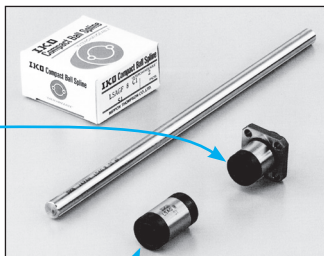


## LSAG IKO

### LSAGc

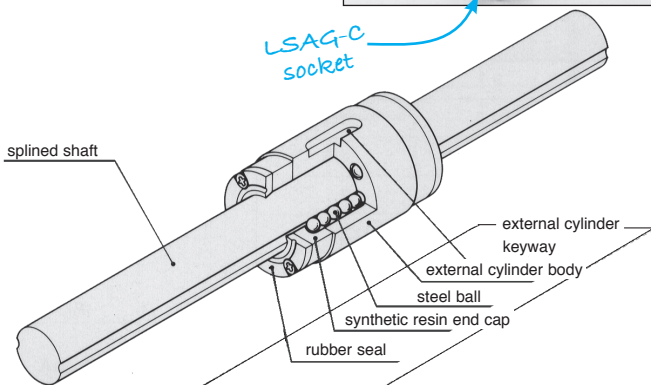
### LSAGF-C

## Introduction



LSAGF-C  
socket

LSAG-C  
socket



splined shaft

external cylinder  
keyway

external cylinder body

steel ball

synthetic resin end cap

rubber seal

The LSAG series of linear ball splines consists of a splined shaft and an external cylinder. Two rows of rotating balls are housed in the external cylinder and turn on tracks in the shaft. These tracks have been precision-ground and allow **an almost unlimited lateral movement**. The splines stop the cylinder from rotating around the shaft. **It is therefore impossible to drive the cylinder in rotation**. The splined shaft and the external cylinder can be replaced easily.

As with the linear slide rule series, the concept of two tracks for rotating balls having four point contact has been put in place for this simple, compact, and efficient linear system. **This series is suited to applications requiring a smooth lateral movement and a precise angle positioning** such as LCD manufacturing machines, integrated circuit production, industrial robots, measuring apparatus, etc...

Two types of external cylinder: the standard type **LSAG-C** and the flanged type **LSAGF-C** are available thus covering the majority of most applications.

## User safety

The normal continuous operating temperature of the LWL linear slides is 100°C with occasional use at up to 120°C. If your application will exceed 100°C, please contact us for advice. When mounting two or more cylinders on to one shaft, we recommend only attaching one cylinder with a key, with the proviso that the moment of rotation could be supported by a single cylinder. Where it is necessary to use two (or more) keys to attach two (or more) cylinders or to assemble two cylinders end-to-end, please consult us.

## Adjusting the cylinder

Generally, a transition fit (J7) is required between the external cylinder of and the housing bore. When high accuracy and rigidity are not required, a clearance fit (H7) may also be acceptable.

## Load capacity and life expectancy

### Basic dynamic load

The basic dynamic load rating is defined as a constant load, both in direction and magnitude to which a group of identical LSAG linear splines are subjected individually and where 90% of the slides in that group can travel for 50km without suffering material damage due to rolling contact fatigue.

### Basic static load capacity

The basic static load rating (Figure 1) is defined as a static load that gives a prescribed constant stress at the centre of the contact area between the rolling element and track whilst receiving the maximum load.

### Dynamic torque

The dynamic torque rating is defined as the moment of rotation at constant load, both in direction and magnitude to which a group of identical LSAG linear splines are subjected individually and where 90% of the slides in that group can travel for 50km without suffering material damage due to rolling contact fatigue.

### Static moment of torsion and static moment

The static torque (figure 1) and the static moment (figure 2) are defined as exerting a constant contact at the centre of the contact zone of the moving parts and the tracks where the maximum load is exerted. The  $T_x$  values in the tables apply to one cylinder or to two cylinders placed end-to-end.

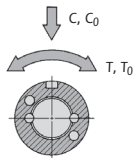


Figure 1 Load direction and torque

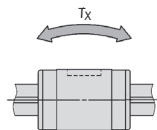


Figure 2 Moment direction

### Life expectancy

The life expectancy of LSAG linear rotary ball splines can be calculated using the following formula:

$$L = 50 \left( \frac{C}{f_w Fr} \right)^3 \quad (1)$$

$$L = 50 \left( \frac{T}{f_w Fr} \right)^3 \quad (2)$$

where:

**L** : Life expectancy in kilometres (or  $10^3$ m)

**Fr** : calculated radial load

**C** : Basic Dynamic load capacity (N)

**Ft** : moment of torsion

**T** : Dynamic load (N)

**f<sub>w</sub>** : load factor (see table 1)

In applications where the stroke length and the number of strokes per minute are known, the life expectancy in hours can be calculated as follows:

$$L_h = \frac{10^6 L}{2 S n_1 \times 60} \quad (3)$$

**L<sub>h</sub>** : Life expectancy in hours (**h**) ..... **S** : Stroke length (mm)

**n<sub>1</sub>** : Number of strokes per minute (**spm**)

**Table 1 Load factor**

| Operating conditions                            | f <sub>w</sub> |
|-------------------------------------------------|----------------|
| Smooth working without vibrations and/or shocks | 1.0 ~ 1.2      |
| Normal working                                  | 1.2 ~ 1.5      |
| Working with vibrations and/or shocks           | 1.5 ~ 3.0      |

### Static security factor

Excessively heavy loads or violent shocks can cause permanent damage to the balls or tracks, causing the overall performance to suffer. The acceptable load will depend on the working conditions and the application, the factor of safety will be determined based on these requirements.

The static safety factor of the LSAG series splined cylindrical linear ball guidance models is calculated using the formula below. Common values are given in table 2.

**f<sub>s</sub>** : static safety factor

**C<sub>0</sub>** : basic static load capacity

$$f_s = \frac{C_0}{P_0} \quad (4)$$

**P<sub>0</sub>** : static load

**Pr<sub>0</sub>** : static radial load

**T<sub>0</sub>** : static torque

**Pt<sub>0</sub>** : static moment

**Table 2 Static safety factor**

| Operating conditions                            | fs    |
|-------------------------------------------------|-------|
| Smooth working without vibrations and/or shocks | 3 ~ 5 |
| Normal working                                  | 2 ~ 4 |
| Working with vibrations and/or shocks           | 1 ~ 3 |

### **Splined shaft**

The geometrical moment of inertia of the section and the shaft section modules are given in table 3.

**Table 3 Geometrical moment of inertia of the section and shaft section modulus**

| PART NUMBER  | Geometrical moment of inertia (mm <sup>4</sup> ) |              | Section modulus (mm <sup>3</sup> ) |              |
|--------------|--------------------------------------------------|--------------|------------------------------------|--------------|
|              | Compact shaft                                    | Hollow shaft | Compact shaft                      | Hollow shaft |
| LSAG(T) 5 R  | 29                                               | 29           | 12                                 | 12           |
| LSAG(T) 6 R  | 61                                               | 61           | 21                                 | 21           |
| LSAG(T) 8 R  | 190                                              | 190          | 49                                 | 49           |
| LSAG(T) 10 R | 470                                              | 460          | 95                                 | 94           |
| LSAG(T) 12 R | 990                                              | 960          | 170                                | 160          |

### **Lubrication and dust protection**

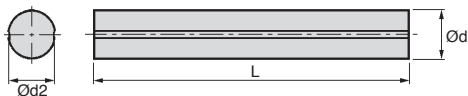
LSAG splined slides are supplied lubricated with a Lithium soap based grease containing extreme pressure additives.

LSAG series precision linear rotary ball splines are protected from dust by special rubber seals. In a particularly polluted atmosphere, for example where sand or swarf can fall on to the shaft, we recommend you install protection for the whole shaft.

# Precision linear rotary ball spline

**LSAG IKO** Dynamic loads from 558 N to 1862 N

- Shafts and cylindrical slides have separate part numbers, remember to order both
- 2 rows of balls which prevent the cylinder from rotating
- Material: Steel

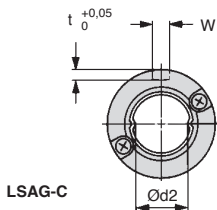


## DISCOUNTS

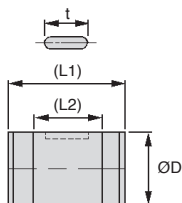
| Qty   | 1+   | 4+  | 8+         |
|-------|------|-----|------------|
| Disc. | List | -6% | On request |

| Part number | Ød          | Ød2 | L        | Max. length (mm) | Type of cylinder | Weight / 100mm (g) | Stock* | Price each 1 to 3 |
|-------------|-------------|-----|----------|------------------|------------------|--------------------|--------|-------------------|
| LSAG5-100   | 5 0/+0,012  | 4,2 | 100      | 200              | -                | 14,9               | ✓      | 59,23 €           |
| LSAG5-150   | 5 0/+0,012  | 4,2 | 150      | 200              | -                | 14,9               | -      | 88,50 €           |
| LSAG5-200   | 5 0/+0,012  | 4,2 | 200      | 200              | -                | 14,9               | -      | 120,80 €          |
| LSAG5-C     | 5 0/+0,012  | -   | Cylinder | -                | Standard         | -                  | ✓      | 85,61 €           |
| LSAG5F-C    | 5 0/+0,012  | -   | Cylinder | -                | Flanged          | -                  | ✓      | 103,24 €          |
| LSAG6-150   | 6 0/+0,012  | 5,2 | 150      | 300              | -                | 19,0               | ✓      | 82,58 €           |
| LSAG6-200   | 6 0/+0,012  | 5,2 | 200      | 300              | -                | 19,0               | -      | 115,06 €          |
| LSAG6-250   | 6 0/+0,012  | 5,2 | 250      | 300              | -                | 19,0               | -      | 146,19 €          |
| LSAG6-300   | 6 0/+0,012  | 5,2 | 300      | 300              | -                | 19,0               | -      | 176,83 €          |
| LSAG6-C     | 6 0/+0,012  | -   | Cylinder | -                | Standard         | -                  | ✓      | 88,50 €           |
| LSAG6F-C    | 6 0/+0,012  | -   | Cylinder | -                | Flanged          | -                  | -      | 106,26 €          |
| LSAG8-150   | 8 0/+0,015  | 7,0 | 150      | 500              | -                | 39,0               | ✓      | 70,70 €           |
| LSAG8-200   | 8 0/+0,015  | 7,0 | 200      | 500              | -                | 39,0               | -      | 88,50 €           |
| LSAG8-250   | 8 0/+0,015  | 7,0 | 250      | 500              | -                | 39,0               | -      | 112,03 €          |
| LSAG8-300   | 8 0/+0,015  | 7,0 | 300      | 500              | -                | 39,0               | -      | 134,71 €          |
| LSAG8-400   | 8 0/+0,015  | 7,0 | 400      | 500              | -                | 39,0               | -      | 182,75 €          |
| LSAG8-500   | 8 0/+0,015  | 7,0 | 500      | 500              | -                | 39,0               | -      | 235,87 €          |
| LSAG8-C     | 8 0/+0,015  | -   | Cylinder | -                | Standard         | -                  | ✓      | 91,36 €           |
| LSAG8F-C    | 8 0/+0,015  | -   | Cylinder | -                | Flanged          | -                  | -      | 109,15 €          |
| LSAG10-200  | 10 0/+0,015 | 8,9 | 200      | 600              | -                | 60,5               | -      | 59,23 €           |
| LSAG10-300  | 10 0/+0,015 | 8,9 | 300      | 600              | -                | 60,5               | -      | 94,41 €           |
| LSAG10-400  | 10 0/+0,015 | 8,9 | 400      | 600              | -                | 60,5               | -      | 129,60 €          |
| LSAG10-500  | 10 0/+0,015 | 8,9 | 500      | 600              | -                | 60,5               | -      | 165,15 €          |
| LSAG10-600  | 10 0/+0,015 | 8,9 | 600      | 600              | -                | 60,5               | -      | 200,68 €          |
| LSAG10-C    | 10 0/+0,015 | -   | Cylinder | -                | Standard         | -                  | -      | 97,47 €           |
| LSAG10F-C   | 10 0/+0,015 | -   | Cylinder | -                | Flanged          | -                  | -      | 115,71 €          |

\*Depending on availability - Dimensions in mm

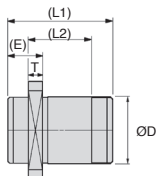
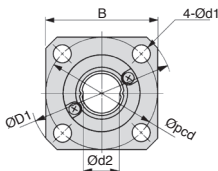


LSAG-C



| Part number | Weight (g) | ØD                     | L1 | L2   | W   | I    | t   | Basic dynamic load C (N) | Basic static load Co (N) | Dynamic torque T (Nm) | Static torque To (Nm) | Static moment Tx (Nm)(1) |
|-------------|------------|------------------------|----|------|-----|------|-----|--------------------------|--------------------------|-----------------------|-----------------------|--------------------------|
| LSAG5-C     | 4,8        | 10 <sup>0/-0,09</sup>  | 18 | 9,4  | 2,0 | 6,0  | 1,2 | 588                      | 637                      | 1,76                  | 1,96                  | 1,08 7,84                |
| LSAG6-C     | 8,9        | 12 <sup>0/-0,011</sup> | 21 | 12,4 | 2,0 | 8,0  | 1,2 | 715                      | 852                      | 2,45                  | 3,04                  | 1,76 11,76               |
| LSAG8-C     | 15,5       | 15 <sup>0/-0,013</sup> | 35 | 14,6 | 2,5 | 8,5  | 1,5 | 1176                     | 1372                     | 5,49                  | 6,17                  | 3,23 21,56               |
| LSAG10-C    | 31,5       | 19 <sup>0/-0,013</sup> | 30 | 18,2 | 3,0 | 11,0 | 1,8 | 1862                     | 2156                     | 10,78                 | 12,74                 | 6,96 41,16               |

LSAGF-C



| Part number | Weight (g) | ØD                     | L1 | L2   | ØD1 | B  | E  | T   | Øpcd | Ød1 |
|-------------|------------|------------------------|----|------|-----|----|----|-----|------|-----|
| LSAG5F-C    | 8,9        | 10 <sup>0/-0,09</sup>  | 18 | 9,4  | 23  | 18 | 7  | 2,7 | 17   | 3,4 |
| LSAG6F-C    | 13,9       | 12 <sup>0/-0,011</sup> | 21 | 12,4 | 25  | 20 | 7  | 2,7 | 19   | 3,4 |
| LSAG8F-C    | 23,5       | 15 <sup>0/-0,013</sup> | 25 | 14,6 | 28  | 22 | 9  | 3,8 | 22   | 3,4 |
| LSAG10F-C   | 45,0       | 19 <sup>0/-0,013</sup> | 30 | 18,2 | 36  | 28 | 10 | 4,1 | 28   | 4,5 |

| Part number | Basic dynamic load C (N) | Basic static load Co (N) | Static torque T (Nm) | Static torque To (Nm) | Static moment Tx (Nm)(1) |
|-------------|--------------------------|--------------------------|----------------------|-----------------------|--------------------------|
| LSAG5F-C    | 588                      | 637                      | 1,76                 | 1,96                  | 1,08 7,84                |
| LSAG6F-C    | 715                      | 852                      | 2,45                 | 3,04                  | 1,76 11,76               |
| LSAG8F-C    | 1176                     | 1372                     | 5,49                 | 6,17                  | 3,23 21,56               |
| LSAG10F-C   | 1862                     | 2156                     | 10,78                | 12,74                 | 6,96 41,16               |

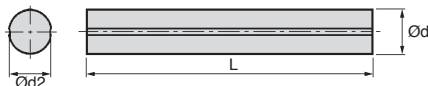
(1) Tx: The values in the second column are for two cylinders in close contact

# Precision linear rotary ball spline

## LSAG IKO

## Dynamic loads from 2156 N to 15386 N

- Shafts and cylindrical slides have separate part numbers, remember to order both
- 2 rows of balls which prevent the cylinder from rotating
- Material: Steel

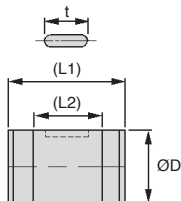
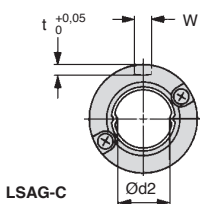


### DISCOUNTS

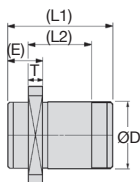
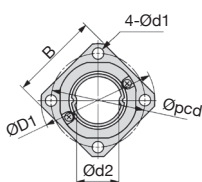
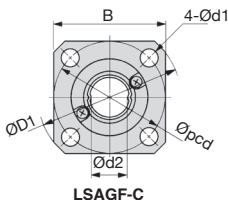
| Qty   | 1+   | 4+  | 8+         |
|-------|------|-----|------------|
| Disc. | List | -6% | On request |

| Part number | Ød          | Ød2  | L        | Max. length (mm) | Type of cylinder | Weight / 100mm (g) | Stock* | Price each 1 to 3 |
|-------------|-------------|------|----------|------------------|------------------|--------------------|--------|-------------------|
| LSAG12-200  | 12,0 Ø0,018 | 10,9 | 200      | 800              | -                | 87,5               | ✓      | 59,23 €           |
| LSAG12-300  | 12,0 Ø0,018 | 10,9 | 300      | 800              | -                | 87,5               | -      | 91,36 €           |
| LSAG12-400  | 12,0 Ø0,018 | 10,9 | 400      | 800              | -                | 87,5               | ✓      | 129,96 €          |
| LSAG12-800  | 12,0 Ø0,018 | 10,9 | 800      | 800              | -                | 87,5               | -      | 288,68 €          |
| LSAG12-C    | 12,0 Ø0,018 | -    | Cylinder | -                | Standard         | -                  | ✓      | 106,26 €          |
| LSAG12F-C   | 12,0 Ø0,018 | -    | Cylinder | -                | Flanged          | -                  | ✓      | 121,49 €          |
| LSAG15-200  | 13,6 Ø0,018 | 11,6 | 200      | 1000             | -                | 111,0              | ✓      | 59,23 €           |
| LSAG15-300  | 13,6 Ø0,018 | 11,6 | 300      | 1000             | -                | 111,0              | -      | 94,41 €           |
| LSAG15-400  | 13,6 Ø0,018 | 11,6 | 400      | 1000             | -                | 111,0              | -      | 135,51 €          |
| LSAG15-C    | 13,6 Ø0,018 | -    | Cylinder | -                | Standard         | -                  | -      | 118,09 €          |
| LSAG15F-C   | 13,6 Ø0,018 | -    | Cylinder | -                | Flanged          | -                  | ✓      | 139,77 €          |
| LSAG20-300  | 18,2 Ø0,021 | 15,7 | 300      | 1000             | -                | 202,0              | ✓      | 88,50 €           |
| LSAG20-400  | 18,2 Ø0,021 | 15,7 | 400      | 1000             | -                | 202,0              | ✓      | 123,85 €          |
| LSAG20-500  | 18,2 Ø0,021 | 15,7 | 500      | 1000             | -                | 202,0              | -      | 165,15 €          |
| LSAG20-600  | 18,2 Ø0,021 | 15,7 | 600      | 1000             | -                | 202,0              | -      | 206,28 €          |
| LSAG20-1000 | 18,2 Ø0,021 | 15,7 | 1000     | 1000             | -                | 202,0              | -      | 394,78 €          |
| LSAG20-C    | 18,2 Ø0,021 | -    | Cylinder | -                | Standard         | -                  | ✓      | 135,51 €          |
| LSAG20F-C   | 18,2 Ø0,021 | -    | Cylinder | -                | Flanged          | -                  | ✓      | 176,32 €          |
| LSAG25-300  | 22,6 Ø0,021 | 19,4 | 300      | 1200             | -                | 310,0              | -      | 100,15 €          |
| LSAG25-400  | 22,6 Ø0,021 | 19,4 | 400      | 1200             | -                | 310,0              | -      | 117,95 €          |
| LSAG25-500  | 22,6 Ø0,021 | 19,4 | 500      | 1200             | -                | 310,0              | -      | 194,60 €          |
| LSAG25-600  | 22,6 Ø0,021 | 19,4 | 600      | 1200             | -                | 310,0              | -      | 218,10 €          |
| LSAG25-800  | 22,6 Ø0,021 | 19,4 | 800      | 1200             | -                | 310,0              | -      | 280,03 €          |
| LSAG25-1100 | 22,6 Ø0,021 | 19,4 | 1100     | 1200             | -                | 310,0              | -      | 470,26 €          |
| LSAG25-1200 | 22,6 Ø0,021 | 19,4 | 1200     | 1200             | -                | 310,0              | -      | 533,18 €          |
| LSAG25-C    | 22,6 Ø0,021 | -    | Cylinder | -                | Standard         | -                  | -      | 156,19 €          |
| LSAG25F-C   | 22,6 Ø0,021 | -    | Cylinder | -                | Flanged          | -                  | -      | 206,28 €          |
| LSAG30-400  | 27,2 Ø0,021 | 23,5 | 400      | 1200             | -                | 450,0              | -      | 176,83 €          |
| LSAG30-500  | 27,2 Ø0,021 | 23,5 | 500      | 1200             | -                | 450,0              | -      | 212,20 €          |
| LSAG30-600  | 27,2 Ø0,021 | 23,5 | 600      | 1200             | -                | 450,0              | -      | 253,47 €          |
| LSAG30-700  | 27,2 Ø0,021 | 23,5 | 700      | 1200             | -                | 450,0              | -      | 300,53 €          |
| LSAG30-800  | 27,2 Ø0,021 | 23,5 | 800      | 1200             | -                | 450,0              | -      | 347,22 €          |
| LSAG30-1100 | 27,2 Ø0,021 | 23,5 | 1100     | 1200             | -                | 450,0              | -      | 518,44 €          |
| LSAG30-1200 | 27,2 Ø0,021 | 23,5 | 1200     | 1200             | -                | 450,0              | -      | 577,34 €          |
| LSAG30-C    | 27,2 Ø0,021 | -    | Cylinder | -                | Standard         | -                  | -      | 176,83 €          |
| LSAG30F-C   | 27,2 Ø0,021 | -    | Cylinder | -                | Flanged          | -                  | -      | 242,81 €          |

\*Depending on availability - Dimensions in mm



| Part number | Weight (g) | ØD          | L1 | L2   | W   | I    | t   | Basic dynamic load C (N) | Basic static load Co (N) | Dynamic torque T (Nm) | Static torque To (Nm) | Static moment Tx (Nm) <sup>(1)</sup> |
|-------------|------------|-------------|----|------|-----|------|-----|--------------------------|--------------------------|-----------------------|-----------------------|--------------------------------------|
| LSAG5-C     | 4,8        | 10 0/-0,09  | 18 | 9,4  | 2,0 | 6,0  | 1,2 | 588                      | 637                      | 1,76                  | 1,96                  | 1,08 7,84                            |
| LSAG6-C     | 8,9        | 12 0/-0,011 | 21 | 12,4 | 2,0 | 8,0  | 1,2 | 715                      | 852                      | 2,45                  | 3,04                  | 1,76 11,76                           |
| LSAG8-C     | 15,5       | 15 0/-0,013 | 35 | 14,6 | 2,5 | 8,5  | 1,5 | 1176                     | 1372                     | 5,49                  | 6,17                  | 3,23 21,56                           |
| LSAG10-C    | 31,5       | 19 0/-0,013 | 30 | 18,2 | 3,0 | 11,0 | 1,8 | 1862                     | 2156                     | 10,78                 | 12,74                 | 6,96 41,16                           |



| Part number | Weight (g) | ØD          | L1 | L2   | ØD1 | B  | E  | T   | Øpcd | Ød1 |
|-------------|------------|-------------|----|------|-----|----|----|-----|------|-----|
| LSAG12F-C   | 59         | 21 0/-0,013 | 35 | 23,0 | 38  | 30 | 10 | 4,0 | 30   | 4,5 |
| LSAG15F-C   | 77         | 23 0/-0,013 | 40 | 27,0 | 40  | 31 | 11 | 4,5 | 32   | 4,5 |
| LSAG20F-C   | 150        | 30 0/-0,016 | 50 | 33,0 | 46  | 35 | 14 | 5,5 | 38   | 4,5 |
| LSAG25F-C   | 255        | 37 0/-0,016 | 60 | 39,2 | 57  | 43 | 17 | 6,6 | 47   | 5,5 |
| LSAG30F-C   | 476        | 45 0/-0,016 | 70 | 43,0 | 65  | 50 | 21 | 7,5 | 54   | 6,6 |

| Part number | Basic dynamic load C (N) | Basic static load Co (N) | Dynamic torque T (Nm) | Static torque To (Nm) | Static moment Tx (Nm) <sup>(1)</sup> |
|-------------|--------------------------|--------------------------|-----------------------|-----------------------|--------------------------------------|
| LSAG12F-C   | 2156                     | 2646                     | 14,7                  | 18,6                  | 10,78 58,8                           |
| LSAG15F-C   | 4214                     | 6076                     | 31,4                  | 45,0                  | 27,44 152,0                          |
| LSAG20F-C   | 6566                     | 9016                     | 65,7                  | 90,0                  | 49,00 287,0                          |
| LSAG25F-C   | 11172                    | 14308                    | 139,0                 | 178,0                 | 93,00 550,0                          |
| LSAG30F-C   | 15386                    | 19404                    | 231,0                 | 291,0                 | 147,00 873,0                         |

(1) Tx: The values in the second column are for two cylinders in close contact



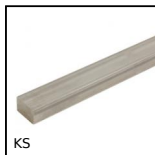
## Our other products



SCE  
U-shaped cable  
clamp, Steel



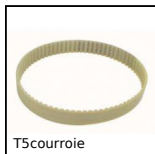
RT25  
Self-centering flanged  
locking assembly,  
Medium/high torque



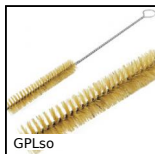
KS  
Keysteel, Stainless  
steel - Keystock



CHMR50  
Worm and wheel gear  
reducer, up to 107  
Nm



T5courroie  
T type timing belt, T5  
Steel cored  
polyurethane



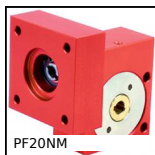
GPLso  
Brush, silk



FBL6000\_K13  
Brush strip per meter  
PP fibres Ø0.2, Black  
striated polypropylene



ACL-PLAngle  
Joining plate for  
aluminium profile,  
Angle connection



PF20NM  
Worm and wheel gear  
reducer, up to 5 Nm



PGM52-M4  
Push/Pull handle,  
Aluminium



RTE  
Rotex®, jaw coupling,  
cast iron



PSG1  
Spur gear - precision  
range, Pre-hardened  
Steel 35NCD6

## Complementary products



LSAG  
Precision linear rotary  
ball spline, Rail - from  
514 N to 15386 N