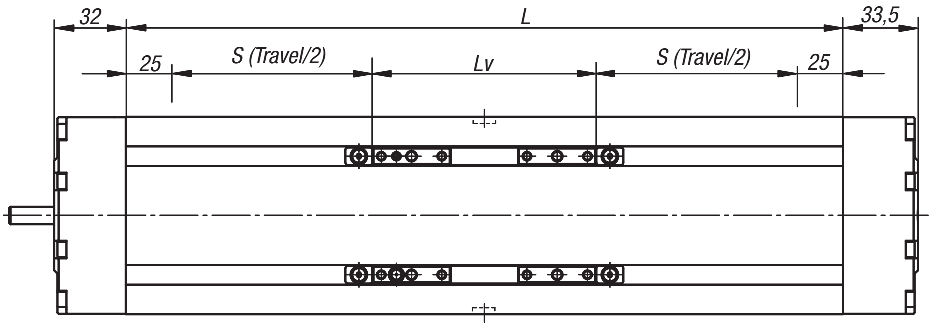
Technical information about linear actuators with ball screws 20331-10

Length calculation of the linear actuators

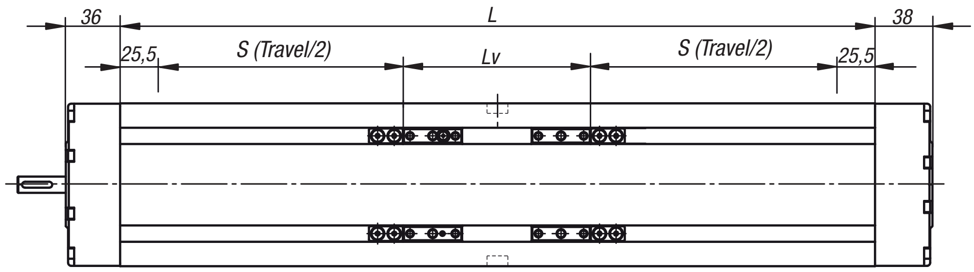
Size



carriage	Length Lv
Form A	35
Form B	100

L = Strav + Lv + 50mm + 2 * travel reserve
Ltotal = L + 65,5mm

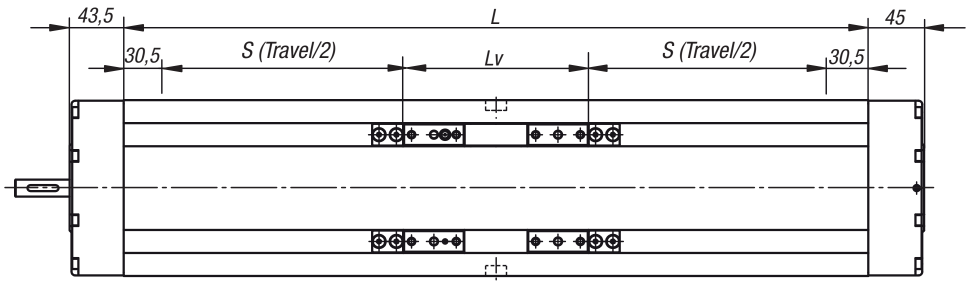
Size



carriage	Length Lv
Form A	39
Form B	124

L = Strav + Lv + 51mm + 2 * travel reserve
Ltotal = L + 74mm

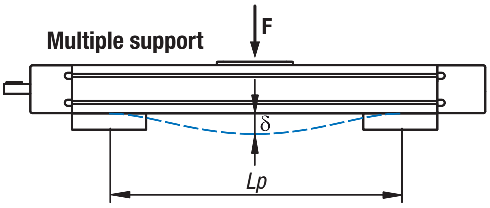
Size

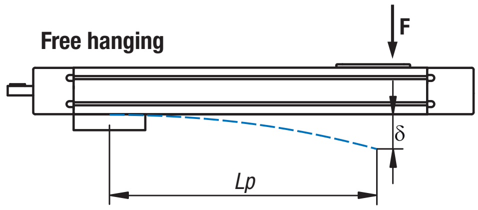


carriage	Length Lv
Form A	49
Form B	149

L = Strav + Lv + 61mm + 2 * travel reserve
Ltotal = L + 88.5mm

Deflection of the mechanical linear actuator

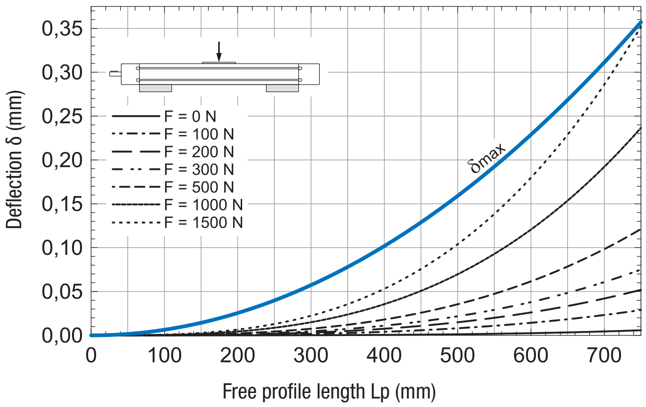


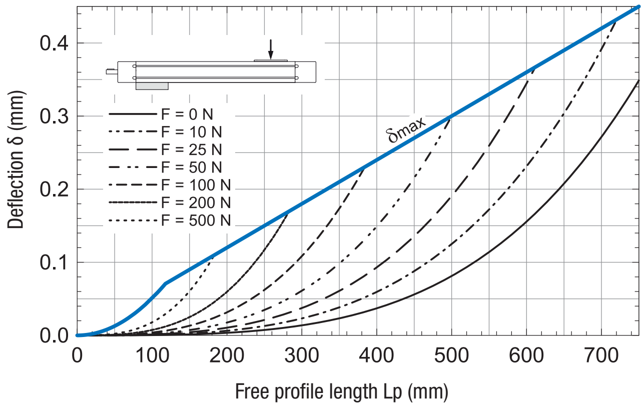


δ Maximum deflection of the linear actuator [mm]
δ Maximum permissible deflection of the linear actuator [mm]
F Force [N]
Lp Free profile length [mm]

If the maximum deflection exceeds the permissible deflection, additional supports are required

Size





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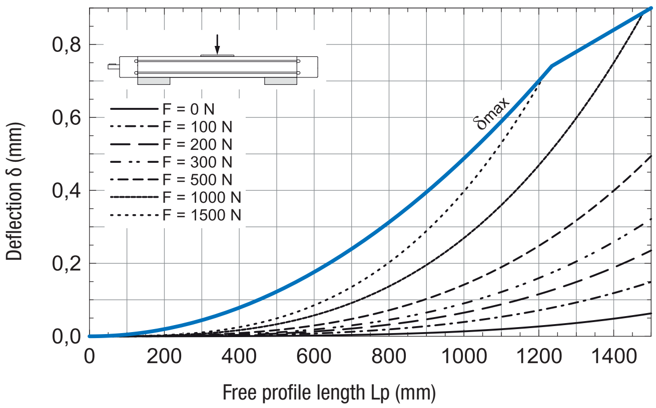

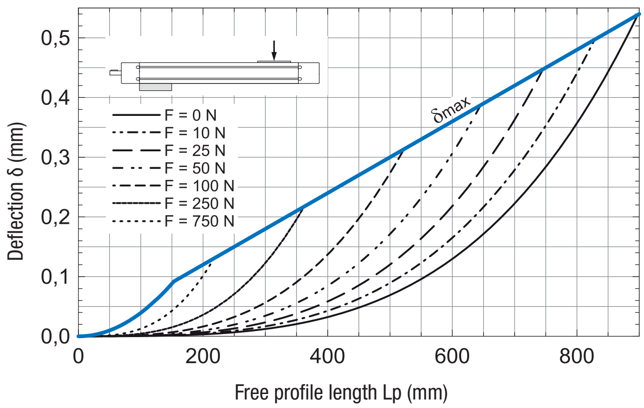

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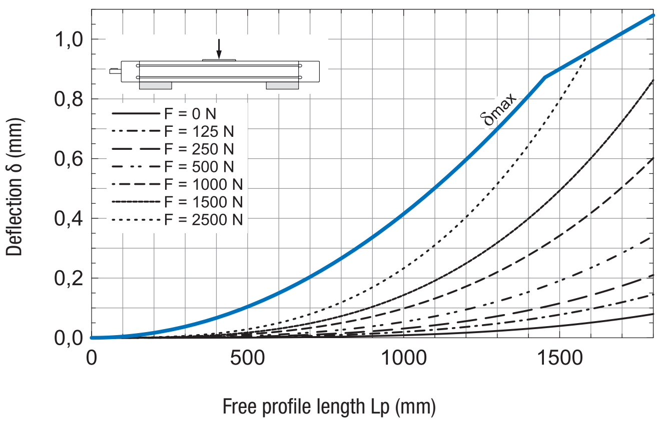
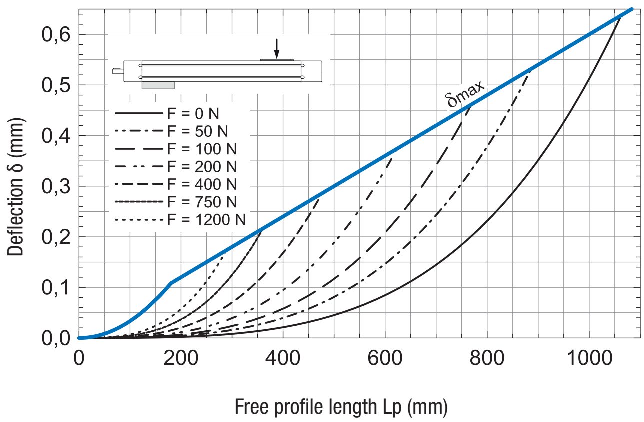
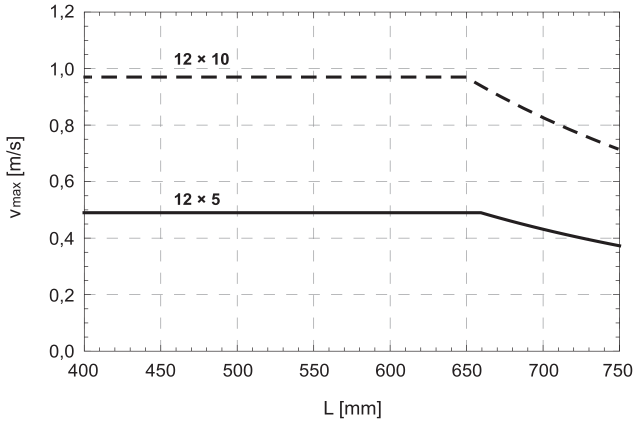




Maximum speed as a function of the profile length

Size



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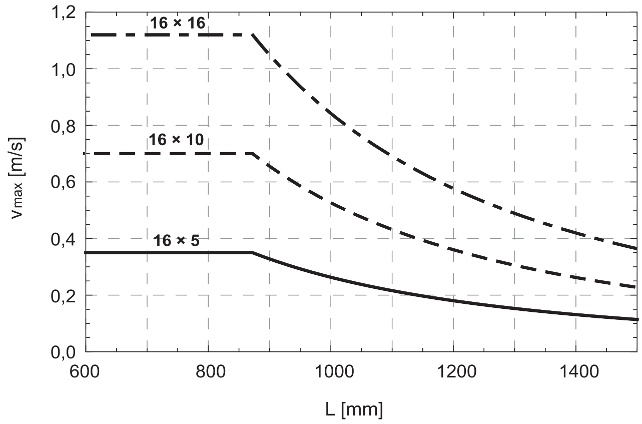

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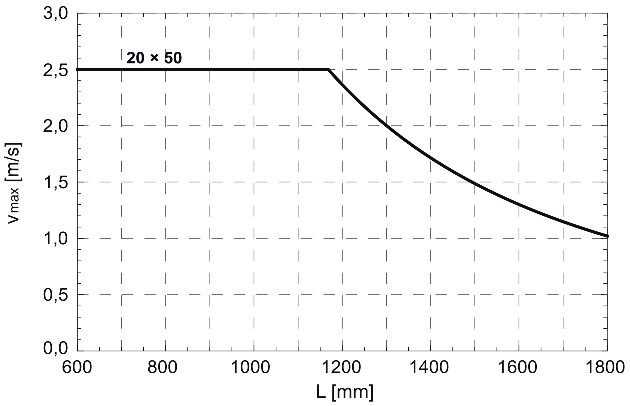
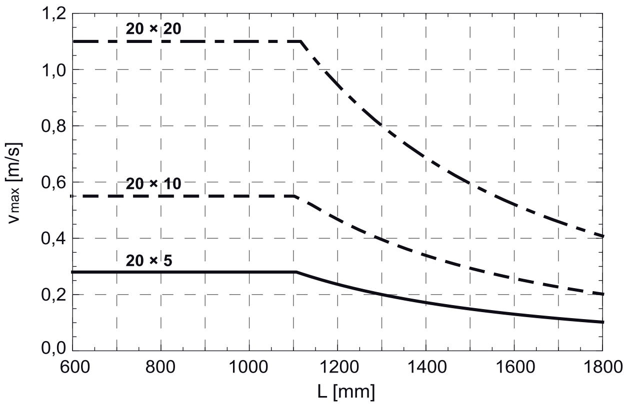


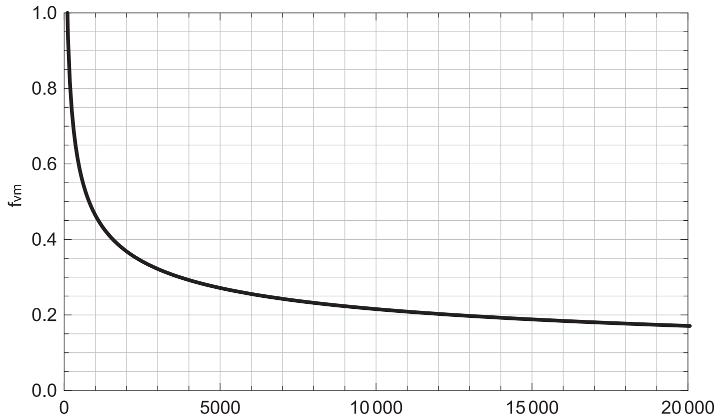


Weight and moment of inertia

Size	Ball screw spindle DxT	carriage	Linear actuator weight kg	Moment of inertia 10-5 kg m²
90	12x5	Form A	1,6 + 0,006 * S Strav + 0,30	0,32 + 0,002 * S Strav + 0,02
		Form B	2,2 + 0,006 * S Strav + 0,50	0,43 + 0,002 * S Strav + 0,03
	12x10	Form A	1,6 + 0,006 * S Strav + 0,30	0,38 + 0,002 * S Strav + 0,08
		Form B	2,2 + 0,006 * S Strav + 0,50	0,53 + 0,002 * S Strav + 0,13
110	16x5	Form A	3,3 + 0,008 * S Strav + 0,63	0,70 + 0,005 * S Strav + 0,04
		Form B	4,6 + 0,008 * S Strav + 1,36	1,19 + 0,005 * S Strav + 0,09
	16x10	Form A	3,3 + 0,008 * S Strav + 0,63	0,82 + 0,005 * S Strav + 0,16
		Form B	4,6 + 0,008 * S Strav + 1,36	1,45 + 0,005 * S Strav + 0,34
	16x16	Form A	3,3 + 0,008 * S Strav + 0,63	1,07 + 0,005 * S Strav + 0,41
		Form B	4,6 + 0,008 * S Strav + 1,36	1,99 + 0,005 * S Strav + 0,88
145	20x5	Form A	5,7 + 0,015 * S Strav + 1,19	3,04 + 0,013 * S Strav + 0,08
		Form B	8,4 + 0,015 * S Strav + 2,61	4,43 + 0,013 * S Strav + 0,17
	20x10	Form A	5,7 + 0,015 * S Strav + 1,19	3,27 + 0,013 * S Strav + 0,30
		Form B	8,4 + 0,015 * S Strav + 2,61	4,92 + 0,013 * S Strav + 0,66
	20x20	Form A	5,7 + 0,015 * S Strav + 1,19	4,17 + 0,013 * S Strav + 1,21
		Form B	8,4 + 0,015 * S Strav + 2,61	6,91 + 0,013 * S Strav + 2,64
	20x50	Form A	5,7 + 0,015 * S Strav + 1,19	10,50 + 0,013 * S Strav + 7,54
		Form B	8,4 + 0,015 * S Strav + 2,61	20,79 + 0,013 * S Strav + 16,53

Linear rails service life:

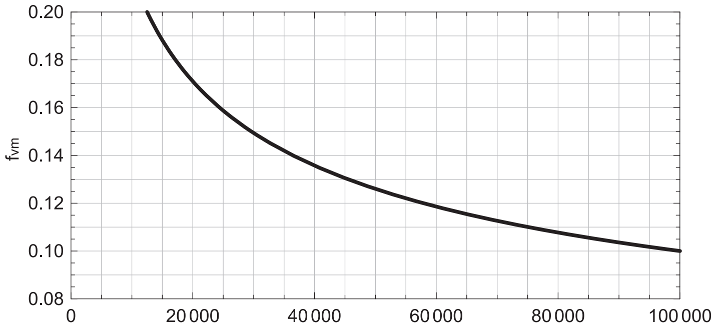
Comparison factor of the average load fvm as a function of the service life Lkm



$$fv = \frac{|Fy|}{Cdyn} + \frac{|Fz|}{Cdyn} + \frac{|Mx|}{Mx\,dyn} + \frac{|My|}{My\,dyn} + \frac{|Mz|}{Mz\,dyn}$$

fv Load comparison factor
Cdyn Dynamic load rating
Mx dyn Dynamic torque around the X axis Nm
My dyn Dynamic torque around the Y axis Nm
Mz dyn Dynamic torque around the Z axis Nm
Fy Acting force in Y axis N
Fz Acting force in Z axis N
Mx Effective torque around the X axis Nm
My Effective torque around the Y axis Nm
Mz Effective torque around the Z axis Nm

More detailed view:

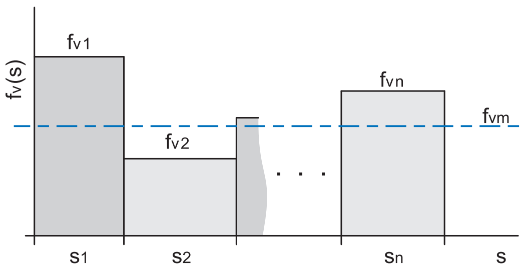


Calculation of the mean load comparison factor fvm:

$$fvm = \sqrt[3]{\frac{fv1^3 \times s1 + fv2^3 \times s2 + \ldots + fvn^3 \times sn}{s1 + s2 + \ldots + sn}}$$

fvm Mean load comparison factor
fv i i-te load comparison factor of a given load mode fv (s), i ε [1,2...,n]
si i-te travel of a given load mode fv (s), i ε [1,2...,n]

Load mode fv (s)



Calculation of the service life:

$$Lkm = \left(\frac{1}{fvm}\right)^3 \cdot 10^2$$

Lkm Service life (km)

Safety factor fs:

$$fs = \frac{1}{fvm}$$

The safety factor depends on the application and its required safety. We recommend a minimum safety factor fs = 5.0.

fs Safety factor

Permissible load factor fp for linear guide

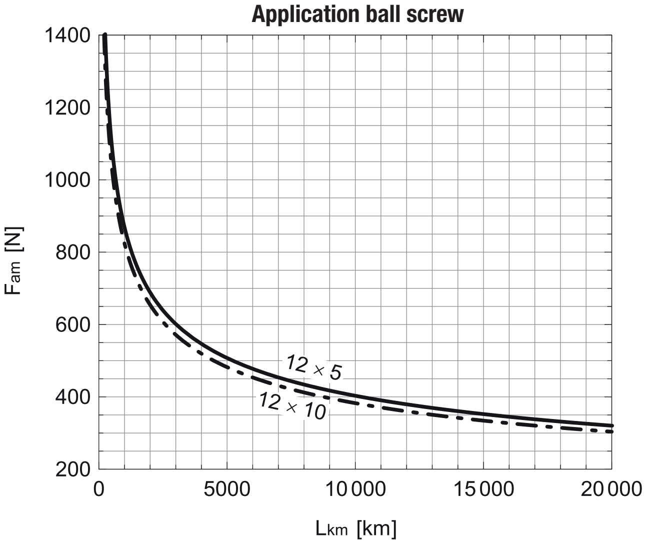
$$fp = \frac{|Fy|}{Fpy} + \frac{|Fz|}{Fpz} + \frac{|Mx|}{Mpx} + \frac{|My|}{Mpy} + \frac{|Mz|}{Mpz} \leq 1$$

fp Permissible load factor
Fpy Max. permissible force in Y axis N
Fpz Max. permissible force in Z axis N
Mpx Max. permissible torque around the X axis Nm
Mpy Max. permissible torque around the Y axis Nm
Mpz Max. permissible torque around the Z axis Nm

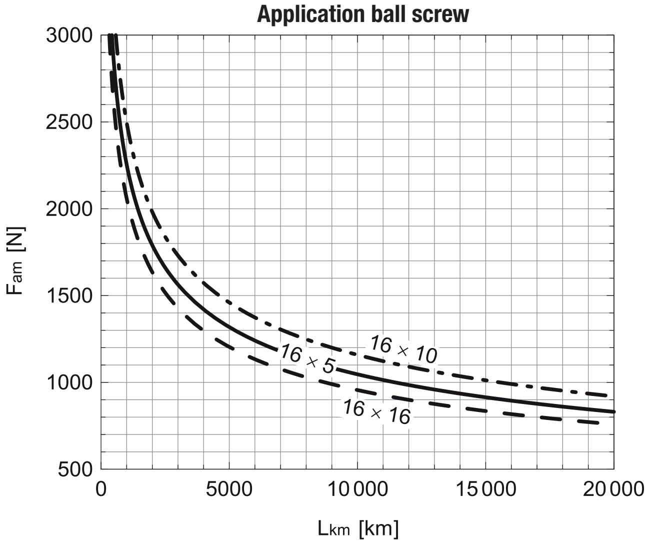
Ball screw service life

Applied average axial force Fam as a function of service life Lkm

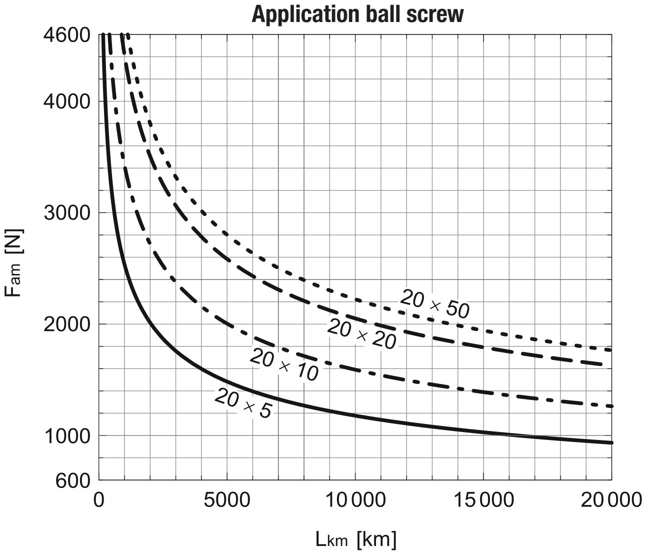
Application ball screw



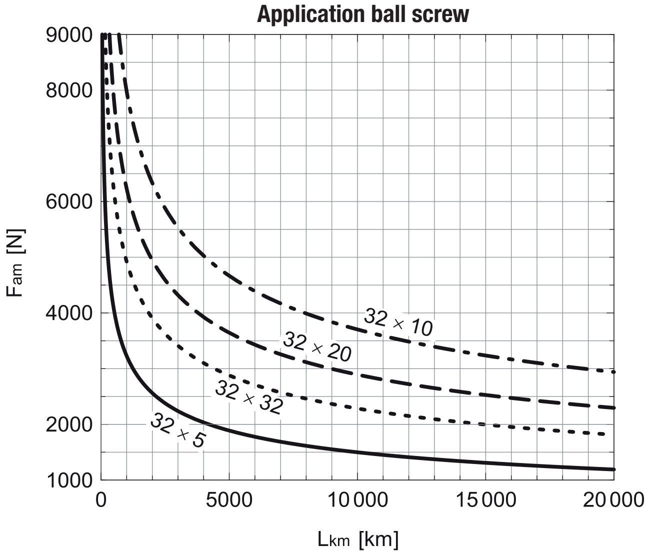
Application ball screw



Application ball screw



Application ball screw



The diagrams show the theoretical service life for the ball screw when the average axial force Fam is taken into account.

Calculation of the mean axial force Fam

$$F_{am} = \sqrt[3]{\frac{|F_{a1}|^3 \times s_1 + |F_{a2}|^3 \times s_2 + \ldots + |F_{an}|^3 \times s_n}{s_1 + s_2 + \ldots + s_n}}$$

Fam mean axial force
Fa i i-te axial force of a given load mode Fa (s), i ε [1,2,...,n]
si i-te travel of a given load mode Fa (s), i ε [1,2,...,n]

Load mode Fa (s)