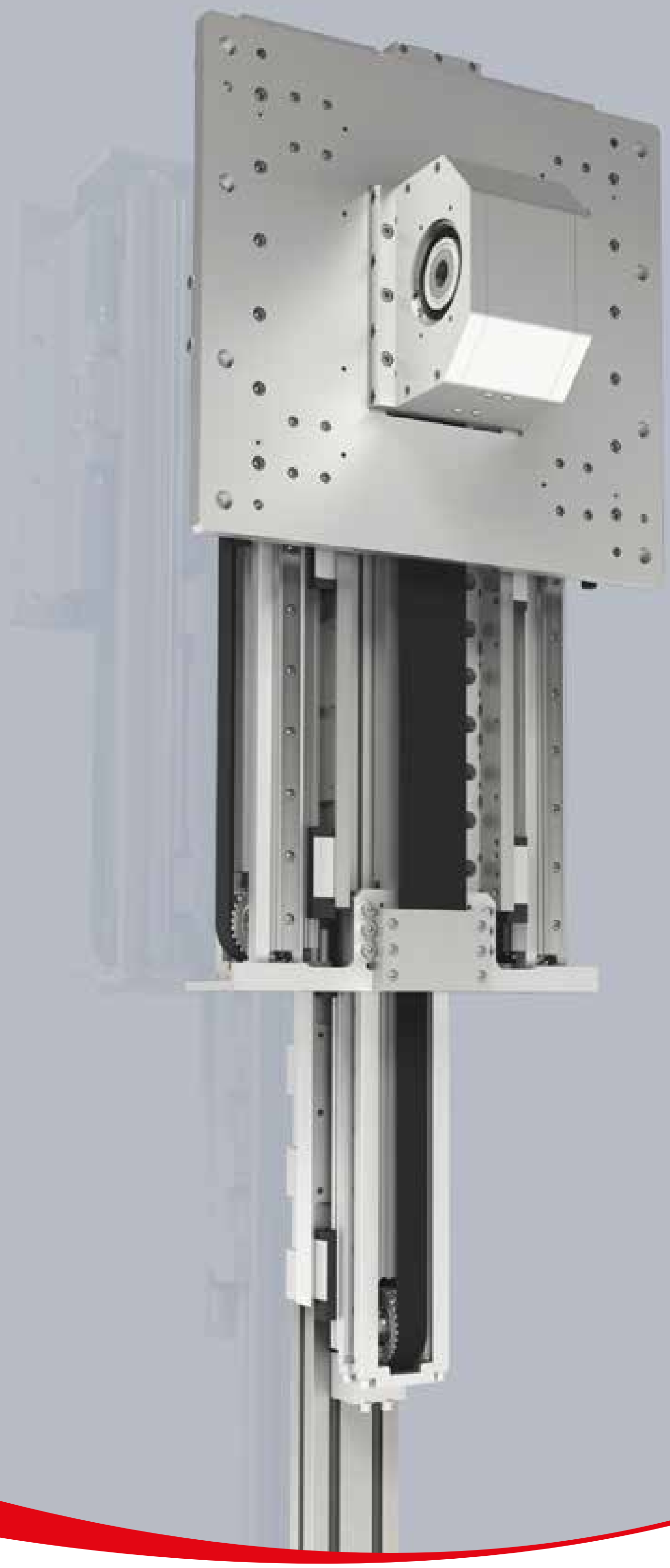
Telescopic System



TELESCOPIC ACTUATORS

Maximize Productivity, Minimize Footprint.
Discover the **6 main advantages** for multiple applications in limited spaces.

1

Efficient space utilization

Compact design and space-saving with 2 or 3 stages solutions.

2

High stiffness

Precision-engineered steel components and extruded aluminum profiles for high stiffness and lightweight construction.

3

Dual stroke advantage

Process optimization enabled by double stroke capability.

4

Enhanced extension

Achieve optimal extension with synchronized belt system.

5

Versatile configurations

Seamlessly integrated into multiple axes configurations.

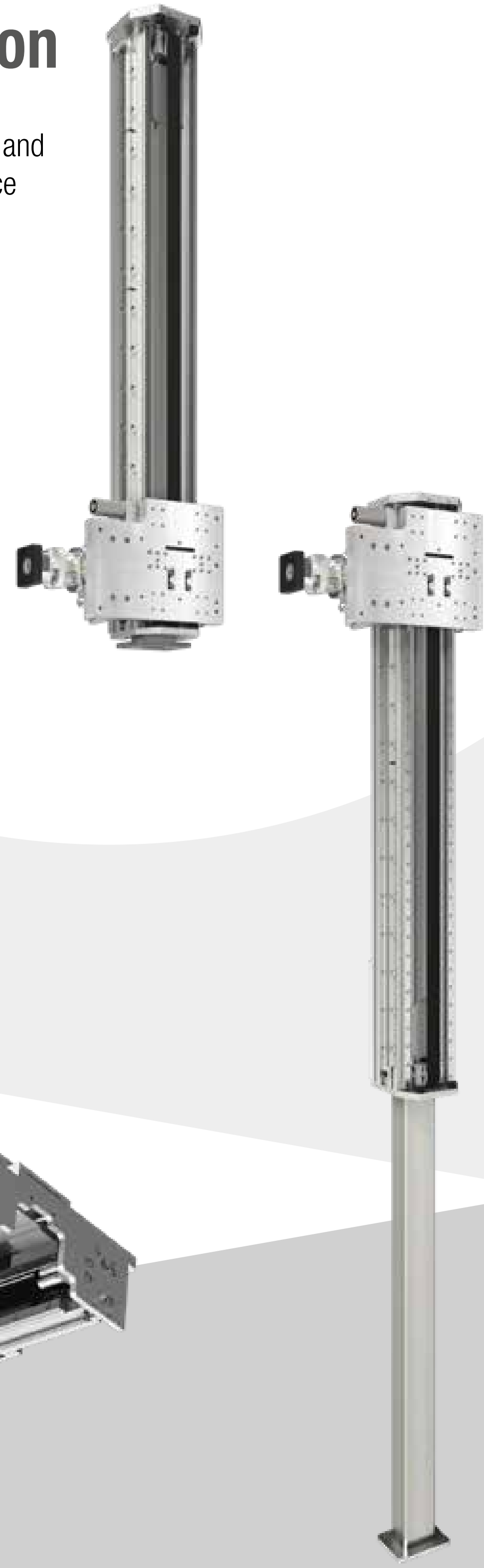
6

Long lifetime

Automated lubrication system ensures longevity and low maintenance.

Vertical solution

TLS - ideal for applications with limited space between machine and ceiling, where axis travel distance exceeds vertical clearance.



TLS series

Fig. 1

Description

Telescopic System - TLS

TLS products are Telescopic actuators made of a self-supporting extruded aluminum with belt (TLS 100) or rack and pinion (TLS 230, 280, 360) driven trasmission designed for several applications like pick and place, industrial machines feeding and metal sheet press.

TLS Telescopic actuators are available with horizontal and vertical movements in several sizes: 100H and 100V (belt), 230V, 280V and 360V (rack and pinion).

TLS Telescopic actuators are ideal for applications with limited space between machine and ceiling, where axis travel distance exceeds vertical clearance.

Some of the main advantages of TLS solutions are:

- Compact solution.
- High quality and competitive performances.
- Dual stroke capability.
- Seamlessly integrated into multiple axes configurations.
- Precise machining of all profiles.

The components

Extruded bodies

The TLS series is created using extruded and anodized Rollon profiles, made of hardened and tempered aluminum alloy tolerance according to UNI EN 755-9. Profiles are specifically designed by Rollon to create rigid and light structures, suitable for manufacturing linear transfer machines.

Driving system

The TLS series is driven by a rack and pinion or belt system. The TLS with rack and pinion transmission is made by hardened and ground helical tooth racks (Q6 quality), for higher load capacity and low noise. They are available with four different modules: m3, m4 and m5.

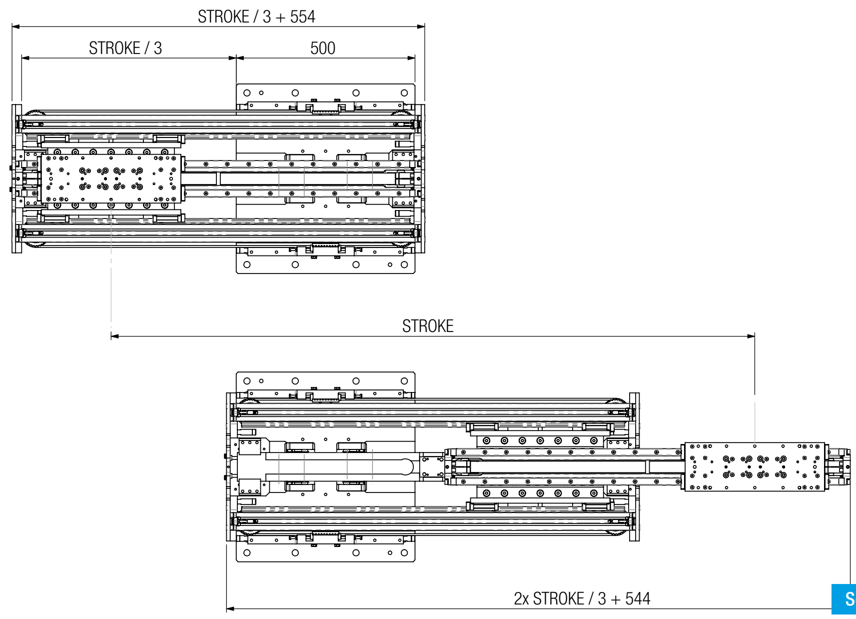
The TLS driven by belt uses a steel reinforced polyurethan belt with AT pitch. This belt is ideal due to its high load transmission characteristics, compact size and low noise. Used in conjunction with a backlash free pulley, smooth alternating motion can be achieved.

Carriage

The carriage of the TLS series is made of anodized aluminum. Different lengths of the carriages are available according to the different sizes.

TLS 100H 1A*

Dimension



See profile section at page TS-12

The length of the safety stroke is provided on request according to the customer's specific requirements. *1A = *Single stroke (asymmetric)

Fig. 1

Technical data

	TLS 100H 1A
Max. useful stroke length [mm]	2250
Max. positioning repeatability [mm]*1	± 0.3
Max. speed [m/s]	6
Max. acceleration [m/s²]	20
Type of belt	75 AT 10 HPF
Type of pulley	Z 29
Carriage displacement per pinion turn [mm]	870
Pulley pitch diameter [mm]	92.31
Carriage weight [kg]	34.1
Zero travel weight [kg]	87.4
Weight for 100 mm useful stroke [kg]	1.5
Starting torque [Nm]	14
Rail size [mm]	25

*1) Positioning repeatability is dependent on the type of transmission used

Tab. 1

Drive

Type of belt	Belt width [mm]	Weight [kg/m]
75 AT 10 HPF	75	0.435

Tab. 2

Closed length

Stroke [mm]	0	1500	2250	X
Closed length [mm]	554	1054	1304	X/3+554

Tab. 3

Typical payloads*

High Dynamics [kg]	Low Dynamics [kg]
30	50

Tab. 4

*The payload capacity is impacted by the center of mass and dynamics. The typical payloads are determined considering them centered on the carriage, considering a useful stroke of 1500 mm and to ensure a theoretical guides lifetime of L10=50000 km. The high dynamics corresponds to a speed of 3 m/s and an acceleration of 8 m/s² while the low dynamics corresponds to a speed of 1 m/s and an acceleration of 1 m/s².

Moments of inertia of the profile

Stage	Material	I_x [10^7 mm⁴]	I_y [10^7 mm⁴]	I_p [10^7 mm⁴]
1st	Aluminium	10.450	0.672	11.122
2nd	Aluminium	0.213	0.063	0.276
3rd	Aluminium	-	-	-

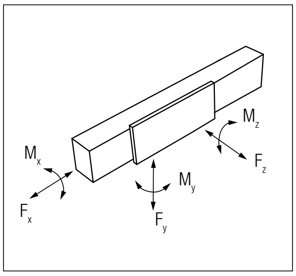
Tab. 5

Load capacity

Stage	F_x [N]		F_y [N]		F_z [N]	M_x [Nm]	M_y [Nm]	M_z [Nm]
	Stat.	Dyn.	Stat.	Dyn.	Stat.	Stat.	Stat.	Stat.
1st	7470	5220	258800	116832	258800	39338	41408	41408
2nd	-	-	307200	141600	307200	34867	48230	48230
3rd	-	-	153600	70800	153600	6298	24115	24115

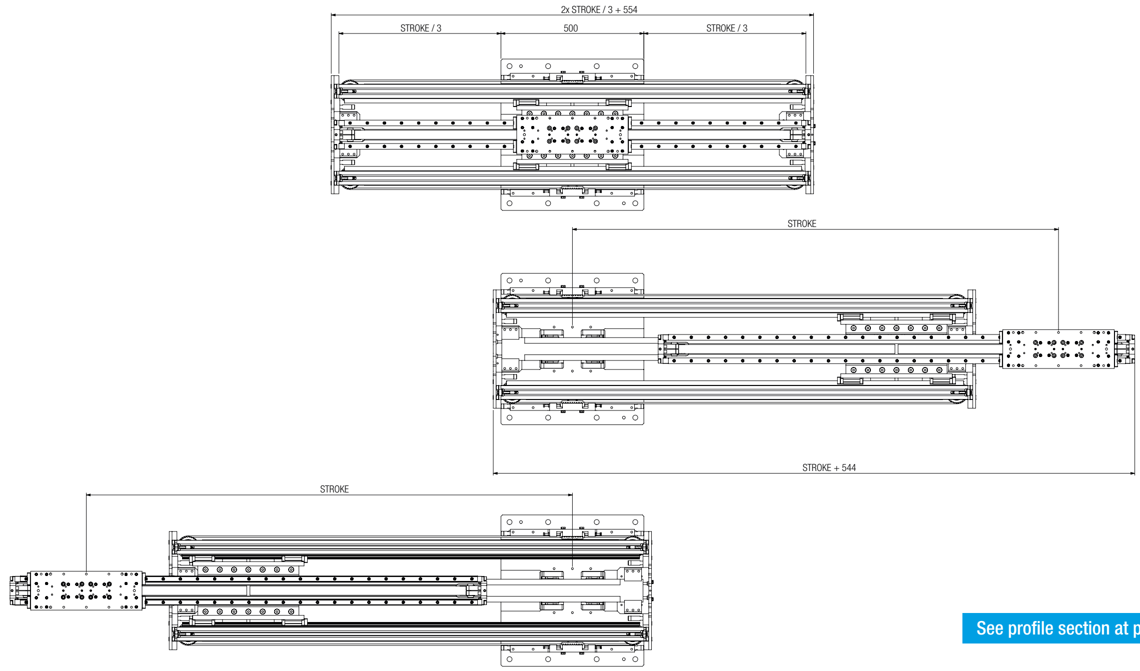
See verification under static load and lifetime on page SL-2 and SL-3

Tab. 6



TLS 100H 2A*

Dimension



See profile section at page TS-12

The length of the safety stroke is provided on request according to the customer's specific requirements. *2A = *Double stroke (symmetric)

Fig. 2

Technical data

	TLS 100H 2A
Max. useful stroke length [mm]	2x2250
Max. positioning repeatability [mm]*1	± 0.3
Max. speed [m/s]	6
Max. acceleration [m/s²]	20
Type of belt	75 AT 10 HPF
Type of pulley	Z 29
Carriage displacement per pinion turn [mm]	870
Pulley pitch diameter [mm]	92.31
Carriage weight [kg]	34.1
Zero travel weight [kg]	87.4
Weight for 2x50 mm useful stroke [kg]	1.5
Starting torque [Nm]	14
Rail size [mm]	25

*1) Positioning repeatability is dependent on the type of transmission used

Tab. 7

Drive

Type of belt	Belt width [mm]	Weight [kg/m]
75 AT 10 HPF	75	0.435

Tab. 8

Closed length

Stroke [mm]	0	2x1500	2x2250	2X
Closed length [mm]	554	1554	2054	2X/3+554

Tab. 9

Typical payloads*

High Dynamics [kg]	Low Dynamics [kg]
30	50

Tab. 10

*The payload capacity is impacted by the center of mass and dynamics. The typical payloads are determined considering them centered on the carriage, considering a useful stroke of 2x750 mm and to ensure a theoretical guides lifetime of L10=50000 km. The high dynamics corresponds to a speed of 3 m/s and an acceleration of 8 m/s² while the low dynamics corresponds to a speed of 1 m/s and an acceleration of 1 m/s².

Moments of inertia of the profile

Stage	Material	I_x [10^7 mm⁴]	I_y [10^7 mm⁴]	I_p [10^7 mm⁴]
1st	Aluminium	10.450	0.672	11.122
2nd	Aluminium	0.213	0.063	0.276
3rd	Aluminium	-	-	-

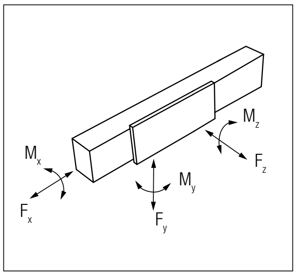
Tab. 11

Load capacity

Stage	F_x [N]		F_y [N]		F_z [N]	M_x [Nm]	M_y [Nm]	M_z [Nm]
	Stat.	Dyn.	Stat.	Dyn.	Stat.	Stat.	Stat.	Stat.
1st	7470	5220	258800	116832	258800	39338	41408	41408
2nd	-	-	307200	141600	307200	34867	48230	48230
3rd	-	-	153600	70800	153600	6298	24115	24115

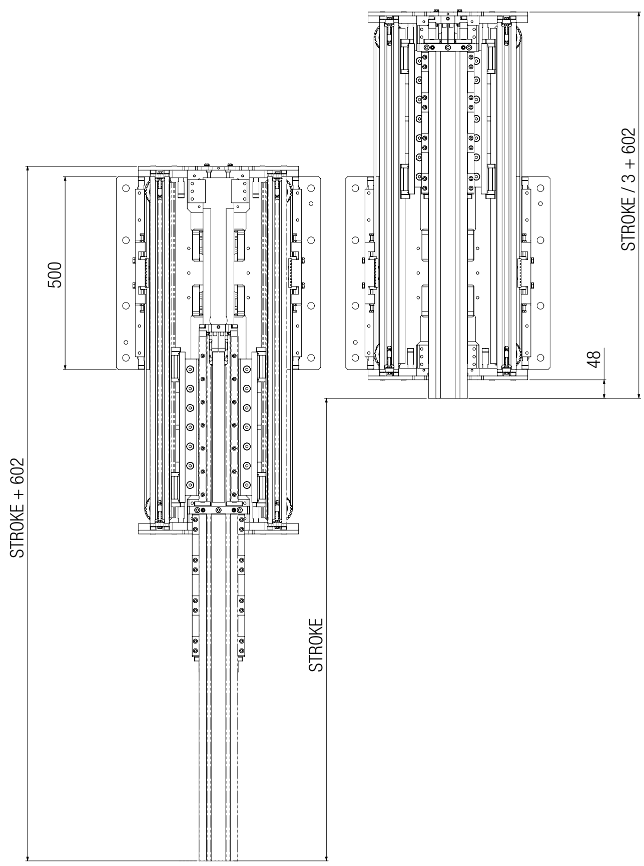
See verification under static load and lifetime on page SL-2 and SL-3

Tab. 12



TLS 100V

Dimension



See profile section at page TS-12

The length of the safety stroke is provided on request according to the customer's specific requirements.

Fig. 3

Technical data

	TLS 100V
Max. useful stroke length [mm]	2250
Max. positioning repeatability [mm]*1	± 0.3
Max. speed [m/s]	3
Max. acceleration [m/s²]	7
Type of belt	75 AT 10 HPF
Type of pulley	Z 29
Carriage displacement per pinion turn [mm]	870
Pulley pitch diameter [mm]	92.31
Carriage weight [kg]	34.1
Zero travel weight [kg]	94.4
Weight for 100 mm useful stroke [kg]	1.7
Starting torque [Nm]	14
Rail size [mm]	25

*1) Positioning repeatability is dependent on the type of transmission used.

Tab. 13

Drive

Type of belt	Belt width [mm]	Weight [kg/m]
75 AT 10 HPF	75	0.435

Tab. 14

Closed length

Stroke	0	1500	2250	X
Closed length [mm]	602	1102	1352	X/3+602

Tab. 15

Typical payloads*

High Dynamics [kg]	Low Dynamics [kg]
5	30

Tab. 16

*The payload capacity is impacted by the center of mass and dynamics. The typical payloads are determined considering them centered on the carriage, considering a useful stroke of 1500 mm and to ensure a theoretical guides lifetime of L10=50000 km. The high dynamics corresponds to a speed of 3 m/s and an acceleration of 7 m/s² while the low dynamics corresponds to a speed of 1 m/s and an acceleration of 1 m/s².

Moments of inertia of the profile

Stage	Material	I_x [10^7 mm⁴]	I_y [10^7 mm⁴]	I_p [10^7 mm⁴]
1st	Aluminium	10.450	0.672	11.122
2nd	Aluminium	0.213	0.063	0.276
3rd	Aluminium	0.230	0.065	0.295

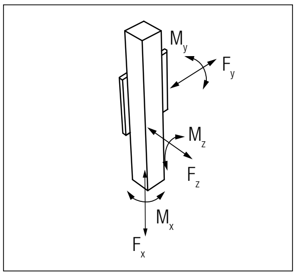
Tab. 17

Load capacity

Stage	F_x [N]		F_y [N]		F_z [N]	M_x [Nm]	M_y [Nm]	M_z [Nm]
	Stat.	Dyn.	Stat.	Dyn.	Stat.	Stat.	Stat.	Stat.
1st	7470	5220	258800	116832	258800	39338	41408	41408
2nd	-	-	307200	141600	307200	34867	48230	48230
3rd	-	-	153600	70800	153600	6298	24115	24115

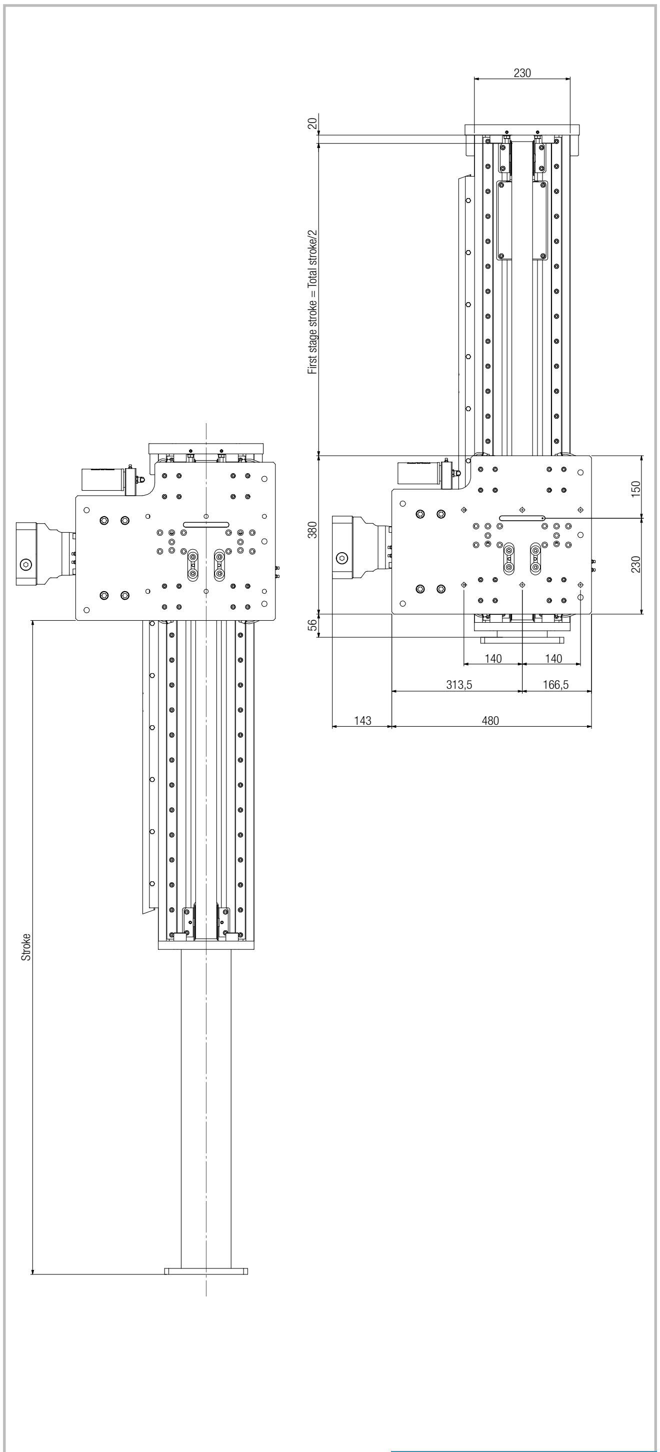
See verification under static load and lifetime on page SL-2 and SL-3

Tab. 18



TLS 230V

Dimension



See profile section at page TS-12

The length of the safety stroke is provided on request according to the customer's specific requirements.

Fig. 4

Technical data

	TLS 230V
Max. useful stroke length [mm]	3000
Max. positioning repeatability [mm]*1	± 0.05
Max. speed [m/s]	6
Max. acceleration [m/s²]	12
Rack module	m3
Carriage displacement per pinion turn [mm]	400
Pulley pitch diameter [mm]	63.66
Carriage weight [kg]	39.5
Zero travel weight [kg]	100.2
Weight for 100 mm useful stroke [kg]	3.1
Rail size [mm]	25

*1) Positioning repeatability is dependent on the type of transmission used.

Tab. 19

Drive

Type of rack	Z [n°]	Rack module	Quality
Helical teeth hardened ground	20	m3	Q6

Tab. 20

Closed length

Stroke	0	1500	3000	X
Closed length [mm]	495	1245	1995	X/2+495

Tab. 21

Typical payloads

High Dynamics [kg]	Low Dynamics [kg]
70	160

Tab. 22

The payload capacity is impacted by the center of mass and dynamics. The typical payloads are determined considering them centered on the carriage, considering a useful stroke of 1500 mm and to ensure a theoretical guides lifetime of L10=50000 km. The high dynamics corresponds to a speed of 3 m/s and an acceleration of 8 m/s² while the low dynamics corresponds to a speed of 1 m/s and an acceleration of 1 m/s².

Moments of inertia of the profile

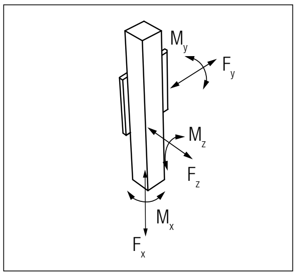
Stage	Material	I_x [10^7 mm^4]	I_y [10^7 mm^4]	I_p [10^7 mm^4]
1st	Aluminium	6.462	3.759	10.221
2nd	Fe 430 B	0.393	0.269	0.662

Tab. 23

Load capacity

Stage	F_x [N]	F_y [N]		F_z [N]	M_x [Nm]	M_y [Nm]	M_z [Nm]
	Stat.	Stat.	Dyn.	Stat.	Stat.	Stat.	Stat.
1st	5714	258800	116832	258800	21351	34291	34291
2nd	-	153600	70800	153600	5376	19584	19584

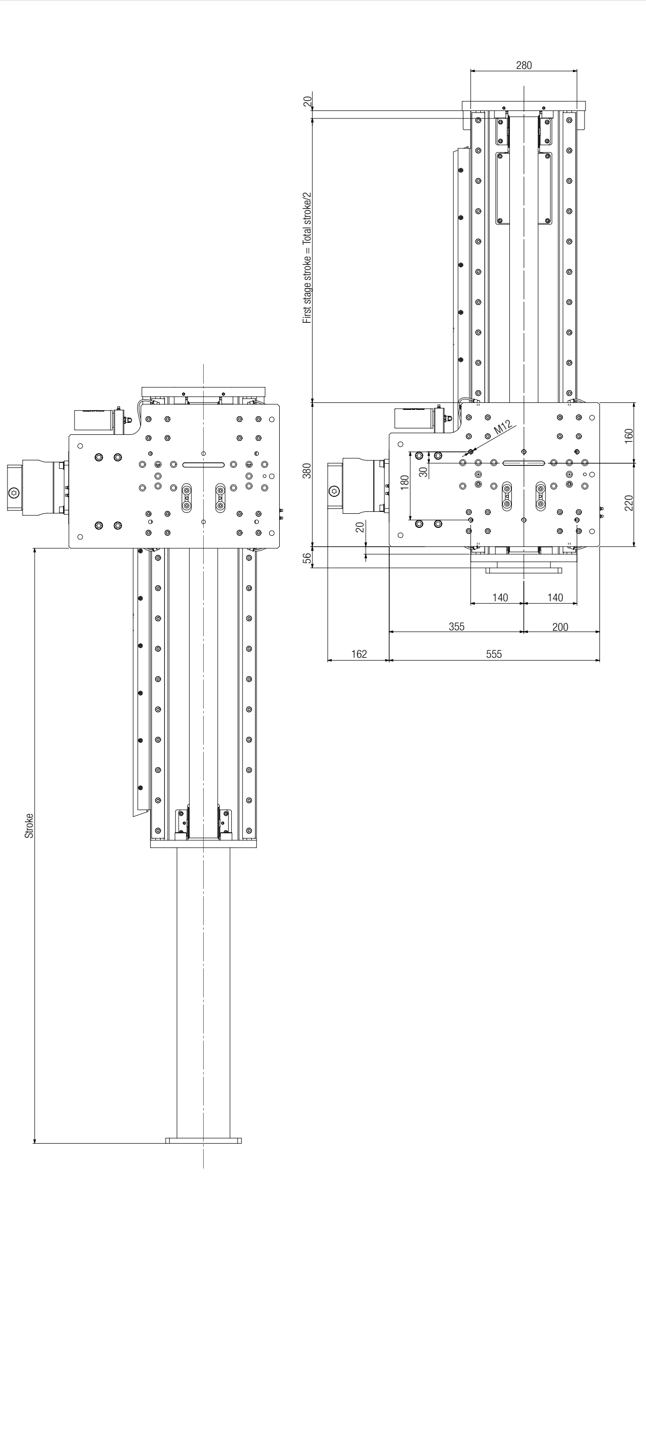
Tab. 24



See verification under static load and lifetime on page SL-2 and SL-3

TLS 280V

Dimension



See profile section at page TS-12

The length of the safety stroke is provided on request according to the customer's specific requirements.

Fig. 5

Technical data

	TLS 280V
Max. useful stroke length [mm]	3000
Max. positioning repeatability [mm]*1	± 0.05
Max. speed [m/s]	6
Max. acceleration [m/s²]	12
Rack module	m4
Carriage displacement per pinion turn [mm]	480
Pulley pitch diameter [mm]	76.39
Carriage weight [kg]	48.0
Zero travel weight [kg]	122.2
Weight for 100 mm useful stroke [kg]	4.8
Rail size [mm]	35

*1) Positioning repeatability is dependent on the type of transmission used.

Tab. 25

Drive

Type of rack	Z [n°]	Rack module	Quality
Helical teeth hardened ground	18	m4	Q6

Tab. 26

Closed length

Stroke	0	1500	3000	X
Closed length [mm]	495	1245	1995	X/2+495

Tab. 27

Typical payloads

High Dynamics [kg]	Low Dynamics [kg]
130	270

Tab. 28

The payload capacity is impacted by the center of mass and dynamics. The typical payloads are determined considering them centered on the carriage, considering a useful stroke of 1500 mm and to ensure a theoretical guides lifetime of L10=50000 km. The high dynamics corresponds to a speed of 3 m/s and an acceleration of 8 m/s² while the low dynamics corresponds to a speed of 1 m/s and an acceleration of 1 m/s².

Moments of inertia of the profile

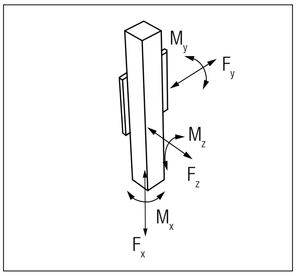
Stage	Material	I_x [10^7 mm^4]	I_y [10^7 mm^4]	I_p [10^7 mm^4]
1st	Aluminium	13.077	4.921	17.998
2nd	Fe 430 B	0.636	0.316	0.952

Tab. 29

Load capacity

Stage	F_x [N]	F_y [N]		F_z [N]	M_x [Nm]	M_y [Nm]	M_z [Nm]
	Stat.	Stat.	Dyn.	Stat.	Stat.	Stat.	Stat.
1st	10989	386400	197792	386400	46368	48300	48300
2nd	-	258800	116832	258800	11646	32997	32997

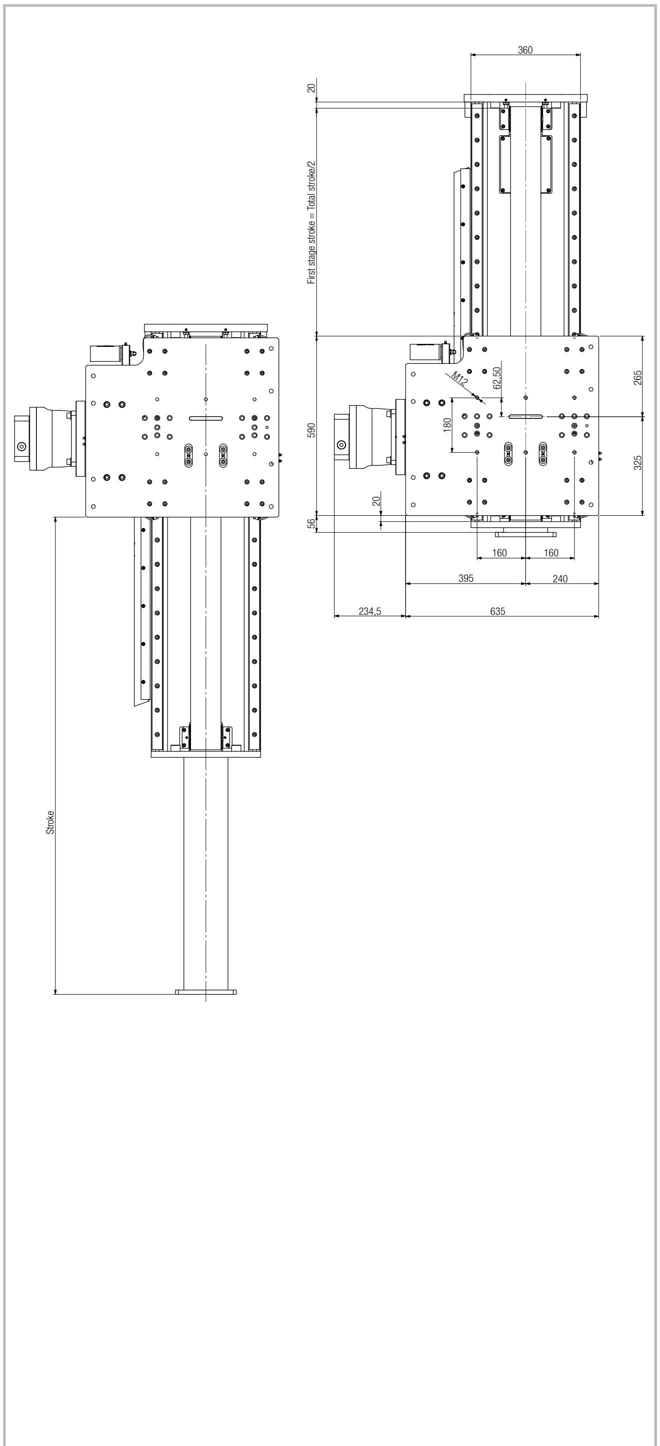
Tab. 30



See verification under static load and lifetime on page SL-2 and SL-3

TLS 360V

Dimension



See profile section at page TS-12

The length of the safety stroke is provided on request according to the customer's specific requirements.

Fig. 6

Technical data

	TLS 360V
Max. useful stroke length [mm]	3000
Max. positioning repeatability [mm]*1	± 0.05
Max. speed [m/s]	6
Max. acceleration [m/s²]	12
Rack module	m5
Carriage displacement per pinion turn [mm]	733
Pulley pitch diameter [mm]	116.71
Carriage weight [kg]	78.0
Zero travel weight [kg]	181.0
Weight for 100 mm useful stroke [kg]	5.9
Rail size [mm]	35

*1) Positioning repeatability is dependent on the type of transmission used.

Tab. 31

Drive

Type of rack	Z [n°]	Rack module	Quality
Helical teeth hardened ground	22	m5	Q6

Tab. 32

Closed length

Stroke	0	1500	3000	X
Closed length [mm]	705	1445	2205	X/2+705

Tab. 33

Typical payloads

High Dynamics [kg]	Low Dynamics [kg]
200	440

Tab. 34

The payload capacity is impacted by the center of mass and dynamics. The typical payloads are determined considering them centered on the carriage, considering a useful stroke of 1500 mm and to ensure a theoretical guides lifetime of L10=50000 km. The high dynamics corresponds to a speed of 3 m/s and an acceleration of 8 m/s² while the low dynamics corresponds to a speed of 1 m/s and an acceleration of 1 m/s².

Moments of inertia of the profile

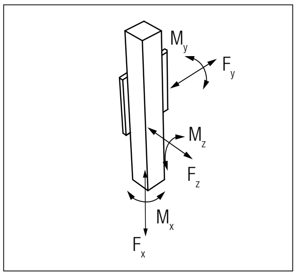
Stage	Material	I_x [10^7 mm⁴]	I_y [10^7 mm⁴]	I_p [10^7 mm⁴]
1st	Aluminium	31.535	10.238	41.773
2nd	Fe 430 B	0.839	0.579	1.418

Tab. 35

Load capacity

Stage	F_x [N]	F_y [N]		F_z [N]	M_x [Nm]	M_y [Nm]	M_z [Nm]
	Stat.	Stat.	Dyn.	Stat.	Stat.	Stat.	Stat.
1st	15873	508000	231444	508000	81280	109220	109220
2nd	-	258800	116832	258800	11646	42055	42055

Tab. 36



See verification under static load and lifetime on page SL-2 and SL-3

Profile specifications

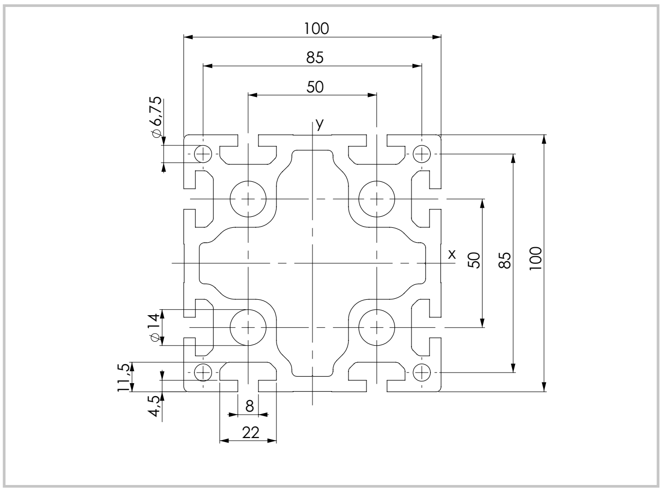


Fig. 7

Profile 100	
Weight [Kg/m]	10.7
Max. length [mm]	6000
Moment of inertia Ix [10^7 mm^4]	0.444
Moment of inertia Iy [10^7 mm^4]	0.444
Polar moment of inertia Ip [10^7 mm^4]	0.887
Bending section modulus Wx [mm^3]	88800
Bending section modulus Wy [mm^3]	88800

Tab. 37

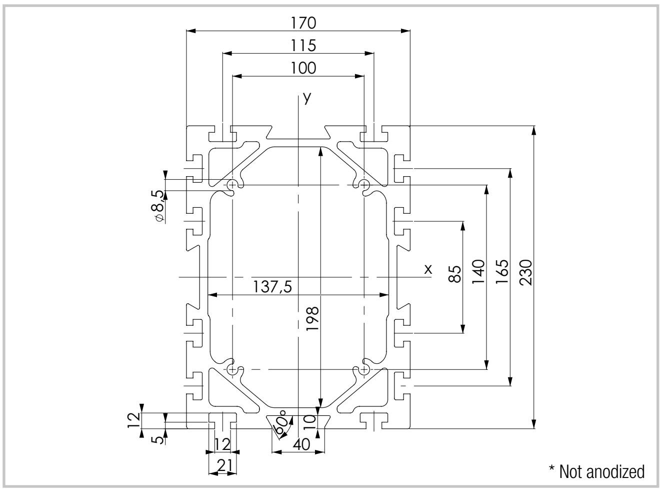


Fig. 8

Profile 230	
Weight [Kg/m]	25.5
Max. length [mm]	12000
Moment of inertia Ix [10^7 mm^4]	6.501
Moment of inertia Iy [10^7 mm^4]	3.778
Polar moment of inertia Ip [10^7 mm^4]	10.279
Bending section modulus Wx [mm^3]	564284
Bending section modulus Wy [mm^3]	444500

Tab. 38

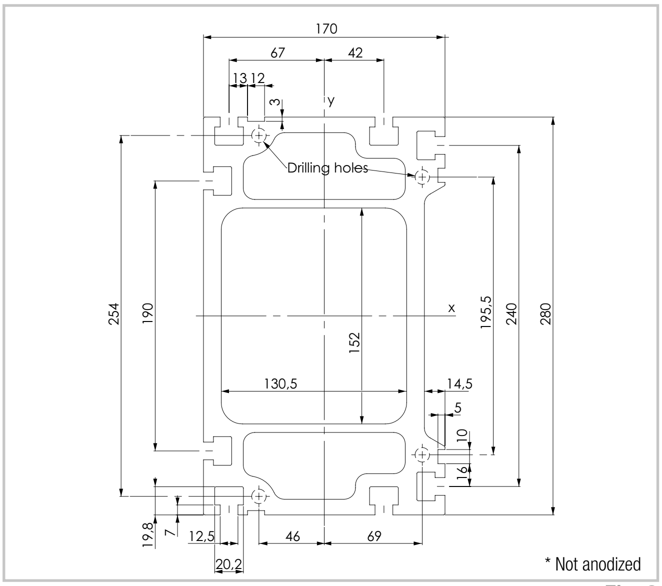


Fig. 9

Profile 280	
Weight [Kg/m]	40
Max. length [mm]	12000
Moment of inertia Ix [10^7 mm^4]	12.646
Moment of inertia Iy [10^7 mm^4]	4.829
Polar moment of inertia Ip [10^7 mm^4]	17.475
Bending section modulus Wx [mm^3]	957790
Bending section modulus Wy [mm^3]	591620

Tab. 39

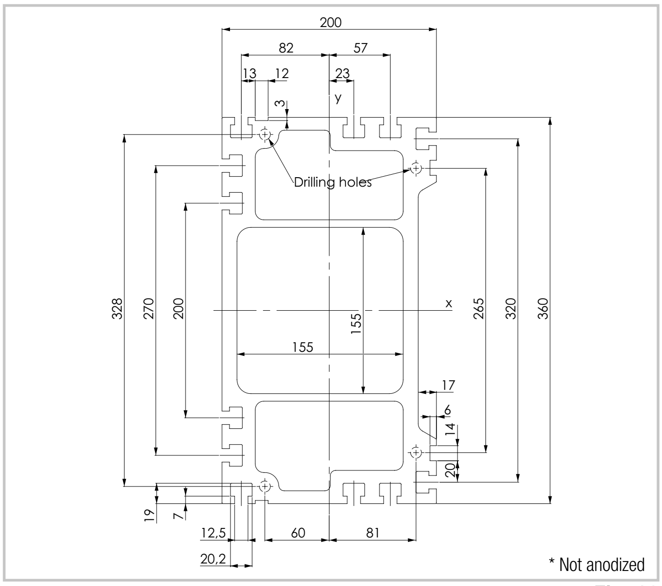


Fig. 10

Profile 360	
Weight [Kg/m]	60
Max. length [mm]	12000
Moment of inertia Ix [10^7 mm^4]	31.721
Moment of inertia Iy [10^7 mm^4]	10.329
Polar moment of inertia Ip [10^7 mm^4]	42.050
Bending section modulus Wx [mm^3]	1770500
Bending section modulus Wy [mm^3]	1035300

Tab. 40

Lubrication of the rack and pinion driving system

Proper lubrication is critical to ensure good lifetime of rack and pinion drive systems. Rollon's rack and pinion lubrication system applies grease directly to the driving pinion via a polyurethane pinion. The lubrication can be made automatically thanks to a lubricator tank that offers continuous and maintenance-free operation of the drive system during the lifetime of the tank. The automatic lubricator tank can be configured to distribute the lubrication over time (up to ~1 year max.) according to the application requirements. The grease is spread evenly on the racks through a felt pinion. You will need one kit per driven carriage.

Fig. 11

1 - Spares

Specification	Code
Programmable grease cartridge (125 ml) [b]	1011244
m3 - helical toolth felt pinion [1]	1160050
m4 - helical toolth felt pinion [1]	1160056
m5 - helical toolth felt pinion [1]	1160055

Tab. 41

2 - Lubrication assembly kit

Specification (see figure C)	Code
Lubrication assembly kit (no felt pinion, nonriscan pipe)	7363137

Tab. 42

Lubrication of the linear guide system

TLS series

TLS Series actuators feature recirculating ball slider blocks, that must be periodically lubricated. The slider blocks are fitted with a retention cage that eliminates "steel-steel" contact between adjacent revolving parts and prevents misalignment in the circuits.

The slider block lubrication points are factory routed to a grease fitting block (Fig. 12) mounted on top of the carriage for easy access. The system guarantees a long interval between maintenances: every 2000 km or 1 year of use, based on the value reached first.

Automatic lubricator tanks (Fig.13) are mounted on the grease block which continuously provides the necessary amount of grease to the ball raceways under load. These lubrication reservoirs considerably reduce the frequency of lubrication of the module. This system guarantees a long interval between maintenances: every 4000 km, based on the value reached first.

If a longer service life is required or in case of high dynamics or high loading applications, please contact our offices for further verification.

Fig. 12

Fig. 13

Quantity of lubricant (approximate) necessary for re-lubrication of each block:

Type	Size	Stage	Lubricant [g]
TLS	100H	1st	3.0
	100V	1st	3.0
	230V	1st	5.0
		2nd	3.0
	280V	1st	6.0
		2nd	5.0
	360V	1st	6.0
		2nd	5.0

Tab. 43

Ordering key

TLS Belt (100H, 100V)

TLS	**10**	**H** **V**	**2** **3** **4**	**1A**	**1000**	**1A** **2A**	
						Stroke version 1A=single* 2A=double**	
					Stroke		
				Carriage configuration (position of driving head) 1A=centered			
			Number of stages				
		Type H=Horizontal; V=Vertical					
	Profile *see pg. TS-12*						
TLS Series *see pg. TS-6*							

*Single stroke (asymmetric); **Double stroke (symmetric)
Ordering example
TLS10H21A10001A

TLS Rack and pinion (230V, 280V, 360V)

TLS	**23** **28** **36**	**V**	**2**	**1A**	**1000**	**1A**	
						Stroke version 1A=single*	
					Stroke		
				Carriage configuration 1A=standard			
			Number of stages				
		Type V=Vertical					
	Profile *see pg. TS-12*						
TLS Series *see pg. TS-9*							

*Single stroke (asymmetric)
Ordering example
TLS23V21A10001A

In order to create identification codes for Actuator Line, you can visit: **http://configureactuator.rollon.com**

Configure Actuator

Notes

Service life

Service life

Calculation of the service life

The dynamic load rating C is a conventional quantity used for calculating the service life. This load corresponds to a nominal service life of 100 km.

The calculated service life, dynamic load rating and equivalent load are linked by the following formula:

$$L_{km} = 100\ km \cdot \left(\frac{Fz\text{-}dyn}{P_{eq}} \cdot \frac{1}{f_i}\right)^3$$

L_{km} = theoretical service life (km)
Fz-dyn = dynamic load rating (N)
P_{eq} = acting equivalent load (N)
f_i = service factor (see tab. 2)

Fig. 1

The effective equivalent load P_{eq} is the sum of the forces and moments acting simultaneously on a slider. If these different load components are known, P is obtained from the following equation:

For SP types

$$P_{eq} = P_{fy} + P_{fz} + \left(\frac{M_1}{M_x} + \frac{M_2}{M_y} + \frac{M_3}{M_z}\right) \cdot F_y$$

Fig. 2

For CI and CE types

$$P_{eq} = P_{fy} + \left(\frac{P_{fz}}{F_z} + \frac{M_1}{M_x} + \frac{M_2}{M_y} + \frac{M_3}{M_z}\right) \cdot F_y$$

Fig. 3

The external constants are assumed to be constant over time. Short-term loads that do not exceed the maximum load ratings have no relevant effect on the service life and can therefore be neglected in the calculation.

Belt safety factor referred to the dynamic F_x

Impact and vibrations	Speed / acceleration	Orietation	Safety Factor
No impacts and/or vibrations	Low	horizontal	1.4
		vertical	1.8
Light impacts and/or vibrations	Medium	horizontal	1.7
		vertical	2.2
Strong impacts and/or vibrations	High	horizontal	2.2
		vertical	3

Tab. 1

Service factor f_i

	f_i
no shocks or vibrations, smooth and low-frequency changes in direction; ($\alpha < 5m/s^2$) clean operating conditions; low speeds (<1 m/s)	1.5 - 2
Slight vibrations; medium speeds; (1-2 m/s) and medium-high frequency of the changes in direction ($5m/s^2 < \alpha < 10\ m/s^2$)	2 - 3
Shocks and vibrations; high speeds (>2 m/s) and high-frequency changes in direction; ($\alpha > 10m/s^2$) high contamination, very short stroke	> 3

Tab. 2

Speedy Rail A Lifetime

The rated lifetime for Speedy Rail A is: SAR 80.000 km, SAB 50.000 km.

Service life Uniline

Service life

Calculation of the service life

The dynamic load rating C is a conventional quantity used for calculating the service life. This load corresponds to a nominal service life of 100 km. The corresponding values for each liner unit are listed in Table 45 shown below. The calculated service life, dynamic load rating and equivalent load are linked by the following formula:

$$L_{km} = 100\ km \cdot \left(\frac{C}{P} \cdot \frac{f_c}{f_i} \cdot f_h\right)^3$$

L_{km} = theoretical service life (km)
C = dynamic load rating (N)
P = acting equivalent load (N)
f_i = service factor (see tab. 5)
f_c = contact factor (see tab. 6)
f_h = stroke factor (see fig. 13)

Fig. 4

The effective equivalent load P is the sum of the forces and moments acting simultaneously on a slider. If these different load components are known, P is obtained from the following equation:

$$P = P_{fy} + \left(\frac{P_{fz}}{F_Z} + \frac{M_1}{M_x} + \frac{M_2}{M_y} + \frac{M_3}{M_z}\right) \cdot F_y$$

Fig. 5

The external constants are assumed to be constant over time. Short-term loads that do not exceed the maximum load ratings have no relevant effect on the service life and can therefore be neglected in the calculation.

Service factor f_i

f_i	
No shocks or vibrations, smooth and low-frequency changes in direction; clean operating conditions; low speeds (<1 m/s)	1 - 1.5
Slight vibrations; medium speeds; (1-2,5 m/s) and medium-high frequency of the changes in direction	1.5 - 2
Shocks and vibrations; high speeds (>2.5 m/s) and high-frequency changes in direction; high contamination	2 - 3.5

Tab. 3

Contact factor f_c

	f_c
Standard slider	1
Long slider	0.8
Double slider	0.8

Tab. 4

Stroke factor f_h

The stroke factor f_h accounts for the higher stress on the raceways and rollers when short strokes are carried out at the same total run distance. The following diagram shows the corresponding values (for strokes above 1 m, f_h remains 1):

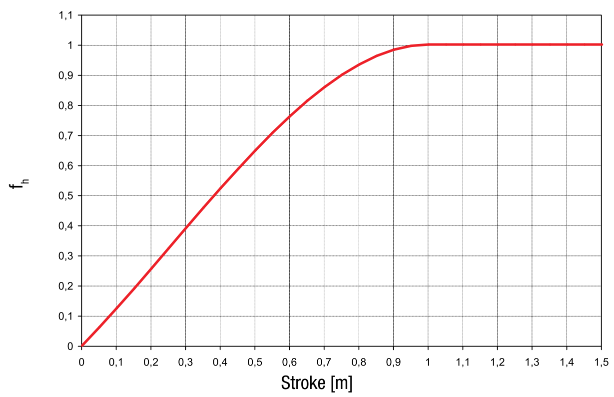


Fig. 6

Determination of the motor torque

The torque C_m required at the drive head of the linear axis is calculated by the following formula:

$$C_m = C_v + \left(F \cdot \frac{D_p}{2} \right)$$

C_m = torque of the motor (Nm)
C_v = starting torque (Nm)
F = force acting on the toothed belt (N)
D_p = pitch diameter of pulley (m)

Fig. 7

Calculation formulae

Moments M_y and M_z for linear units with long slider plate

The allowed loads for the moments M_y and M_z depend on the length of the slider plate. The allowed moments M_{zn} and M_{yn} for each slider plate length are calculated by the following formulae:

$$S_n = S_{min} + n \cdot \Delta S$$

$$M_{zn} = \left(1 + \frac{S_n - S_{min}}{K} \right) \cdot M_{z\,min}$$

$$M_{yn} = \left(1 + \frac{S_n - S_{min}}{K} \right) \cdot M_{y\,min}$$

M_{zn} = allowed moment (Nm)
$M_{z\,min}$ = minimum values (Nm)
M_{yn} = allowed moment (Nm)
$M_{y\,min}$ = minimum values (Nm)
S_n = length of the slider plate (mm)
S_{min} = minimum length of the slider plate (mm)
ΔS = factor of the change in slider length
K = constant

Fig. 8

Type	$M_{y\,min}$ [Nm]	$M_{z\,min}$ [Nm]	S_{min} [mm]	ΔS	K
A40L	22	61	240		74
A55L	82	239	310		110
A75L	287	852	440		155
C55L	213	39	310		130
C75L	674	116	440	10	155
E55L	165	239	310		110
E75L	575	852	440		155
ED75L (M_z)	1174	852	440		155
ED75L (M_y)	1174	852	440		270

Tab. 5

Moments M_y and M_z for linear units with two slider plates

The allowed loads for the moments M_y and M_z are related to the value of the distance between the centers of the sliders. The allowed moments M_{yn} and M_{zn} for each distance between the centers of the sliders are calculated by the following formulae:

$$L_n = L_{min} + n \cdot \Delta L$$

$$M_y = \left(\frac{L_n}{L_{min}}\right) \cdot M_{y\,min}$$

$$M_z = \left(\frac{L_n}{L_{min}}\right) \cdot M_{z\,min}$$

M_y = allowed moment (Nm)
M_z = allowed moment (Nm)
$M_{y\,min}$ = minimum values (Nm)
$M_{z\,min}$ = minimum values (Nm)
L_n = distance between the centers of the sliders (mm)
L_{min} = minimum value for the distance between the centers of the sliders (mm)
ΔL = factor of the change in slider length

Fig. 9

Type	$M_{y\,min}$ [Nm]	$M_{z\,min}$ [Nm]	L_{min} [mm]	ΔL
A40D	70	193	235	5
A55D	225	652	300	5
A75D	771	2288	416	8
C55D	492	90	300	5
C75D	1809	312	416	8
E55D	450	652	300	5
E75D	1543	2288	416	8
ED75D	3619	2288	416	8

Tab. 6

Warnings and legal notes

Before incorporating the partly completed machinery, we recommend consulting this chapter carefully, in addition to the assembly manual supplied with the individual modules. The information contained in this chapter and in the manuals for the individual modules, is provided by highly qualified and certified personnel, possessing adequate competence in incorporating the partly completed machinery.

Precaution in installation and handling operations. Significantly heavy equipment.

When handling the axis or system of axes, always make sure that the support or anchoring surfaces do not leave room for bending.

In order to stabilize the axis or system of axes, before handling it is mandatory to securely block the mobile parts. When moving axes with vertical translation (Z AXES) or combination systems (horizontal X and/or more than one vertical Z), it is mandatory to use the vertical movement to put all of the axes at the corresponding lower limit switch.

Do not overload. Do not subject to torsion stress.

Do not leave exposed to atmospheric agents.

Before mounting the motor on the gearbox, it is advisable to perform a pre-test of the motor itself, without connection to the gear unit. The testing of this component was not carried out by the manufacturer of the machine. It will therefore be the responsibility of the customer of Rollon to perform the testing of the same, in order to verify its correct operation.

The manufacturer cannot be considered responsible for any consequences derived from improper use or any use other than the purpose the axis or system of axes was designed for, or derived from failure to comply, during incorporation phases, with the rules of Good Technique and with what is indicated in this manual.

Avoid damage. Do not operate with inadequate tools

Warning: moving parts. Do not leave objectson the axis

Special installations: check the depth of the threads on moving elements

Make sure that the system has been installed on a level floor surface.

In use, accurately comply with the specific performance values declared in the catalog or, in particular cases, the load and dynamic performance characteristics requested in the phase prior to design.

For modules or parts of modular systems with vertical movement (Z axis), it is mandatory to mount self-braking motors to neutralize the risk of the axis dropping.

The images in this manual are to be considered merely an indication and not binding; therefore, the supply received could be different from the images contained in this manual, and Rollon S.p.A has deemed it useful to insert only one example.

Systems supplied by Rollon S.p.A. were not designed/envisaged to operate in ATEX environments.

Residual risks

- Mechanical risks due to the presence of moving elements (X, Y axes).
- Risk of fire resulting from the flammability of the belts used on the axes, for temperatures in excess of 250 °C in contact with the flame.
- The risk of the Z axis dropping during handling and installation operations on the partly completed machinery, before commissioning.
- Risk of the Z axis dropping during maintenance operations in the case of a drop in the electrical power supply voltage.
- Crushing hazard near moving parts with divergent and convergent motion.
- Shearing hazard near moving parts with divergent and convergent motion.
- Cutting and abrasion hazards.

Basic components

The Partly Completed Machinery shown in this catalog is to be considered a mere supply of simple Cartesian axes and their accessories agreed when the contract is stipulated with the client. The following are therefore to be considered excluded from the contract:

1. Assembly on the client's premises (direct or final)
2. Commissioning on the client's premises (direct or final)
3. Testing on the client's premises (direct or final)

It is therefore understood that the aforementioned operations in points 1.,2., and 3. are not chargeable to Rollon. Rollon is the supplier of Partly Completed Machinery, the (direct or final) client is responsible for testing and safely checking all equipment which, by definition, cannot be theoretically tested or checked at our facilities where the only movement possible is manual movement (for example: motors or reduction gears, cartesian axes movements that are not manually operated, safety brakes, stopper cylinders, mechanical or induction sensors, decelerators, mechanical limit switches, pneumatic cylinders, etc.). The partly completed machine must not be commissioned until the final machine, in which it is to be incorporated, has been declared compliant, if necessary, with the instructions in Machinery Directive 2006/42/CE.

Instructions of an environmental nature

Rollon operates with respect for the envirorment, in order to limit environmental impact. The following is a list of some instructions of an environmental nature for correct management of our supplies. Our products are mainly composed of:

Material	Details of the supply
Alluminum alloys	Profiles, pleates, various details
Steel with various composition	Screws, racks and pinions, and rails
Plastic	PA6 – Chains PVC – Covers and sliding block scrapers
Rubber of various types	Plugs, seals
Lubrification of various types	Used for the lubrication of sliding rails and bearings
Rust proof protectione	Rust proof protection oil
Wood, polyethylene, cardboard	Transport packaging

At the end of the product's life cycle, it is therfore possible to recover the various elements, in compliance with current regulations on waste issues.

Safety warnings for handling and transport

- The manufacturer has paid the utmost attention to packaging to minimize risks related to shipping, handling and transport.
- Transport can be facilitated by shipping certain components dismantled and appropriately protected and packaged.
- Handling (loading and unloading) must be carried out in compliance with information directly provided on the machine, on the packing and in the user manuals.
- Personnel authorized to lift and handle the machine and its components shall possess acquired and acknowledged skills and experience in the specific sector, besides having full control of the lifting devices used.
- During transport and/or storage, temperature shall remain within the allowed limits to avoid irreversible damage to electric and electronic components.
- Handling and transport must be carried out with vehicles presenting adequate loading capacity, and the machines shall be anchored to the established points indicated on the axes.
- DO NOT attempt to bypass handling methods and the established lifting points in any way.
- During handling and if required by the conditions, make use of one or more assistants to receive adequate warnings.
- If the machine has to be moved with vehicles, ensure that they are adequate for the purpose, and perform loading and unloading without risks for the operator and for people directly involved in the process.
- Before transferring the device onto the vehicle, ensure that both the machine and its components are adequately secured, and that their profile does not exceed the maximum bulk allowed. Place the necessary warning signs, if necessary.
- DO NOT perform handling with an inadequate visual field and when there are obstacles along the route to the final location.
- DO NOT allow people to either transit or linger within the range of action when lifting and handling loads.
- Download the axes just near the established location and store them in an environment protected against atmospheric agents.
- Failure to comply with the information provided might entail risks for the safety and health of people, and can cause economic loss.
- The Installation Manager must have the project to organize and monitor all operative phases.
- The Installation Manager shall ensure that the lifting devices and equipment defined during the contract phase are available.
- The Manager of the established location and the Installation Manager shall implement a “safety plan” in compliance with the legislation in force for the workplace.
- The “safety plan” shall take into account all surrounding work-related activities and the perimeter spaces indicated in the project for the established location.
- Mark and delimit the established location to prevent unauthorized personnel from accessing the installation area.
- The installation site must have adequate environmental conditions (lighting, ventilation, etc.).
- Installation site temperature must be within the maximum and minimum range allowed.
- Ensure that the installation site is protected against atmospheric agents, does not contain corrosive substances and is free of the risk of explosion and/or fire.
- Installation in environments presenting a risk of explosion and/or of fire must ONLY be carried out if the machine has been DECLARED COMPLIANT for such use.
- Check that the established location has been correctly fitted out, as defined during the contract phase and based on indications in the relative project.
- The established location must be fitted out in advance to carry out complete installation in compliance with the defined methods and schedule.

Note

- Evaluate in advance whether the machine must interact with other production units, and that integration can be implemented correctly, in compliance with standards and without risks.
- The manager shall assign installation and assembly interventions ONLY to authorized technicians with acknowledged know-how.
- State of the art connections to power sources (electric, pneumatic, etc.) must be ensured, in compliance with relevant regulatory and legislative requirements.
- “State of the art” connection, alignment and leveling are essential to avoid additional interventions and to ensure correct machine function.
- Upon completion of the connections, run a general check to ascertain that all interventions have been correctly carried out and compliance with requirements.
- Failure to comply with the information provided might entail risks for the safety and health of people, and can cause economic loss.

Transport

- Transport, also based on the final destination, can be done with different vehicles.
- Perform transport with suitable devices that have adequate loading capacity.
- Ensure that the machine and its components are adequately anchored to the vehicle.

Handling and lifting

- Correctly connect the lifting devices to the established points on the packages and/or on the dismantled parts.
- Before handling, read the instructions, especially safety instructions, provided in the installation manual, on the packages and/or on the dismantled parts.
- DO NOT attempt, in any way, to bypass handling methods and the established lifting, moving and handling points of each package and/or dismantled part.
- Slowly lift the package to the minimum necessary height and move it with the utmost caution to avoid dangerous oscillations.
- DO NOT perform handling with an inadequate visual field and when there are obstacles along the route to reach the final location.
- DO NOT allow people to either transit or linger within the range of action when lifting and handling loads.
- Do not stack packages to avoid damaging them, and reduce the risk of sudden and dangerous movements.
- In case of prolonged storage, regularly ensure that there are no variations in the storage conditions of the packages.

Check axis integrity after shipment

Every shipment is accompanied by a document ("Packing list") with the list and description of the axes.

- Upon receipt check that the material received corresponds to specifications in the delivery note.
- Check that packaging is perfectly intact and, for shipments without packaging, check that each axis is intact.
- In case of damages or missing parts, contact the manufacturer to define the relevant procedures.

Data sheet

General data: **Date:** .... **Inquiry N°:** ....

Address: .... **Contact:** ....

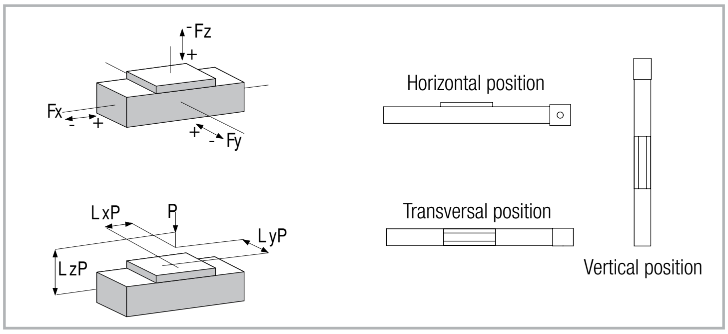
Company: .... **Zip Code:** ....

Phone: .... **Fax:** ....

E-Mail: ....

Technical data:

				X axis	Y axis	Z axis
Useful stroke (Including safety overtravel)		S	[mm]			
Load to be translated		P	[kg]			
Location of Load in the	X-Direction	LxP	[mm]			
	Y-Direction	LyP	[mm]			
	Z-Direction	LzP	[mm]			
Additional force	Direction (+/-)	Fx (Fy, Fz)	[N]			
Position of force	X-Direction	Lx Fx (Fy, Fz)	[mm]			
	Y-Direction	Ly Fx (Fy, Fz)	[mm]			
	Z-Direction	Lz Fx (Fy, Fz)	[mm]			
Assembly position (Horizontal/Vertical/Transversal						
Max. speed		V	[m/s]			
Max. acceleration		a	[m/s^2]			
Positioning repeatability		Δs	[mm]			
Required life		L	yrs			



Attention: Please enclose drawing, sketches and sheet of the duty cycle

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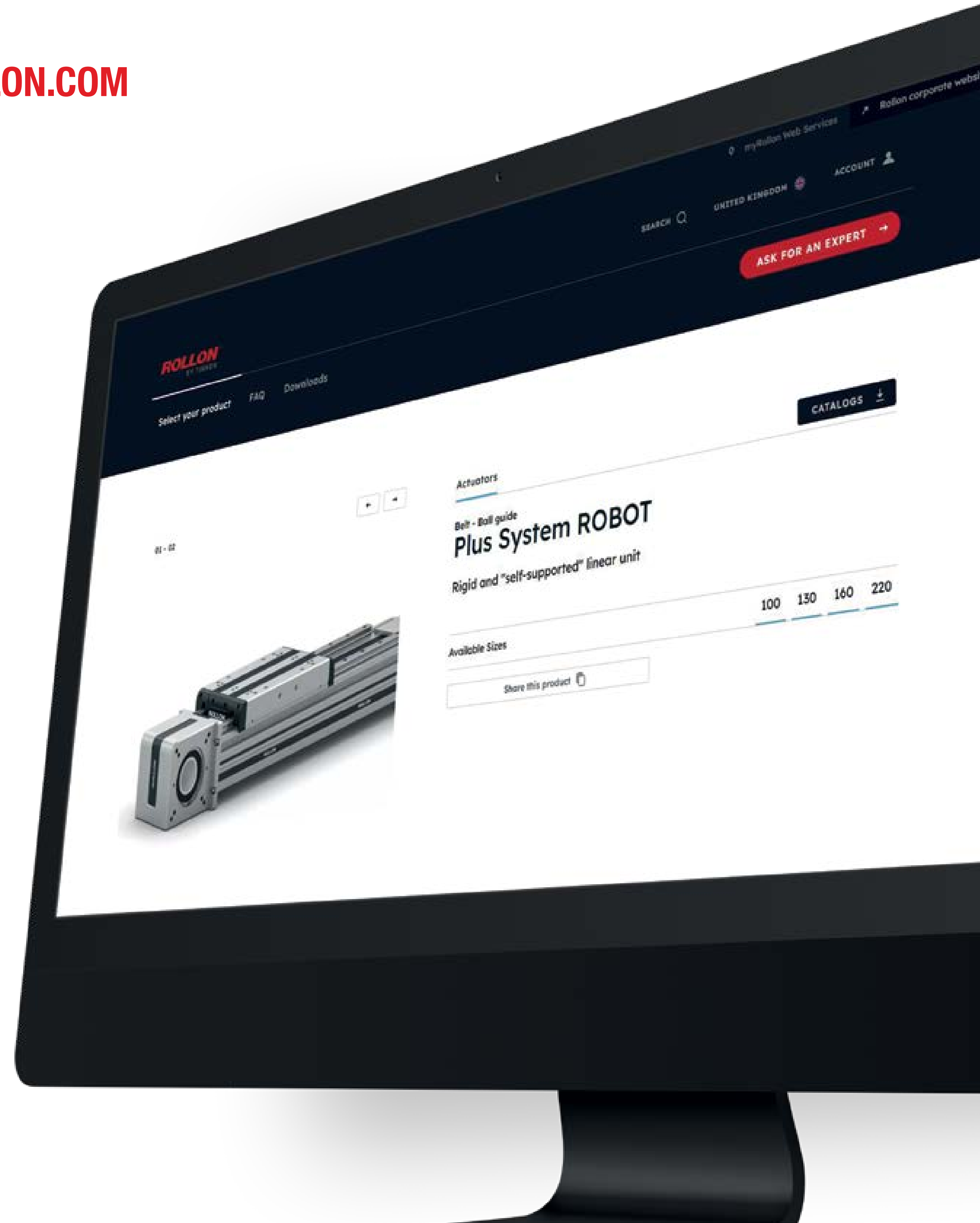

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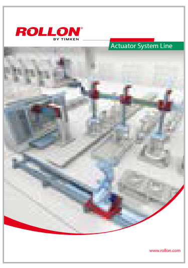

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