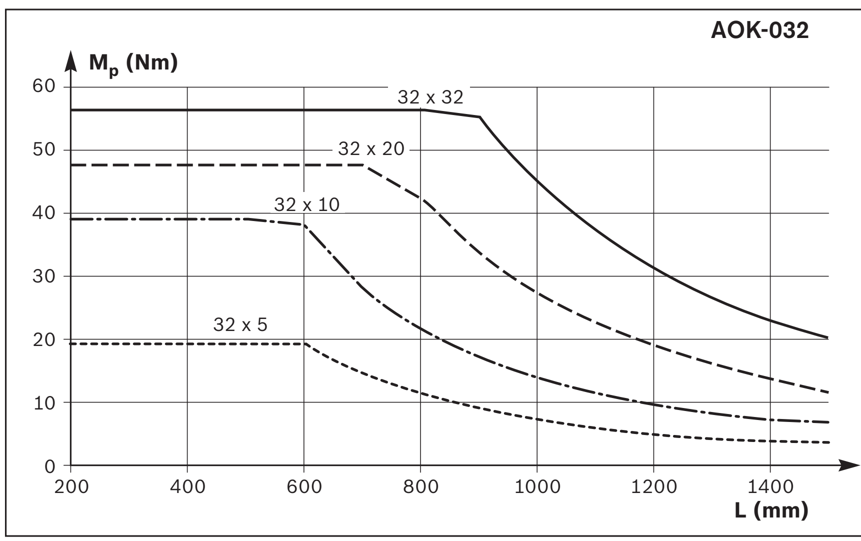




Permissible drive torque M_P with fixed bearing only



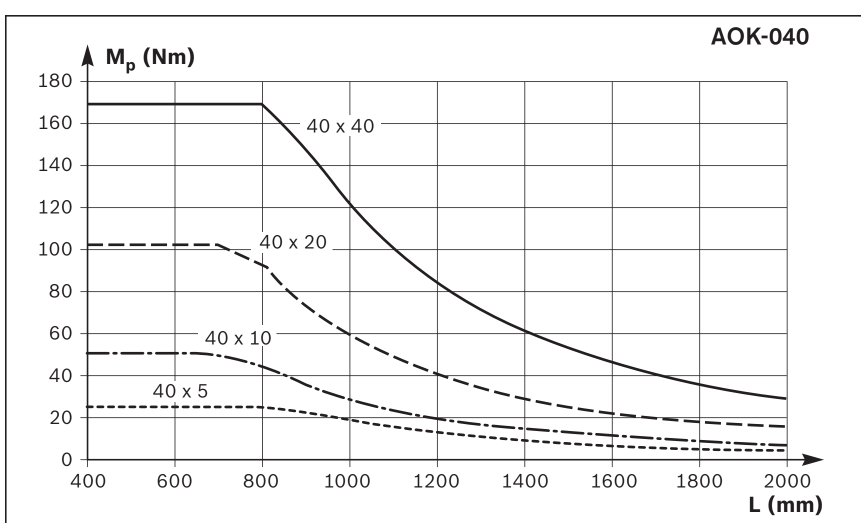




Note

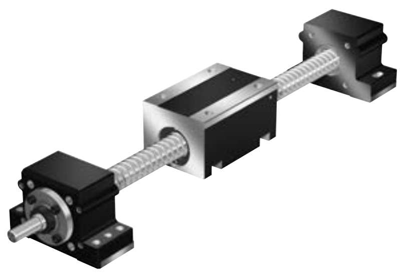
The values shown for M_p apply under the following conditions:

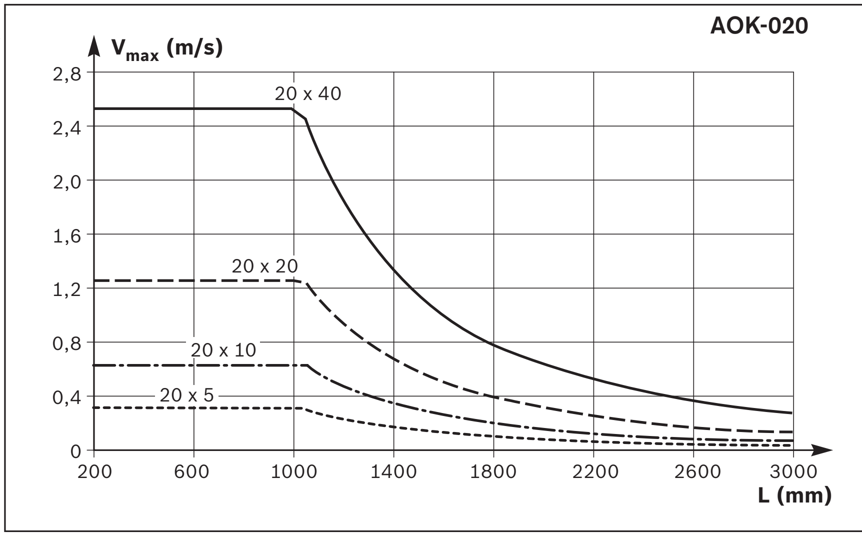
– No radial loads on screw journal

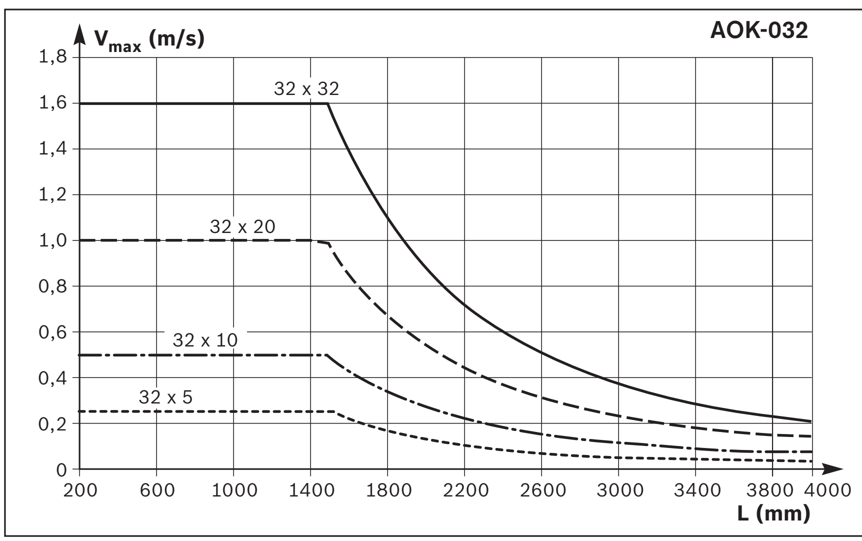


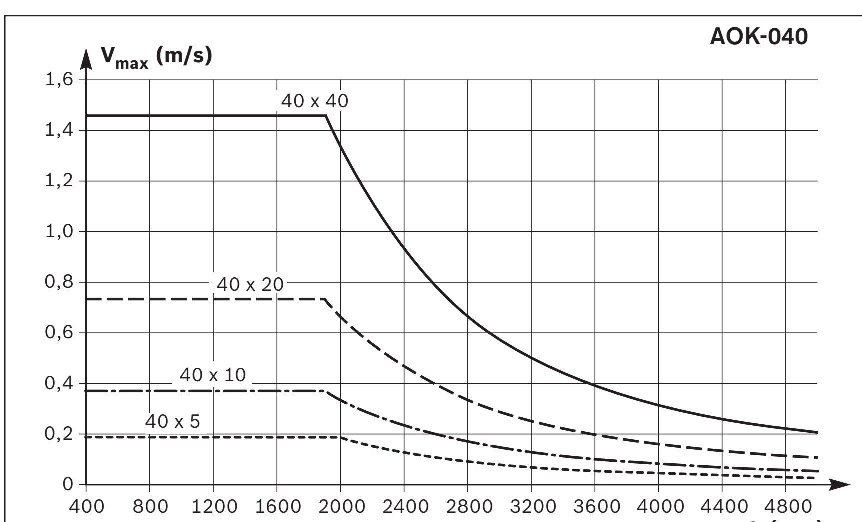
Technical data

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

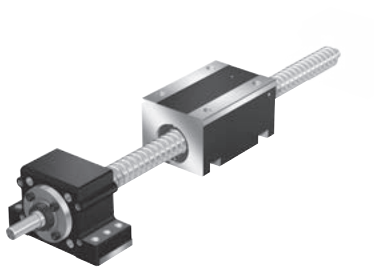


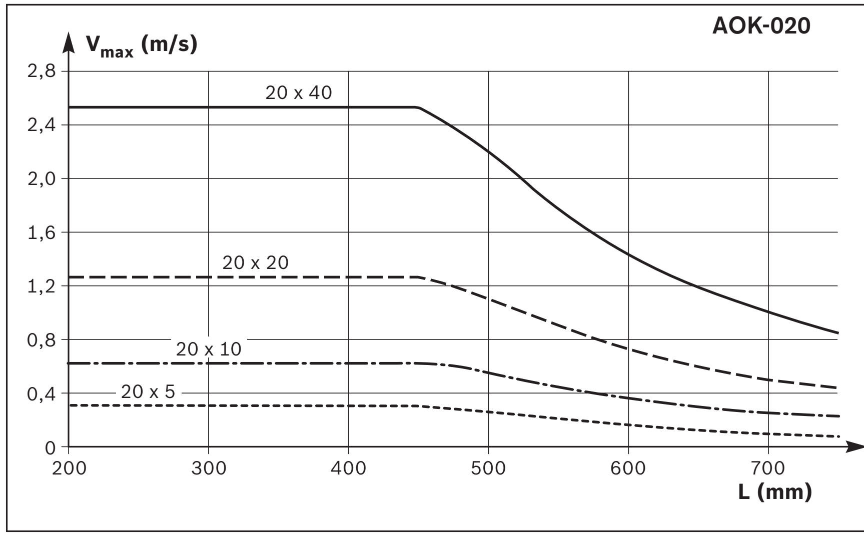


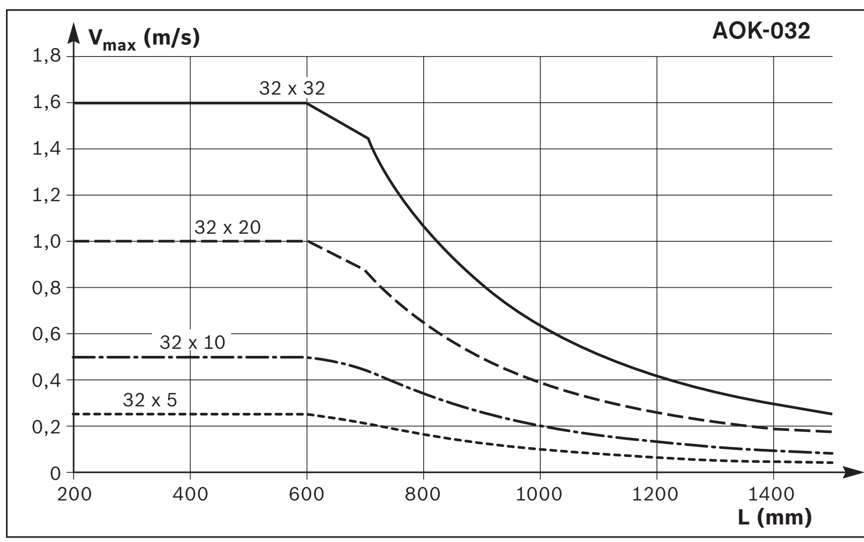


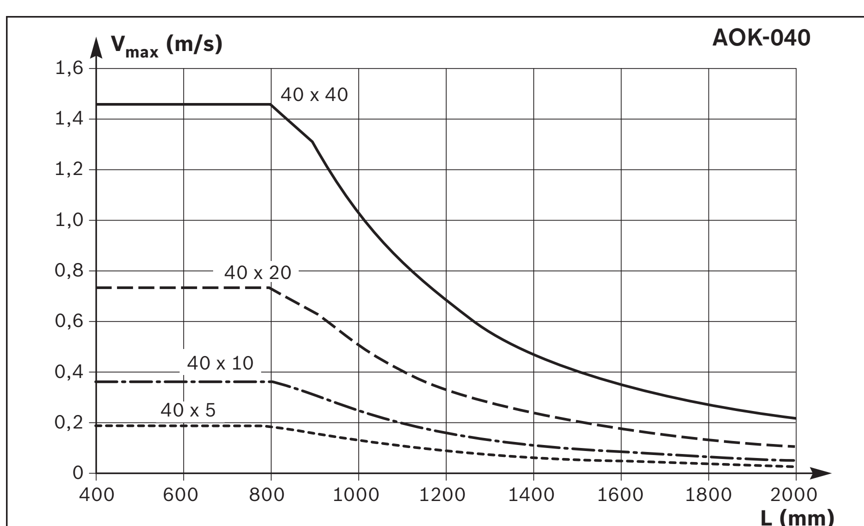


Maximum permissible speed v_{max} with fixed bearing only



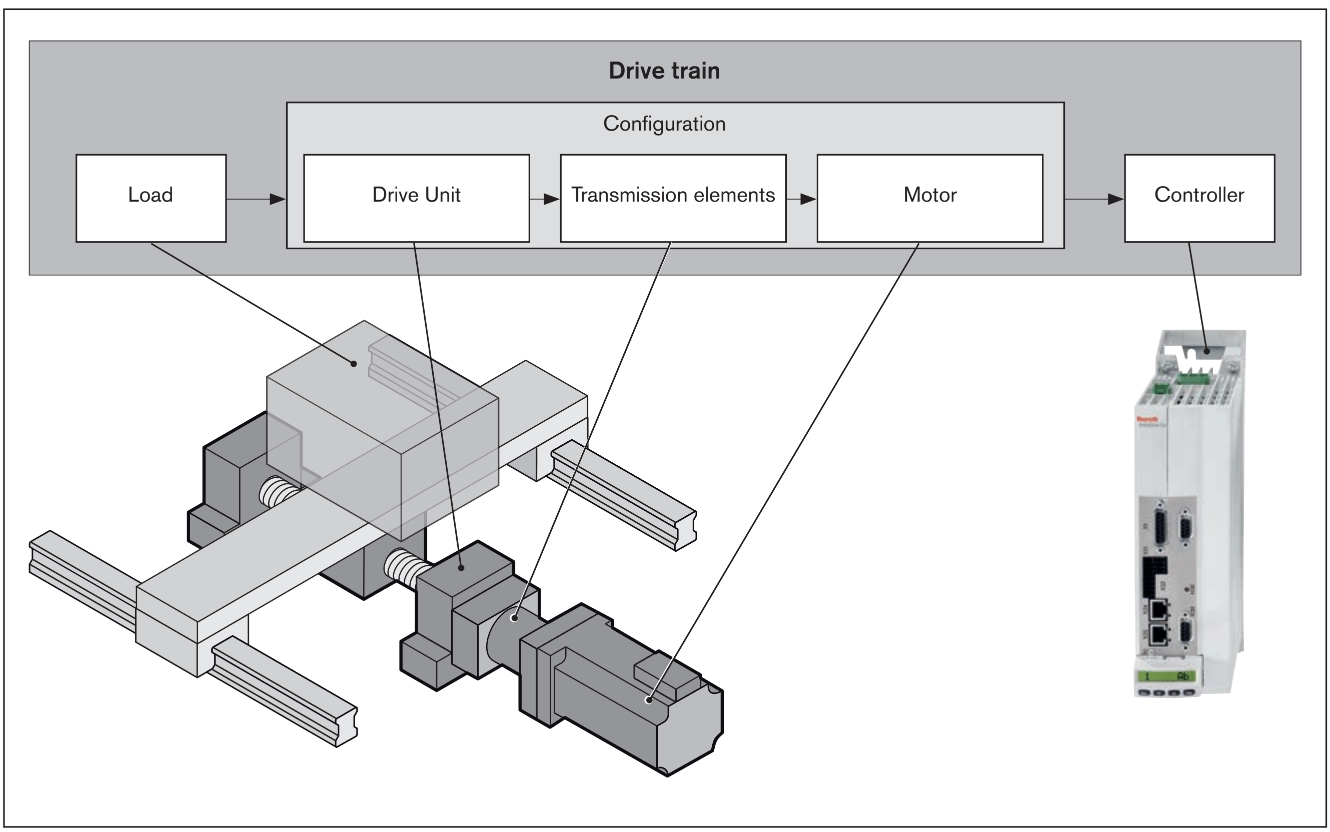






Calculation

Calculation principles



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

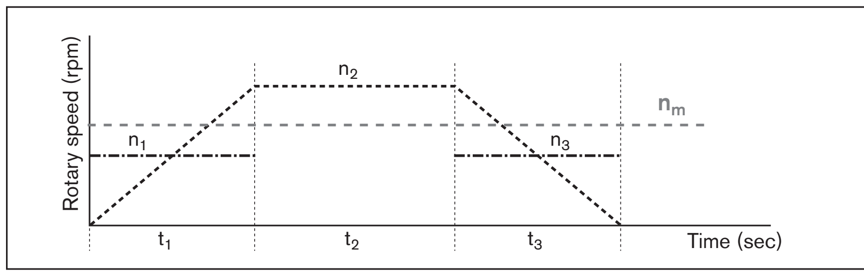
The service life of the rolling bearing points contained in a Drive Unit can be calculated using the formulas given below. In a Drive Unit with ball screw drive, the rolling bearing points that are relevant for the service life are the linear guide, the ball screw drive (nut), and the fixed bearing.

⚠ **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 $\mathbf{F_m}$ and $\mathbf{n_m}$.

If rotary speed varies, average rotary speed $\mathbf{n_m}$ is calculated as follows:



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

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

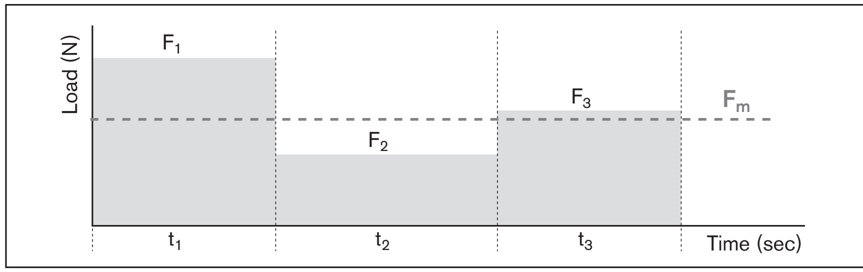
Rotary speed in acceleration and braking phases $\mathbf{n_{1 \ldots n}}$:

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

$n_1, n_2, \ldots n_n$	=	rotary speed in phases 1 … n	(rpm)
n_m	=	average rotary speed	(rpm)
$t_1, t_2, \ldots t_n$	=	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	
$n_{A1 \ldots n}$	=	rotary speed at start in phase 1 … n	(rpm)
$n_{E1 \ldots n}$	=	rotary speed at end in phase 1 … n	(rpm)

Calculation

Where both the load and the rotary speed vary, the average load $\mathbf{F_m}$ is calculated as follows:



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

Nominal life
Nominal life in revolutions:

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

Nominal life in hours:

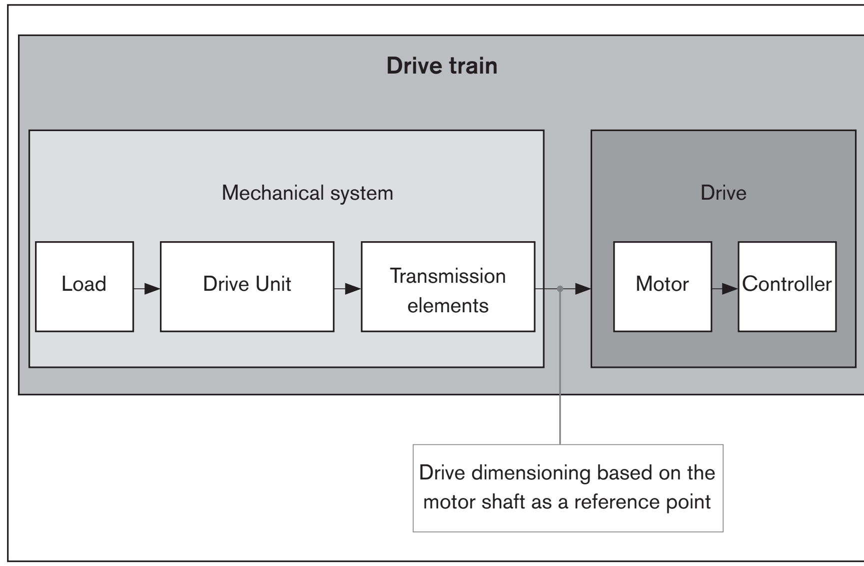
$$L_h = \frac{L}{n_m \cdot 60}$$

C	=	dynamic load rating	(N)
$F_1, F_2, \ldots F_n$	=	axial load during phases 1 ... n	(N)
F_m	=	equivalent dynamic axial load	(N)
$n_1, n_2, \ldots n_n$	=	rotary speed in phases 1 … n	(rpm)
n_m	=	average rotary speed	(rpm)
$t_1, t_2, \ldots t_n$	=	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	**(kgm²)**	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

$$v_{mech} = v_{max}$$

Maximum permissible rotary speed
For motor attachment via mount and coupling

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

For motor attachment via timing belt side drive

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

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

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

For motor attachment via timing belt side drive

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

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).

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

n_{max} = max. rotary speed of motor (rpm)
n_{mech} = maximum permissible rotary speed of the mechanical system (rpm)

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

$$V = \frac{J_{ex}}{J_m + J_{br}}$$

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

J_{br} = mass moment of inertia of motor brake (kgm^2)
J_{ex} = mass moment of inertia of mechanical system (kgm^2)
J_m = mass moment of inertia of motor (kgm^2)
V = ratio of mass moments of inertia of drive train and motor (–)

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

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

Static load moment

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

Weight moment
For vertical mounting only!
For motor attachment via mount and coupling: $i = 1$

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

g	=	force of gravity (= 9.81)	(m/s²)
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	(–)

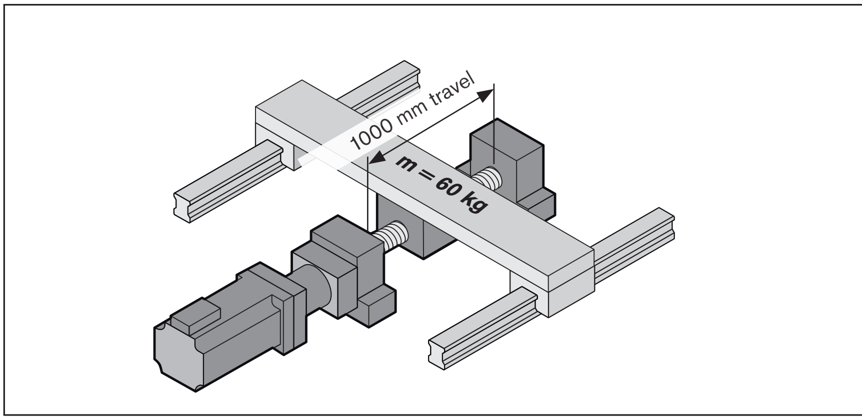
In the section ➠“Configuration and ordering”, users can put together standard configurations, including motor attachment and motor, for the various Drive Unit sizes by selecting the appropriate options. By checking the above conditions, it is possible to see whether a standard motor selected in a particular 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 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.)

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

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 m/s and L = 1370 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:

$v_{max} = 1.0$ m/s

Calculation of length L

(for selected BASA)

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

Frictional torque M_R

(motor attachment via timing belt side drive)

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

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: $J_s = (k_{J\ fix} + k_{J\ var} \cdot L) \cdot 10^{-6}$
$= (163.8 + 0.7117 \cdot 1322) \cdot 10^{-6}$
$= 1104.67 \cdot 10^{-6}\ \text{kgm}^2$

External load: $J_t = m_{ex} \cdot k_{J\ m} \cdot 10^{-6}$
$= 60 \cdot 10.1321 \cdot 10^{-6}$
$= 607.93 \cdot 10^{-6}\ \text{kgm}^2$

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_{mech}	=	minimum $(M_{sd}; \frac{M_p}{i})$
Timing belt side drive:	M_{sd}	=	12.3 Nm (gear ratio i = 2 for MSK 060C)
Drive Unit:	M_p	=	47 Nm
Drive torque:	M_{mech}	=	minimum $(12.3; \frac{47}{2})$
		=	minimum (12.3; 23.5)
		=	12.3 Nm

Checking motor preselection

Selected motor:
MSK 060C without brake

Condition 1:

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

$6000 \geq 3600$ condition met – motor selection OK

Condition 2:

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

Motor inertia: $J_m = 800 \cdot 10^{-6}$ kgm²

Brake inertia: $J_{br} = 0 \cdot 10^{-6}$ kgm² (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: $V \leq 6$

$0.86 \leq 6$ condition fulfilled – motor selection OK

Condition 3:

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

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

$= 1.175$ Nm

Torque of the motor at standstill $M_0 = 8$ Nm

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

$0.15 \leq 0.6$ 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.

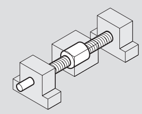
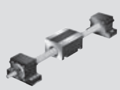
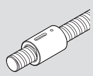
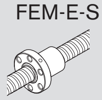
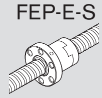
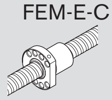
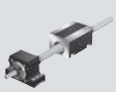
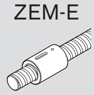
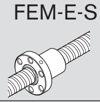
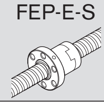
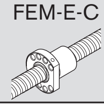
When doing this, the following data must be considered.

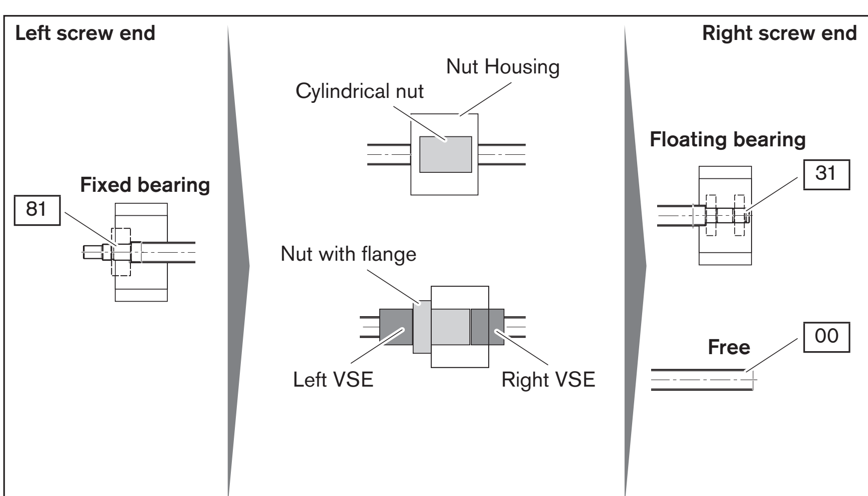
Frictional torque: M_R = 1.175 Nm
Mass moment of inertia: J_{ex} = $688.15 \cdot 10^{-6}$ kgm²
Speed: v_{mech} = 0.6 m/s (n_{mech} = 3600 rpm)
Drive torque limit: M_{mech} = 12.3 Nm
➠ Motor torque should be limited to 12.3 Nm on the drive side.
Acceleration limit: a_{max} = 50 m/s²
Speed limit value: v_{max} = 1 m/s (n_{mech} = 6000 rpm)

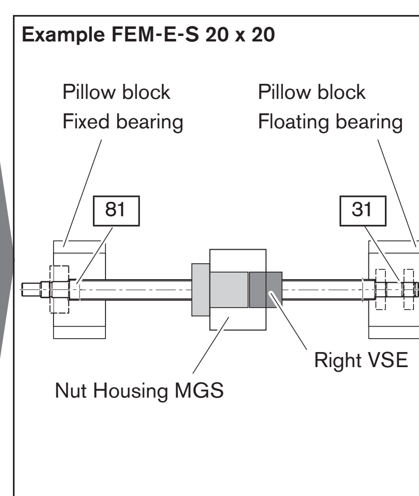
Besides the preferred type MSK 060C, other motors with identical connection dimensions can be adapted while taking care not to exceed the limits.

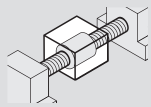
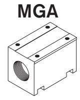
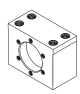
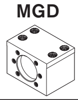
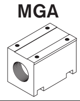
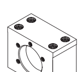
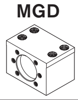
AOK-020

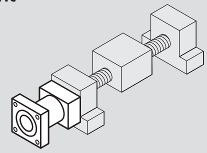
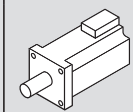
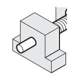
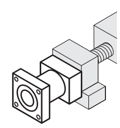
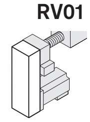
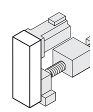
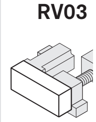
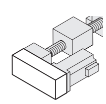
Configuration and ordering

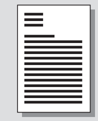
Short product name, length: AOK-020-NN-1, ... mm	Drive BASA  nut	Size d_0 x P 20 x 5	20 x 10	20 x 20	20 x 40	Tolerance grade		Standard seal	Lubrication Initial greasing	Left VSE	Right VSE	Preload class C1 (moderate)	C2 (medium)	C3 (high)
Fixed and floating bearing 	ZEM-E 	01	04	02	–	T5	T7	1	1	–	–	3	6	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	–			



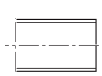


Screw ends Left	Screw ends Right	Pillow block Aluminum	Pillow block Steel	Nut Housing  without	Nut Housing with	Type
81	31	02	12	–	01	MGA 
				–	02	
81	31	02	12	00	11	MGS 
				00	14	
				00	12	
81	31	02	12	00	13	
81	31	02	12	00	21	MGD 
				00	23	
				00	22	
81	00	01	11	–	01	MGA 
				–	12	
81	00	01	11	00	11	MGS 
				00	14	
				00	12	
81	00	01	11	00	13	
81	00	01	11	00	21	MGD 
				00	23	
				00	12	

Motor attachment 	Version	Gear ratio	Attachment kit 1)	for motor	Motor  without brake	Motor with brake
without mount	OF01 	–	00	–	00	
with mount	MF01 	–	06	MSM 041B[2]	110	111
			02	MSK 040C[2]	86	87
			07	MSK 050C[2]	88	89
with timing belt side drive	RV01  RV02  RV03  RV04 	i = 1	32	MSM 041B[2]	110	111
			30	MSK 040C[2]	86	87
			23	MSK 050C[2]	88	89

Documentation  Standard report	Measurement report
01	03 Lead deviation

Screw ends
Free end

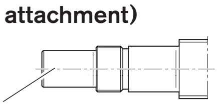


00

Floating bearing end

31

Fixed bearing end (motor attachment)



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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

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

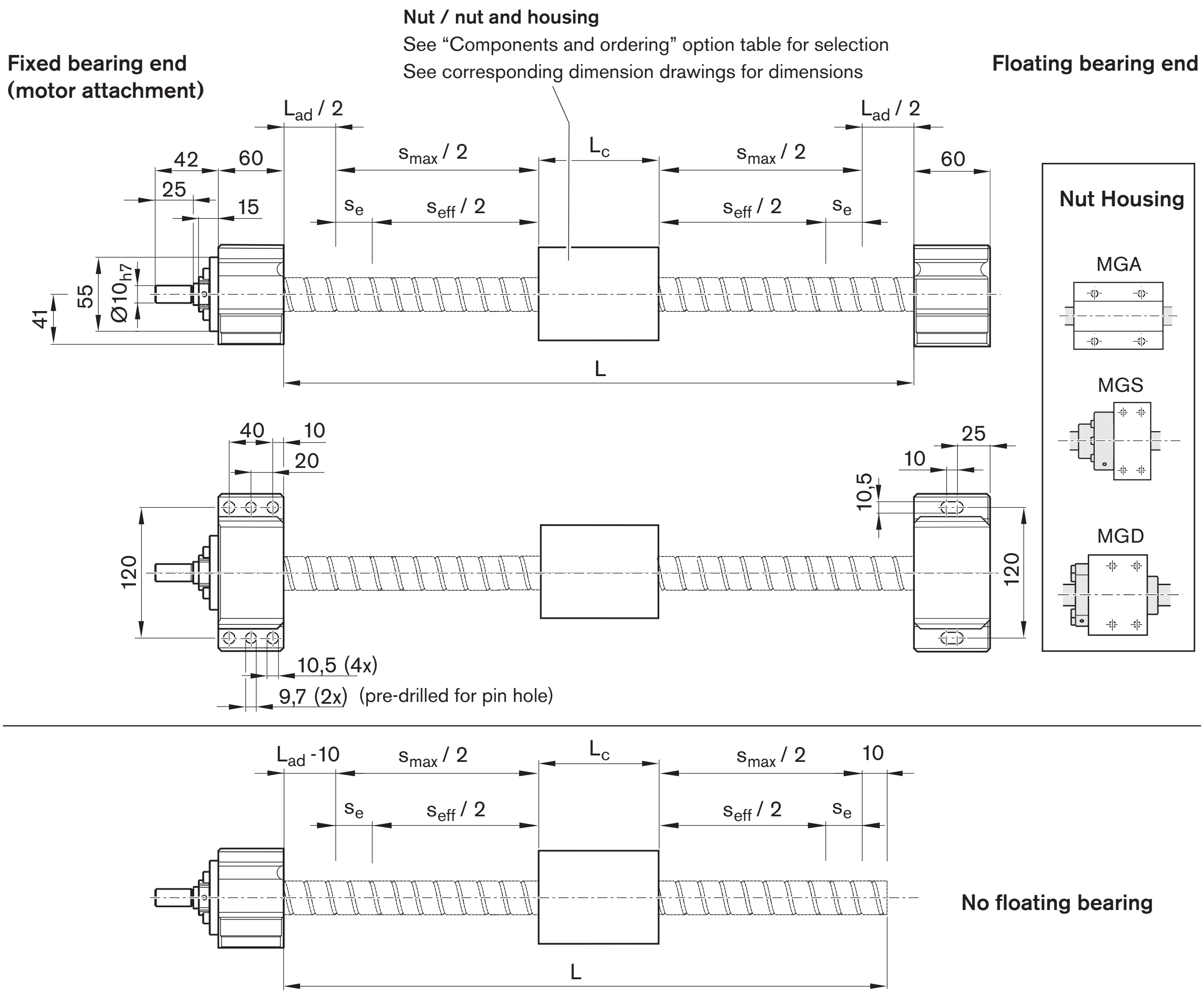
d_0	= nominal diameter
P	= lead
VSE	= Front Lube Unit
s_e	= excess travel
s_{max}	= max. travel
s_{eff}	= effective stroke
L	= length
L_c	= nut length/nut and housing length
L_{ad}	= additional length (see "Technical data" section)

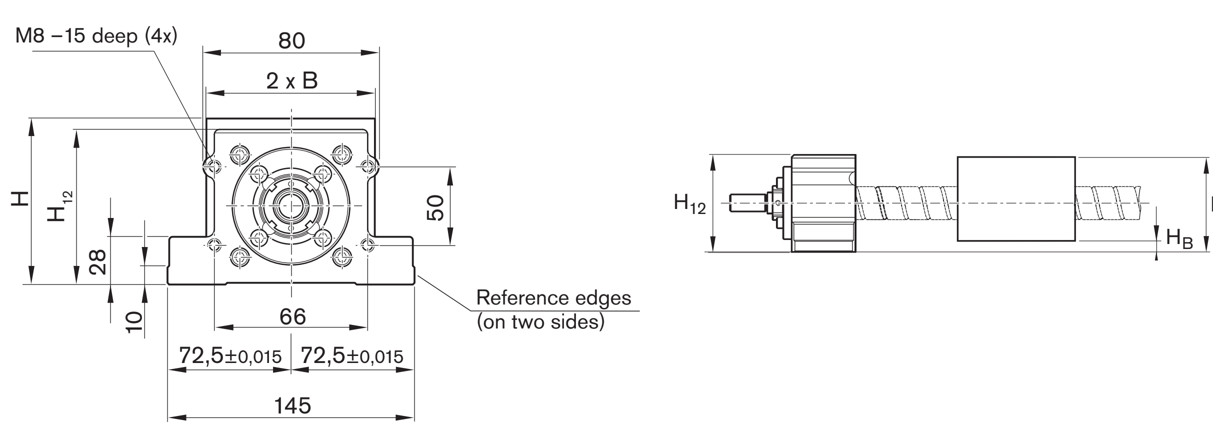
See ordering example for sample length calculation.

AOK-020

Dimensional drawings

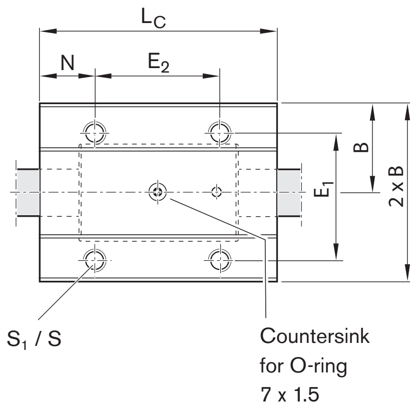
All dimensions in mm. Drawings not to scale.
Straightness and flatness tolerance in accordance with DIN EN 12020-02

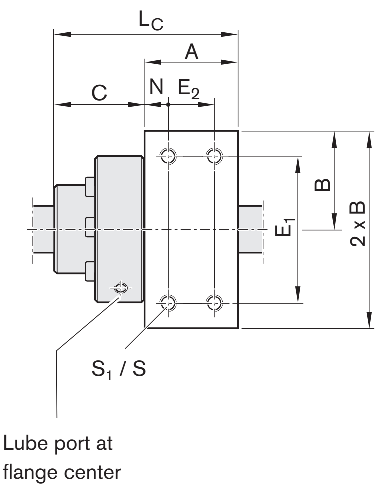


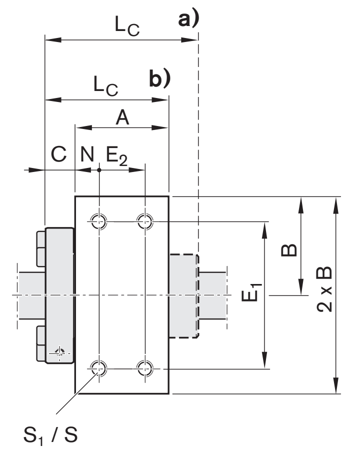


Nut and housing dimension drawings

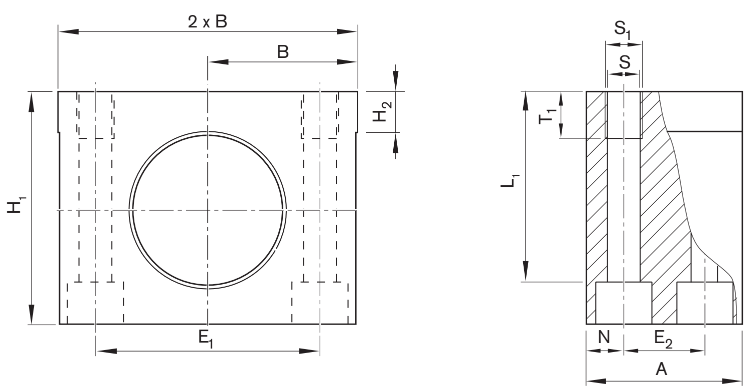
Figure 1 (MGA) **Figure 2 (MGS, MGD)** **Figure 3 a) / Figure 3 b) (MGS, MGD)**







Dimension drawing for all Nut Housings (Figure 1, 2, 3)

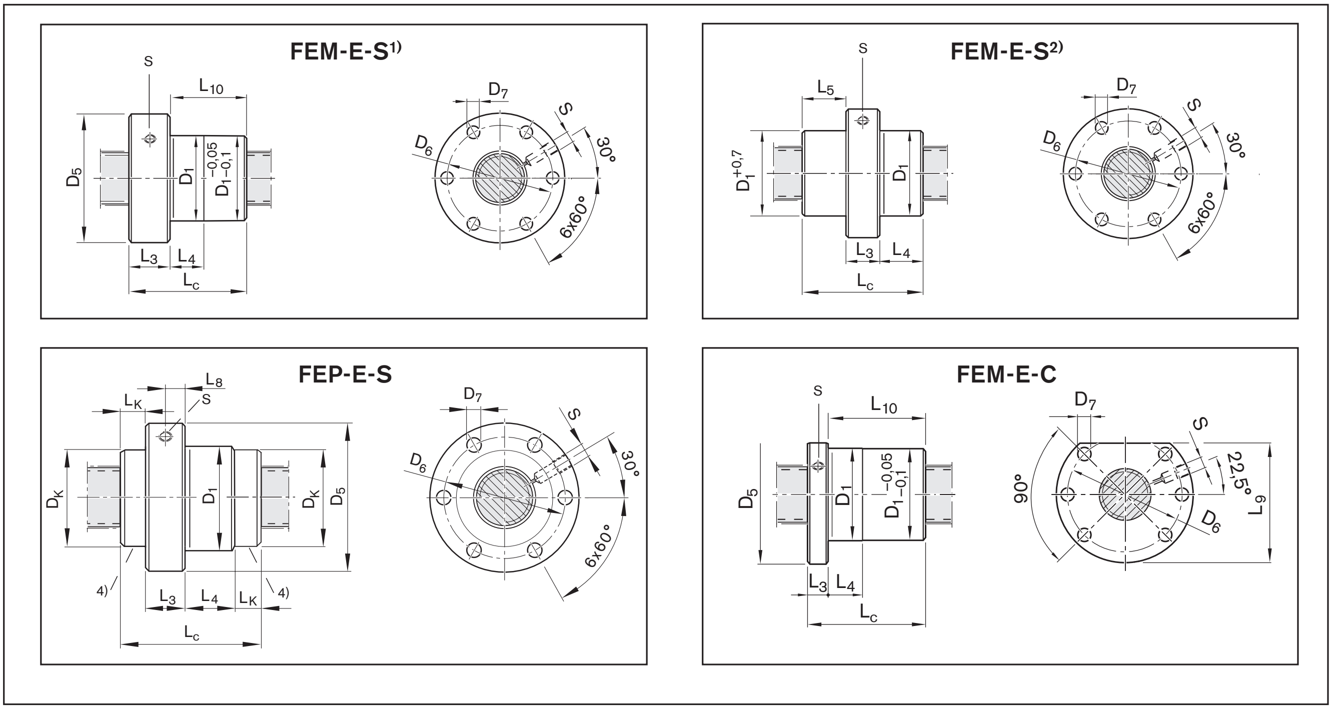


S_1 = 4x thread
S = 4x through-hole

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	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	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	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)

AOK-020 Nut dimension drawings

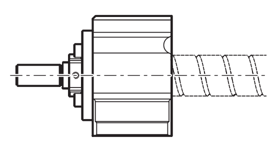
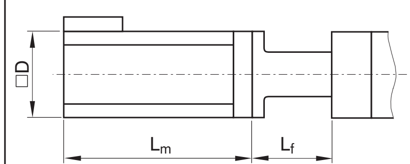
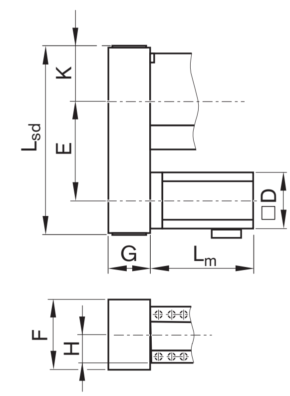


AOK-020	Nut	Dimensions (mm)												
d_0 x P		D_1 (g6)	D_5	D_6	D_7	D_K	L_C	L_3	L_4	L_5	L_8	L_9	L_{10}	L_K	S[3)]
20 x 5	FEM-E-S[1)]	33	58	45	6.6	–	40	12	10.0	–	–	–	28	–	M6
	FEM-E-C	36	58	47	6.6	–	40	12	10.0	–	–	51	28	–	M6
20 x 10	FEM-E-S[1)]	33	58	45	6.6	–	60	12	16.0	18.5	–	–	48	–	M6
	FEM-E-C	36	58	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	$57^{\pm0.5}$	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 L3 ≤ 15 mm, countersink L3 > 15 mm;
4) Plastic recirculation cap

Motor attachment dimension drawings

Version

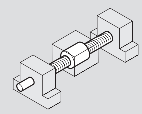
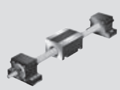
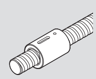
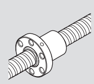
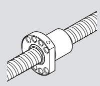
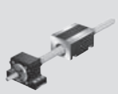
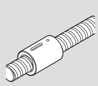
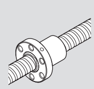
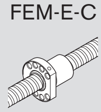
OF01	MF01	RV01, RV02, RV03, RV04
		

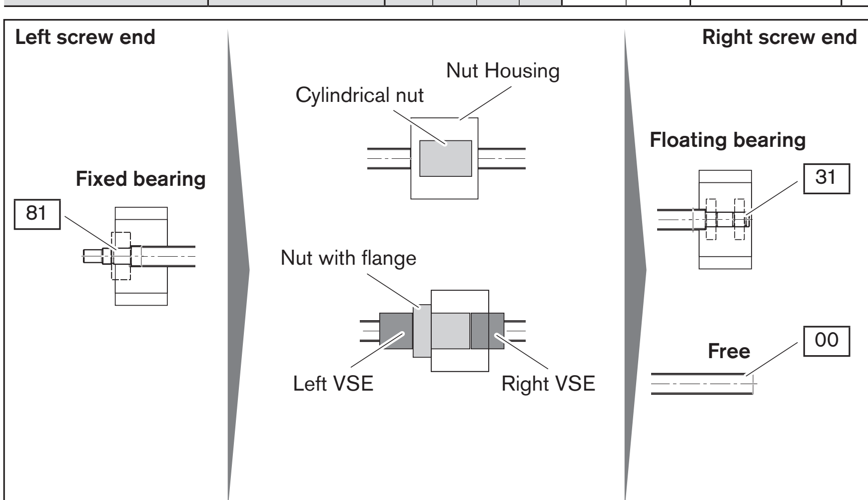
Version	Motor	Dimensions (mm) D	E i = 1	F	G	H	K	L_f	L_m without brake	L_m with brake	L_{sd} i = 1
RV01, RV02, RV03, RV04	MSM 041B	80	122.5	88	51	41	47.5	–	112.0	149.0	231
	MSK 040C	82	122.5	88	51	41	47.5	–	185.5	215.5	231
	MSK 050C	100	155	116	66	41	56	–	203.0	233.0	287
MF01	MSM 041B	80	–	–	–	–	–	90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

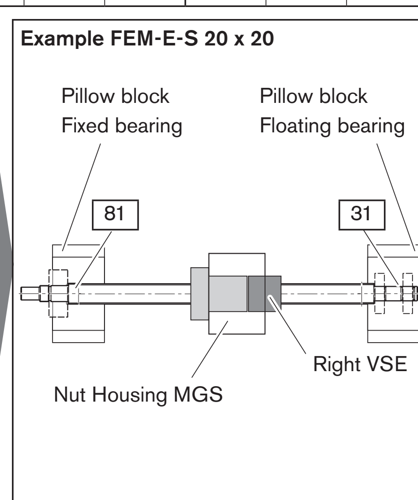
See “Motors” section for more information and dimensions

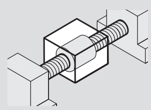
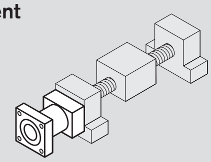
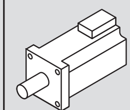
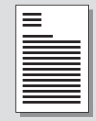
AOK-032

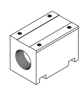
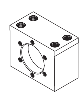
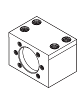
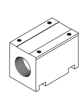
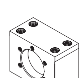
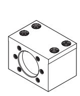
Configuration and ordering

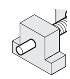
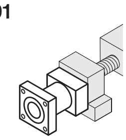
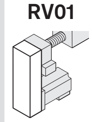
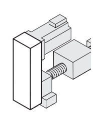
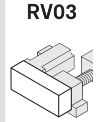
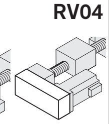
Short product name, length: AOK-032-NN-1, ... mm	Drive BASA  nut	Size d_0 x P				Tolerance grade		Standard seal	Lubrication			Preload class		
		32 x 5	32 x 10	32 x 20	32 x 32				Initial greasing	Left VSE	Right VSE	C1 (moderate)	C2 (medium)	C3 (high)
Fixed and floating bearing 	ZEM-E 	01	02	03	04	T5	T7	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									



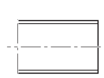


Screw ends Left	Screw ends Right	Pillow block Aluminum	Pillow block Steel	Nut Housing without	Nut Housing with	Type
81	31	02	12	–	01	MGA 
81	31	02	12	00	11	MGS 
				00	13	
				00	12	
				00	14	
81	31	02	12	00	21	MGD 
				00	22	
				00	23	
				00	24	
81	00	01	11	–	01	MGA 
81	00	01	11	00	11	MGS 
				00	13	
				00	12	
				00	14	
81	00	01	11	00	21	MGD 
				00	22	
				00	23	
				00	24	

Motor attachment	Version	Gear ratio	Attachment kit[1]	for motor	Motor without brake	Motor with brake	Documentation: Standard report	Documentation: Measurement report
without mount	OF01 	–	00	–	00		01	03 Lead deviation
with mount	MF01 	–	03	MSK 60C[2]	90	91		
			02	MSK 76C[2]	92	93		
with timing belt side drive	RV01  RV02 	i = 1	23	MSK 60C[2]	90	91		
	RV03  RV04 	i = 2	24	MSK 60C[2]	90	91		

Screw ends
Free end

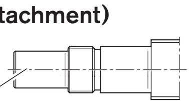


00

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

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

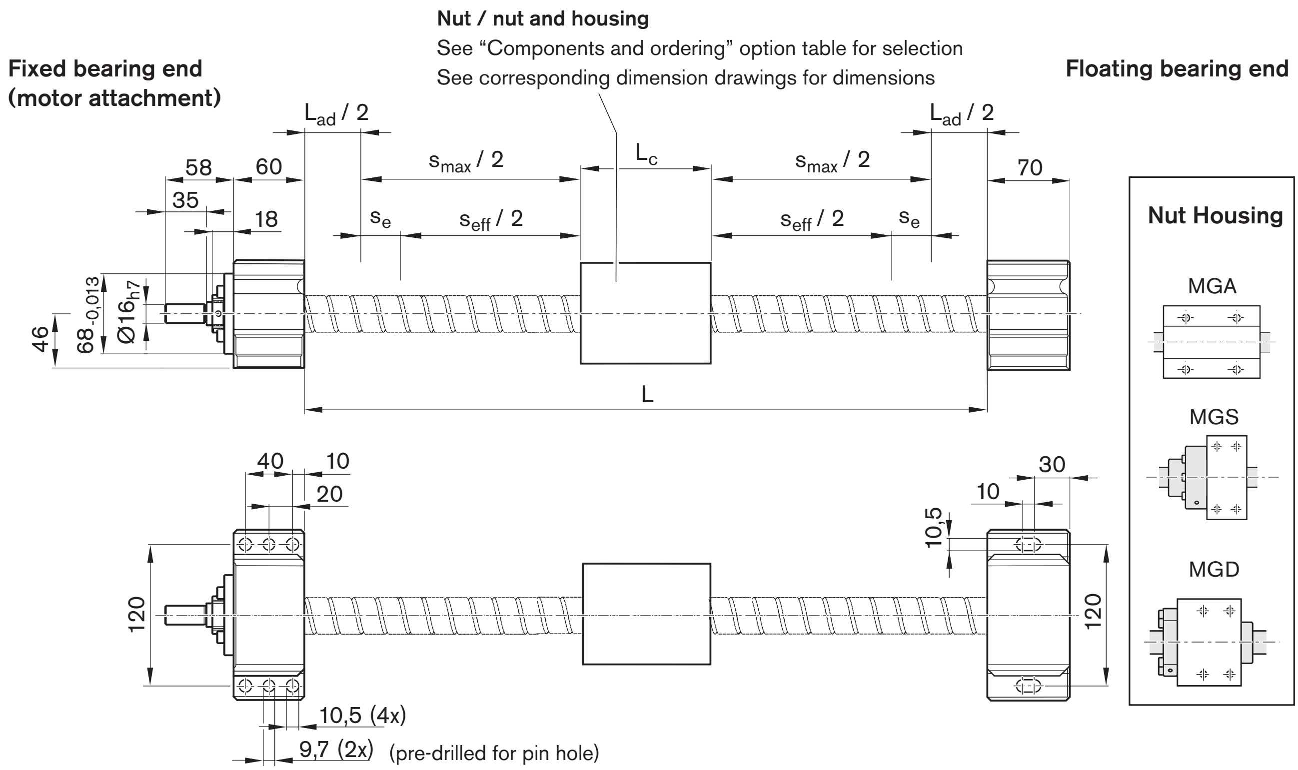
d_0	= nominal diameter
P	= lead
VSE	= Front Lube Unit
s_e	= excess travel
s_{max}	= max. travel
s_{eff}	= effective stroke
L	= length
L_c	= nut length/nut and housing length
L_{ad}	= additional length (see "Technical data" section)

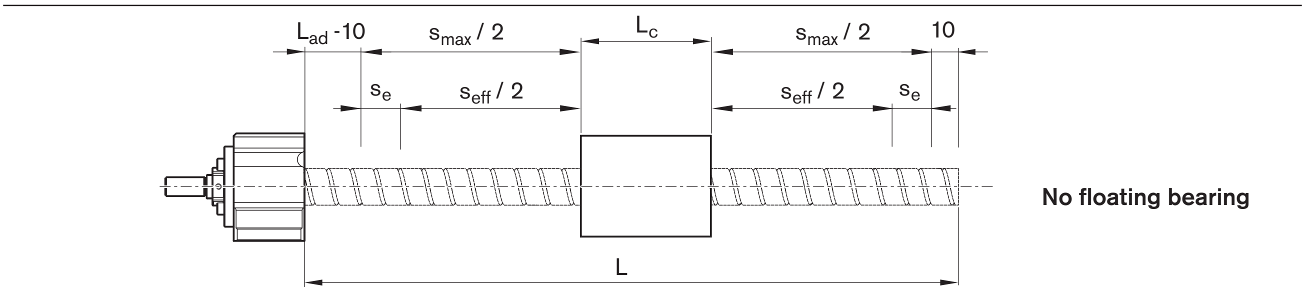
See ordering example for sample length calculation.

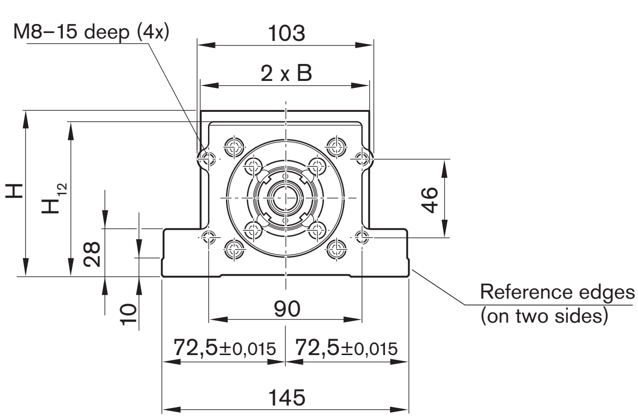
AOK-032

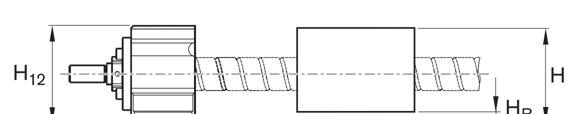
Dimensional drawings

All dimensions in mm. Drawings not to scale.
Straightness and flatness tolerance in accordance with DIN EN 12020-02









Nut and housing dimension drawings

Figure 1 (MGA)

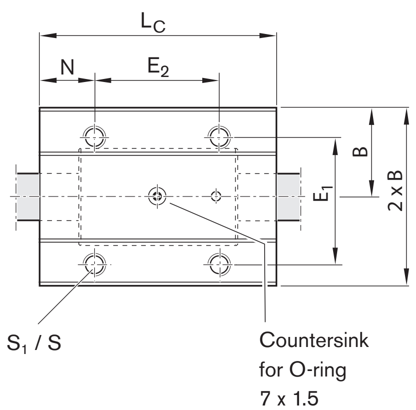


Figure 2 (MGS, MGD)

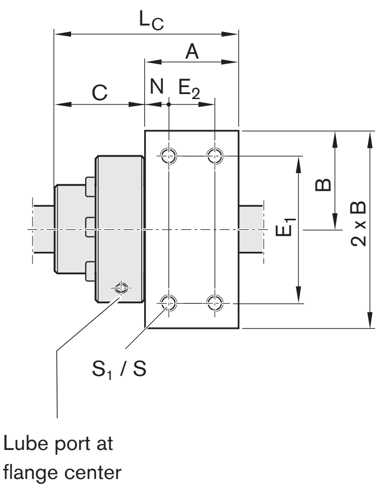
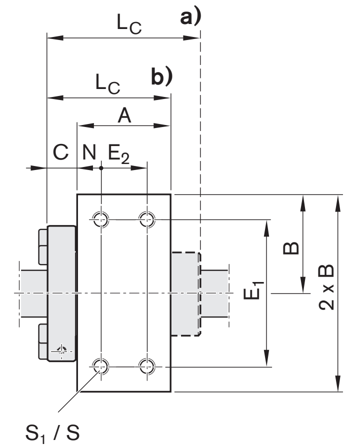
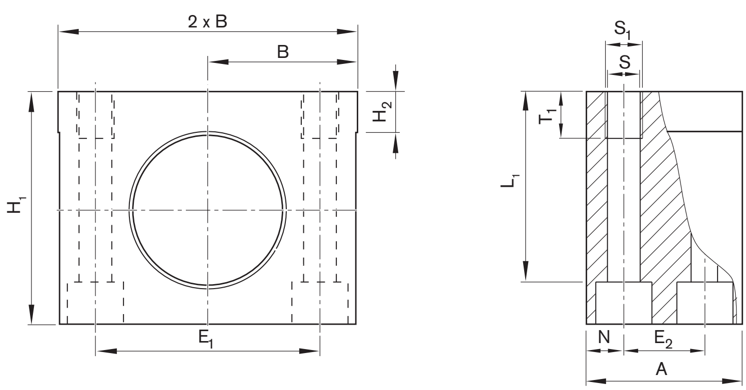


Figure 3 a) / Figure 3 b) (MGS, MGD)



Dimension drawing for all Nut Housings (Figure 1, 2, 3)



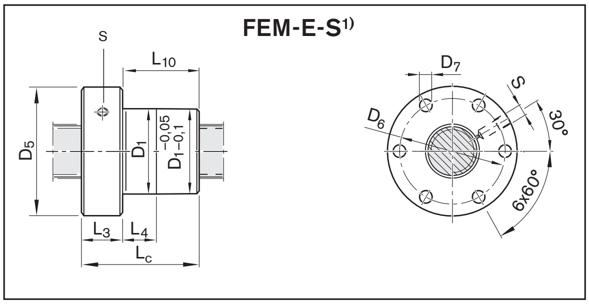
S_1 = 4x thread
S = 4x through-hole

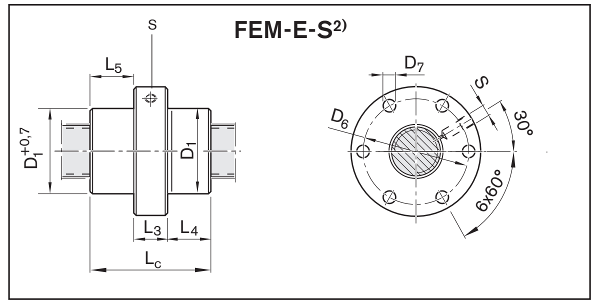
AOK-032 d_0 x P	Nut	Nut Housing	Fig-ure	A	B ±0.01	C	E_1	E_2	H	H_1	H_2	H_{12} ±0.15	H_B	L_C	L_1	N	S_1	S	T_1
32 x 5	ZEM-E	MGA	1	–	50	–	75	100	95	75	10	91	15	150	61	25	M12	10.5	18
	FEM-E-S	MGS	3 b)	50	47.5	13	$72^{\pm0.1}$	$26^{\pm0.1}$	84				9	63		12	M12	10.5	15
	FEM-E-C	MGD	3 b)	70	50	13	$75^{\pm0.1}$	$30^{\pm0.1}$	81				11	83		27	M16	13.0	20
32 x 10	ZEM-E	MGA	1	–	50	–	75	100	95				15	150	61	25	M12	10.5	18
	FEM-E-S	MGS	3 a)	50	47.5	13	$72^{\pm0.1}$	$26^{\pm0.1}$	84				9	77		15	M12	10.5	15
	FEM-E-C	MGD	3 b)	70	50	13	$75^{\pm0.1}$	$30^{\pm0.1}$	81				11	83		27	M16	13.0	20
32 x 20	ZEM-E	MGA	1	–	50	–	75	100	95	82	12		15	150	64	25	M12	10.5	18
	FEM-E-S	MGS	3 b)	60	52.5	15	$82^{\pm0.1}$	$30^{\pm0.1}$	88				6	75		15	M16	13.0	20
	FEM-E-C	MGD	3 a)	70	50	13	$75^{\pm0.1}$	$30^{\pm0.1}$	81				11	84		27	M16	13.0	20
32 x 32	ZEM-E	MGA	1	–	50	–	75	100	95				15	150	64	25	M12	10.5	18
	FEM-E-S	MGS	2	60	52.5	54	$82^{\pm0.1}$	$30^{\pm0.1}$	88				6	114		15	M16	13.0	20
	FEM-E-C	MGD	3 a)	70	50	13	$75^{\pm0.1}$	$30^{\pm0.1}$	81				11	120		27	M16	13.0	20

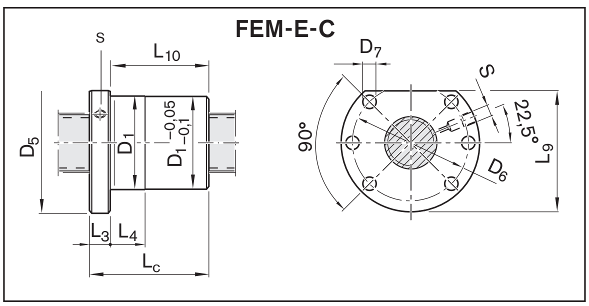
L_{ad} = additional length (see “Technical data” section)

AOK-032

Nut dimension drawings





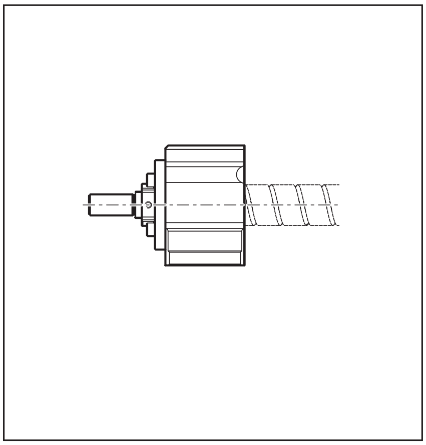
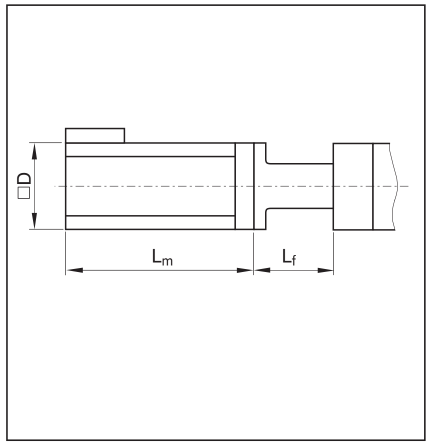
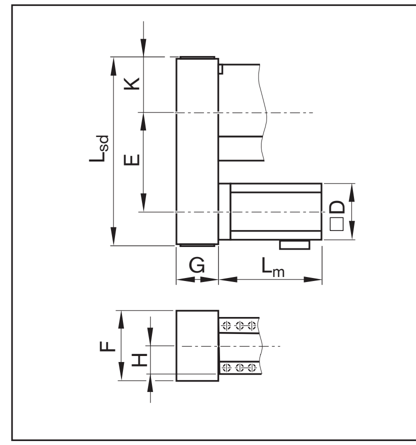


AOK-032	Nut	(mm)										
d_0 x P		D_1 (g6)	D_5	D_6	D_7	L_C	L_3	L_4	L_5	L_9	L_{10}	S3)
32 x 5	FEM-E-S1)	48	73	60	6.6	48	13	10	–	–	35	M6
	FEM-E-C	50	80	65	9.0	48	13	10	–	71	35	M6
32 x 10	FEM-E-S1)	48	73	60	6.6	77	13	16	–	–	64	M6
	FEM-E-C	50	80	65	9.0	77	13	16	–	71	64	M6
32 x 20	FEM-E-S1)	56	80	60	6.6	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 L3 ≤ 15 mm, countersink L3 > 15 mm;

Motor attachment dimension drawings

Version

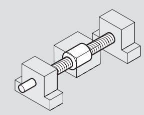
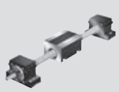
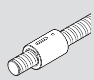
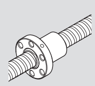
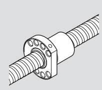
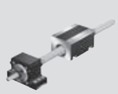
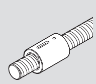
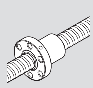
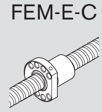
OF01	MF01	RV01, RV02, RV03, RV04
		

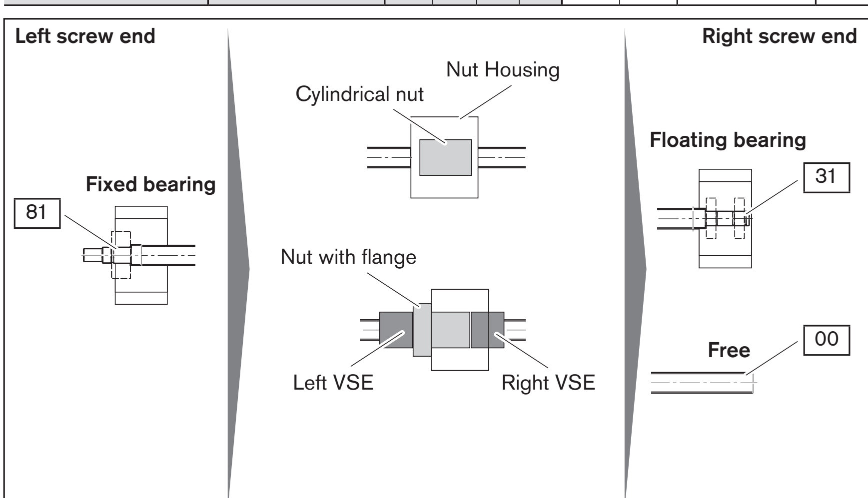
Version	Motor	Dimensions (mm) D	E i = 1	E i = 2	F	G	H	K	L_f	L_m without brake	L_m with brake	L_{sd} i = 1	L_{sd} i = 2
RV01, RV02, RV03, RV04	**MSK 060C**	116	165	162	116	66	46	59	–	226.0	259.0	300	300
MF01	**MSK 060C**	116	–	–	–	–	–	–	125	226.0	259.0	–	–
	MSK 076C	140	–	–	–	–	–	–	133	292.5	292.5	–	–

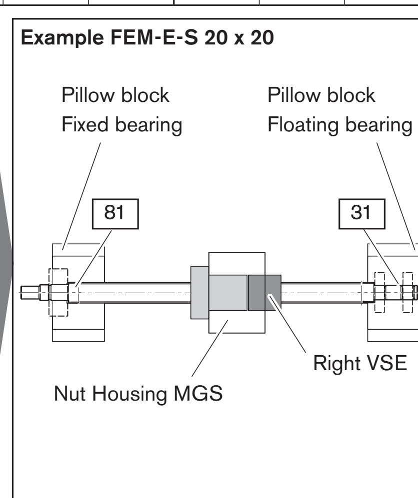
See “Motors” section for more information and dimensions

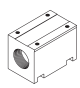
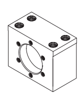
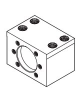
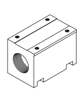
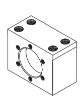
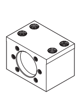
AOK-040

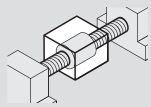
Configuration and ordering

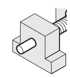
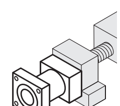
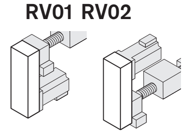
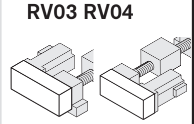
Short product name, length: AOK-040-NN-1, ... mm	Drive BASA  nut	Size d_0 x P 40 x 5	40 x 10	40 x 20	40 x 40	Tolerance grade		Seal Standard	Lubrication Initial greasing	Left VSE	Right VSE	Preload class C1 (moderate)	C2 (medium)	C3 (high)
Fixed and floating bearing 	ZEM-E 	01	02	03	04	T5	T7	1	1	–	–	3	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									

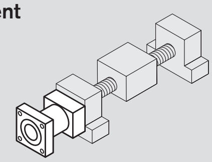


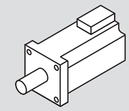


	Screw ends		Pillow block		Nut Housing		
	Left	Right	Aluminum	Steel	without	with	Type
	81	31	02	12	–	01	MGA 
	81	31	02	12	00	11	MGS 
					00	12	
					00	14	
					00	13	
	81	31	02	12	00	21	MGD 
					00	22	
					00	23	
					00	24	
	81	00	01	11	–	01	MGA 
	81	00	01	11	00	11	MGS 
					00	12	
					00	14	
					00	13	
	81	00	01	11	00	21	MGD 
					00	22	
					00	23	
					00	24	

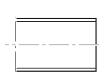


Motor attachment					Motor		Documentation	
Version		Gear ratio	Attachment kit 1)	for motor	without brake	with brake	Standard report	Measurement report
without mount	OF01 	–	00	–	00		01	03 Lead deviation
with mount	MF01 	–	02	MSK 076C[2]	92	93		
with timing belt side drive	RV01 RV02 	i = 1	23	MSK 076C[2]	92	93		
	RV03 RV04 	i = 2	24	MSK 076C[2]	92	93		





Screw ends
Free end

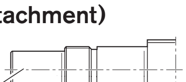


00

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

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

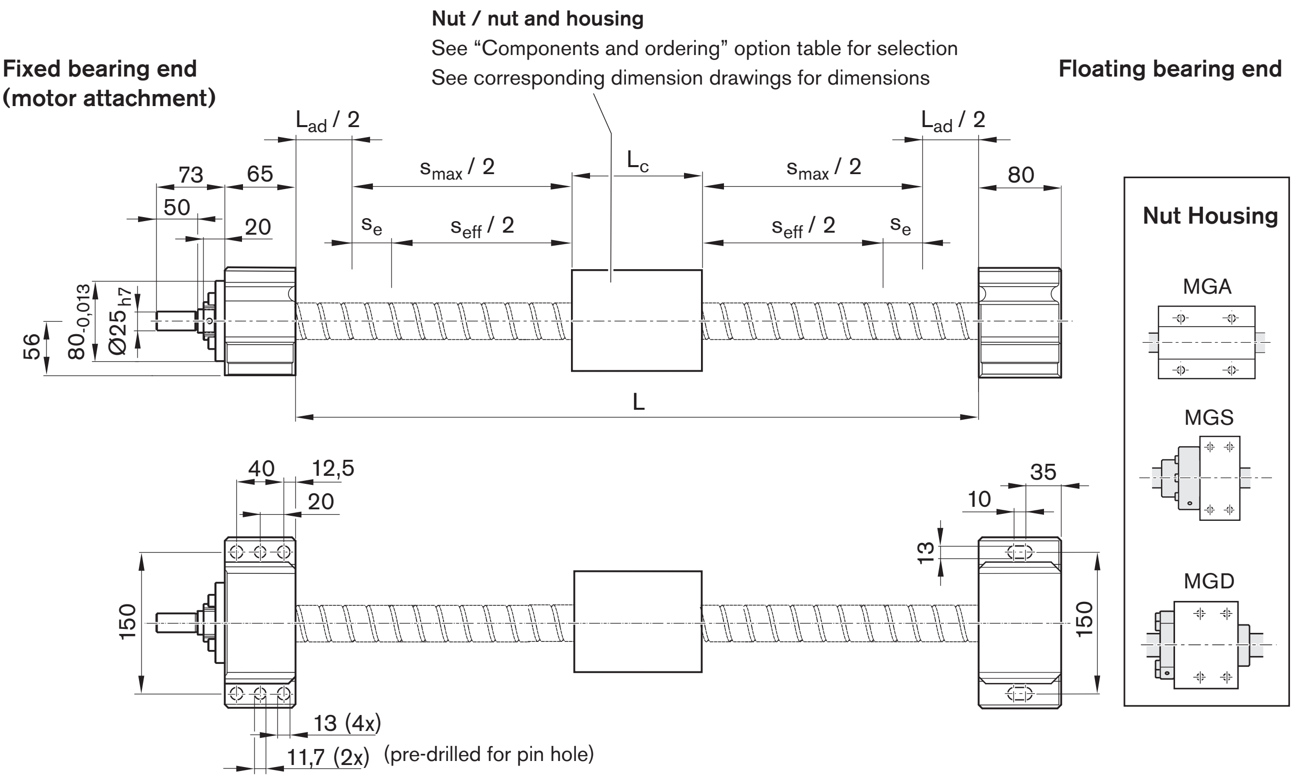
d_0	= nominal diameter
P	= lead
VSE	= Front Lube Unit
s_e	= excess travel
s_{max}	= max. travel
s_{eff}	= effective stroke
L	= length
L_c	= nut length/nut and housing length
L_{ad}	= additional length (see “Technical data” section)

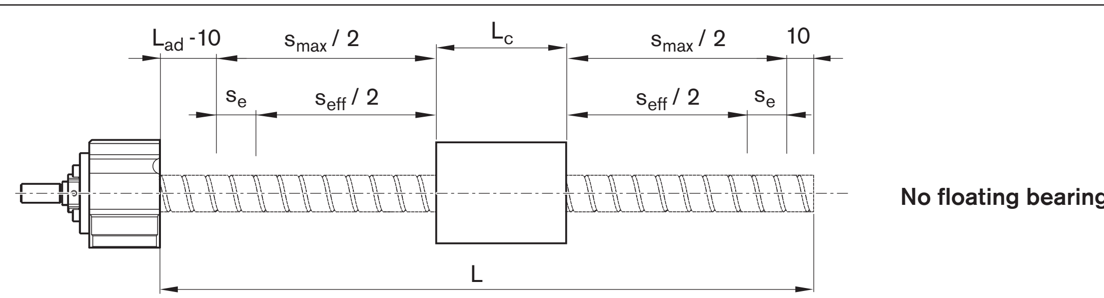
See ordering example for sample length calculation.

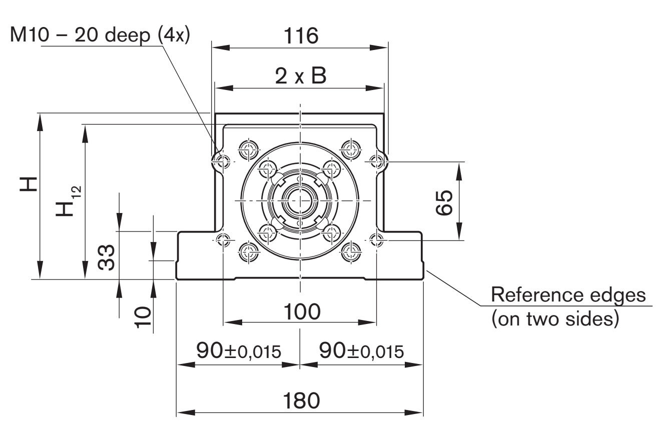
AOK-040

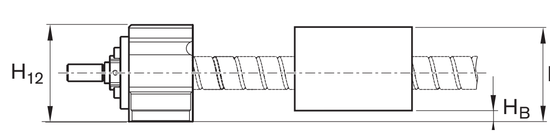
Dimensional drawings

All dimensions in mm. Drawings not to scale.
Straightness and flatness tolerance in accordance with DIN EN 12020-02



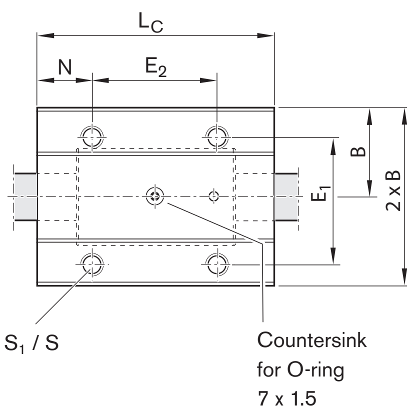


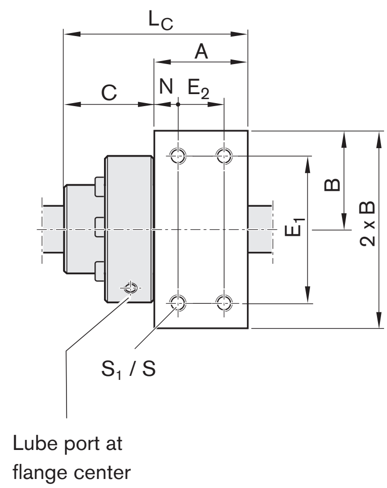


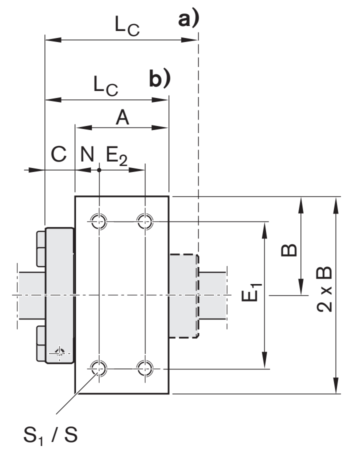


Nut and housing dimension drawings

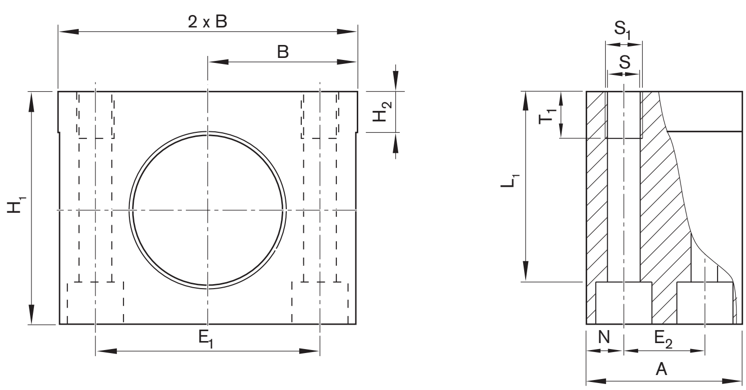
Figure 1 (MGA) **Figure 2 (MGS, MGD)** **Figure 3 a) / Figure 3 b) (MGS, MGD)**







Dimension drawing for all Nut Housings (Figure 1, 2, 3)



S_1 = 4x thread
S = 4x through-hole

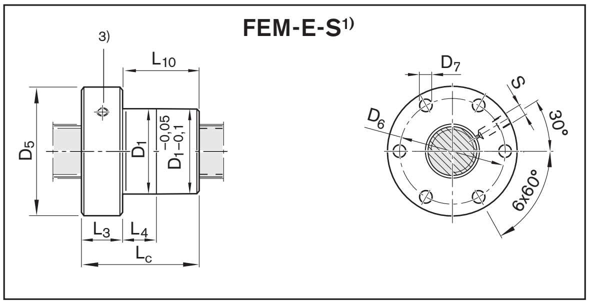
AOK-040 d_0 x P	Nut	Nut Housing	Figure	A	B ±0.01	C	E_1	E_2	H	H_1	H_2	H_{12} ±0.15	H_B	L_C	L_1	N	S_1	S	T_1
40 x 5	ZEM-E	MGA	1	–	60	–	90	120	115				10	180		30	M16	14.5	24
	FEM-E-S	MGS	3 b)	60	52.5	13	$82^{\pm0.1}$	$30^{\pm0.1}$	98	82			16	75	64	15	M16	13.0	20
	FEM-E-C	MGD	3 b)	80	60	13	$90^{\pm0.1}$	$35^{\pm0.1}$	98				14	95		31	M18	15.0	25
40 x 10	ZEM-E	MGA	1	–	60	–	90	120	115				10	180		30	M16	14.5	24
	FEM-E-S	MGS	3 b)	65	60	13	$93^{\pm0.1}$	$35^{\pm0.1}$	106	98			8	80	79	15	M18	15.0	25
	FEM-E-C	MGD	3 b)	80	60	13	$90^{\pm0.1}$	$35^{\pm0.1}$	98				14	95		31	M18	15.0	25
40 x 20	ZEM-E	MGA	1	–	60	–	90	120	115		12	111	10	180		30	M16	14.5	24
	FEM-E-S	MGS	3 a)	65	60	15	$93^{\pm0.1}$	$35^{\pm0.1}$	106	98			8	88	79	15	M18	15.0	25
	FEM-E-C	MGD	3 b)	80	60	13	$90^{\pm0.1}$	$35^{\pm0.1}$	98				14	95		31	M18	15.0	25
40 x 40	ZEM-E	MGA	1	–	60	–	90	120	115				10	180		30	M16	14.5	24
	FEM-E-S	MGS	2	80	70	54	$108^{\pm0.1}$	$46^{\pm0.1}$	114	113			1	151	92	17	M20	17.0	30
	FEM-E-C	MGD	3 a)	80	60	13	$90^{\pm0.1}$	$35^{\pm0.1}$	98				14	142		31	M18	15.0	25

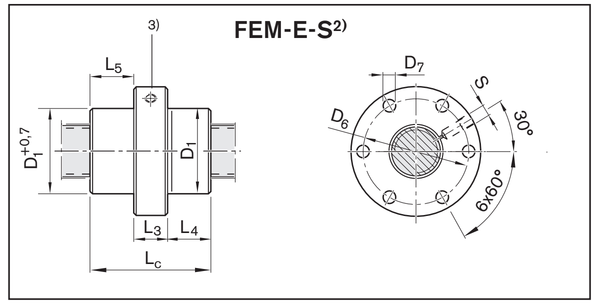
Dimensions (mm)

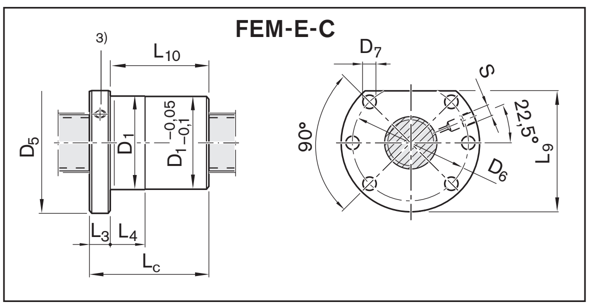
L_{ad} = additional length (see "Technical data" section)

AOK-040

Nut dimension drawings





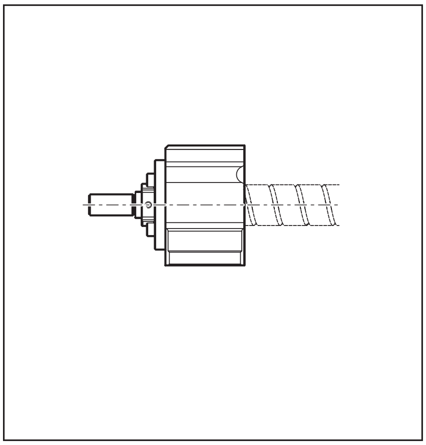
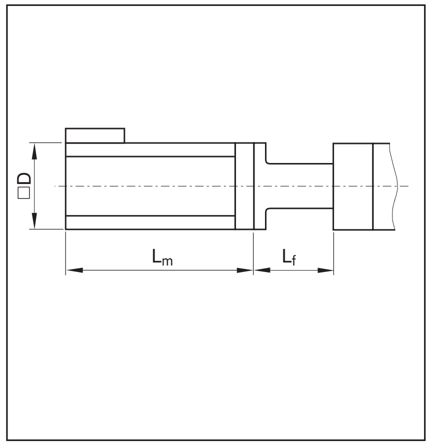
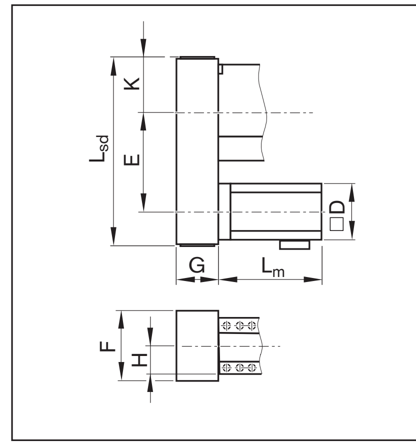


AOK-040	Nut	(mm)										
d_0 x P		D_1 (g6)	D_5	D_6	D_7	L_C	L_3	L_4	L_5	L_9	L_{10}	S3)
40 x 5	FEM-E-S1)	56	80	68	6.6	54	15	10	–	–	39	M8x1
	FEM-E-C	63	93	78	9.0	54	15	10		81.5	39	M8x1
40 x 10	FEM-E-S1)	63	95	78	9.0	70	15	16	–	–	55	M8x1
	FEM-E-C	63	93	78	9.0	70	15	16		81.5	55	M8x1
40 x 20	FEM-E-S1)	63	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 L3 ≤ 15 mm, countersink L3 > 15 mm;

Motor attachment dimension drawings

Version

OF01	MF01	RV01, RV02, RV03, RV04
		

Version	Motor	Dimensions (mm)											
		D	E		F	G	H	K	L_f	L_m		L_{sd}	
			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

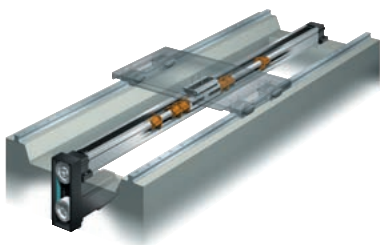
Product description

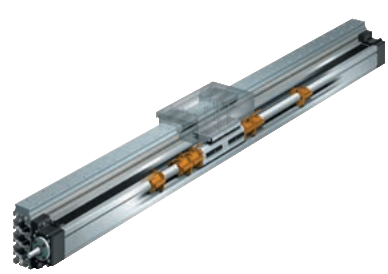
Properties
- AGK Drive Units in closed format are ready-to-install drive axes consisting of ball screw drive, Nut Housings and pillow blocks, as well as a protective aluminum profile with cover strip as an enclosure
- Three coordinated sizes available in any length up to L_{max}
- The BASA is optimally 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.

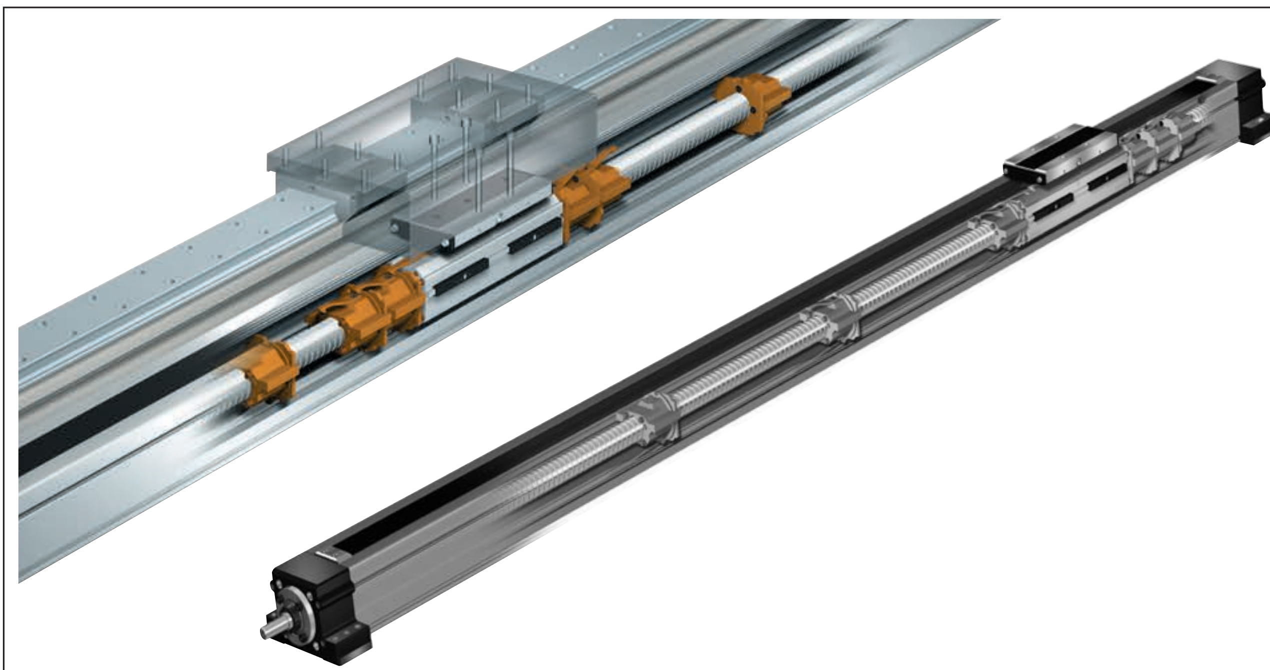
SPU product description

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

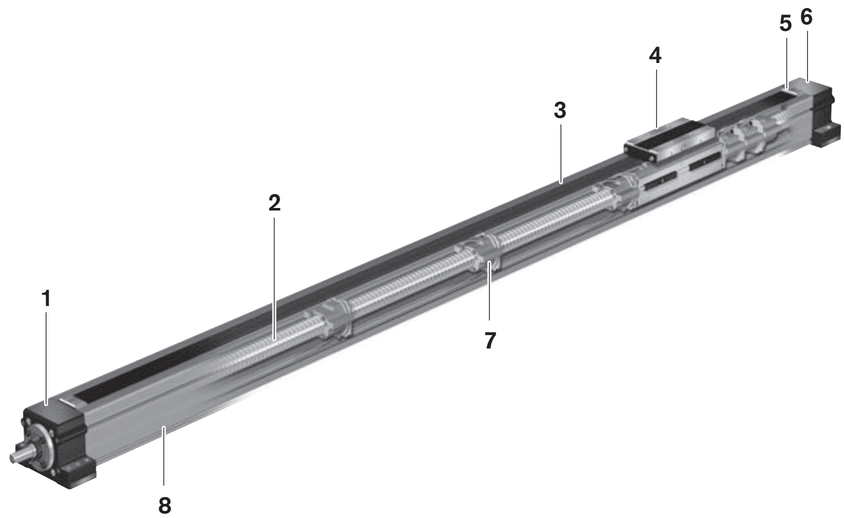
⚠ **Screw support designed for horizontal operation only.**

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.



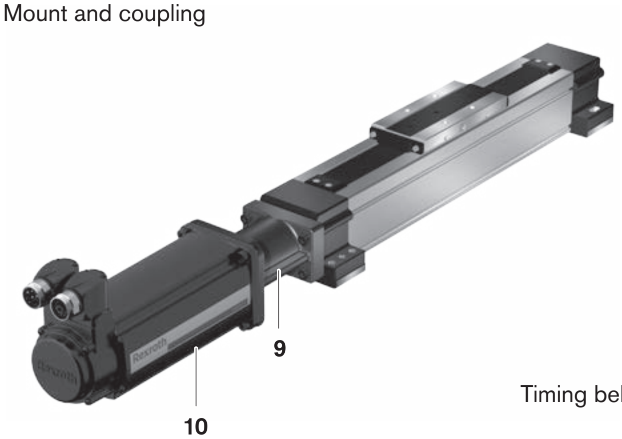
Structural design

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

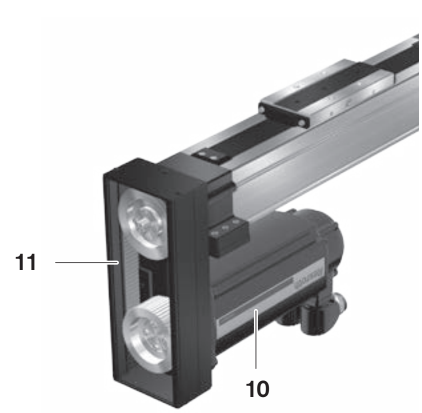


Motor attachment
9 Mount and coupling
10 Servo motor
11 Timing belt side drive

Mount and coupling



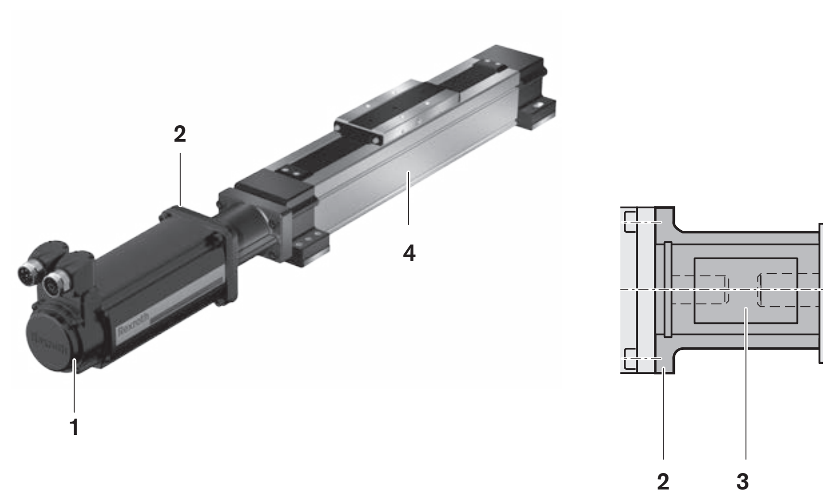
Timing belt side drive



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.

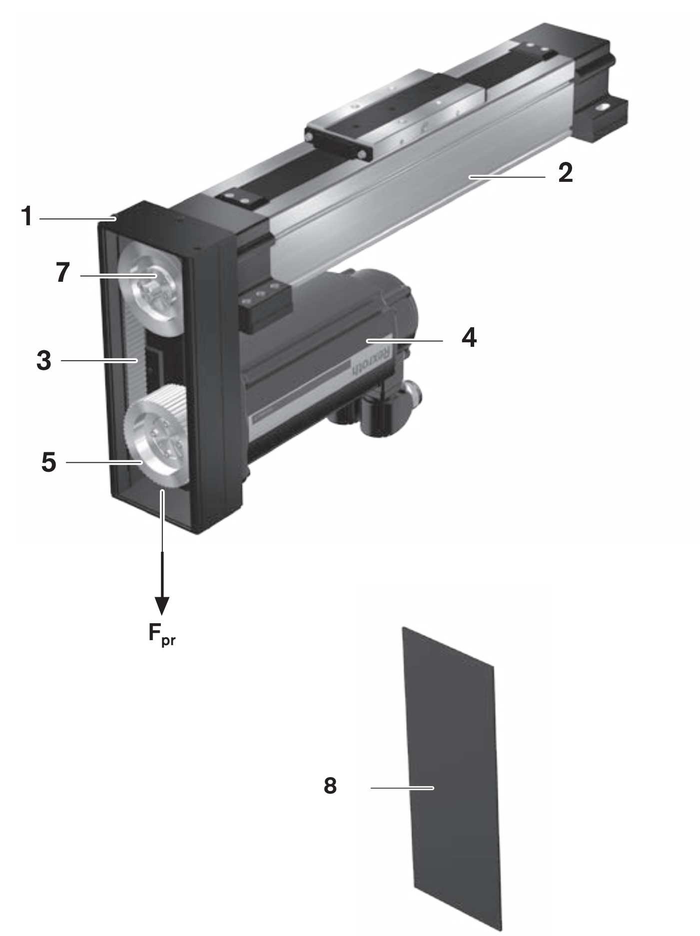
1 Motor
2 Mount
3 Coupling
4 Drive Unit



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



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							
						without	1	2	3				
	d_0 x P (mm)	(N)	(N)	s_{min} (mm)	L_{max} (mm)	L_{ad} (mm)				L_C (mm)	m_{ca} (kg)	$k_{g\ fix}$ (kg)	$k_{g\ var}$ (kg/mm)
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)

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

Drive data

AGK	BASA	Constant mass moment of inertia			Frictional torque				Max. permissible acceleration	Maximum permissible drive torque	Max. speed
					with number of SPU						
					without	1	2	3			
	d_0 x P (mm)	$k_{J\ fix}$ (kgmm²)	$k_{J\ var}$ (kgmm)	$k_{J\ m}$ (mm²)	M_{Rs} (Nm)				a_{max} (m/s²)	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		

Drive data for motor attachment via timing belt side drive

AGK	Motor	BASA (mm) d_0 x P	up to L[2] (mm)	M_{sd}[1] (Nm) i = 1	i = 2	J_{sd} (10^{-6} kgm²) i = 1	i = 2	M_{Rsd} (Nm)	m_{sd} (kg)	F (mm)	B_t 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

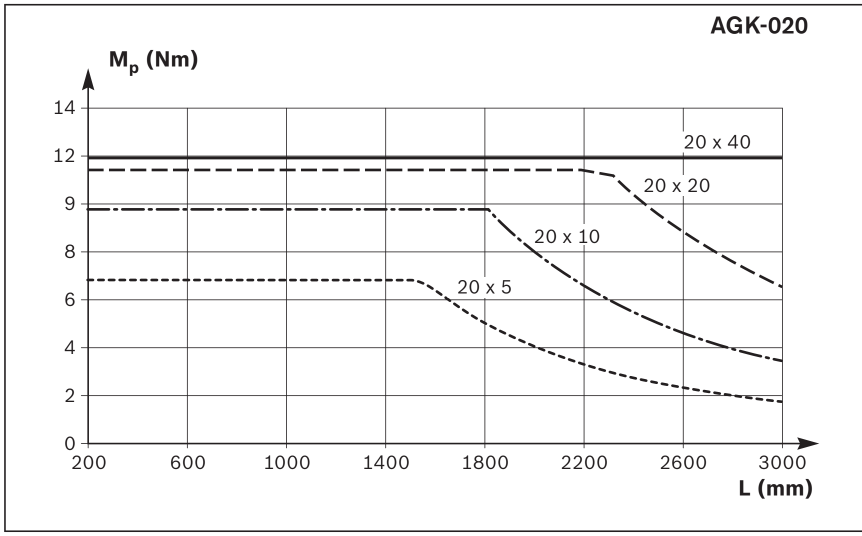
AGK	Motor Type	Coupling M_{cN} (Nm)	J_c (10^{-6} kgm²)	Mount and coupling m_{fc} (kg)
AGK-020	MSM 041B	14.5	63	0.85
	MSK 040C	19.0	57	0.55
	MSK 050C	50.0	200	2.00
AGK-032	MSK 060C	50.0	200	1.80
	MSK 076C	98.0	390	2.40
AGK-040	MSK 076C	98.0	390	2.80

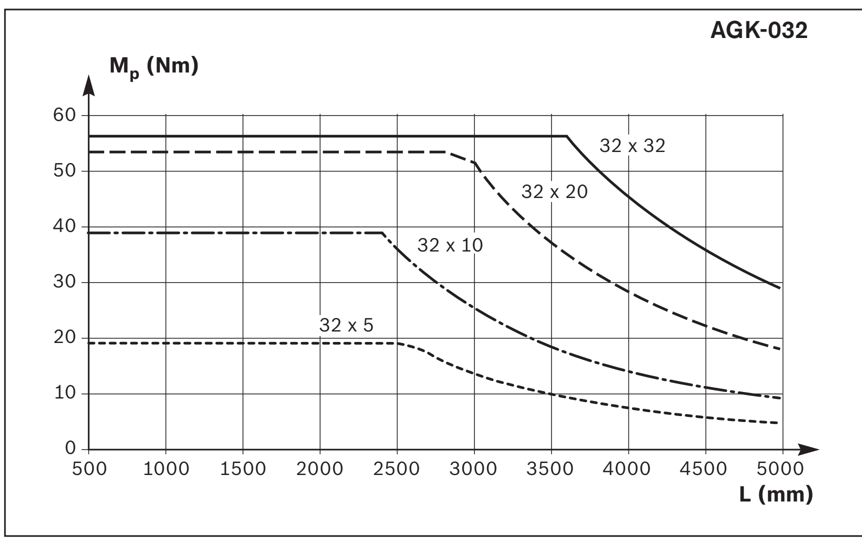
a_{max} = maximum acceleration
C = dynamic load rating
d_0 = nominal diameter
$k_{g\ fix}$ = constant for fixed-length portion of the mass
$k_{g\ var}$ = constant for variable-length portion of the mass
$k_{J\ fix}$ = constant for fixed-length portion of mass moment of inertia
$k_{J\ var}$ = constant for variable-length portion of mass moment of inertia
$k_{J\ m}$ = 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

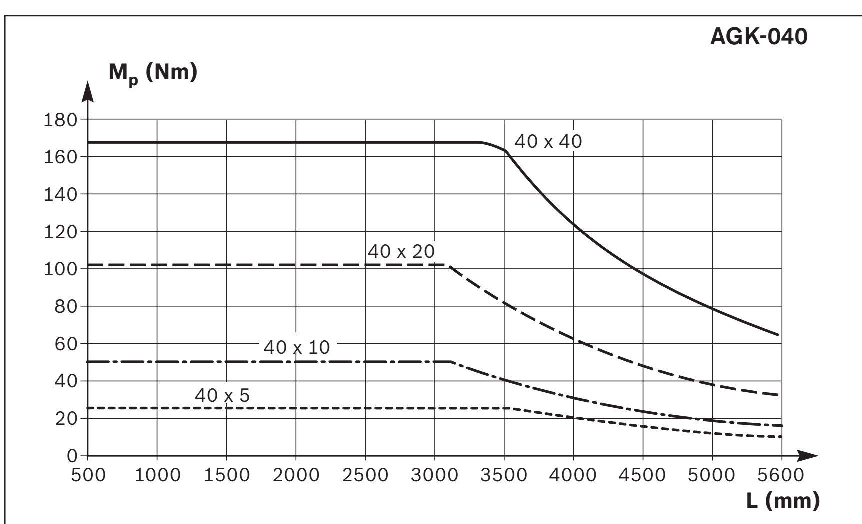
Technical data

Permissible drive torque M_p

The values shown for M_p apply under the following conditions:
- No radial loads on screw journal

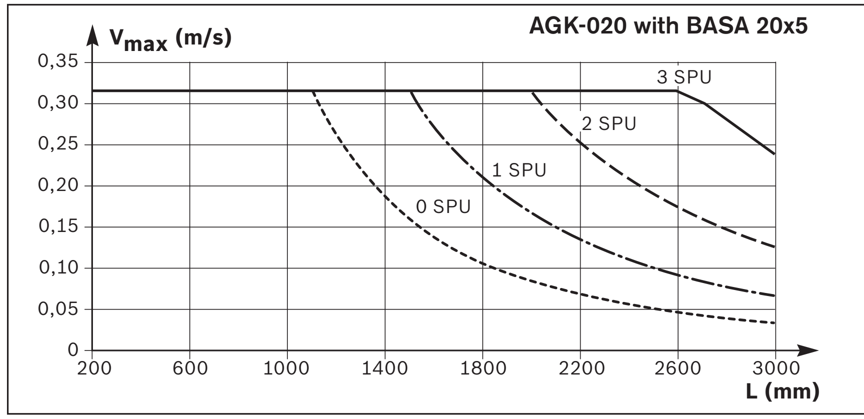


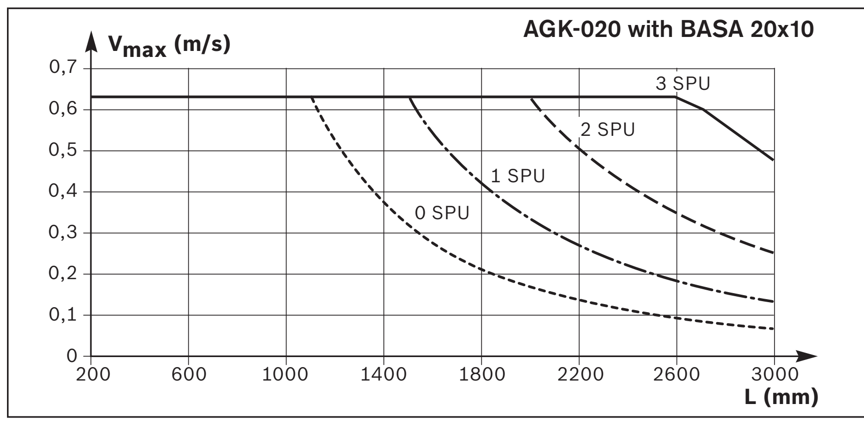


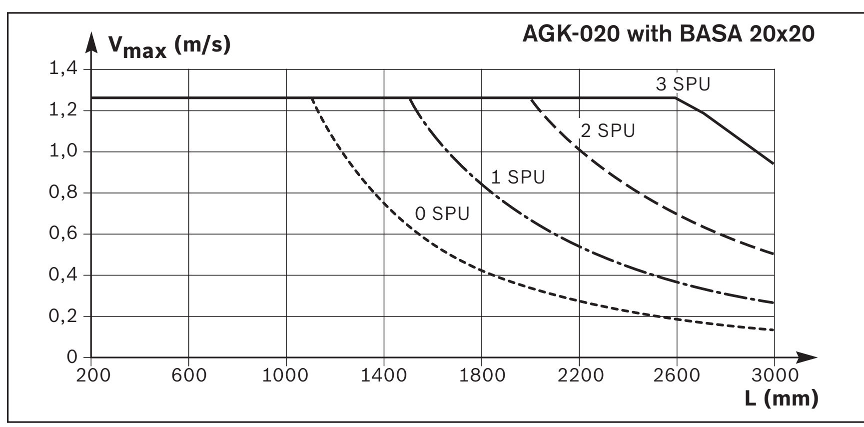


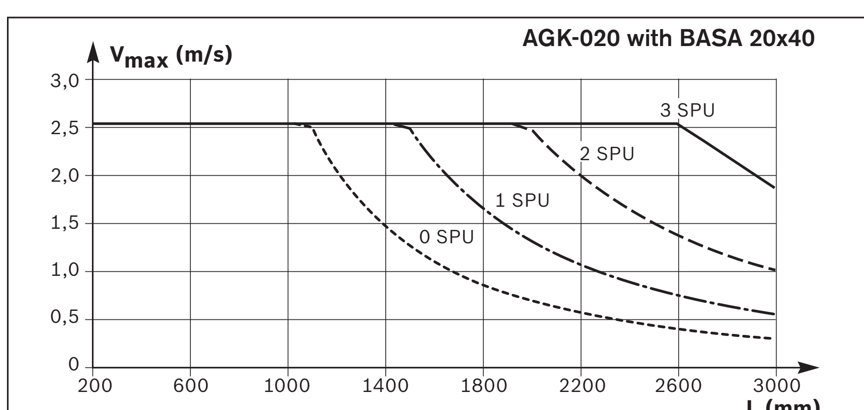
Permissible speed v_{max}

SPU = screw support





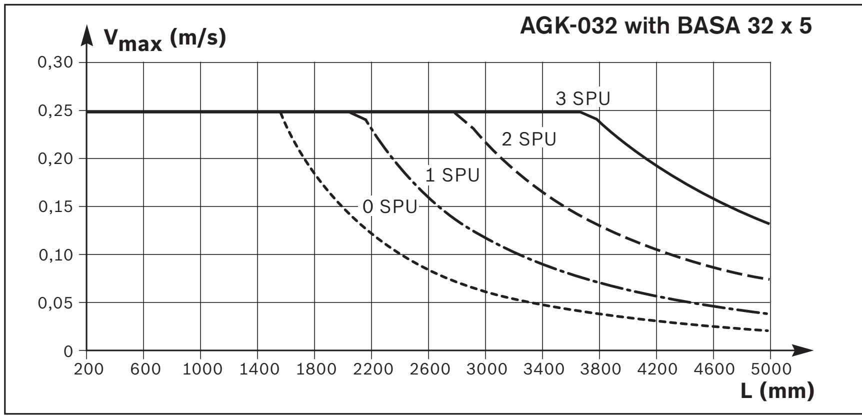


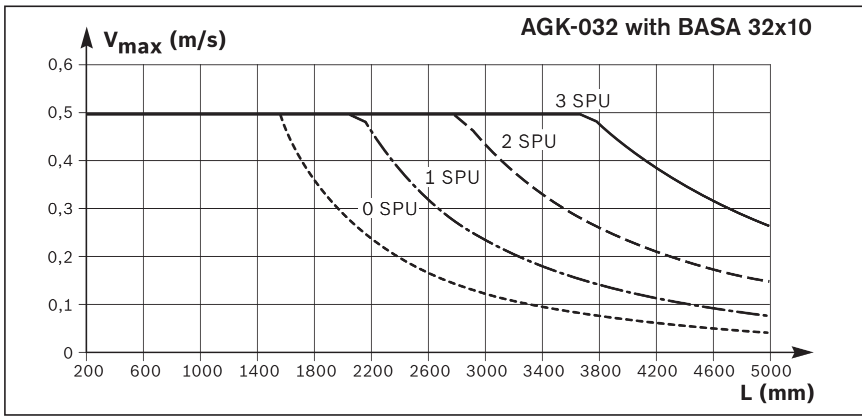


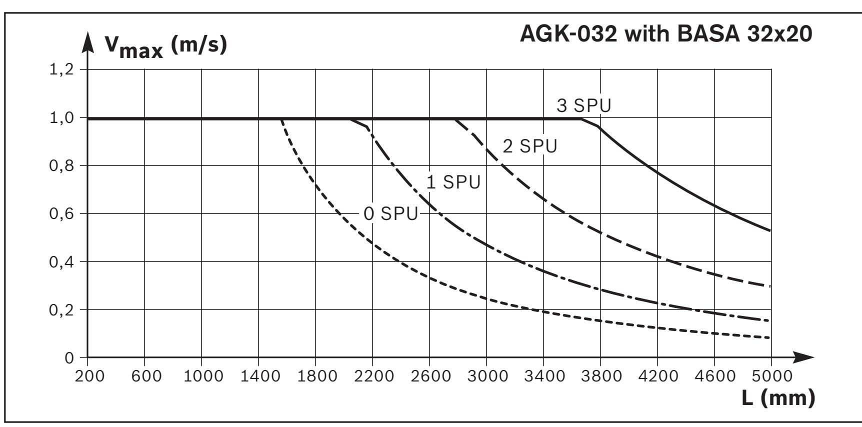
Technical data

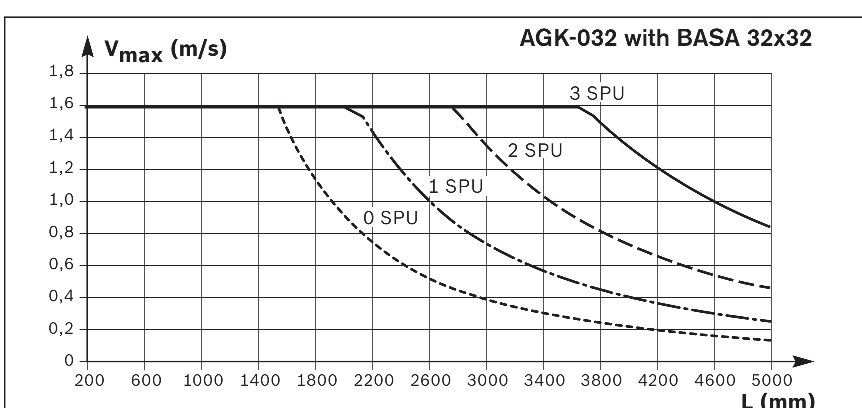
Permissible speed v_{max}

SPU = screw support



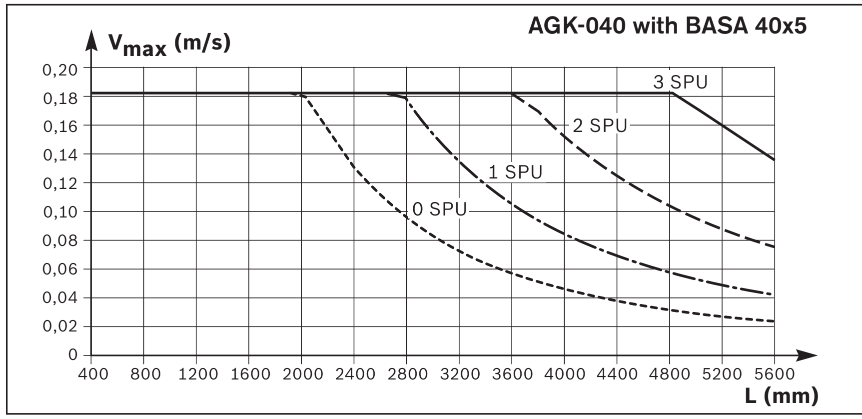


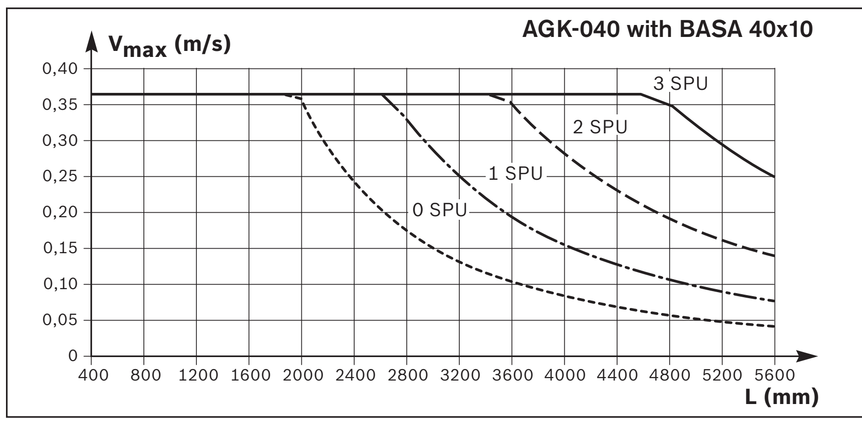


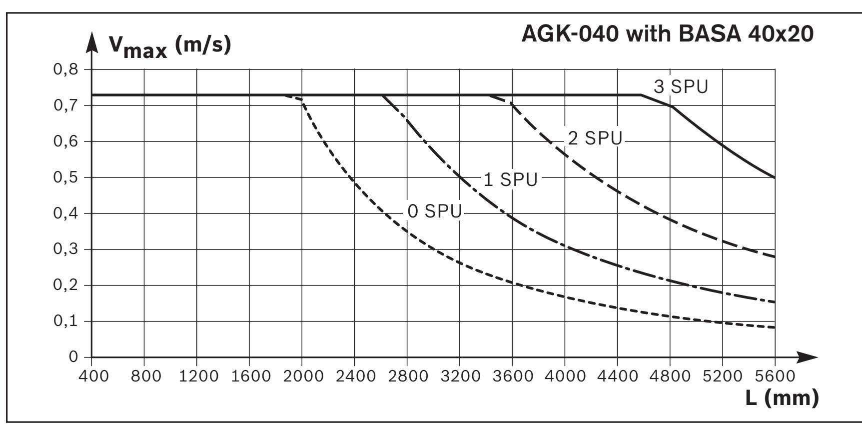


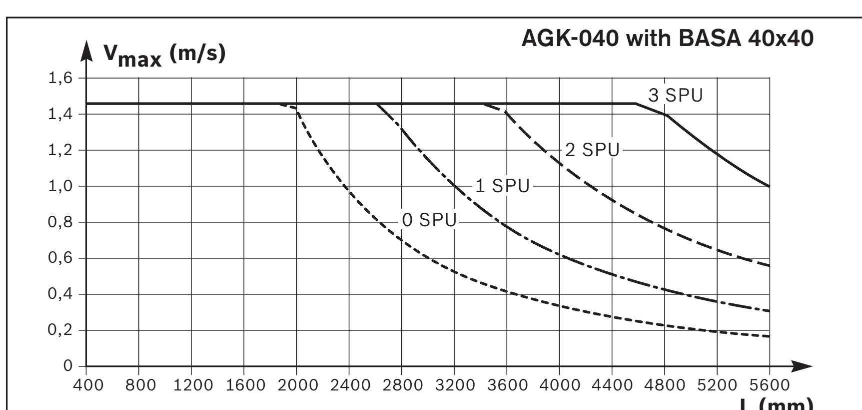
Permissible speed v_{max}

SPU = screw support









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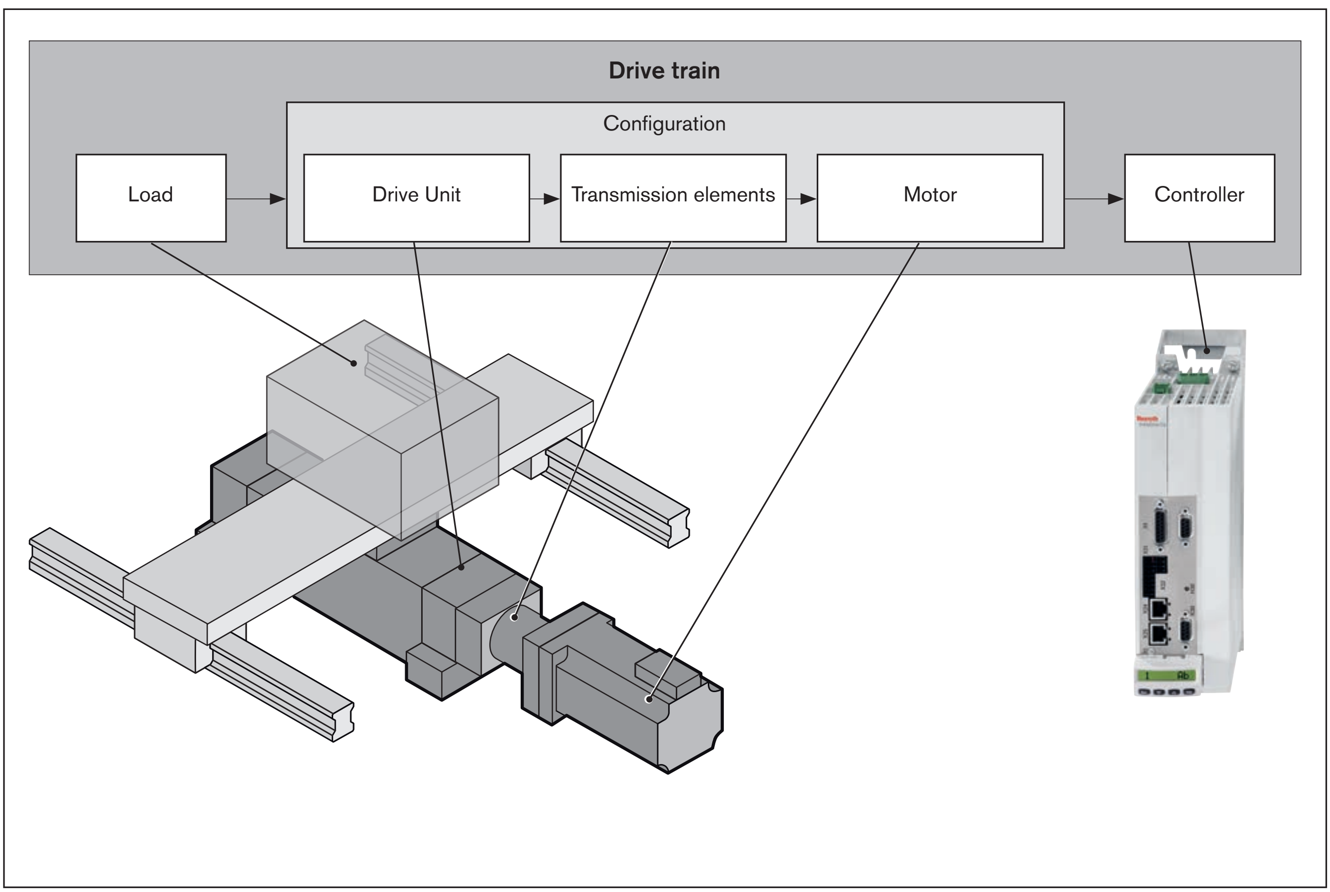
Calculation

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

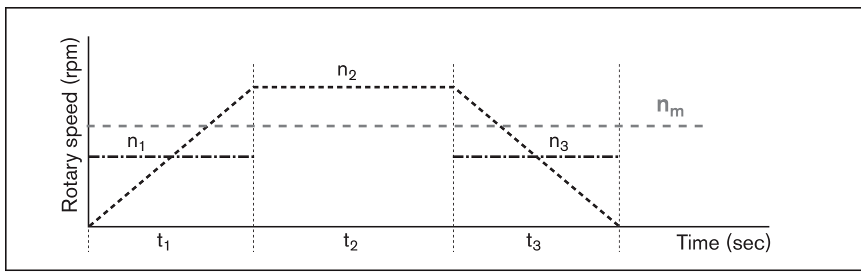
The service life of the rolling bearing points contained in a Drive Unit can be calculated using the formulas given below. In a Drive Unit with ball screw drive, the rolling bearing points that are relevant for the service life are the linear guide, the ball screw drive (nut), and the fixed bearing.

⚠ **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 $\mathbf{F_m}$ and $\mathbf{n_m}$.

If rotary speed varies, average rotary speed $\mathbf{n_m}$ is calculated as follows:



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

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

$n_1, n_2, \dots n_n$ = 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)

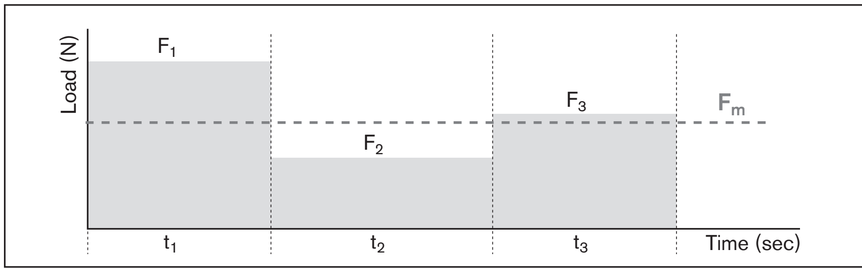
Rotary speed in acceleration and braking phases $\mathbf{n_{1 \dots n}}$:

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

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)

Calculation

Where both the load and the rotary speed vary, the average load $\mathbf{F_m}$ is calculated as follows:



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

Nominal life
Nominal life in revolutions:

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

Nominal life in hours:

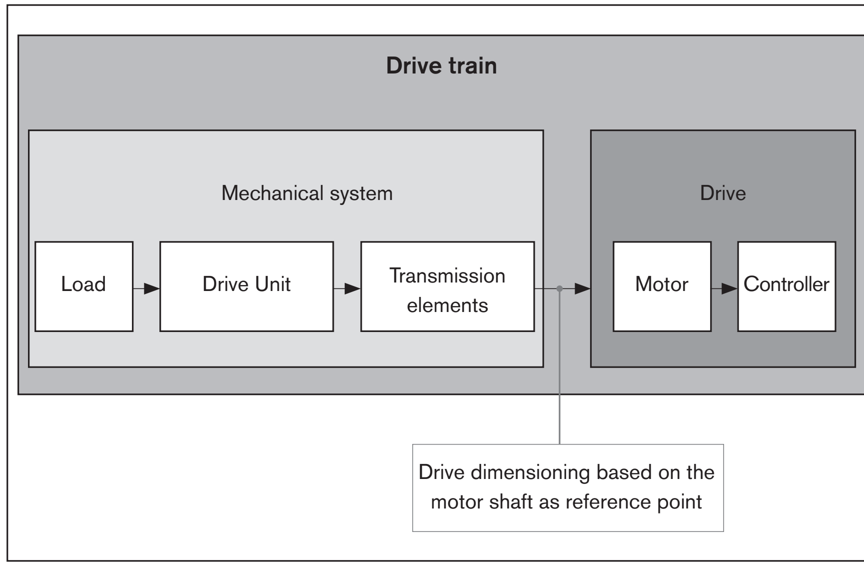
$$L_h = \frac{L}{n_m \cdot 60}$$

C	=	dynamic load rating	(N)
$F_1, F_2, \ldots F_n$	=	axial load during phases 1 ... n	(N)
F_m	=	equivalent dynamic axial load	(N)
$n_1, n_2, \ldots n_n$	=	rotary speed in phases 1 … n	(rpm)
n_m	=	average rotary speed	(rpm)
$t_1, t_2, \ldots t_n$	=	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	**(kgm²)**	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 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

$$v_{mech} = v_{max}$$

Maximum permissible rotary speed
For motor attachment via mount and coupling

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

For motor attachment via timing belt side drive

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

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

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

For motor attachment via timing belt side drive

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

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).

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

n_{max} = max. rotary speed of motor (rpm)

n_{mech} = maximum permissible rotary speed of the mechanical system (rpm)

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

$$V = \frac{J_{ex}}{J_m + J_{br}}$$

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

J_{br} = mass moment of inertia of motor brake (kgm^2)

J_{ex} = mass moment of inertia of mechanical system (kgm^2)

J_m = mass moment of inertia of motor (kgm^2)

V = ratio of mass moments of inertia of drive train and motor (–)

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

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

Static load moment

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

Weight moment
For vertical mounting only!
For motor attachment via mount and coupling: i = 1

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

g	=	force of gravity (= 9.81)	(m/s²)
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.

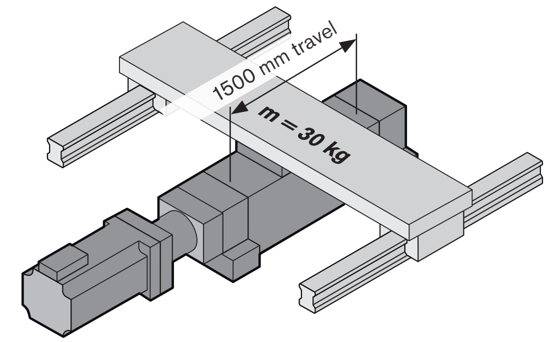
Calculation example

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.)

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

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 m/s and L = 1950 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:

$v_{max} = 0.4$ m/s

Calculation of length L

(for selected BASA)

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

Frictional torque M_R

(motor attachment via mount and coupling)

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

Mass moment of inertia J_{ex}
(motor attachment via mount and coupling)

	J_{ex}	$= J_s + J_t + J_c$
Coupling:	J_c	$= 57 \cdot 10^{-6}$ kgm²
Drive Unit:	J_s	$= (k_{J\ fix} + k_{J\ var} \cdot L) \cdot 10^{-6}$
		$= (40.7 + 0.1004 \cdot 1870) \cdot 10^{-6}$
		$= 228.45 \cdot 10^{-6}$ kgm²
External load:	J_t	$= m_{ex} \cdot k_{J\ m} \cdot 10^{-6}$
		$= 30 \cdot 10.1321 \cdot 10^{-6}$
		$= 303.96 \cdot 10^{-6}$ kgm²
Moment of inertia:	J_{ex}	$= 228.45 \cdot 10^{-6} + 303.96 \cdot 10^{-6} + 57 \cdot 10^{-6}$
		$= 589.41 \cdot 10^{-6}$ kgm²

Maximum permissible rotary speed n_{mech}
(motor attachment via mount and coupling)
Limit for mechanical system

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

Max. permissible speed: $v_{mech} = v_{max} = 0.4$ m/s

Max. permissible rotary speed: $n_{mech} = \frac{(0.4 \cdot 1000 \cdot 60)}{20}$

$= 1200$ rpm

Max. rotary speed of application n_{mech}:
(motor attachment via mount and coupling)
Application limit

Speed: $v_{mech} = 0.3$ m/s

Rotary speed: $n_{mech} = \frac{0.3 \cdot 1000 \cdot 60}{20}$

$= 900$ rpm

Calculation example

Maximum permissible drive torque M_{mech}

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

	$M_{mech} =$ minimum $(M_{cN}; M_p)$
Coupling:	$M_{cN} = 19$ Nm (for MSK 040C)
Drive Unit:	$M_p = 11.5$ Nm
Drive torque:	$M_{mech} =$ minimum (19; 11.5)
	$= 11.5$ Nm

Checking motor preselection

Selected motor:
MSK 040C without brake

Condition 1:

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

$6000 \geq 900$ condition met – motor selection OK

Condition 2:

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

Motor inertia: $J_m = 140 \cdot 10^{-6}$ kgm²

Brake inertia: $J_{br} = 0 \cdot 10^{-6}$ kgm² (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: $V \leq 6$

$4.21 \leq 6$ condition met – motor selection OK

Condition 3:

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

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

$= 0.92$ Nm

Torque of the motor at standstill $M_0 = 2.7$ Nm

Torque ratio: $\frac{0.92}{2.7} = 0.34$

$0.34 \leq 0.6$ condition met – motor selection OK

All three conditions met ➠ 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:	$J_{ex} = 589.41 \cdot 10^{-6}$ kgm^2
Speed:	$v_{mech} = 0.3$ m/s ($n_{mech} = 900$ rpm)
Drive torque limit:	$M_{mech} = 11.5$ Nm

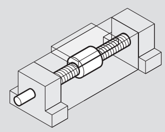
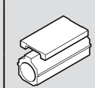
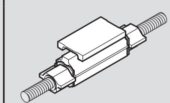
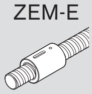
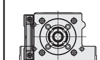
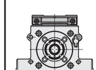
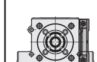
➠ Motor torque should be limited to 11.5 Nm on the drive side.

Acceleration limit:	$a_{max} = 50$ m/s^2
Limit value for speed:	$v_{max} = 0.4$ m/s ($n_{mech} = 1200$ 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 									Screw ends		Pillow block	Nut Housing without SPU 	Nut Housing with SPU 			Nut Housing Mounting orientation
	Nut	BASA size d_0 x P				Tolerance grade	Seal	Lubrication	Preload class					Number of SPU per side[3)]			
		20 x 5	20 x 10	20 x 20	20 x 40		Standard	Initial greasing	C1 (moderate)	Left (fixed bearing)	Right (floating bearing)	Aluminum		1	2	3	
	ZEM-E 	01	04	02	03	T5 T7	1	1	3	81	31	02	01	21	22	23	 MR01 Left  MR02 Top  MR03 Right

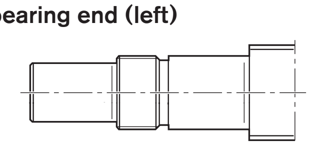
Ordering example: See “Request/order”

BASA = ball screw drive
d_0 = nominal diameter BASA (mm)
P = lead (mm)
SPU = screw support

Screw ends:

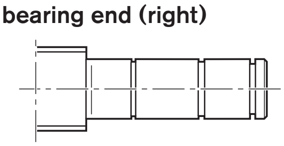
Fixed bearing end (left)

81

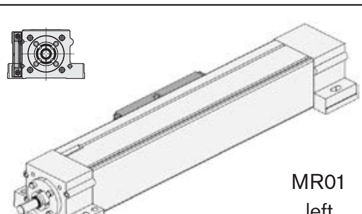


Floating bearing end (right)

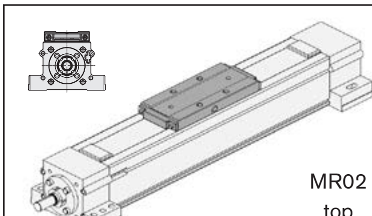
31



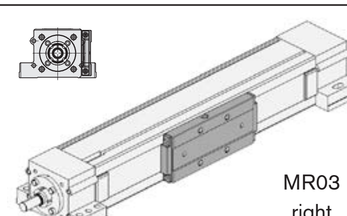
Nut Housing Mounting orientation



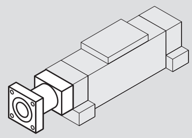
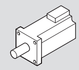
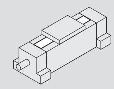
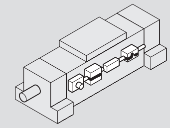
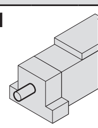
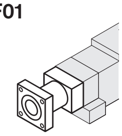
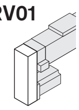
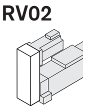
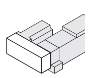
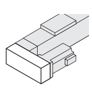
MR01
left



MR02
top



MR03
right

	Motor attachment 				Motor 		Cover 		Switch/ socket-plug 	Documentation 	
	Version	Gear ratio	Attachment kit[1]	for motor	without Brake	with Brake	Steel	PU		Standard report	Measurement report
without mount	OF01 		00	–	00		01	02	see table below	01	02 Frictional torque 03 Lead deviation
with mount	MF01 		06	**MSM 041B**[2]	140	141					
			02	**MSK 040C**[2]	86	87					
			07	**MSK 050C**[2]	88	89					
with timing belt side drive	RV01  RV02  RV03  RV04 	i = 1	32	**MSM 041B**[2]	140	141					
			30	**MSK 040C**[2]	86	87					
			23	**MSK 050C**[2]	88	89					

Switch/socket-plug	
Without switch Without socket-plug	00
Magnetic sensor	
REED sensor	21
Hall sensor PNP NC	22
Socket-plug	17

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

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

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)

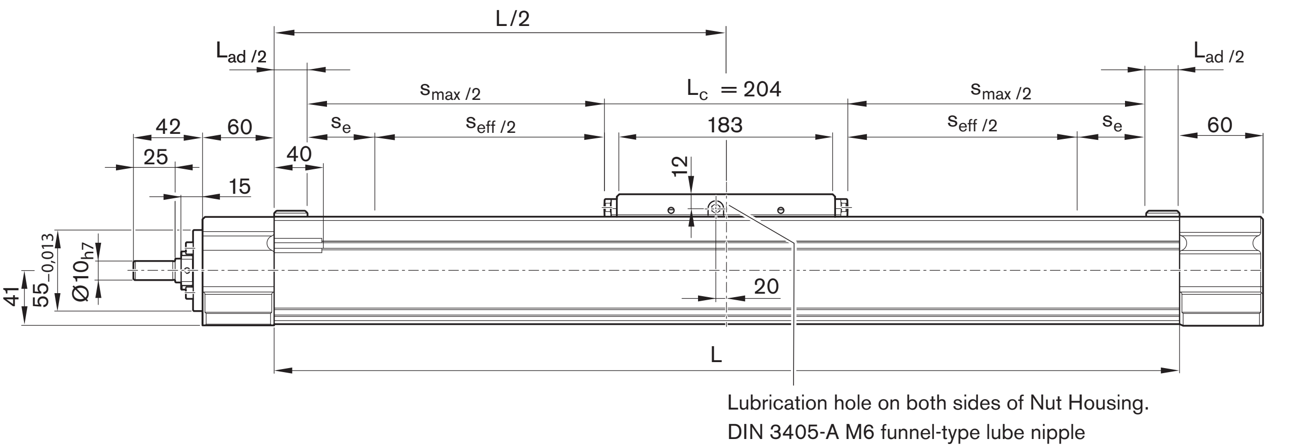
AGK-020

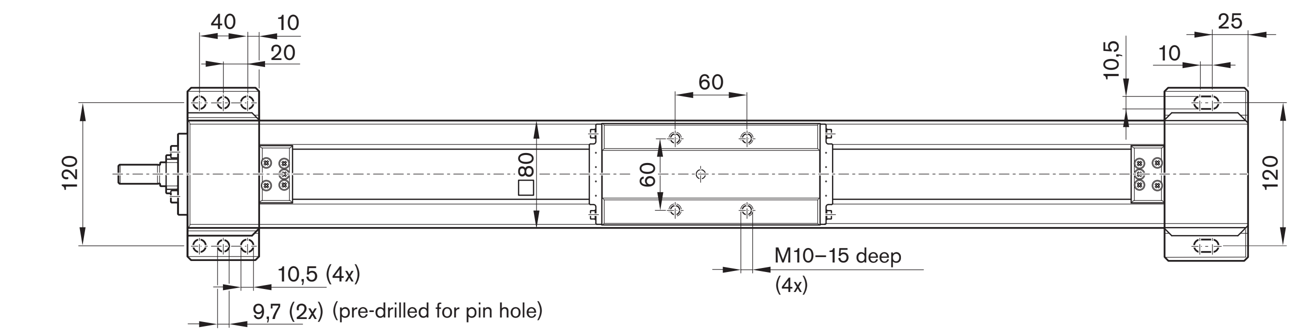
Dimensional drawings

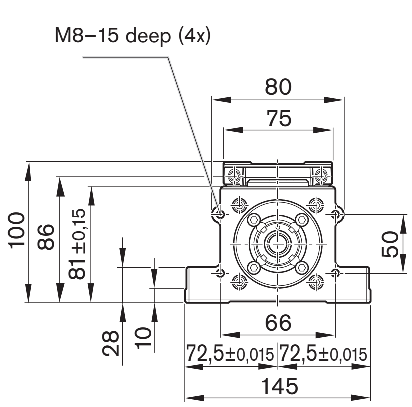
All dimensions in mm. Drawings not to scale.
Straightness and flatness tolerance in accordance with DIN EN 12020-02

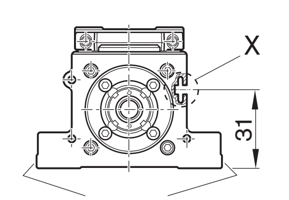
Fixed bearing end

Floating bearing end

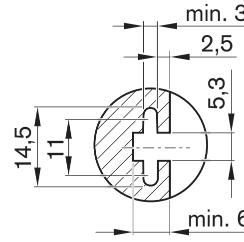








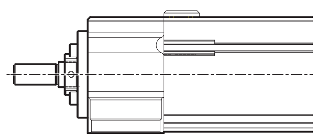
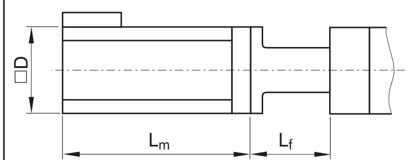
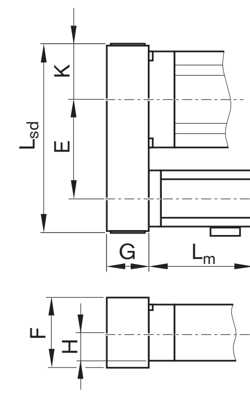
Reference edges on two sides



Slot for switch

Motor attachment dimension drawings

Version

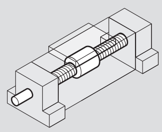
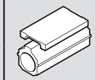
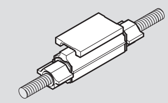
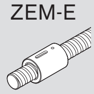
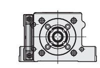
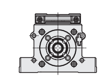
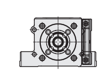
OF01	MF01	RV01, RV02, RV03, RV04
		

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  Nut	BASA size d_0 x P				Tolerance grade	Seal	Lubrication	Preload class	Screw ends		Pillow block	Nut Housing without SPU 	Nut Housing with SPU  Number of SPU per side[3)]			Nut Housing Mounting orientation
		32 x 5	32 x 10	32 x 20	32 x 32		Standard	Initial greasing	C1 (moderate)	Left (fixed bearing)	Right (floating bearing)	Aluminum		1	2	3	
	ZEM-E 	01	02	03	04	T5 T7	1	1	3	81	31	02	01	11	12	13	 MR01 Left  MR02 Top  MR03 Right

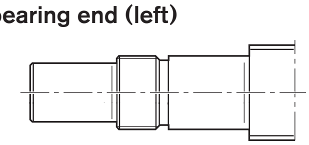
Ordering example: See "Request/order"

BASA = Ball screw drive
d_0 = nominal diameter BASA (mm)
P = lead (mm)
SPU = screw support

Screw ends:

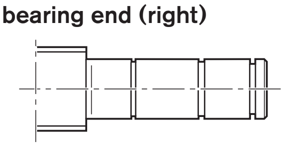
Fixed bearing end (left)

81

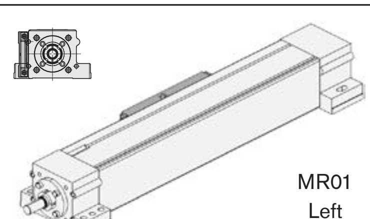


Floating bearing end (right)

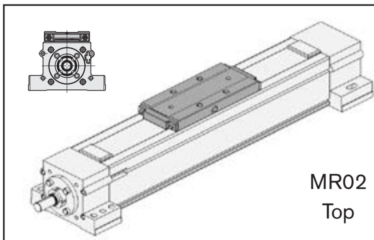
31



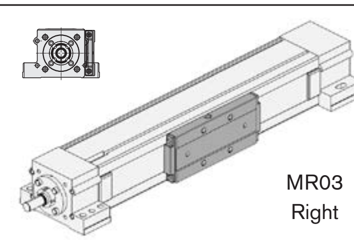
Nut Housing
Mounting orientation



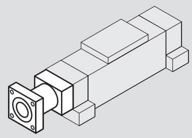
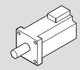
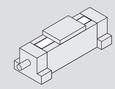
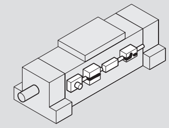
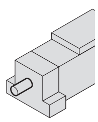
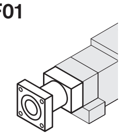
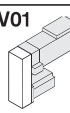
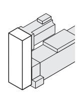
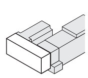
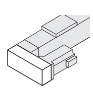
MR01
Left



MR02
Top



MR03
Right

	Motor attachment 					Motor 		Cover 		Switch/socket-plug 	Documentation 	
	Version		Gear ratio	Attachment kit[1]	for motor	without Brake	with Brake	Steel	PU		Standard report	Measurement report
without mount	OF01			00	–	00						
with mount	MF01			03	**MSK 060C**[2]	90	91					
				02	**MSK 076C**[2]	92	93	01	02	Without switch / Without socket-plug: 00 **Magnetic sensor** REED sensor: 21 Hall sensor PNP NC: 22 Socket-plug: 17	01	02 Frictional torque 03 Lead deviation
with timing belt side drive	RV01 	RV02 	i = 1	23	**MSK 060C**[2]	90	91					
	RV03 	RV04 	i = 2	24	**MSK 060C**[2]	90	91					

1) Attachment kit available without motor (when ordering: enter “00” for motor)
2) Recommended motor (motor data and type designation ➟ “Motors”)
3) SPUs 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

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

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)

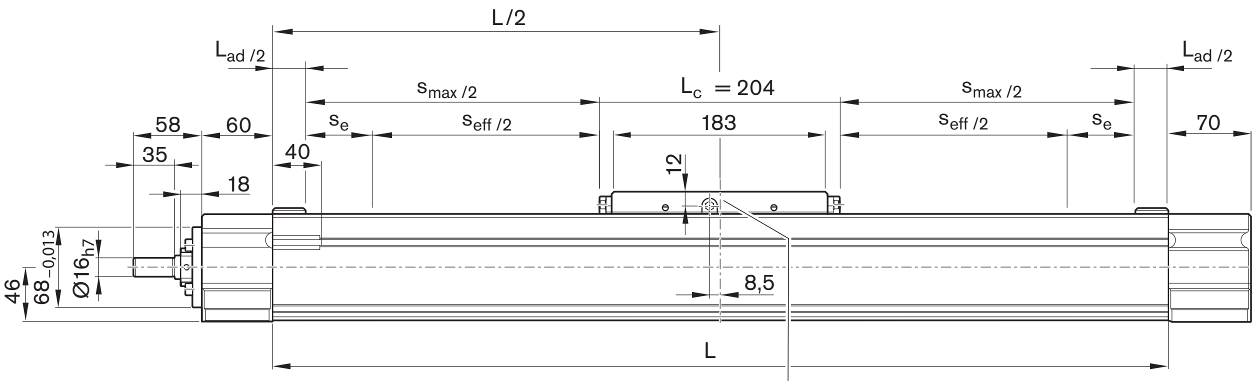
AGK-032

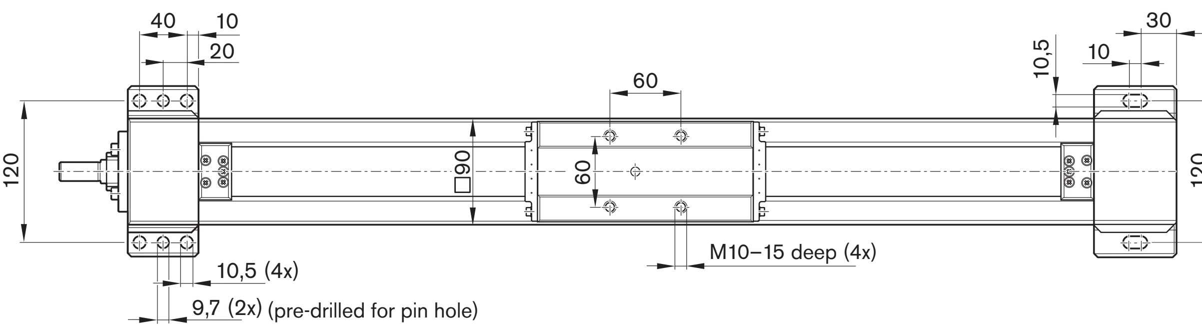
Dimensional drawings

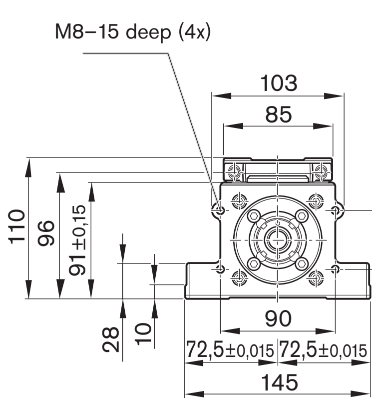
All dimensions in mm. Drawings not to scale.
Straightness and flatness tolerance in accordance with DIN EN 12020-02

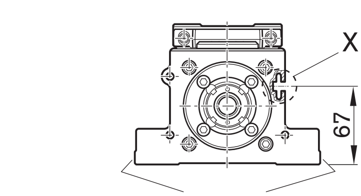
Fixed bearing end

Floating bearing end

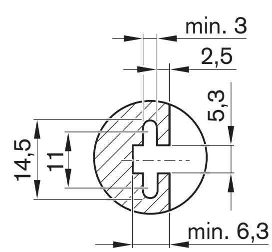








Reference edges on two sides

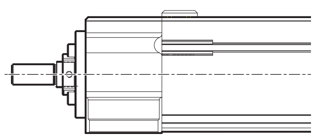


Slot for switch

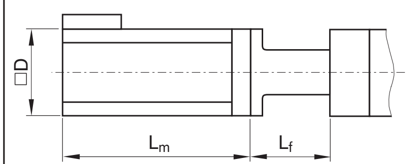
Motor attachment dimension drawings

Version

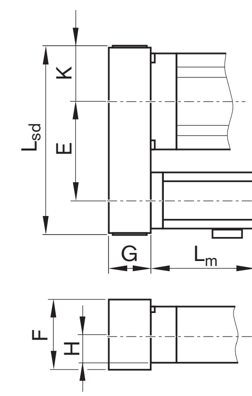
OF01



MF01



RV01, RV02, RV03, RV04

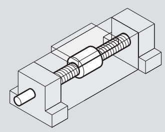
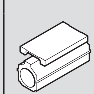
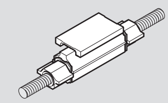
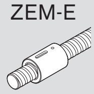
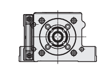
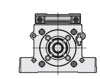
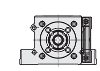


Version	Motor	Dimensions (mm) D	E i = 1	E i = 2	F	G	H	K	L_f	L_m without brake	L_m with brake	L_{sd} i = 1	L_{sd} i = 2
RV01, RV02, RV03, RV04	MSK 060C	116	165	162	116	66	46	59	–	226.0	259.0	300	300
MF01	MSK 060C	116	–	–	–	–	–	–	125	226.0	259.0	–	–
	MSK 076C	140	–	–	–	–	–	–	133	292.5	292.5	–	–

See “Motors” section for more information and dimensions
L_{ad} = additional length (see “Technical data” section)

AGK-040

Configuration and ordering

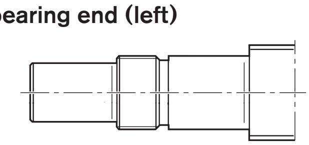
Short product name, length AGK-040-NN-1, ... mm	Drive BASA  Nut	BASA size d_0 x P: 40 x 5	40 x 10	40 x 20	40 x 40	Tolerance grade	Seal: Standard	Lubrication: Initial greasing	Preload class: C1 (moderate)	Screw ends: Left (fixed bearing)	Right (floating bearing)	Pillow block: Aluminum	Nut Housing without SPU 	Nut Housing with SPU  Number of SPU per side[3)]: 1	2	3	Nut Housing Mounting orientation
	ZEM-E 	01				T5 T7	1	1	3	81	31	02	01	11	12	13	 MR01 left  MR02 top  MR03 right
			02	03	04	T5 T7	1	1	3	81	31	02	01	21	22	23	

Ordering example: See "Request/order"

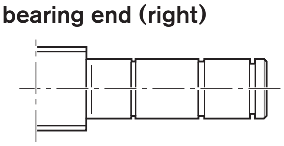
BASA = Ball screw drive
d_0 = nominal diameter BASA (mm)
P = lead (mm)
SPU = screw support

Screw ends:

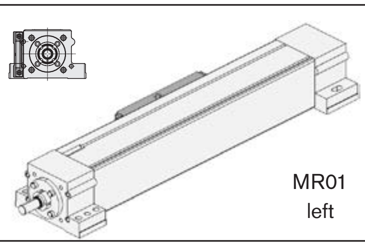
Fixed bearing end (left)
81

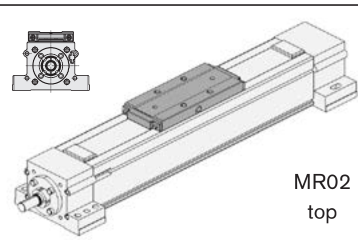


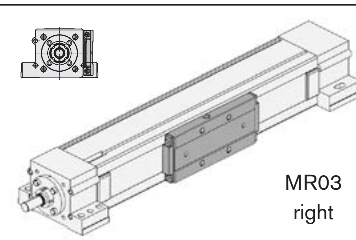
Floating bearing end (right)
31

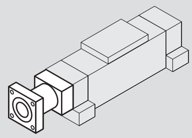
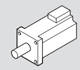
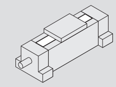
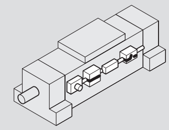
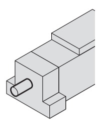
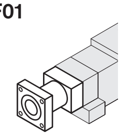
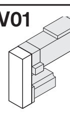
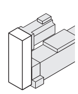
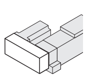
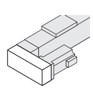


Nut Housing Mounting orientation


MR01 left


MR02 top


MR03 right

	Motor attachment					Motor		Cover		Switch/socket-plug	Documentation	
												
	Version		Gear ratio	Attachment kit[1)]	for motor	without Brake	with Brake	Steel	PU		Standard report	Measurement report
without mount	OF01 			00	–	00		01	02	without switch without socket-plug: 00 **Magnetic sensor** REED sensor: 21 Hall sensor PNP NC: 22 Socket-plug: 17	01	02 Frictional torque 03 Lead deviation
with mount	MF01 			02	**MSK 076C**[2)]	92	93					
with timing belt side drive	RV01 	RV02 	i = 1	23	**MSK 076C**[2)]	92	93					
	RV03 	RV04 	i = 2	24	**MSK 076C**[2)]	92	93					

1) Attachment kit available without motor (when ordering: enter “00” for motor)
2) Recommended motor (motor data and type designation ➠ “Motors”)
3) SPUs 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

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

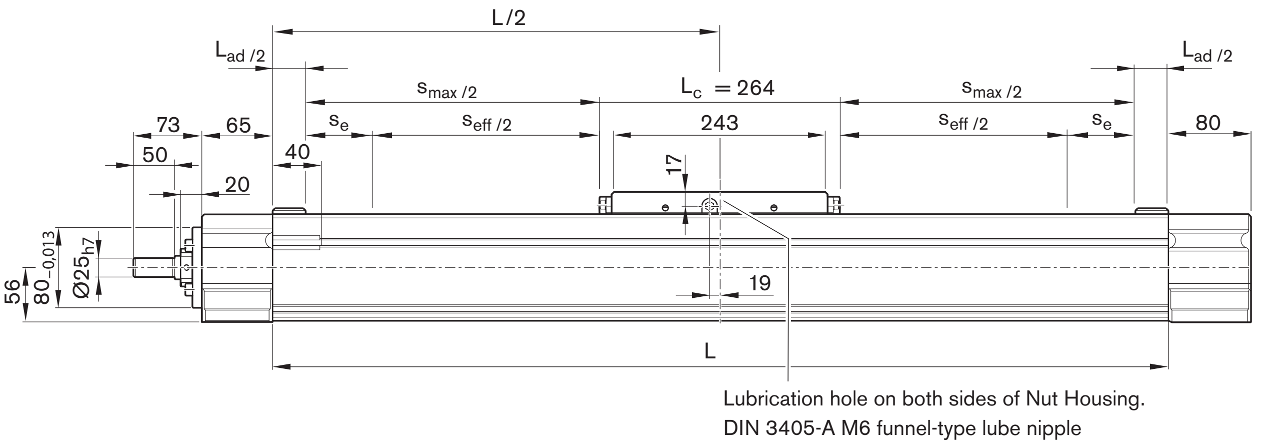
s_e = excess travel
s_{max} = maximum travel
s_{eff} = effective stroke
L = length
L_c = Nut Housing length
L_{ad} = additional length (see “Technical data” section)

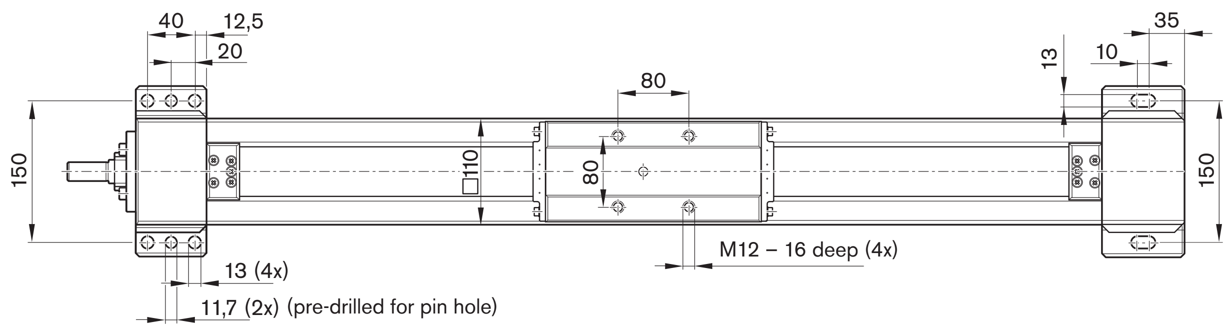
AGK-040

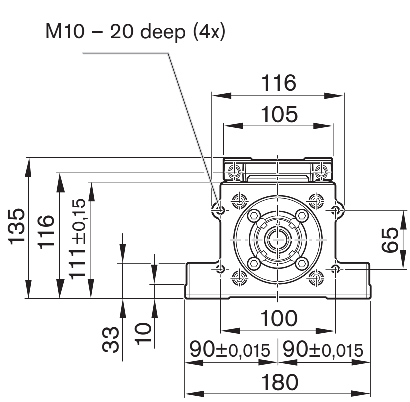
Dimensional drawings

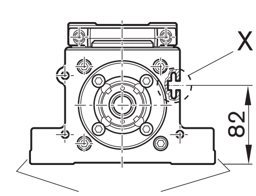
All dimensions in mm. Drawings not to scale.
Straightness and flatness tolerance in accordance with DIN EN 12020-02

Fixed bearing end **Floating bearing end**

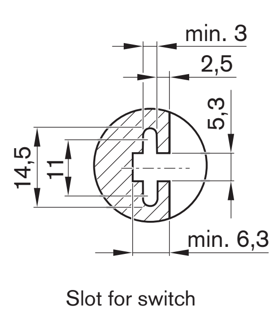








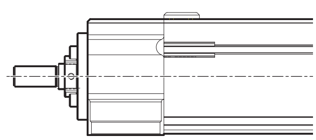
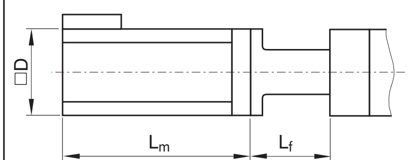
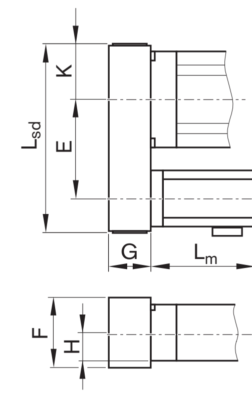
Reference edges on two sides



Slot for switch

Motor attachment dimension drawings

Version

OF01	MF01	RV01, RV02, RV03, RV04
		

Version	Motor	Dimensions (mm)											
		D	E		F	G	H	K	L_f	L_m		L_{sd}	
			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
L_{ad} = additional length (see “Technical data” section)

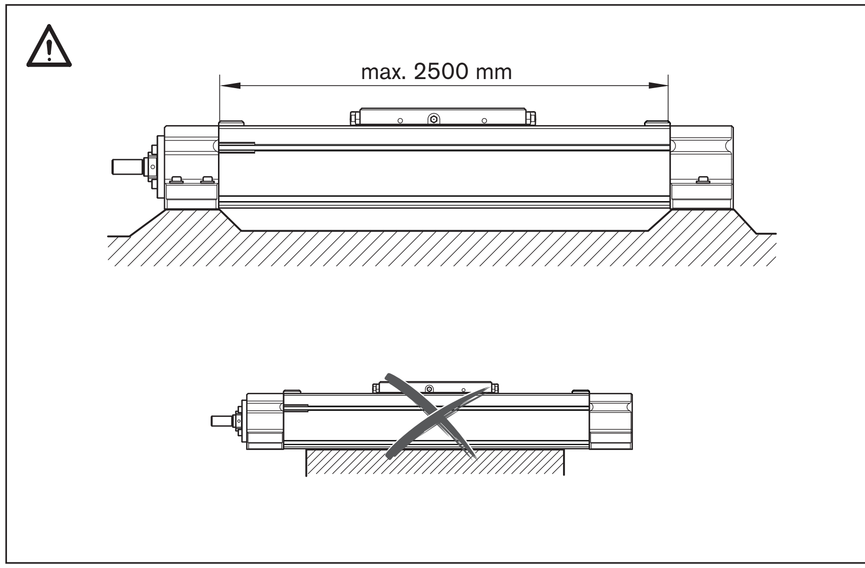
AGK fastening instructions

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.

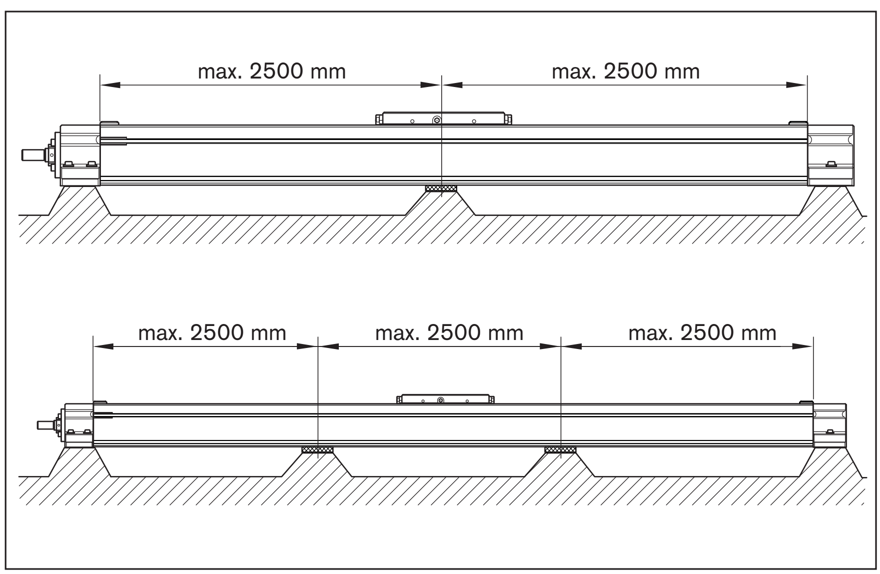
For more information on fastening see "Instructions for AGK Drive Unit" R310D4 3372



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.

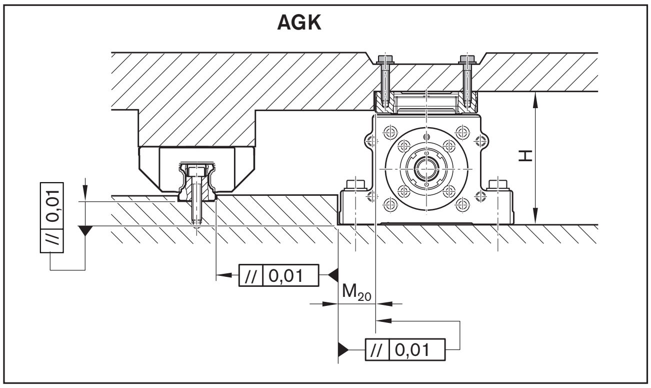
- Spacing between the support points: max. 2500 mm
- The mounting bases for the protective profile supports and the pillow blocks should be on the same level.

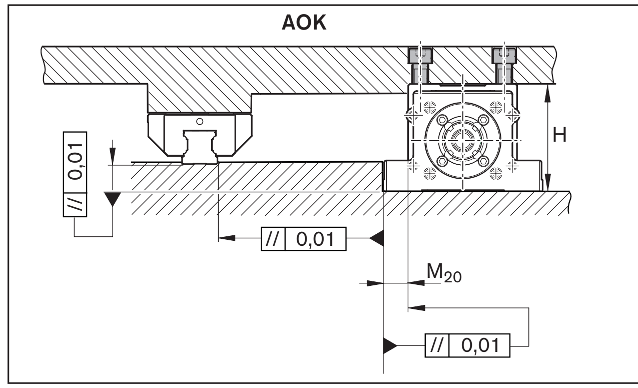
When the Drive Unit is in operation, the protective profile lifts as the drive carriage passes over it, then sinks back down onto the supporting surface. Provide cushioning material on the surfaces of the protective profile supports, e.g., foam rubber pads.



AGK/AOK installation tolerances

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





	Dimensions (mm)	
	H $^{\pm0.01}$	M_{20} $^{\pm0.01}$
AGK-020	100	35.0
AGK-032	110	30.0
AGK-040	135	37.5

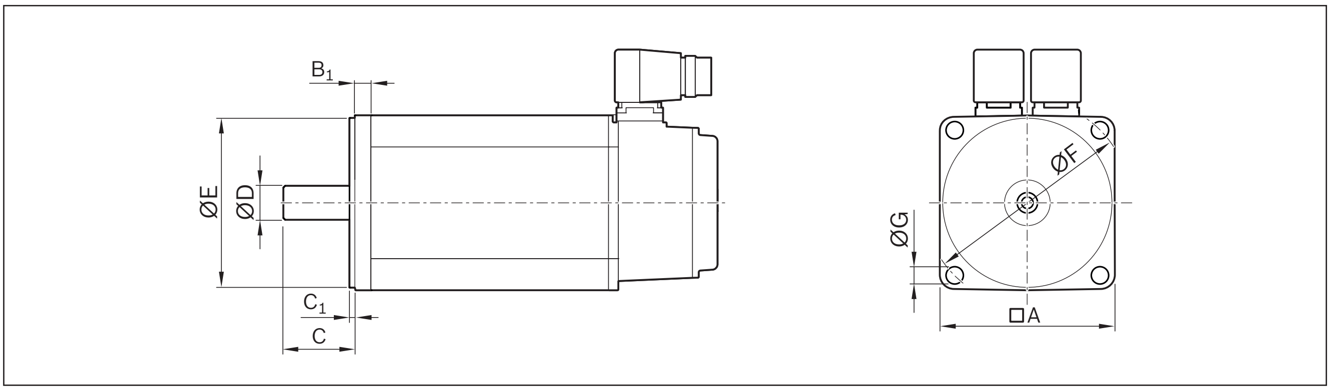
AOK-020	**Nut**	**Nut**	**Dimensions** (mm)	
d_0 x P		**Housing**	**H** $^{\pm0.01}$	**M_{20}** $^{\pm0.01}$
20 x 5	ZEM-E	MGA	85	35
	FEM-E-S	MGS	73	35
	FEM-E-C	MGD	69	35
20 x 10	ZEM-E	MGA	85	35
	FEM-E-S	MGS	73	35
	FEM-E-C	MGD	73	35
20 x 20	ZEM-E	MGA	85	35
	FEM-E-S	MGS	75	30
	FEM-E-C	MGD	69	35
20 x 40	ZEM-E	MGA	85	35
	FEP-E-S	MGS	75	30

AOK-032	**Nut**	**Nut**	**Dimensions** (mm)	
d_0 x P		**Housing**	**H** $^{\pm0.01}$	**M_{20}** $^{\pm0.01}$
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	**Nut**	**Nut**	**Dimensions** (mm)	
d_0 x P		**Housing**	**H** $^{\pm0.01}$	**M_{20}** $^{\pm0.01}$
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.

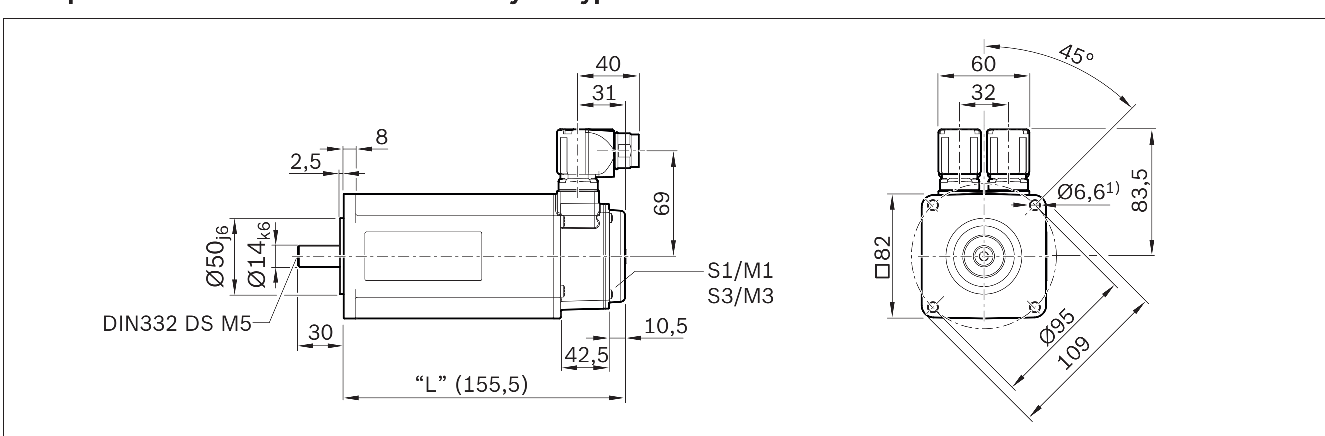


The dimensions queried result in a unique “motor geometry code”:

□□-□□-□□□-□□□-□□□-M□□-□□□-□□□

ØD	=	Shaft diameter
C	=	Shaft length
ØE	=	Centering diameter
C_1	=	Centering depth
ØF	=	Pitch diameter
ØG	=	Through-hole for mounting screw (specify thread diameter)
B_1	=	Mount thickness
A	=	Mount edge dimension

Example illustration of servo motor IndraDyn S Type MSK040C

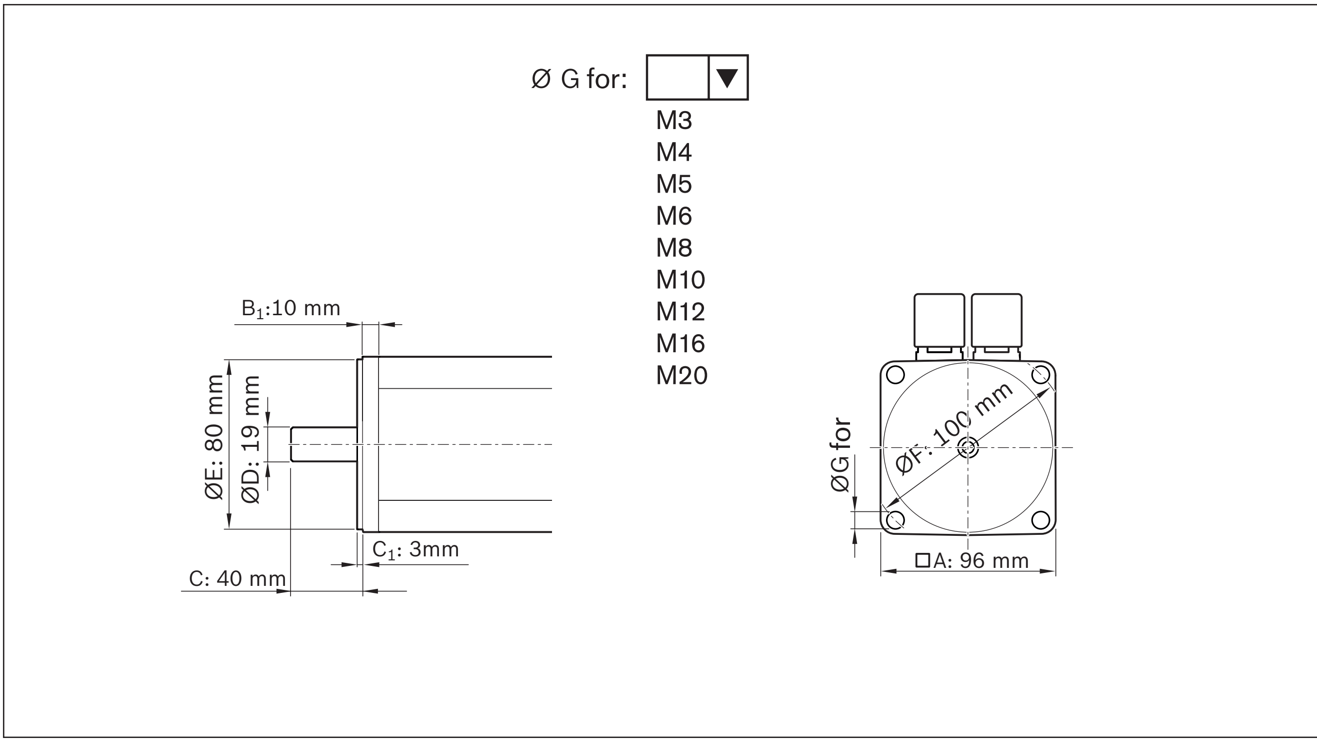


1 4 – 3 0 – 0 5 0 – 2 . 5 – 0 9 5 – M 0 6 – 0 0 8 – 0 8 2

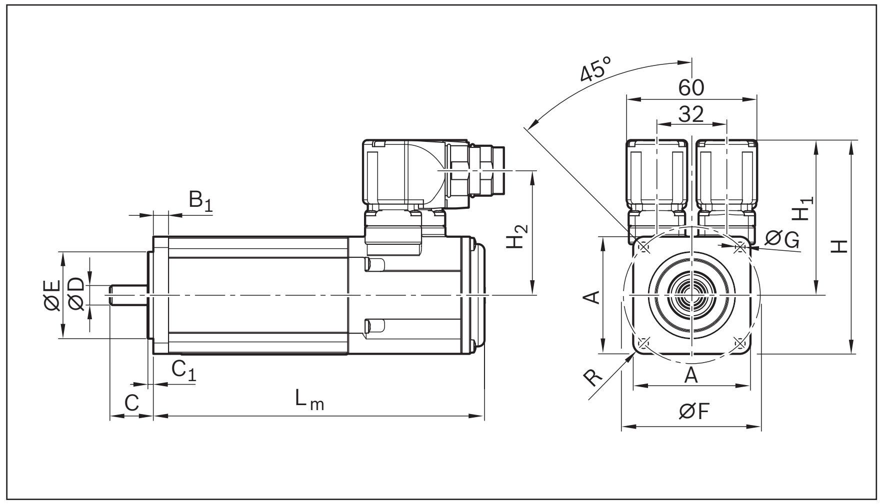
1) The through-hole Ø 6.6 mm results in the type designation M06 for the geometry motor code (M6 fastening screw nominal thread).

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.



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 without holding brake	L_m with holding brake	R
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 (kgm²)	J_{br} (kgm²)	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

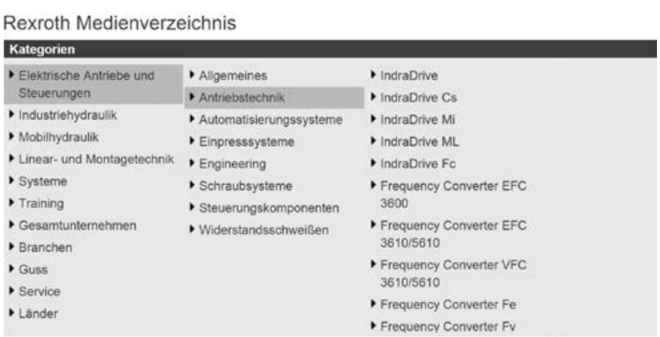
J_{br} = holding brake mass moment of inertia
J_m = motor mass moment of inertia
L_m = motor length
M_0 = torque at standstill
M_{br} = holding torque of holding brake when switched off
M_{max} = max. motor torque
m_m = motor mass
m_{br} = holding brake mass
n_{max} = max. rotary speed

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

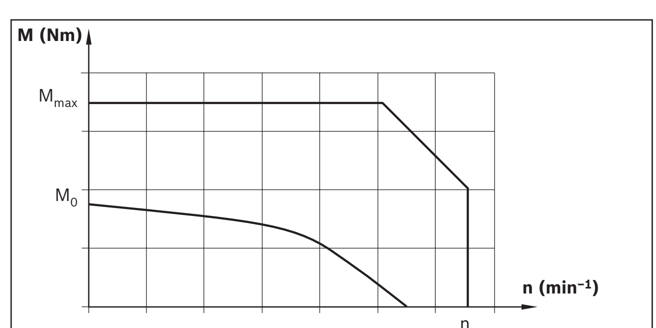
Note
Motors are available with controllers and control systems. See the Rexroth Drive Technology catalog for other motor types and more information on motors, controllers and control systems.



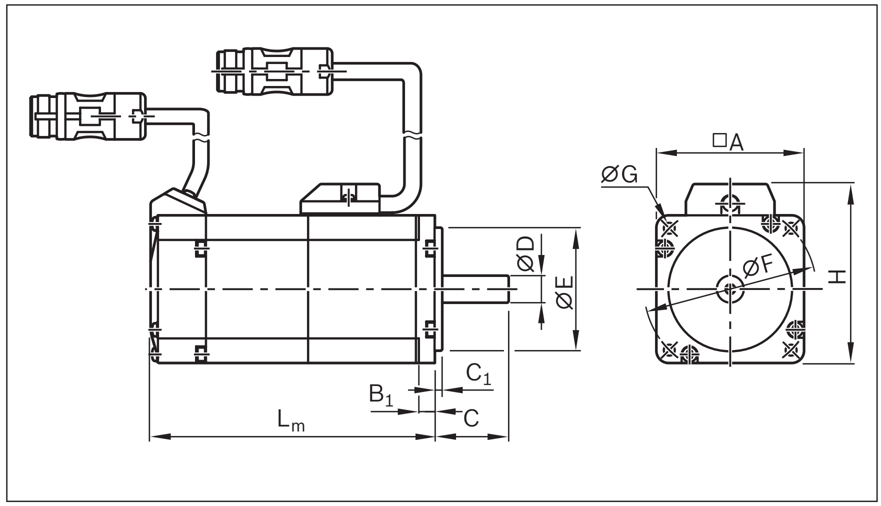
Recommended motor/controller combination

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)



IndraDyn S - MSM servo motors



Motor schematic

Motor	Dimensions (mm)										
	A	B_1	C	C_1	ØD h6	ØE h7	ØF	ØG	H	L_m 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 (kgm²)	J_{br} (kgm²)	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
M_0 = 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

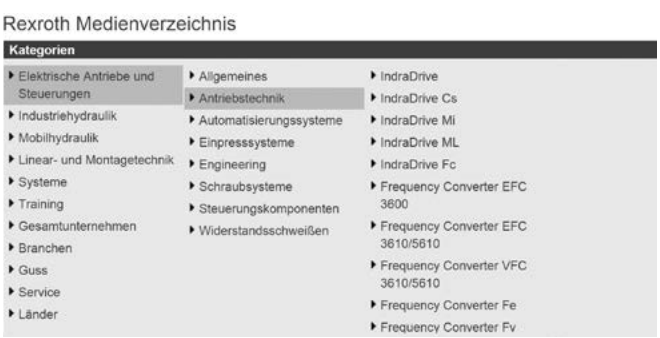
[1] From "Configuration and ordering" table

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

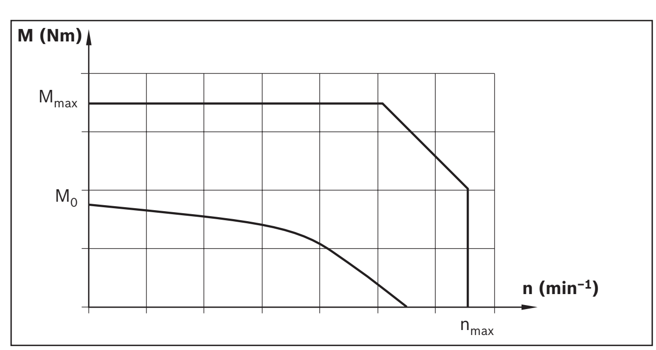
Motors are available with controllers and control systems. See the Rexroth Drive Technology catalog for other motor types and more information on motors, controllers and control systems.



Recommended motor/controller combination

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

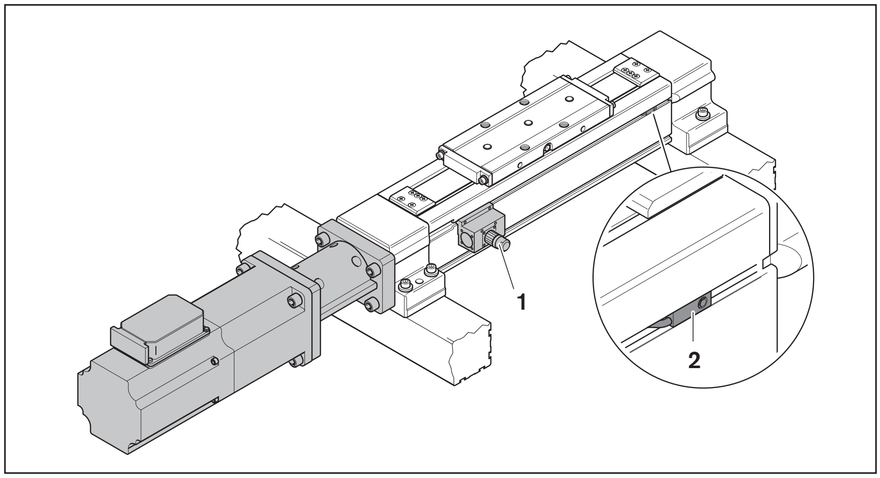
Torque/speed characteristic
(schematic)



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.

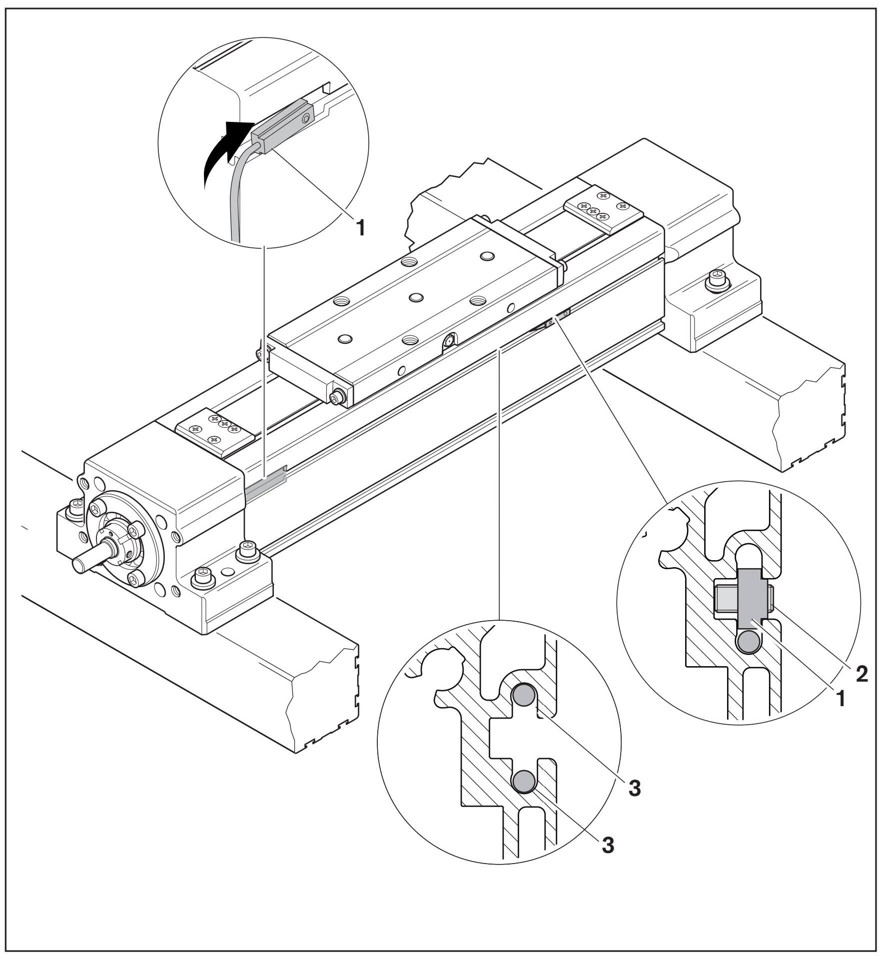
Version

– 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.



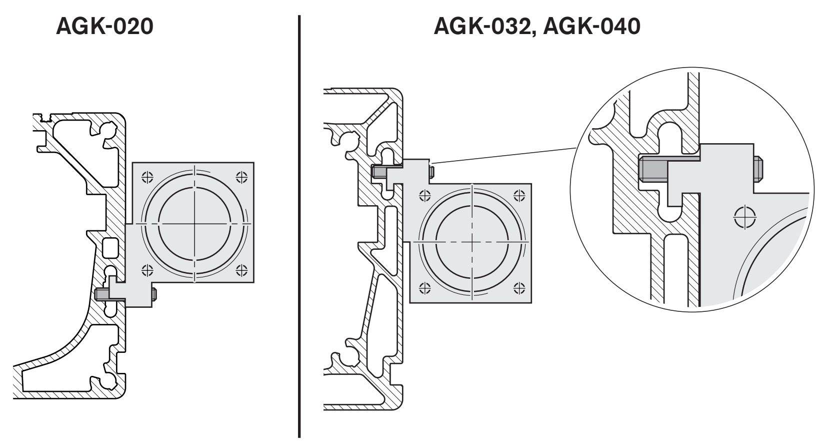
Socket-plug mounting arrangements

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.



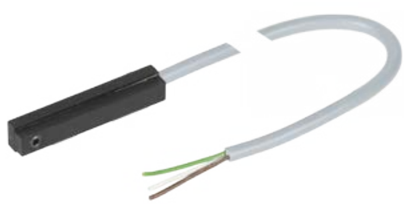
Switches and attachments

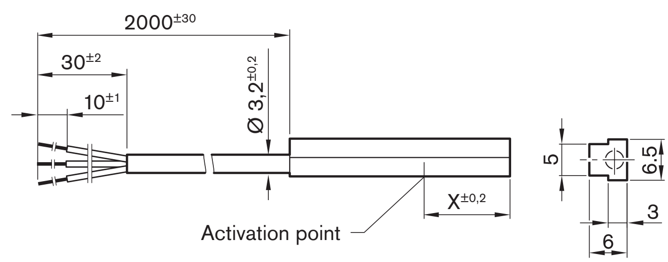
Description	Switching function		Option number[1]	Part number
Socket-plug	–		17	R117500153
Magnetic sensor	REED	Changeover contact (NC: C+NC; NO:C+NO)	21	R347600903
	Hall	PNP/normally closed (NC)	22	R347601003
	Hall	PNP/normally open (NO)	nv[2]	R347601203
	Hall	NPN/normally closed (NC)	nv[2]	R347601303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

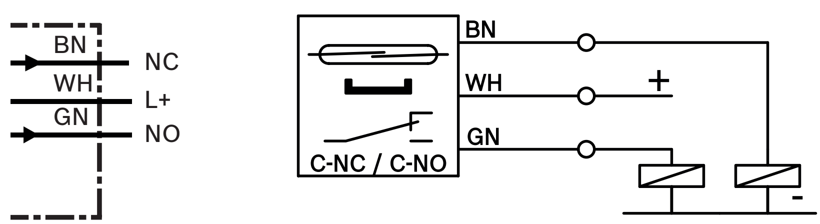
Sensors

Magnetic sensor with free cable end

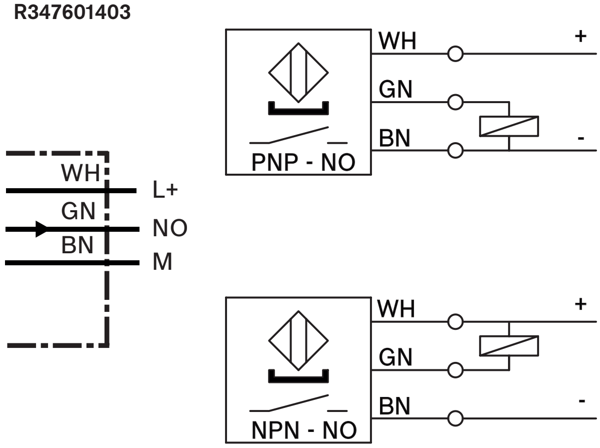




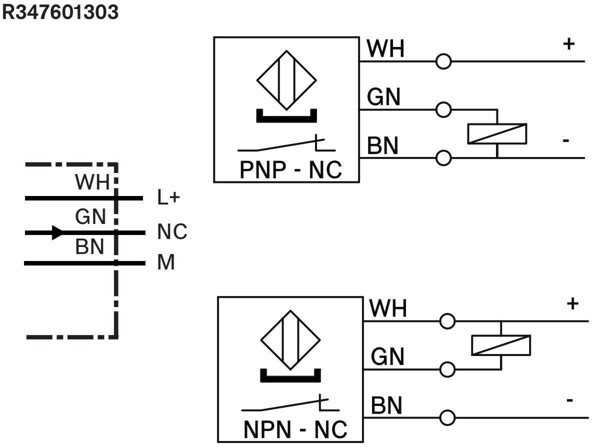
R347600903



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).

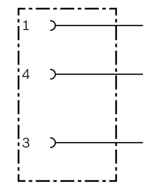
** No certificate is required to introduce these products to the Chinese market.

Extensions

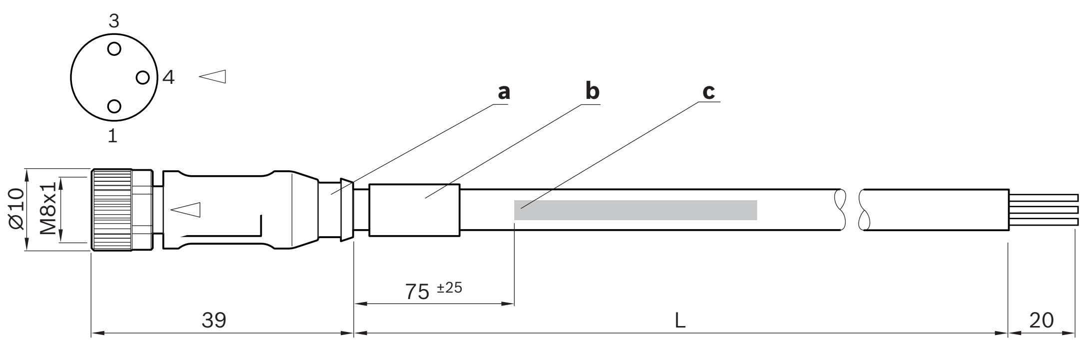
Pre-assembled on one side

Connection diagram

1 brown (BN) (+)
3 blue (BU) (–)
4 black (BK) (signal)



Dimension drawing



Part numbers

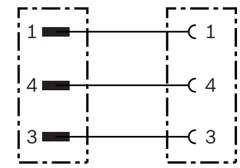
Use	Extension cable		
Part number	R911344602	R911344619	R911344620
Designation	7000-08041-6500500	7000-08041-6501000	7000-08041-6501500
Length (L)	5.0 m	10.0 m	15.0 m
1st connection type	Straight plug, M8x1, 3-pin		
2nd connection type	free cable end		

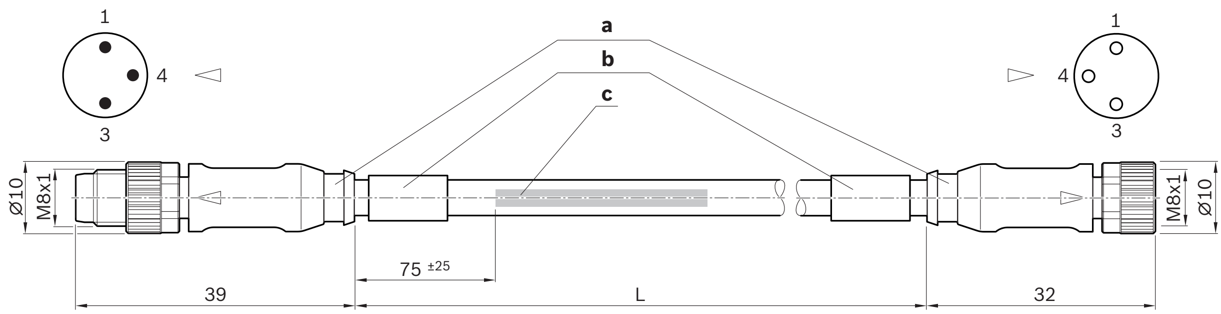
Pre-assembled on two sides

Dimension drawing

Connection diagram

1 brown (BN) (+)
3 blue (BU) (–)
4 black (BK) (signal)





Part numbers

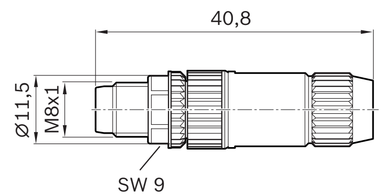
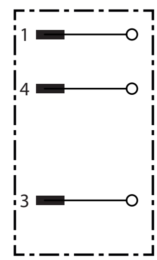
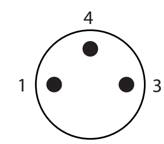
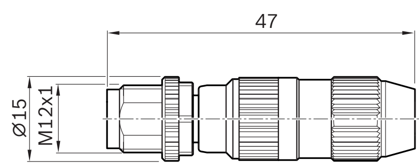
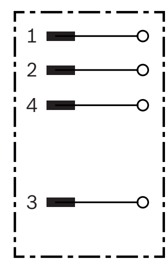
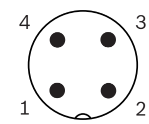
Use	Extension cable				
Part number	R911344621	R911344622	R911344623	R911344624	R911344625
Designation	7000-88001-6500050	7000-88001-6500100	7000-88001-6500200	7000-88001-6500500	7000-88001-6501000
Length (L)	0.5 m	1.0 m	2.0 m	5.0 m	10.0 m
1st connection type	M8x1 3-pole straight female connector				
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 mm²
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/s²
Ambient temperature when secured	-40 °C to +85 °C
Ambient temperature when loose	-25 °C to +85 °C
Protection rating	IP68
Certifications and approvals	CE, c UL us LISTED, C SA US, PC, RoHS

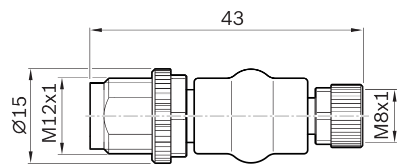
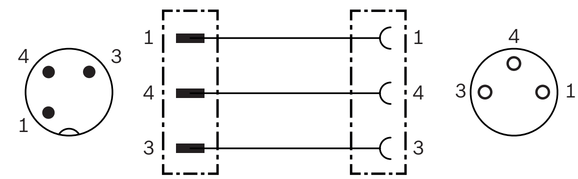
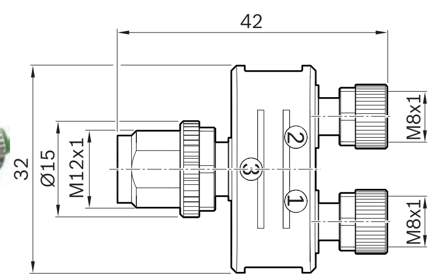
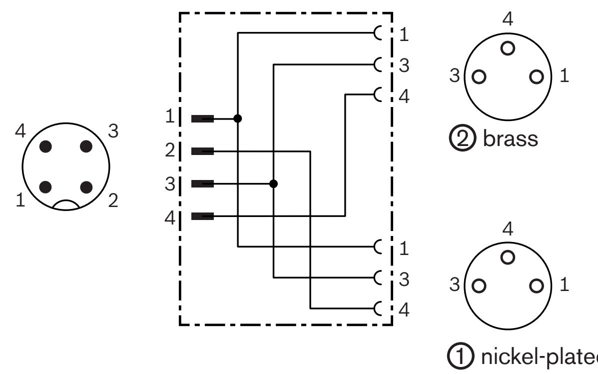
a) Contour for 6.5 mm corrugated tube (inner diameter)
b) Cable grommet
c) Cable label in accordance with labeling regulation

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 mm²	
Ambient temperature	-25 °C to +85 °C	
Protection rating	IP67 (plugged in & screwed down)	
Certifications and approvals	cULus, PCT, RoHS	

Adapters

	Dimension drawing	**Connection diagram**
 R911344591		
 R911344592		

Part numbers / technical data

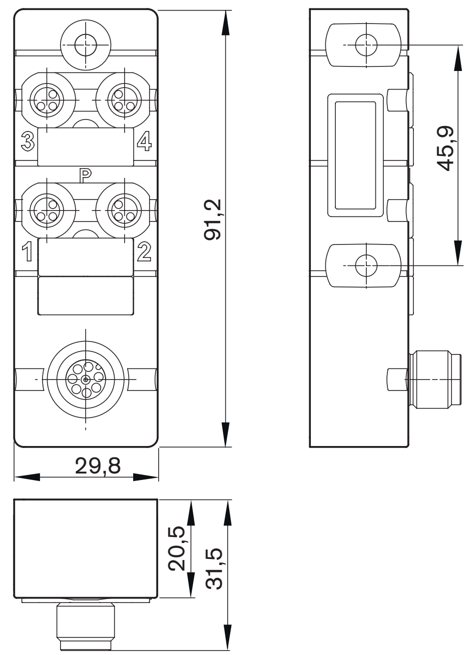
Use	Adapter	Adapter or distributor
Part number	R911344591	R911344592
Designation	7000-42201-0000000	7000-41211-0000000
Version	straight for 1 sensor	straight, for 1 - 2 sensors
Operating current per contact	max. 4 A	
Operating voltage	max. 32 V AC/DC	
1st connection type	Straight female connector, M8x1, 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	RoHS	c UL us LISTED, PC, RoHS

Passive distributors

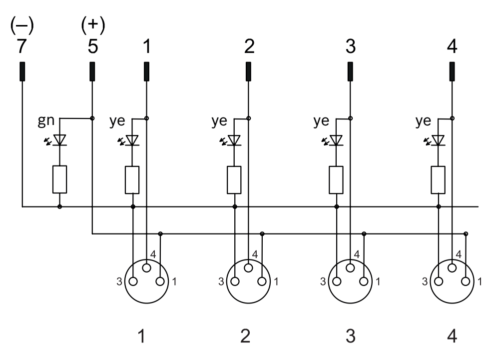

R901425737


R901429917

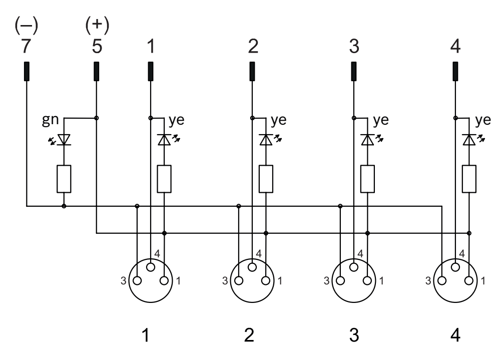

R911344592



R901425737



R901429917



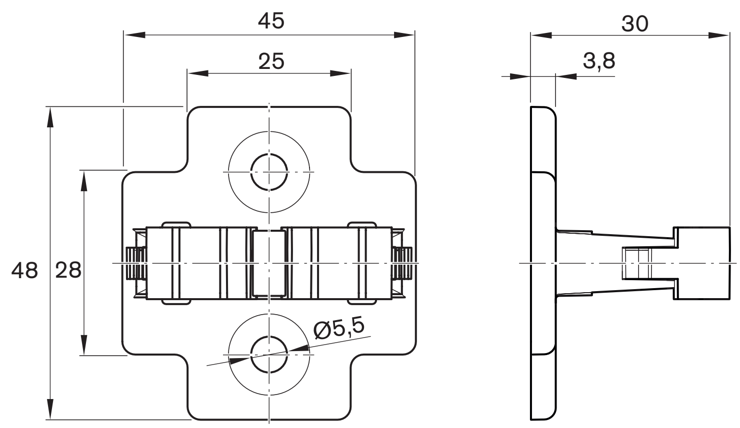
Part numbers / technical data

Use	Passive distributor		
Part number	R901425737	R901429917	R911344592
Designation	8000-84070-0000000	8000-84071-0000000	See the adapter for technical data and drawing
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	c UL us LISTED, RoHS		

Accessories for passive distributors

Holding plate

Screw plug



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.

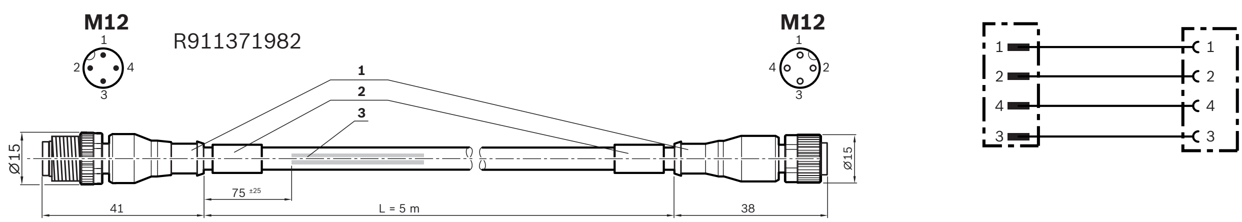
Extensions for passive distributors

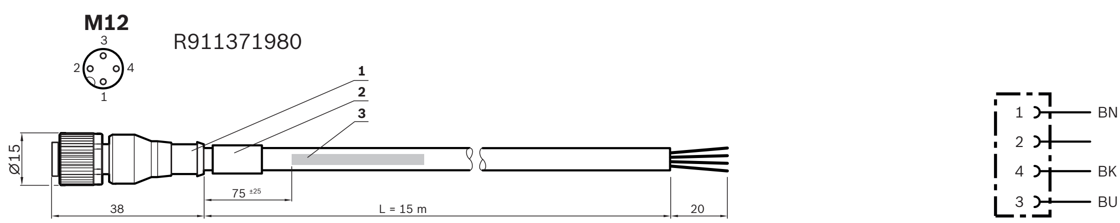
R911371982

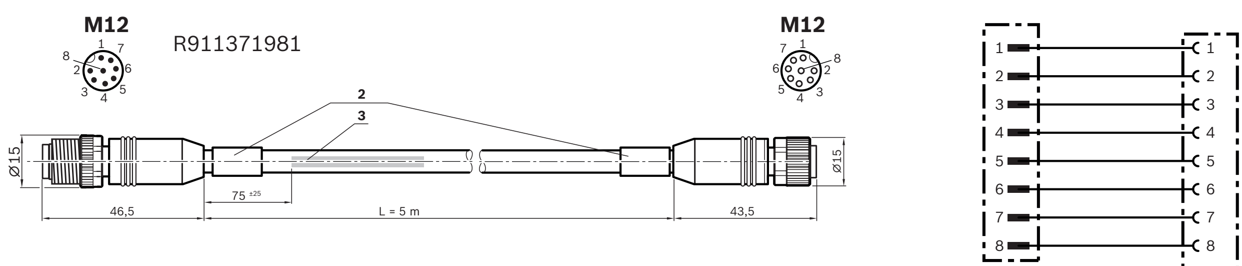
R911371981

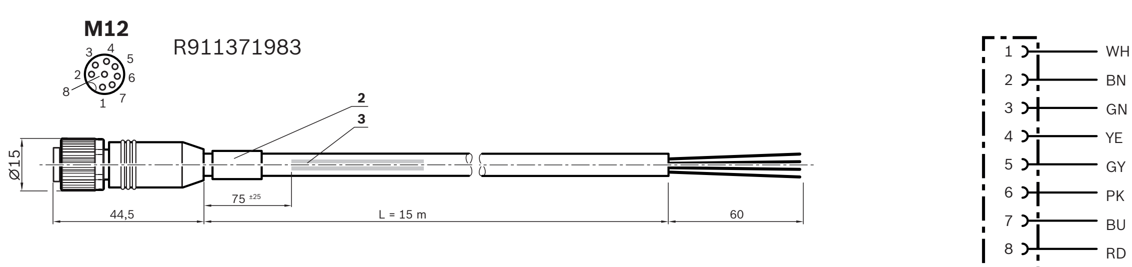
R911371980

R911371983







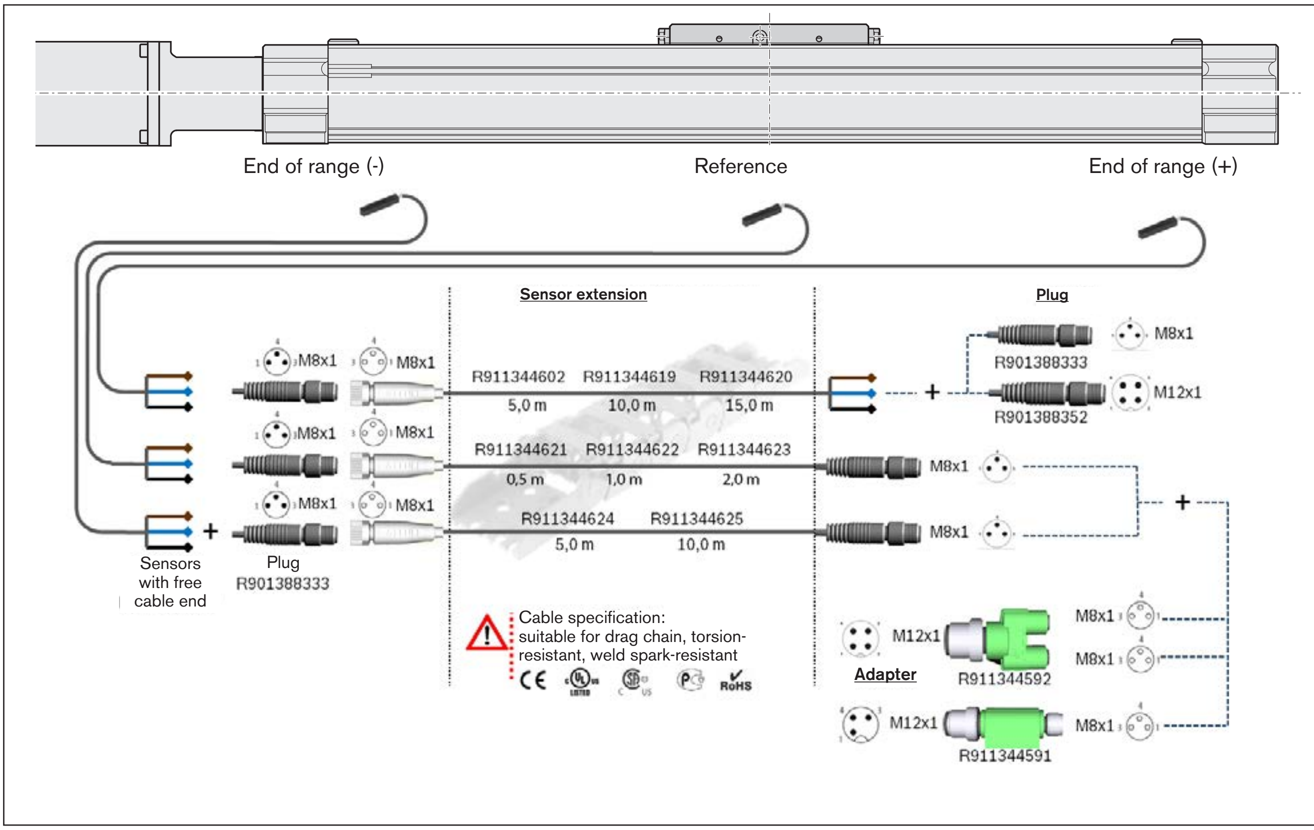


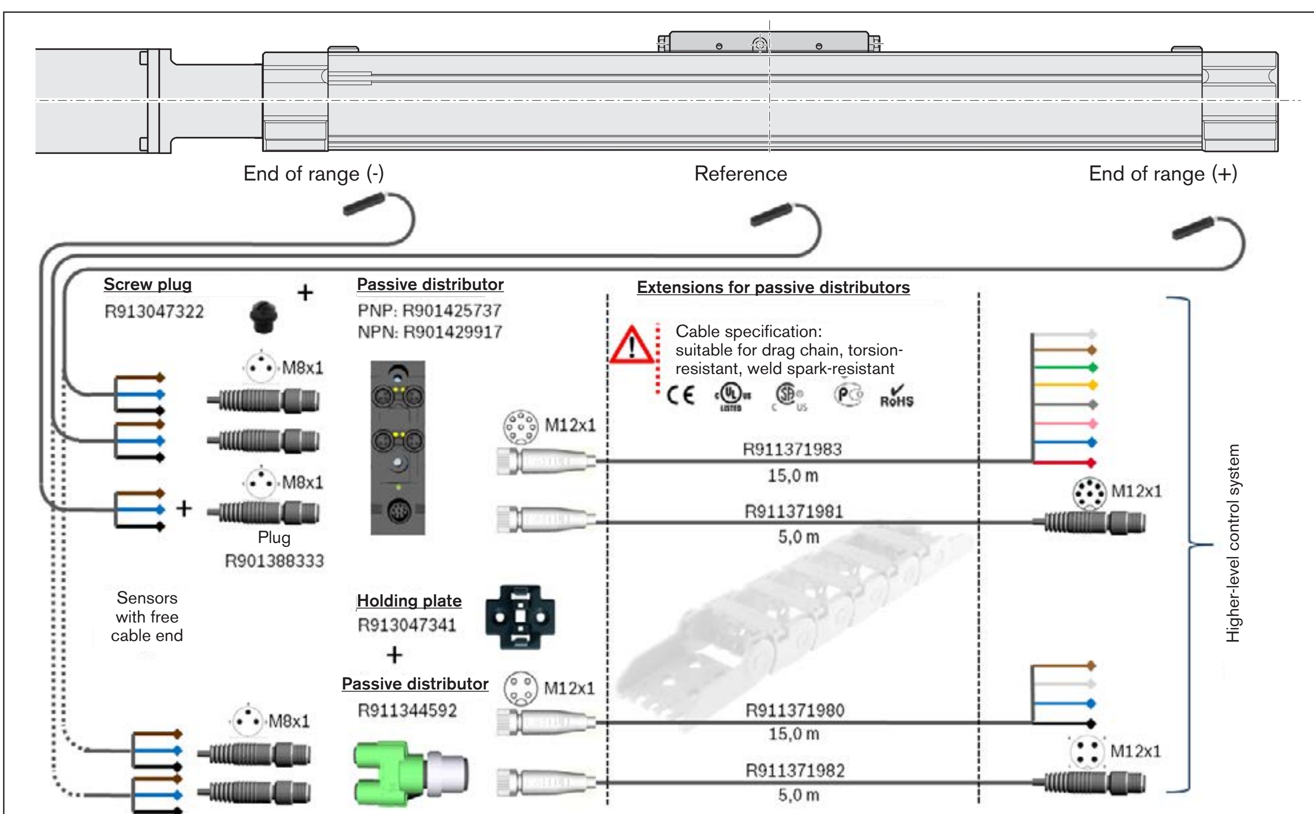
1) Contour for 10 mm corrugated tube (inner diameter)
2) Cable grommet
3) Label in accordance with ordering regulation 7000-08001

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 mm²		8x 0.34 mm²	
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/s²			
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	CE, c UL us LISTED, C US, RoHS			

Combination examples

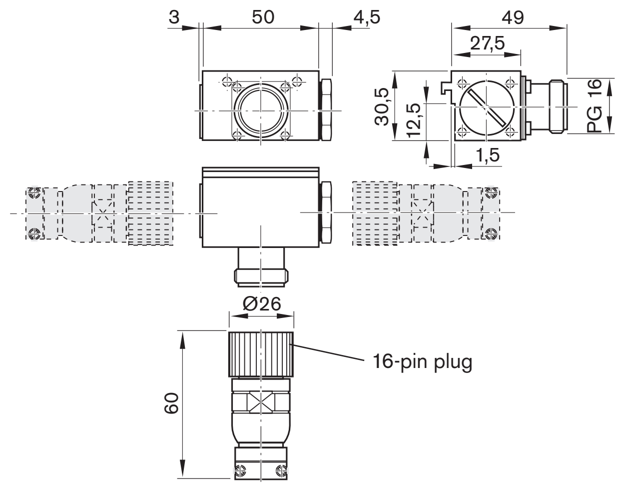


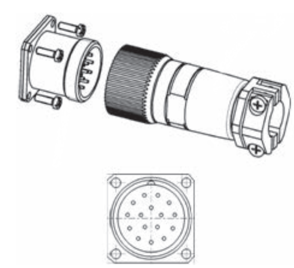


Socket and plug

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.

R117500153





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.

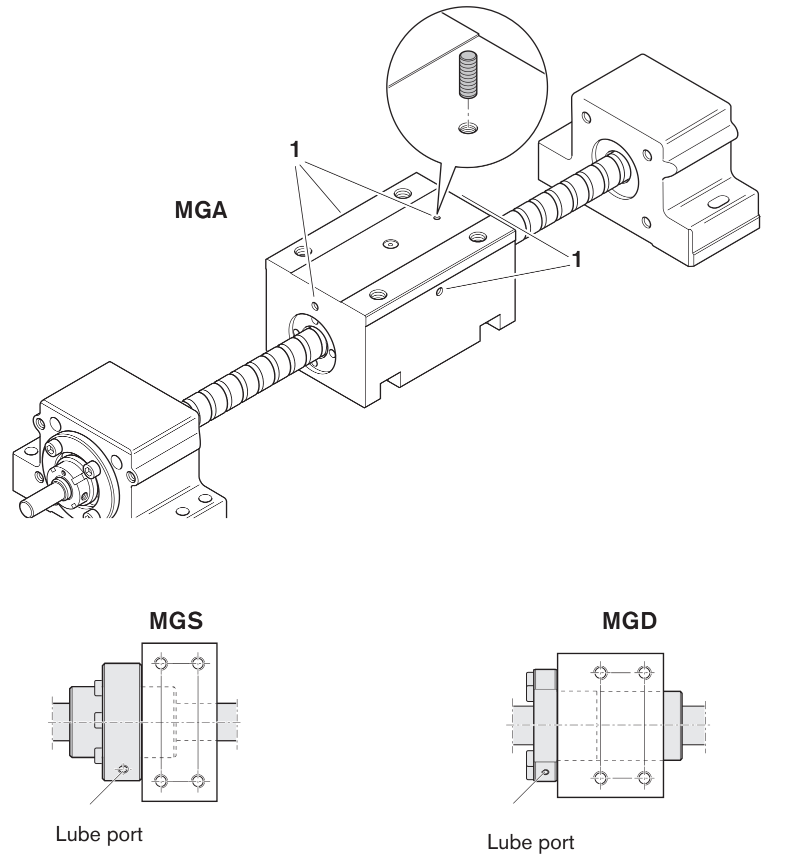
Lubrication

Lube fittings

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

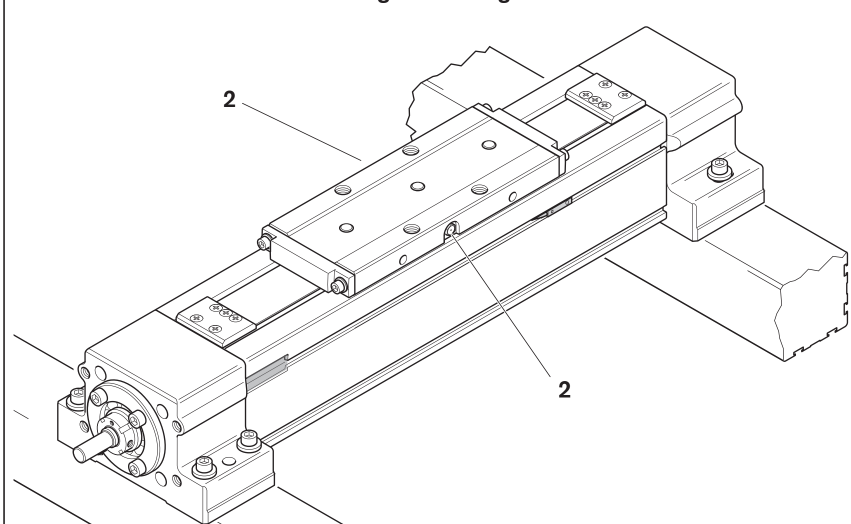
The nuts in all other version are lubricated. See dimensional drawings for location of lube port.

Lube fittings in AOK



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

Lube fittings in carriage of AGK



Lubrication

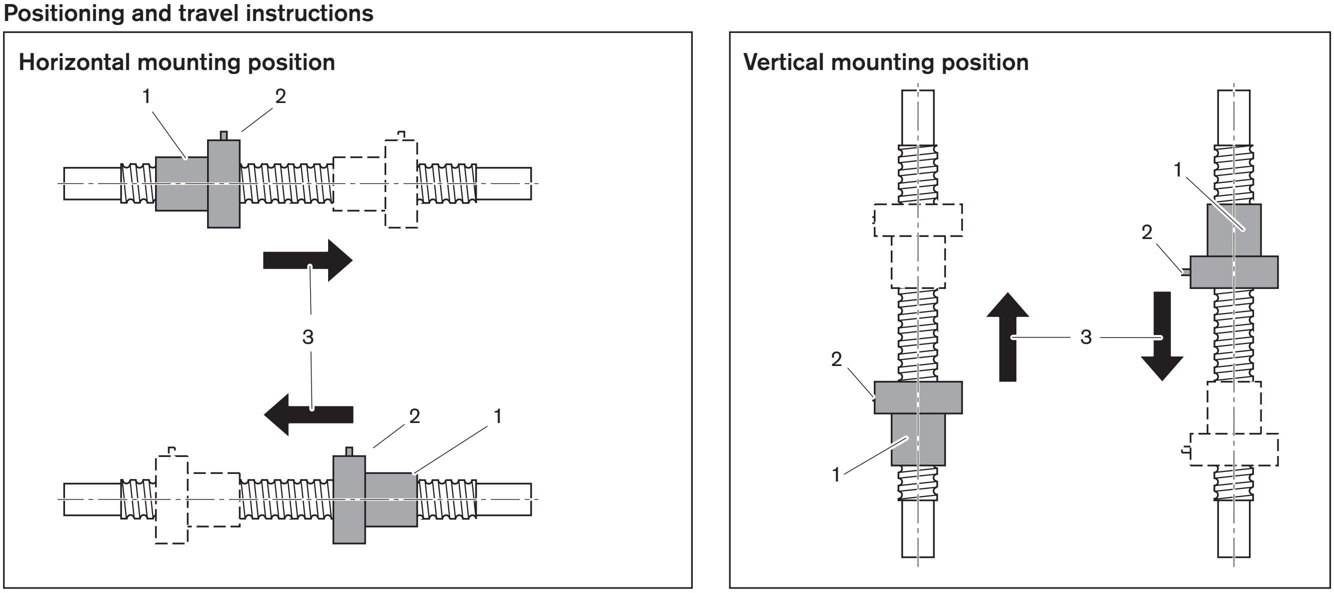
Overview

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 ≥ 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 MoS_2 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.

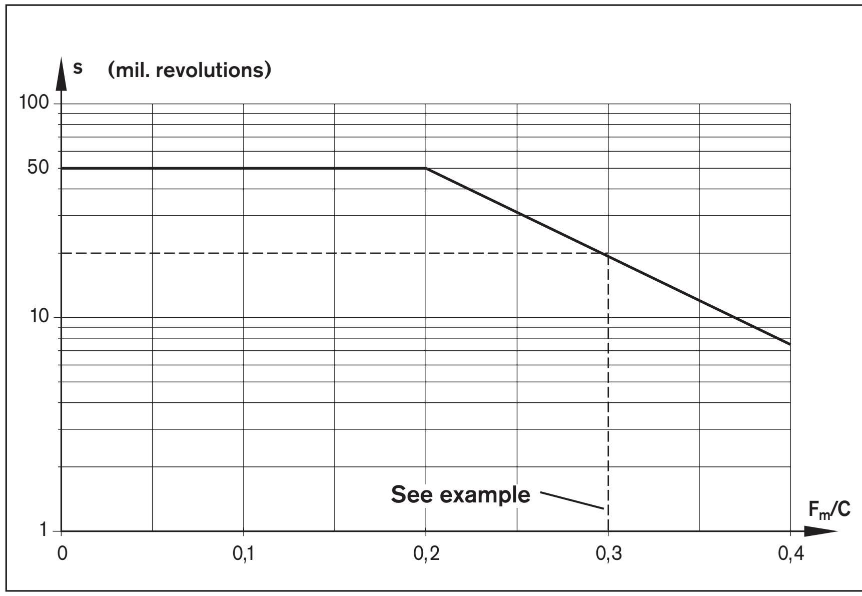
Grease lubrication			
		Maintenance lubrication quantity	**Maintenance lubrication interval**
Size	**BASA**	**ZEM-E/FEM-E-S/FEP-E-S/FEM-E-C**	**Based on load ratio Fm/C ≤ 0.2**
	d_0xP	**(cm^{33})**	**(km)**
AOK-020 AGK-020	20x5	1.0	250
	20x10	1.5	500
	20x20	2.4	1 000
	20x40	1.8	2 000
AOK-032 AGK-032	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 °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:

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

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 • 10^6 revs

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

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.

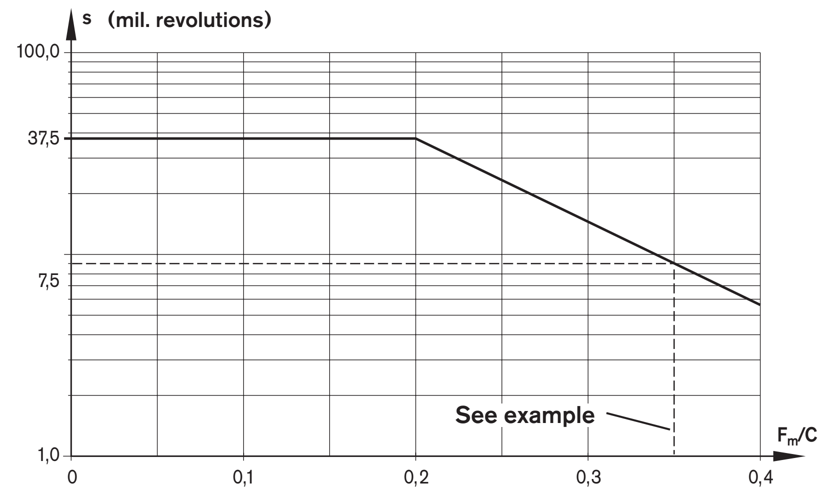
When using single-line distributor systems, always make sure all lines and the piston distributors (including the connection to the BASA nut) are filled before relubricating.
The pulse count that is needed for this is the integer quotient of the relubrication quantity according to the table and the piston 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

		Maintenance lubrication quantity	Maintenance lubrication interval
Size	**BASA**	**ZEM-E/FEM-E-S/FEP-E-S/FEM-E-C**	**Based on load ratio Fm/C ≤ 0.2**
	d_0xP	**(cm³³)**	**(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 °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:

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

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

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

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 cm^3. 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 Fm/C ≤ 0.2**	**Time**
	d_0xP	**(cm^{33})**	**(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	

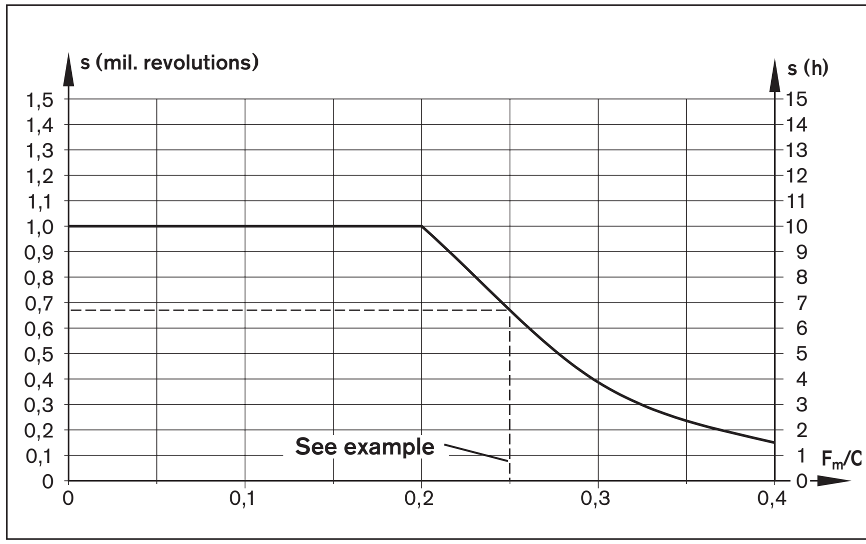
The load ratio F_m/C is the quotient of the average load F_m and the dynamic load rating C (see “Calculation”).

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:

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

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

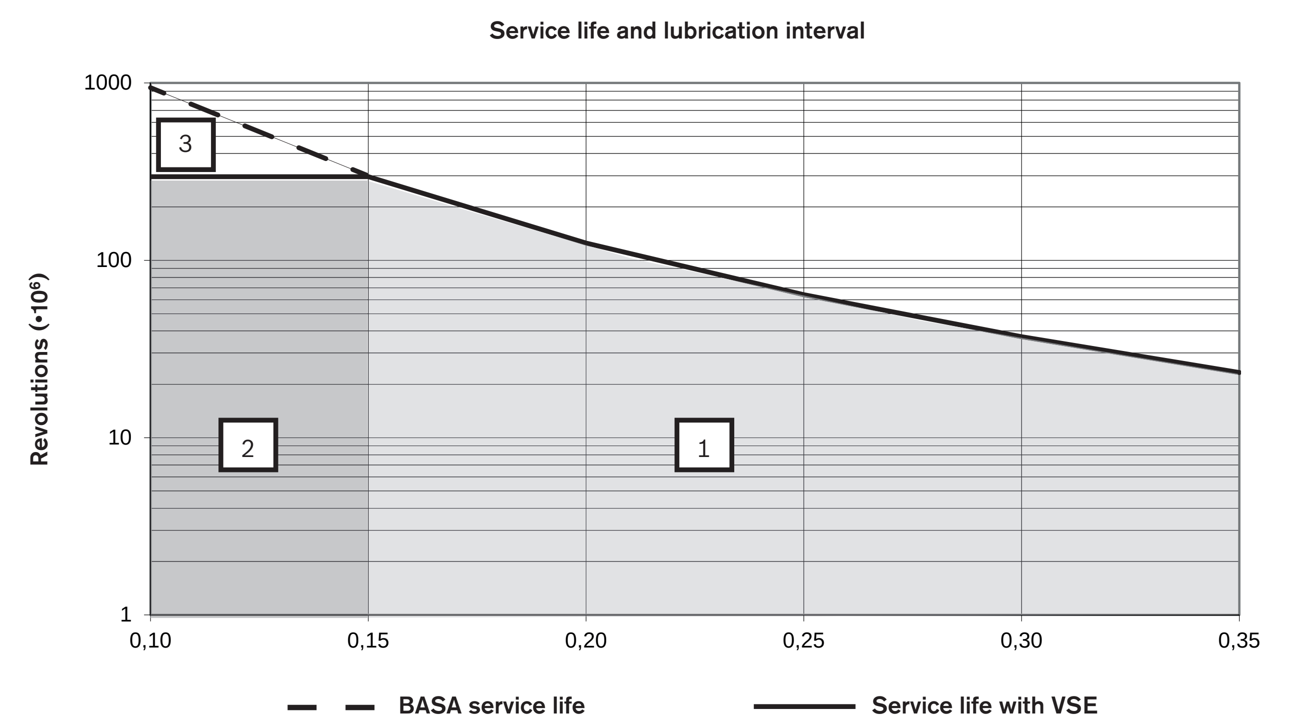
$$\text{s in kilometers} = \frac{0.65 \cdot 10^6 \text{ (revs)} \cdot 20 \text{ (mm)}}{10^6} = 13 \text{ km}$$

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.



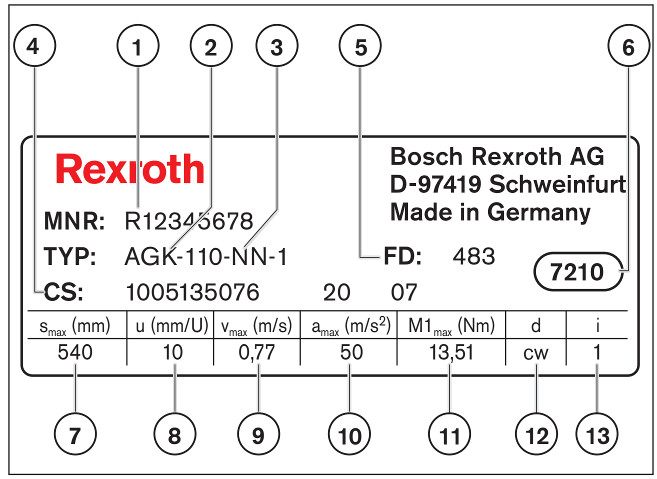
1 Lifelong lubrication:
For load ratios of $0.15 \leq F_m/C \leq 0.35$ (graph area 1), the readable revolutions correspond to the theoretical service life of the BASA and the effective life of the VSE. This means the BASA is lubricated for life.

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.

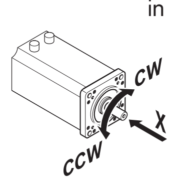
3 Relubrication required:
After 300 mil. revolutions (graph area 3), the nut should be relubricated as usual. The VSE does not have to be removed, however it will no longer continue to lubricate past the interval.

Parameterization (start-up)

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



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/s^2)
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

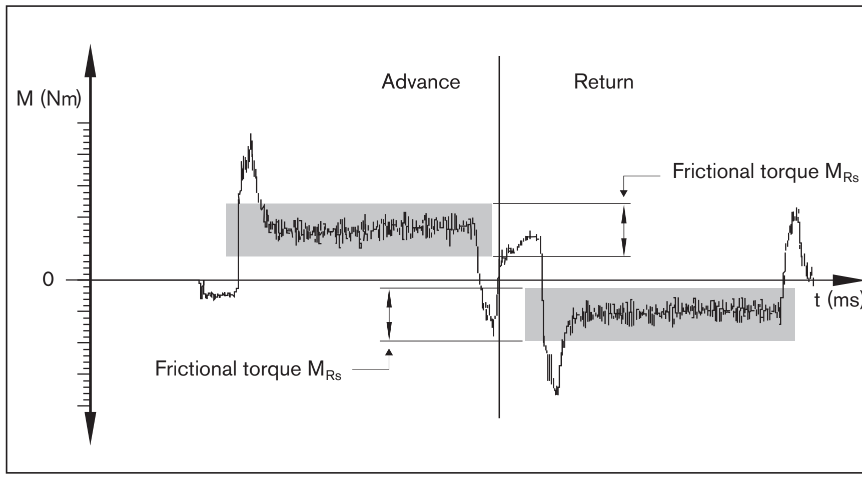
Documentation

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

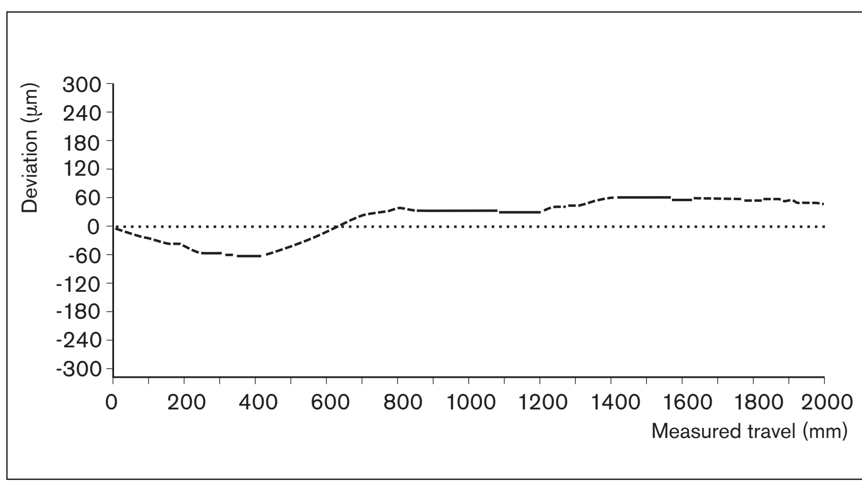
Frictional torque measurement for entire system (for AGK)
Option 02 (includes Option 01)

Frictional torque is measured over the entire travel range.

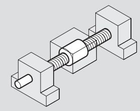
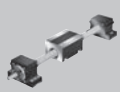
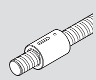
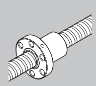
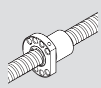


Lead deviation of the ball screw drive
Option 03 (includes Option 01)

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



AOK-032

Short product name, length: AOK-032-NN-1, ... mm	Drive BASA  nut	Size d_0 x P 32 x 5	32 x 10	32 x 20	32 x 32	Tolerance grade		Standard seal	Lubrication Initial greasing	Left VSE	Right VSE	Preload class C1 (moderate)	C2 (medium)	C3 (high)
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

▒ = 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

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

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

d_0 = screw diameter (mm)
P = lead (mm)
L_c = nut length/nut and housing length (mm)

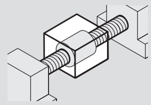
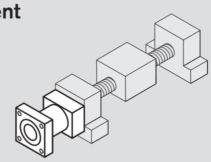
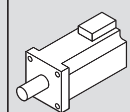
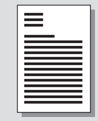
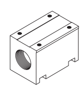
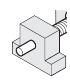
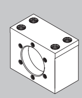
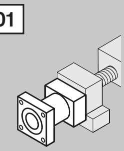
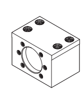
Max. travel: s_{max} = 1000 mm
Drive: BASA 32x10 (d_0 x P)
Nut length/nut and housing length L_c = 77 mm
Additional length: L_{ad} = 128 mm

L = 1000 + 77 + 128
L = 1205 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 Left	Screw ends Right	Pillow block Aluminum	Pillow block Steel	Nut Housing without	Nut Housing with	Nut Housing Type	Motor attachment Version	Gear ratio	Attachment kit[1]	for motor	Motor without brake	Motor with brake	Documentation Standard report	Documentation 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]	[01]	03 Lead deviation
				00	[13]				02	MSK 76C[2]	92	93		
				00	12									
				00	14									
81	31	02	12	00	21	MGD 								
				00	22									
				00	23									
				00	24									
81	00	01	11	–	01	MGA								

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

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 (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

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] └ ☐☐-☐☐-☐☐☐-☐☐☐-☐☐☐-M☐☐-☐☐☐-☐☐☐
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]		☐☐-☐☐-☐☐☐-☐☐☐-☐☐☐-M☐☐-☐☐☐-☐☐☐
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

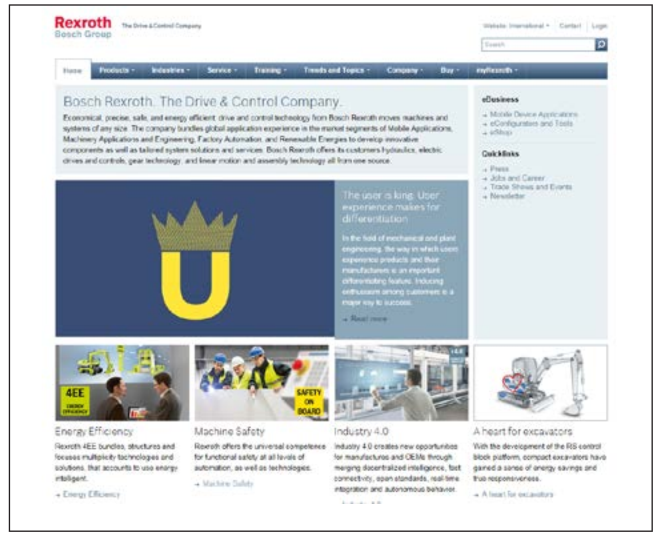
Company: ______________________
Address: ______________________

Responsible person: ______________________
Department: ______________________
Telephone: ______________________
Fax: ______________________

Further information

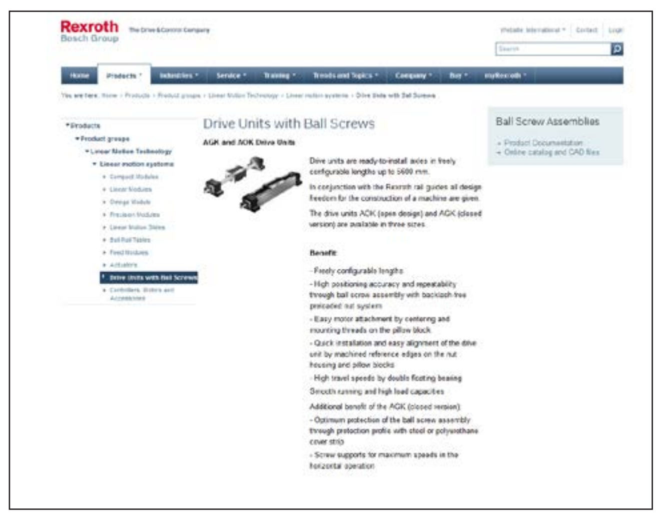
Bosch Rexroth homepage:

http://www.boschrexroth.com



Drive Unit
product information:

https://www.boschrexroth.com/de/de/produkte/produkt-gruppen/lineartechnik/linearsysteme/antriebseinheiten-mit-kugelgewindetrieben/index



Notes

The Drive & Control Company

Rexroth
Bosch Group

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