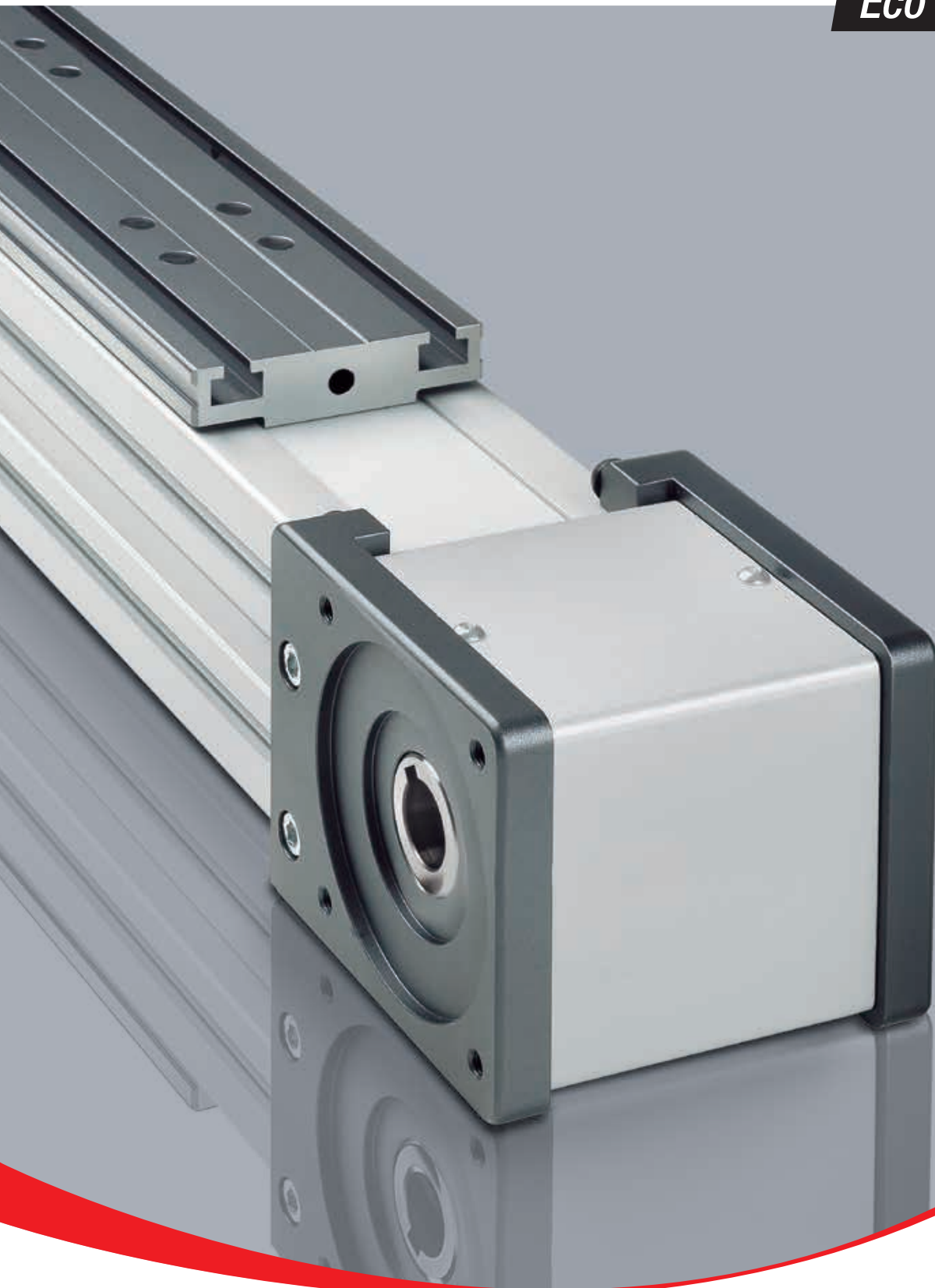


**ROLLON**<sup>®</sup>  
BY TIMKEN

*Eco System*



# TO SUPPORT YOU, WE DESIGN AND PRODUCE

An industrialized process with various levels  
of customization



For over 40 years, Rollon has adopted an approach entailing responsibility and ethics in the design and production of our linear motion solutions for different industrial sectors. The reliability of an international technology group has now been combined with the availability of a local support and service network



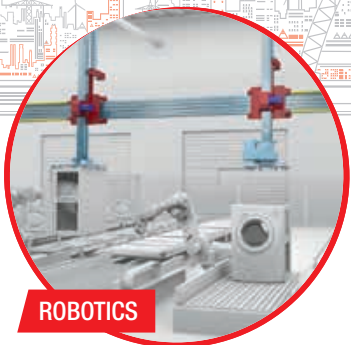
**VALUES**



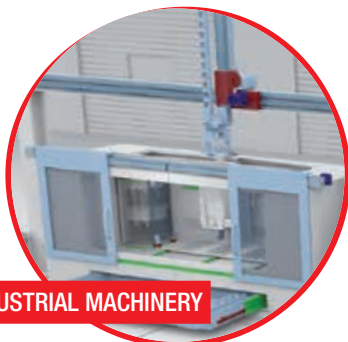
**PERFORMANCE**



Rollon's goal is to help our clients become more competitive in their markets through technological solutions, design simplification, productivity, reliability, duration, and low maintenance.



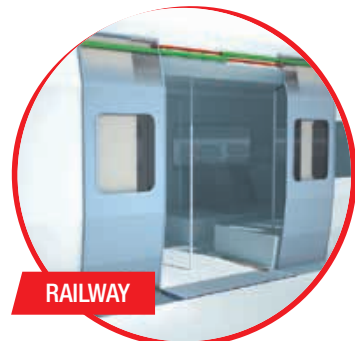
**ROBOTICS**



**INDUSTRIAL MACHINERY**



**LOGISTICS**

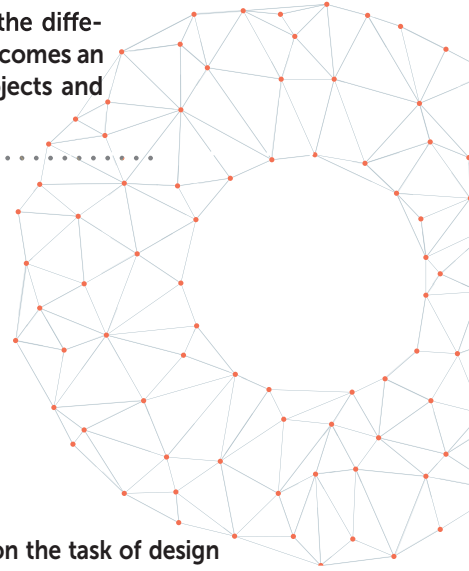


**RAILWAY**

## COLLABORATION



High-level technical consulting and cross-competence allow us to identify the needs of our clients and transform them into guidelines for continuous exchange, while our strong specialization in the different industrial sectors becomes an factor in developing projects and innovative applications.



Rollon takes on the task of design and development of linear motion solutions, taking care of everything for our customers, so that they can concentrate on their core business. We offer everything from individual components to specifically designed, mechanically integrated systems: the quality of our applications is an expression of our technology and competence.

## SOLUTIONS APPLICATIONS



INTERIORS AND ARCHITECTURE



MEDICAL



SPECIAL VEHICLES



AERONAUTICS

# DIVERSIFIED LINEAR SOLUTIONS FOR EVERY APPLICATION REQUIREMENT

## Linear and telescopic rails

### *Linear Line*



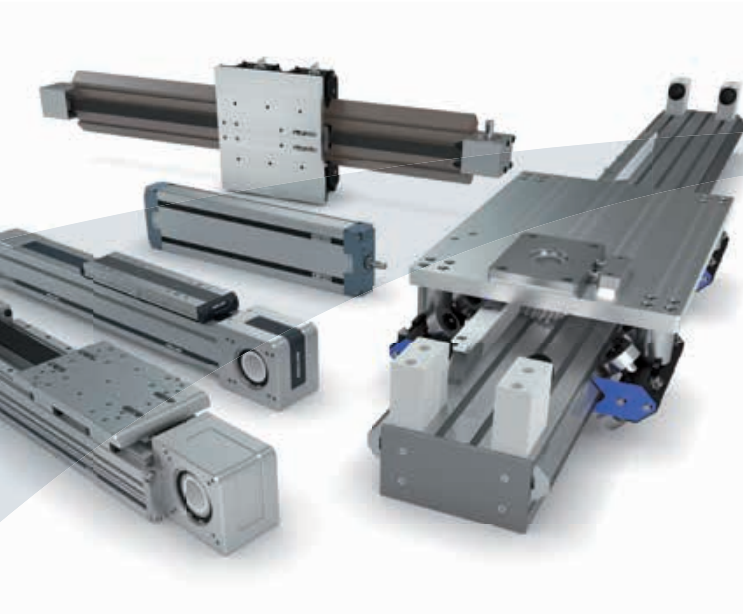
**Linear and curved rails with ball and roller bearings**, with hardened raceways, high load capacity, self-alignment, and capable of working in dirty environments.

### *Telescopic Line*



**Telescopic rails with ball and roller bearings**, with hardened raceways, high load capacities, low bending, resistant to shocks and vibrations. For partial, total or extended extraction up to 200% of the length of the guide.

## Linear actuators and automation systems



### Actuator Line

**Linear actuators with different rail configurations and transmissions,** available with belt, screw, or rack and pinion drives for different needs in terms of precision and speed. Rails with bearings or ball recycle systems for different load capacities and critical environments.



### Actuator System Line

**Integrated actuators for industrial automation,** used in applications in several industrial sectors: automated industrial machinery, precision assembly lines, packaging lines and high speed production lines. The Actuator Line evolves to satisfy the requests of our most discerning clients.

## > Eco System



### 1 ECO series

ECO series description	ES-2
The components	ES-3
The linear motion system	ES-4
ECO 60 SP2 - ECO 60 CI	ES-5
ECO 80 SP2 - ECO 80 SP1 - ECO 80 CI	ES-6
ECO 100 SP2 - ECO 100 SP1 - ECO 100 CI	ES-7
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**ECO series****> ECO series description**

Fig. 1

The ECO SYSTEM units are linear actuators made of a self-supporting extruded aluminum frame and are driven by a polyurethane belt with AT metric profile steel inserts.

- Three different sizes available: 60mm, 80mm, 100mm
- Version available with recirculating ball bearing or roller rails
- Reduced weight ensured by the light frame and the aluminum sliders
- High sliding speed

The ECO SYSTEM series actuators are offered with two motion systems:

**ECO SYSTEM – SP**

Featuring a maintenance free recirculating linear guide rail fitted inside the profile.

**ECO SYSTEM – CI**

Featuring four rollers with a Gothic arch outer profile sliding on hardened steel bars placed inside the profile.

## > The components

### Extruded bodies

The anodized aluminum extrusion used for the profile of the Rollon ECO series linear units was designed and manufactured by industry experts to optimise weight while maintaining mechanical strength. The anodized aluminum alloy 6060 used (see physical-chemical characteristics below) was extruded with dimensional tolerances compliant with EN 755-9 standards.

### Driving belt

The Rollon ECO series linear units use steel reinforced polyurethane drive belts 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.

Optimisation of the maximum belt width/body dimension ratio enables the following performance characteristics to be achieved:

- **High speed**
- **Low noise**
- **Low wear**

The driving belt is guided by specific slots in the aluminum extruded body thus covering the inside components.

### Carriage

The carriage of the Rollon ECO series linear units is made of anodized aluminum. Two different length carriages are available for each type of linear unit.

### General data about aluminum used: AL 6060

Chemical composition [%]

Al	Mg	Si	Fe	Mn	Zn	Cu	Impurites
Remaining	0.35-0.60	0.30-0.60	0.30	0.10	0.10	0.10	0.05-0.15

Tab. 1

Physical characteristics

Density	Coeff. of elasticity	Coeff. of thermal expansion (20°-100°C)	Thermal conductivity (20°C)	Specific heat (0°-100°C)	Resistivity	Melting point
$\frac{\text{kg}}{\text{dm}^3}$	$\frac{\text{kN}}{\text{mm}^2}$	$\frac{10^{-6}}{\text{K}}$	$\frac{\text{W}}{\text{m} \cdot \text{K}}$	$\frac{\text{J}}{\text{kg} \cdot \text{K}}$	$\Omega \cdot \text{m} \cdot 10^{-9}$	°C
2.70	69	23	200	880-900	33	600-655

Tab. 2

Mechanical characteristics

Rm	Rp (02)	A	HB
$\frac{\text{N}}{\text{mm}^2}$	$\frac{\text{N}}{\text{mm}^2}$	%	—
205	165	10	60-80

Tab. 3



## > The linear motion system

The linear motion system has been designed to meet the load capacity, speed, and maximum acceleration conditions of a wide variety of applications. Two linear motion systems are offered:

### ECO...SP with ball bearing guides

- A ball bearing guide with high load capacity is mounted in a dedicated seat on the inside of the aluminum body.
- The carriage is assembled on two pre-loaded ball bearing blocks.
- The two ball bearing blocks enable the carriage to withstand loading in the four main directions.
- The two blocks have seals on both sides and, if necessary, an additional scraper can be fitted for very dusty conditions.
- The ball bearing carriages of the SP versions are also fitted with a retention cage that eliminates "steel-steel" contact between adjacent revolving parts and prevents misalignment.
- Lubrication reservoirs (pockets) installed on the front of the ball bearing blocks supply the appropriate amount of grease, thus promoting a long maintenance interval.

#### The linear motion system described above offers:

- High speed and acceleration
- High load capacity
- High permissible bending moments
- Low friction
- Long life
- Maintenance Free (dependent on application)
- Low noise
- Suitable for long stroke

### ECO...CI with gothic arch bearing guides inside the body

- Two hardened steel rods (58/60 HRC tolerance h6) are securely inserted inside the aluminum body.
- The carriage is fitted with six bearing assemblies each having a gothic arch groove machined into its outer race to run on the steel rods.
- The six bearings are mounted on steel pins, two of which are eccentric, to allow setting of running clearance and pre-load.
- To keep the running tracks clean and lubricated, four grease impregnated felt seals, complete with grease reservoirs, are fitted on the ends of the carriage.
- The driving belt is supported by the entire length of the profile in order to avoid deflection as well as to protect the linear guide.

#### The linear motion system described above offers:

- Good positioning accuracy
- Low noise
- Maintenance Free (dependent on application)

ECO SP

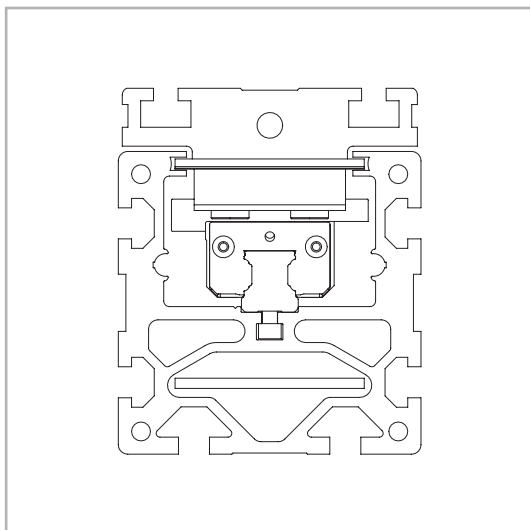


Fig. 2

ECO CI

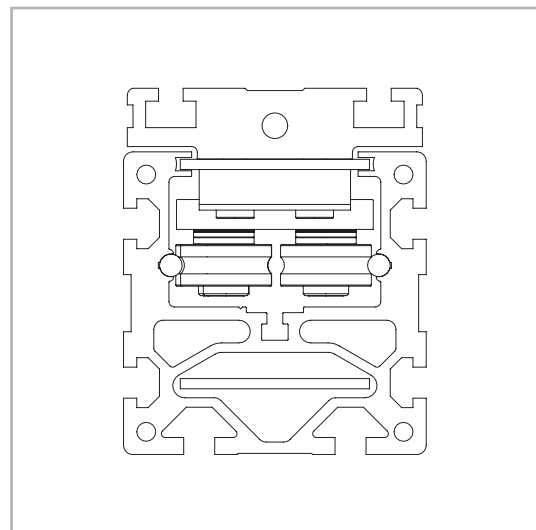
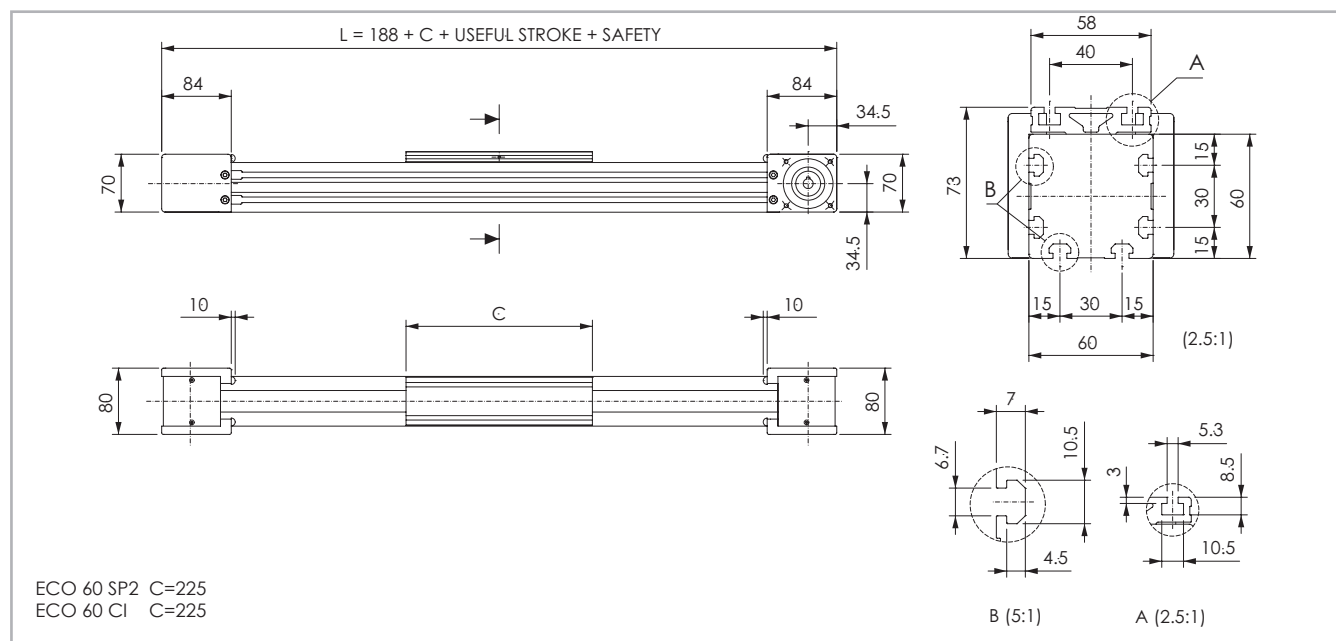


Fig. 3

> ECO 60 SP2 - ECO 60 CI

ECO 60 SP2 - ECO 60 CI Dimensions



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

Fig. 4

Technical data

	Type	
	ECO 60 SP2	ECO 60 CI
Max. useful stroke length [mm]	6025	5725
Max. positioning repeatability [mm]*1	± 0.05	± 0.05
Max. speed [m/s]	4.0	1.5
Max. acceleration [m/s <sup>2</sup> ]	50	1.5
Type of belt	32 AT 5	32 AT 5
Type of pulley	Z 28	Z 28
Pulley pitch diameter [mm]	44.56	44.56
Carriage displacement per pulley turn [mm]	140	140
Carriage weight [kg]	0.51	0.80
Zero travel weight [kg]	3.5	3.2
Weight for 100 mm useful stroke [kg]	0.45	0.68
Starting torque [Nm]	0.24	0.32
Moment of inertia of pulleys [g mm <sup>2</sup> ]	163000	163000
Rail size [mm]	12 mini	Ø6

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

Tab. 4

Moments of inertia of the aluminum body

Type	$I_x$ [10 <sup>7</sup> mm <sup>4</sup> ]	$I_y$ [10 <sup>7</sup> mm <sup>4</sup> ]	$I_p$ [10 <sup>7</sup> mm <sup>4</sup> ]
ECO 60	0.037	0.054	0.093

Tab. 5

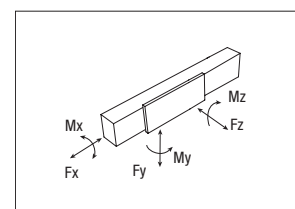
Driving belt

The driving belt is manufactured with friction resistant polyurethane, with steel cord reinforcement for high tensile stress resistance.

Type	Type of belt	Belt width [mm]	Weight [kg/m]
ECO 60	32 AT 5	32	0.105

Tab. 6

Belt length (mm) SP2/CI = 2 x L - 166



Load capacity

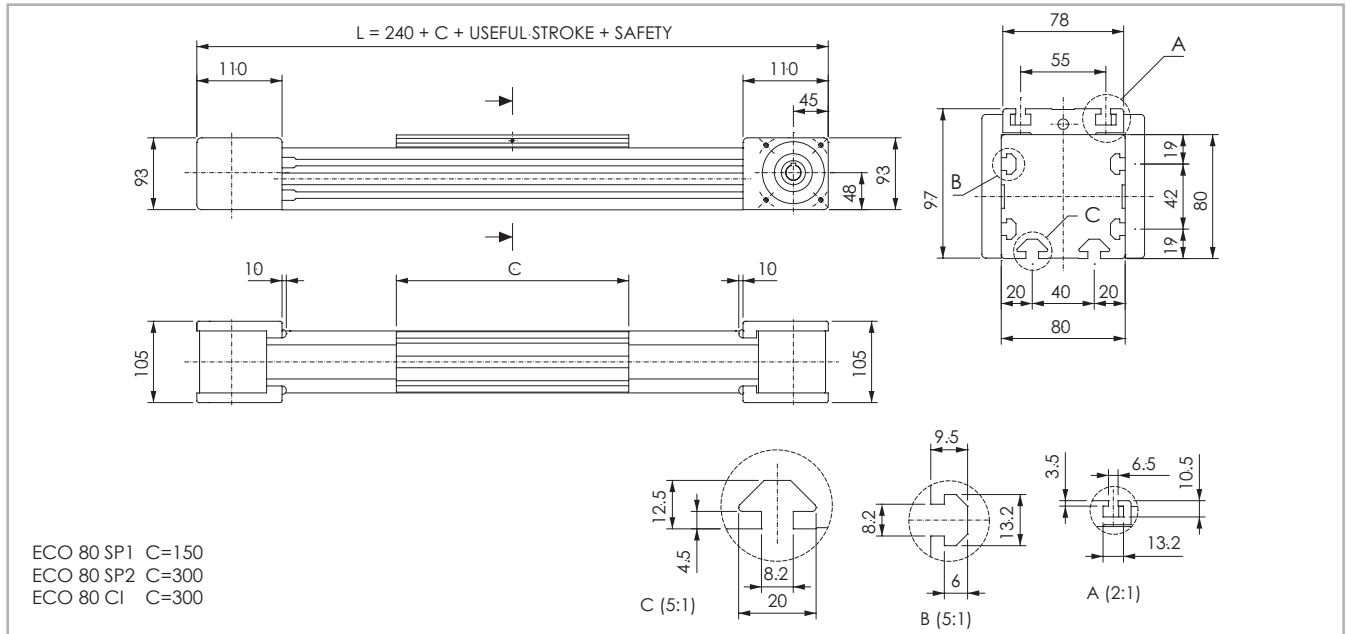
Type	$F_x$ [N]		$F_y$ [N]		$F_z$ [N]	$M_x$ [Nm]		$M_y$ [Nm]		$M_z$ [Nm]	
	Stat.	Dyn.	Stat.	Dyn.	Stat.	Stat.	Stat.	Stat.	Stat.	Stat.	
ECO 60 SP2	1344	922	7060	6350	7060	46.2	325	325			
ECO 60 CI	1344	922	1648	3072	1110	24.4	33	76.2			

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

Tab. 7

> ECO 80 SP2 - ECO 80 SP1 - ECO 80 CI

ECO 80 SP2 - ECO 80 SP1 - ECO 80 CI Dimensions



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

Fig. 5

Technical data

	Type		
	ECO 80 SP2	ECO 80 SP1	ECO 80 CI
Max. useful stroke length [mm]	5940	6090	5640
Max. positioning repeatability [mm]*1	± 0.05	± 0.05	± 0.05
Max. speed [m/s]	5.0	5.0	1.5
Max. acceleration [m/s <sup>2</sup> ]	50	50	1.5
Type of belt	50 AT 5	50 AT 5	50 AT 5
Type of pulley	Z 37	Z 37	Z 37
Pulley pitch diameter [mm]	58.89	58.89	58.89
Carriage displacement per pulley turn [mm]	185	185	185
Carriage weight [kg]	1.6	0.9	2.1
Zero travel weight [kg]	7.7	5.9	8.2
Weight for 100 mm useful stroke [kg]	0.8	0.8	0.65
Starting torque [Nm]	0.75	0.75	0.75
Moment of inertia of pulleys [g mm <sup>2</sup> ]	706000	706000	706000
Rail size [mm]	15	15	Ø6

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

Tab. 8

Load capacity

Type	F <sub>x</sub> [N]		F <sub>y</sub> [N]		F <sub>z</sub> [N]	M <sub>x</sub> [Nm]	M <sub>y</sub> [Nm]	M <sub>z</sub> [Nm]
	Stat.	Dyn.	Stat.	Dyn.	Stat.	Stat.	Stat.	Stat.
ECO 80 SP2	2100	1440	25400	19720	25400	240	1791	1791
ECO 80 SP1	2100	1440	12700	9860	12700	120	87	87
ECO 80 CI	2100	1770	4229	8731	2849	83	129	297

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

Tab. 11

Moments of inertia of the aluminum body

Type	I <sub>x</sub> [10 <sup>7</sup> mm <sup>4</sup> ]	I <sub>y</sub> [10 <sup>7</sup> mm <sup>4</sup> ]	I <sub>p</sub> [10 <sup>7</sup> mm <sup>4</sup> ]
ECO 80	0.117	0.173	0.280

Tab. 9

Driving belt

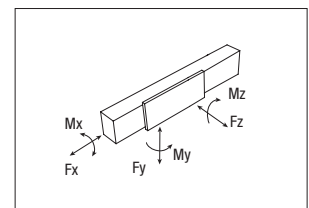
The driving belt is manufactured with friction resistant polyurethane, with steel cord reinforcement for high tensile stress resistance.

Type	Type of belt	Belt width [mm]	Weight [kg/m]
ECO 80	50 AT 5	50	0.164

Tab. 10

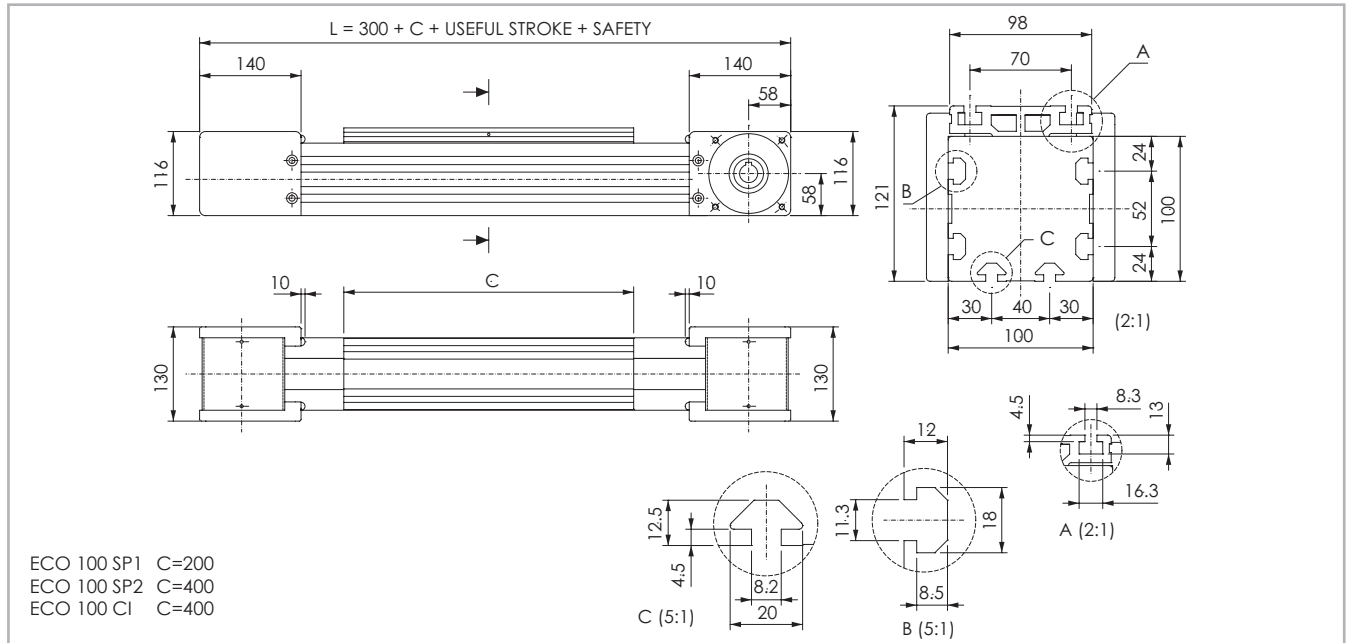
Belt length (mm) SP2/CI = 2 x L - 240

SP1 = 2 x L - 90



> ECO 100 SP2 - ECO 100 SP1 - ECO 100 CI

ECO 100 SP2 - ECO 100 SP1 - ECO 100 CI Dimensions



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

Fig. 6

Technical data

	Type		
	ECO 100 SP2	ECO 100 SP1	ECO100 CI
Max. useful stroke length [mm]	6630	6830	5530
Max. positioning repeatability [mm]*1	± 0.05	± 0.05	± 0.05
Max. speed [m/s]	5.0	5.0	1.5
Max. acceleration [m/s <sup>2</sup> ]	50	50	1.5
Type of belt	50 AT 10	50 AT 10	50 AT 10
Type of pulley	Z 24	Z 24	Z 24
Pulley pitch diameter [mm]	76.39	76.39	76.39
Carriage displacement per pulley turn [mm]	240	240	240
Carriage weight [kg]	2.9	1.5	3.3
Zero travel weight [kg]	16.7	12.5	17.1
Weight for 100 mm useful stroke [kg]	1.3	1.3	1.1
Starting torque [Nm]	1.90	1.35	1.35
Moment of inertia of pulleys [g mm <sup>2</sup> ]	2070000	2070000	2070000
Rail size [mm]	20	20	Ø10

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

Tab. 12

Load capacity

Type	F <sub>x</sub> [N]		F <sub>y</sub> [N]		F <sub>z</sub> [N]	M <sub>x</sub> [Nm]	M <sub>y</sub> [Nm]	M <sub>z</sub> [Nm]
	Stat.	Dyn.	Stat.	Dyn.	Stat.	Stat.	Stat.	Stat.
ECO 100 SP2	4565	2832	55400	44400	55400	700	5485	5485
ECO 100 SP1	4565	2832	27700	22200	27700	350	240	240
ECO 100 CI	4565	3740	9154	20079	6167	214	310	962

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

Tab. 15

Moments of inertia of the aluminum body

Type	I <sub>x</sub> [10 <sup>7</sup> mm <sup>4</sup> ]	I <sub>y</sub> [10 <sup>7</sup> mm <sup>4</sup> ]	I <sub>p</sub> [10 <sup>7</sup> mm <sup>4</sup> ]
ECO 100	0.342	0.439	0.781

Tab. 13

Driving belt

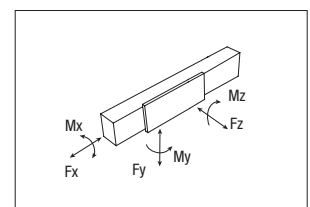
The driving belt is manufactured with friction resistant polyurethane, with steel cord reinforcement for high tensile stress resistance.

Type	Type of belt	Belt width [mm]	Weight [kg/m]
ECO 100	50 AT 10	50	0.290

Tab. 14

Belt length (mm) SP1 = 2 x L - 112

SP2/CI = 2 x L - 312



## > Lubrication

### ECO linear units with ball bearing guides

ECO linear are equipped with self lubricating linear ball guides.

The ball bearing carriages of the ECO series are also fitted with a retention cage that eliminates "steel-steel" contact between adjacent revolving parts and prevents misalignment of these in the circuits.

Special lubrication reservoirs are mounted on the front plates of the linear blocks which continuously provide the necessary amount of grease to the ball raceways under load. These lubrication reservoirs also considerably reduce the frequency of lubrication of the module. This system guarantees

a long interval between maintenances: every 5000 km or 1 year of use, based on the value reached first. If a longer service life is required or in case of high dynamic or high loaded applications please contact our offices for further verification.

### ECO

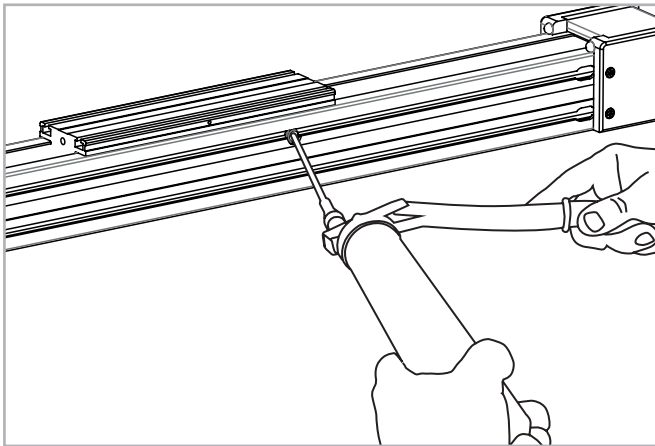


Fig. 7

- Insert the tip of the grease gun in the specific grease blocks.
- For lubrication of linear units use lithium soap grease NLGI 2.
- For specially stressed applications or difficult environmental conditions, lubrication should be carried out more frequently. Refer to Rollon for further advice.

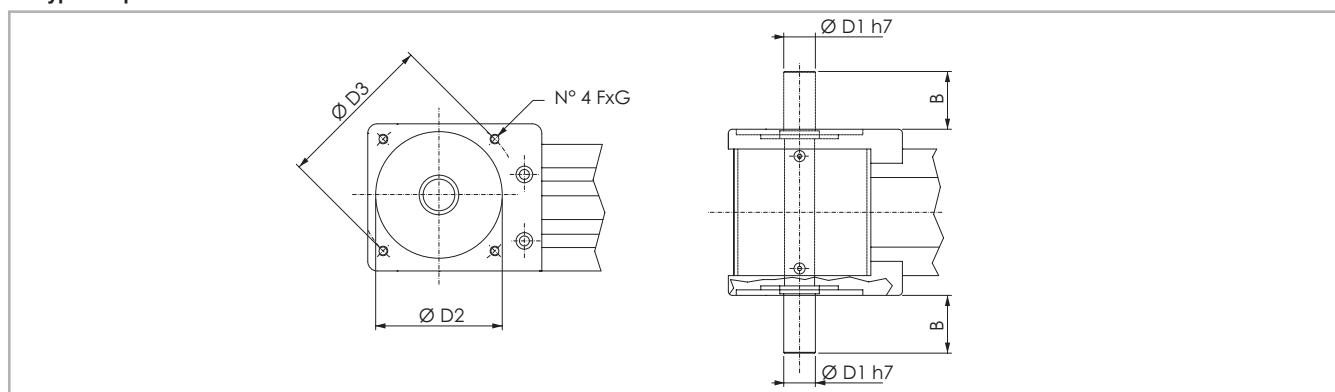
Quantity of lubricant necessary for re-lubrication of each block:

Type	Unit: [cm <sup>3</sup> ]
ECO 60	0.5
ECO 80	0.7
ECO 100	1.4

Tab. 16

## > Simple shafts

### AS type simple shafts



Position of the simple shaft can be to the left or right of the drive head.

Fig. 8

### Dimensions (mm)

Applicable to unit	Shaft type	D1	D2	D3	B	F	G	Head code AS left	Head code AS right
ECO 60	AS 12	12	60	75	25	M5	12	2G	2I
ECO 80	AS 20	20	80	100	36.5	M6	16	2G	2I
ECO 100	AS 25	25	110	130	50	M8	20	2G	2I

Tab. 17

## > Hollow shafts

### Transmission of torque to the drive pulley

Torque is transmitted to the drive pulley from a hollow shaft and keyway.

This system may create backlash in the case of alternating loads and high level acceleration. For further information, contact our offices.

### Hollow shaft

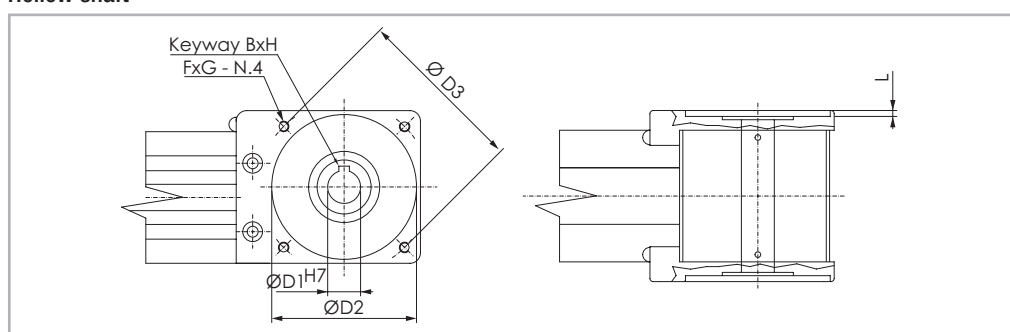


Fig. 9

An (optional) connection flange is required to fit the standard reduction units selected by Rollon.

For further information, contact our offices

Unit	Shaft type	D1	D2	D3	L	Key way BxH	F	G	Drive head code
ECO 60	AC 12	12H7	60	75	3.5	4 x 4	M5	12	2A
ECO 80	AC 19	19H7	80	100	3.5	6 x 6	M6	16	2A
ECO 100	AC 25	25H7	110	130	4.5	8 x 7	M8	20	2A

Tab. 18

## > Linear units in parallel

### Synchronisation kit for use of ECO linear units in parallel

When movement consisting of two linear units in parallel is essential, a synchronisation kit must be used. The kit contains original Rollon blade type precision joints complete with tapered splines and hollow aluminum drive shafts.

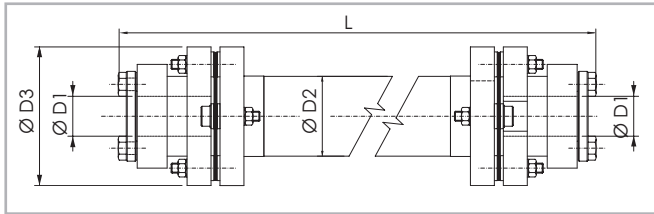


Fig. 10

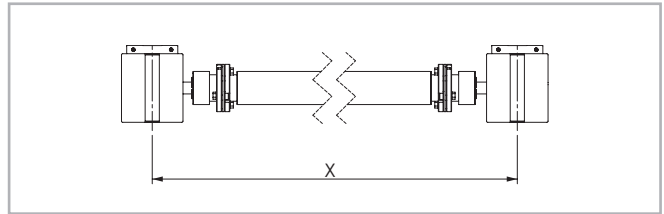


Fig. 11

Unit	Shaft type	D1	D2	D3	Code	Formula for length calculation
ECO 60	AP 12	12	25	45	GK12P...1A	$L = X - 88$ [mm]
ECO 80	AP 20	20	40	69.5	GK20P...1A	$L = X - 116$ [mm]
ECO 100	AP 25	25	70	99	GK25P...1A	$L = X - 165$ [mm]

Tab. 19

## > Accessories

### Fixing by brackets

The linear motion systems used for the Rollon ECO series linear units enables them to support loads in any direction. They can therefore be installed in any position.

To install the units, we recommend use of the dedicated T-slots in the aluminum extruded bodies as shown below.

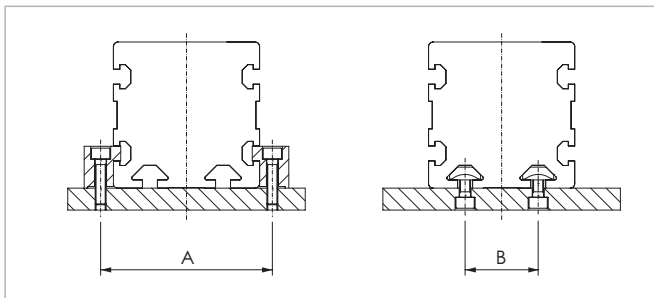


Fig. 12

### Moment of inertia [g mm<sup>2</sup>] C1 + C2 · (X-Y)

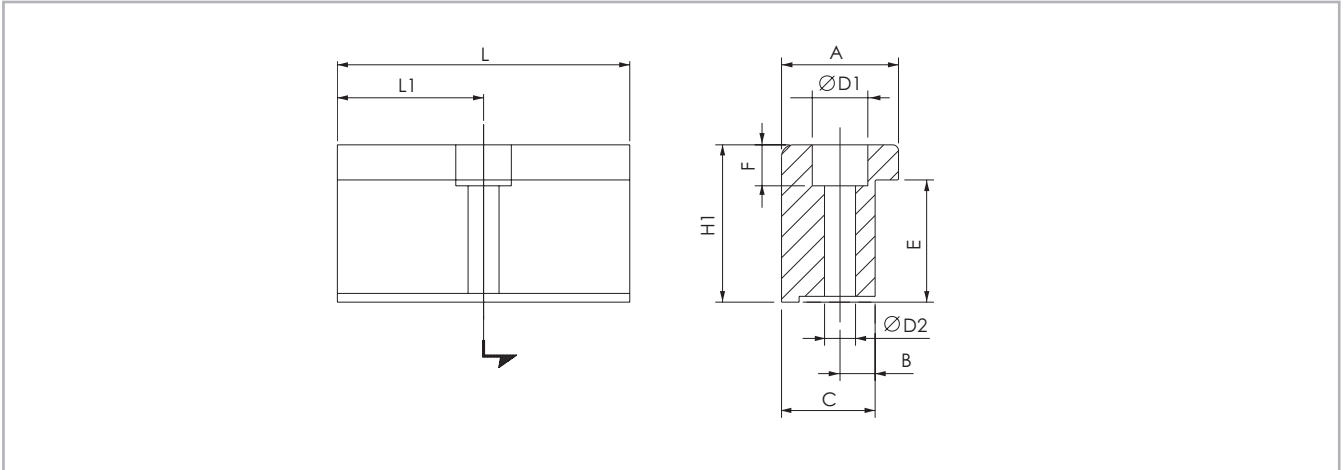
	C1	C2	Y	Weight [ Kg ] C1+C2 · (X-Y)	
	[g mm <sup>2</sup> ]	[g mm <sup>2</sup> ]	[mm]	C1 [Kg]	C2 [Kg mm]
GK12P	61.456	69	166	0.308	0.00056
GK20P	1.014.968	464	250	2.48	0.00148
GK25P	5.525.250	4.708	356	6.24	0.0051

Tab. 20

Unit	A (mm)	B (mm)
ECO 60	72	30
ECO 80	94	40
ECO 100	120	40

Tab. 21

Fixing brackets



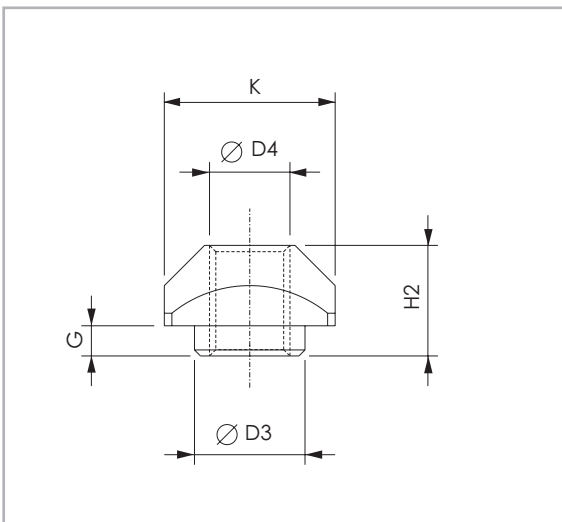
Anodized aluminum block for fixing the linear units through the side slots of the body

Fig. 13

Unit	A	H1	B	C	E	F	D1	D2	L	L1	Code
ECO 60	20	17.5	6	16	11.5	6	9.4	5.3	50	25	1001490
ECO 80	20	20.7	7	16	14.7	7	11	6.4	50	25	1001491
ECO 100	36.5	28.5	10	31	18.5	11.5	16.5	10.5	100	50	1001233

Tab. 22

T-nuts



Steel nuts to be used in the slots of the body.

Fig. 14

Dimensions (mm)

Unit		D3	D4	G	H2	K	Code
ECO 60	S	6.7	M5	2.3	6.5	10	1000627
ECO 60	C	-	M5	-	5	10	1000620
ECO 80	S	8	M6	3.3	8.3	13	1000043
ECO 80	C	-	M6	-	5.8	13	1000910
ECO 80	L	-	M6	-	6.5	17	1000911
ECO 100	S	11	M8	3	11	17	1000932
ECO 100	C	-	M8	-	8	16	1000942
ECO 100	L	-	M8	-	6.5	17	1000943

S = Side - C = Carriage - L = Lower

Tab. 23

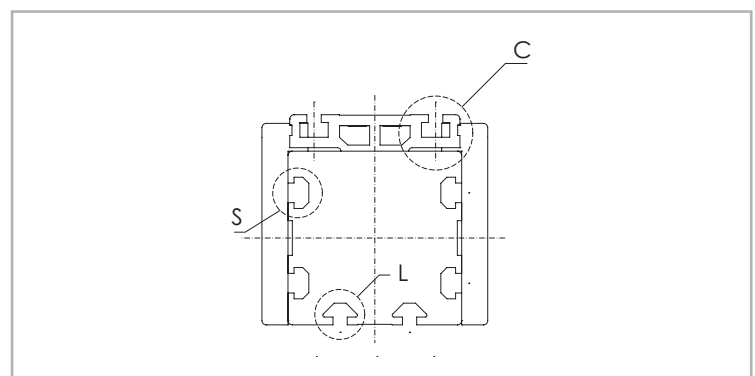


Fig. 15



Proximity

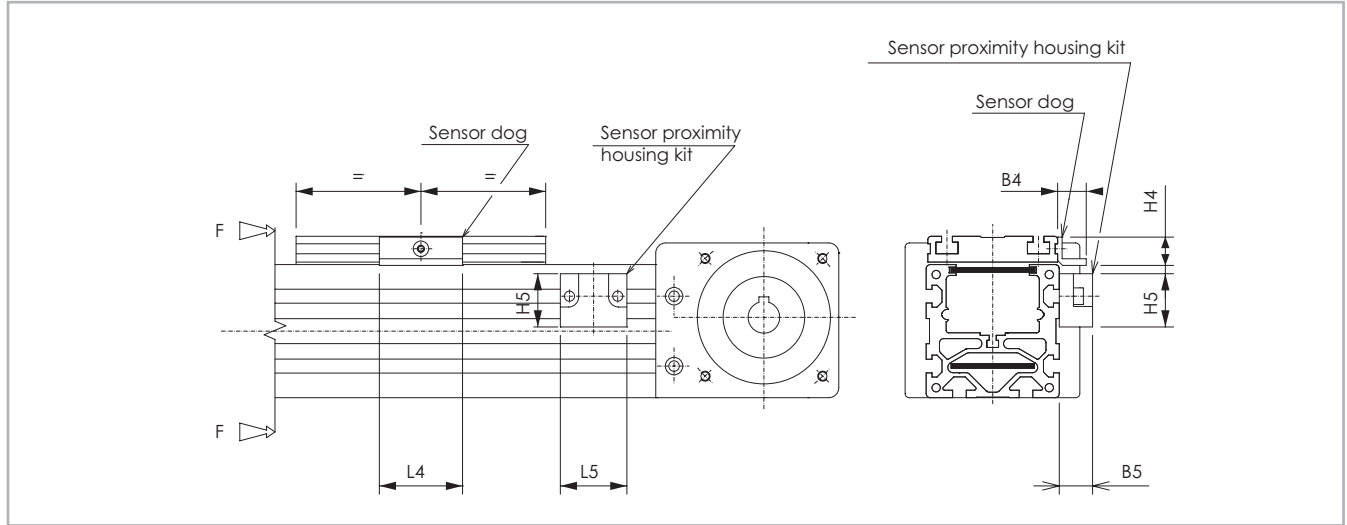


Fig. 16

**Sensor proximity housing kit**

Anodized aluminum block, red colour, equipped with T-nuts for fixing into the body slots.

**Sensor dog**

L-shaped bracket in zinc-plated iron, mounted on the carriage and used for the proximity switch operation.

Unit	B4	B5	L4	L5	H4	H5	For proximity	Sensor dog Code	Sensor proximity housing kit code
ECO 60	9.5	14	25	29	12	22.5	Ø 8	G000268	G000213
ECO 80	17.2	20	50	40	17	32	Ø 12	G000267	G000209
ECO 100	17.2	20	50	40	17	32	Ø 12	G000267	G000210

Tab. 24

# Ordering key

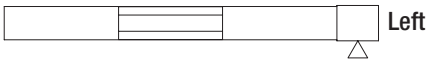
## > Identification codes for the ECO linear unit

<b>C</b>	<b>06</b> 06=60 08=80 10=100	<b>2A</b>	<b>0 2000</b>	<b>1A</b> 1A=SP1 2A=SP2 1C=CI	
					Linear motion system <i>see pg. ES-4</i>
					L=total length of the unit
					Driving head code <i>see pg. ES-8</i>
					Linear unit size <i>see from pg. ES-5 to pg. ES-7</i>
					ECO series <i>see pg. ES-2</i>

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



### Left / right orientation



## Multiaxis systems



Previously, customers wishing to build multiaxis units have had to design, draw and manufacture all the elements necessary to assemble two or more axis. Rollon now offers a set of fittings including brackets and cross plates to enable multiaxis units to be built. In addition to standard elements, Rollon also provides plates for special applications.

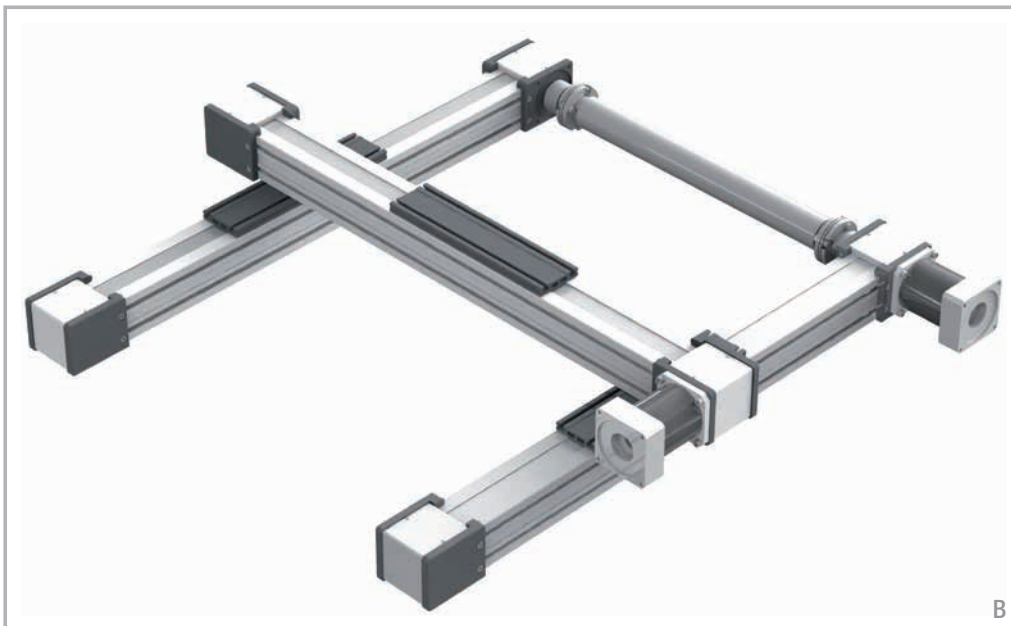
### ECO axis system



A

A - Linear units: X axis 1 ECO 80

### Two axis X-Y system



B

B - Linear units: X axis: 2 ECO 80 - Y axis 1 ECO 80

**Connection kit:** 2 Kits of fixing brackets for the ECO 80 unit (Y axis) on the carriages of the ECO 80 units (X axis).

# Static load and service life

## > Static load

In the static load test, the radial load rating  $F_y$ , the axial load rating  $F_z$ , and the moments  $M_x$ ,  $M_y$  und  $M_z$  indicate the maximum allowed load values. Higher loads will impair the running characteristics. To check the static load, a safety factor  $S_0$  is used, which accounts for the special conditions of the application defined in more detail in the table below:

All load capacity values refer to the actuator well fixed to a rigid structure. For cantilever applications the deflection of the actuator profile must be taken in account.

### Safety factor $S_0$

No shocks or vibrations, smooth and low-frequency change in direction High mounting accuracy, no elastic deformations, clean environment	2 - 3
Normal assembly conditions	3 - 5
Shocks and vibrations, high-frequency changes in direction, substantial elastic deformations	5 - 7

Fig. 1

The ratio of the actual to the maximum allowed load must not be higher than the reciprocal value of the assumed safety factor  $S_0$ .

$\frac{P_{fy}}{F_y} \leq \frac{1}{S_0}$	$\frac{P_{fz}}{F_z} \leq \frac{1}{S_0}$	$\frac{M_1}{M_x} \leq \frac{1}{S_0}$	$\frac{M_2}{M_y} \leq \frac{1}{S_0}$	$\frac{M_3}{M_z} \leq \frac{1}{S_0}$
---	---	--------------------------------------	--------------------------------------	--------------------------------------

Fig. 2

The above formulae only apply to a one load case. If one or more of the forces described are acting simultaneously, the following calculation must be carried out:

$\frac{P_{fy}}{F_y} + \frac{P_{fz}}{F_z} + \frac{M_1}{M_x} + \frac{M_2}{M_y} + \frac{M_3}{M_z} \leq \frac{1}{S_0}$	$P_{fy}$	= acting load (y direction) (N)
	$F_y$	= static load rating (y direction) (N)
	$P_{fz}$	= acting load (z direction) (N)
	$F_z$	= static load rating (z direction) (N)
	$M_1, M_2, M_3$	= external moments (Nm)
	$M_x, M_y, M_z$	= maximum allowed moments in the different load directions (Nm)

Fig. 3

The safety factor  $S_0$  can be at the lower limit given if the acting forces can be determined with sufficient accuracy. If shocks and vibrations act on the system, the higher value should be selected. In dynamic applications, higher safeties are required. For further information, please contact our Application Engineering Department.

### Belt safety factor referred to the dynamic $F_x$

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

Tab. 1

## > 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:

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

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

Fig. 4

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. 5

### 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. 6

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; ( $\alpha < 5\text{m/s}^2$ ) 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 ( $5\text{m/s}^2 < \alpha < 10\text{m/s}^2$ )	2 - 3
Shocks and vibrations; high speeds (>2 m/s) and high-frequency changes in direction; ( $\alpha > 10\text{m/s}^2$ ) high contamination, very short stroke	> 3

Tab. 2

### Speedy Rail A Lifetime

The rated lifetime for SRA actuators is 80,000 Km.

# Static load and service life Uniline

## > Static load

In the static load test, the radial load rating  $F_y$ , the axial load rating  $F_z$ , and the moments  $M_x$ ,  $M_y$  and  $M_z$  indicate the maximum allowed load values. Higher loads will impair the running characteristics. To check the static load, a safety factor  $S_0$  is used, which accounts for the special conditions of the application defined in more detail in the table below:

### Safety factor $S_0$

No shocks or vibrations, smooth and low-frequency change in direction High mounting accuracy, no elastic deformations, clean environment	1 - 1.5
Normal assembly conditions	1.5 - 2
Shocks and vibrations, high-frequency changes in direction, substantial elastic deformations	2 - 3.5

Fig. 7

The ratio of the actual to the maximum allowed load must not be higher than the reciprocal value of the assumed safety factor  $S_0$ .

$\frac{P_{fy}}{F_y} \leq \frac{1}{S_0}$	$\frac{P_{fz}}{F_z} \leq \frac{1}{S_0}$	$\frac{M_1}{M_x} \leq \frac{1}{S_0}$	$\frac{M_2}{M_y} \leq \frac{1}{S_0}$	$\frac{M_3}{M_z} \leq \frac{1}{S_0}$
---	---	--------------------------------------	--------------------------------------	--------------------------------------

Fig. 8

The above formulae apply to a one load case. If one or more of the forces described are acting simultaneously, the following test must be carried out:

$\frac{P_{fy}}{F_y} + \frac{P_{fz}}{F_z} + \frac{M_1}{M_x} + \frac{M_2}{M_y} + \frac{M_3}{M_z} \leq \frac{1}{S_0}$	<ul style="list-style-type: none"> <li><math>P_{fy}</math> = acting load (y direction) (N)</li> <li><math>F_y</math> = static load rating (y direction) (N)</li> <li><math>P_{fz}</math> = acting load (z direction) (N)</li> <li><math>F_z</math> = static load rating (z direction) (N)</li> <li><math>M_1, M_2, M_3</math> = external moments (Nm)</li> <li><math>M_x, M_y, M_z</math> = maximum allowed moments in the different load directions (Nm)</li> </ul>
--	--

Fig. 9

The safety factor  $S_0$  can be at the lower limit given if the acting forces can be determined with sufficient accuracy. If shocks and vibrations act on the system, the higher value should be selected. In dynamic applications, higher safeties are required. For further information, please contact our Application Engineering Department.

## > 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:

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

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

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

$M_{zn}$  = allowed moment (Nm)

$M_{zmin}$  = minimum values (Nm)

$M_{yn}$  = allowed moment (Nm)

$M_{ymin}$  = minimum values (Nm)

$S_n$  = length of the slider plate (mm)

$S_{min}$  = minimum length of the slider plate (mm)

$\Delta S$  = factor of the change in slider length

$K$  = constant

Fig. 10

Type	$M_{ymin}$ [Nm]	$M_{zmin}$ [Nm]	$S_{min}$ [mm]	$\Delta S$	$K$
A40L	22	61	240	10	74
A55L	82	239	310		110
A75L	287	852	440		155
C55L	213	39	310		130
C75L	674	116	440		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. 3

### 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  $M_{y,n}$  and  $M_{z,n}$  for each distance between the centers of the sliders are calculated by the following formulae:

$L_n = L_{min} + n \cdot \Delta L$ $M_y = \left( \frac{L_n}{L_{min}} \right) \cdot M_{y,min}$ $M_z = \left( \frac{L_n}{L_{min}} \right) \cdot M_{z,min}$	<p><math>M_y</math> = allowed moment (Nm)</p> <p><math>M_z</math> = allowed moment (Nm)</p> <p><math>M_{y,min}</math> = minimum values (Nm)</p> <p><math>M_{z,min}</math> = minimum values (Nm)</p> <p><math>L_n</math> = distance between the centers of the sliders (mm)</p> <p><math>L_{min}</math> = minimum value for the distance between the centers of the sliders (mm)</p> <p><math>\Delta L</math> = factor of the change in slider length</p>
--	--

Fig. 11

Type	$M_{y,min}$ [Nm]	$M_{z,min}$ [Nm]	$L_{min}$ [mm]	$\Delta L$
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. 4

## > 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:

$L_{km} = 100 \text{ km} \cdot \left( \frac{C}{P} \cdot \frac{f_c}{f_i} \cdot f_n \right)^3$	<p><math>L_{km}</math> = theoretical service life (km)</p> <p>C = dynamic load rating (N)</p> <p>P = acting equivalent load (N)</p> <p><math>f_i</math> = service factor (see tab. 5)</p> <p><math>f_c</math> = contact factor (see tab. 6)</p> <p><math>f_n</math> = stroke factor (see fig. 13)</p>
--	---

Fig. 12

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. 13

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. 5

### Contact factor $f_c$

$f_c$	
Standard slider	1
Long slider	0.8
Double slider	0.8

Tab. 6

### 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):

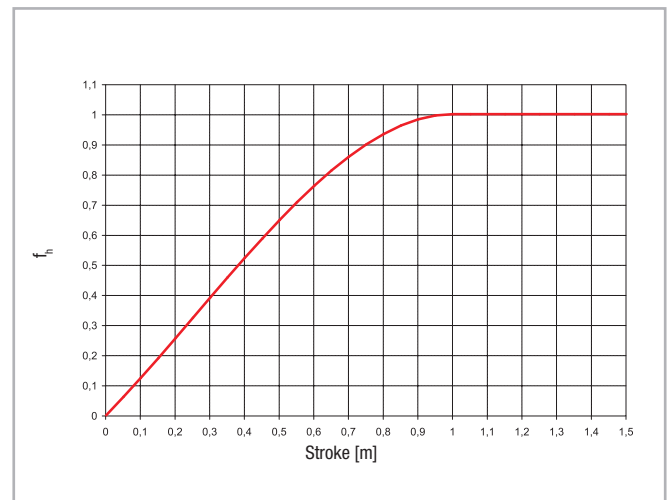


Fig. 14

## > 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. 15

## 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 objects on 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 environment, 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
Lubrication 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 therefore 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.

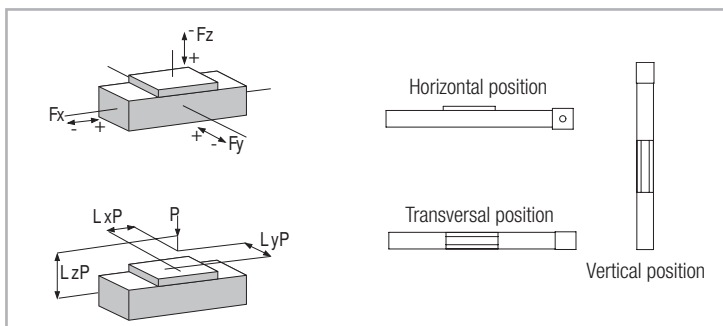
# Data sheet

v

**General data:** Date: ..... Inquiry N°: .....  
**Address:** ..... Contact: .....  
**Company:** ..... Zip Code: .....  
**Phone:** ..... Fax: .....  
**E-Mail:** .....

**Technical data:**

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



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



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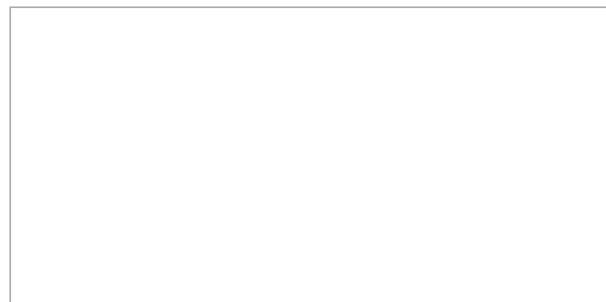
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