U.S. PATENTED

IKO

# C-Sleeve Linear Ball Spline

# MAG


*Maintenance free for 20,000 km or 5 years*

CAT-57147

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IKO Website
http://www.ikont.co.jp/eg/

Printed in Japan 

IKO

# C-Sleeve Linear Ball Spline MAG has launched.

IKO strives to be a leader in Technology. Our primary source for development is listening to the customer wants and needs. Our performance and work separate us from others by utilizing our creative thinking and original technologies. IKO is constantly developing and implementing new and advanced technologies in pursuit of excellent motion performance and service for your cost savings.

**Maintenance free for 20,000km or 5 years**

IKO C-Sleeve

## The final answer to your lube requirement.

# Releasing maintenance free type for IKO C-Sleeve Linear Ball Spline well-known for its original compact structure

## IKO Maintenance Free Series C-Sleeve Linear Ball Spline

# MAG

Maintenance free type has been released for IKO C-Sleeve Linear Ball Spline MAG having an overwhelmingly high market share in the field of semiconductor and liquid crystal manufacturing systems that are forced to be operated in severe operating conditions of high acceleration/deceleration motion.


**U.S. PATENT**

| | |
|---|---|
| No. 4,799,803 | No. 6,176,617 |
| No. 4,505,522 | No. 6,082,899 |
| No. 5,490,729 | No. 5,967,667 |
| No. 4,505,522 | No. 5,464,288 |
| No. 4,390,215 | No. 5,356,223 |
| No. 6,190,046 | |



## *Maintenance free for 20,000 km or 5 years!!*

### A large amount of lubricant is incorporated in the compact external cylinder

Incorporating the lubricating component C-Sleeve in the steel ball circulating path of the external cylinder has achieved maintenance free operation for 5 years or 20,000 km. This lubrication effect lasts for a long time and can reduce the cost of the whole system as a result of the reduction in the lubrication mechanism of the system and in the running cost as the result of reduction in man-hours for lubricational maintenance.

### High rigidity and high accuracy have been achieved in spite of the compact size

A simple two-row four-point contact structure using large-diameter steel balls has achieved compactness, high rigidity, high accuracy and low cost.

### Ultimate interchangeable system Interchangeable specification

The product conforms to the interchangeable specification in which the external cylinder and the spline shaft can be separately handled. This system allow us to meet customer requirements of short delivery term and selecting what is needed in desired quantity.

***The existing type can be changed into the maintenance free type by replacing only the external cylinder.***

## The following requirements can also be satisfied.

### No need of change in your structure

**C-Sleeve Linear Ball Spline MAG can attain maintenance free operation without changing your design.**

The external dimensions and stroke lenght of C-Sleeve Linear Ball Spline MAG that are designed in compact form and are not changed from IKO Linear Ball Spline LSAG. By replacing existing IKO Linear Ball Spline LSAG with C-Sleeve Linear Ball Spline MAG, you can attain maintenance free operation without changing the structure on your system.

### To be operated in an environment in which ordinary lubricant cannot be used

**C-Sleeve Linear Ball Spline MAG can take different lubricants for different requirements.**

The lubricant to be impregnated in the C-Sleeve can be freely selected. This is a good feature for applications such as food machines where the common lubricant cannot be used. Contact IKO if necessary.

### Product considering the global environment

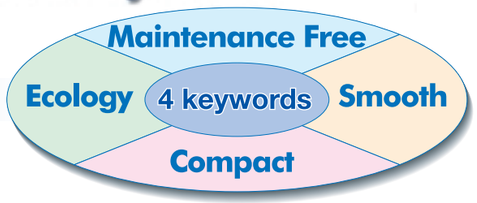
**C-Sleeve Linear Ball Spline MAG contributes to the ecology around the structure.**

While the product is in operation, it consumes only a small amount of oil required for lubrication, so that the product meets the ecological requirements controlling the total lubricant consumption.

# Features of C-Sleeve Linear Ball Spline MAG 1

## *Incorporating a large amount of lubricant in the compact spline external cylinder.*

**Incorporating the C-Sleeve has achieved the following.**




## Maintenance free

The IKO original lubricating component, C-Sleeve, is incorporated in the external cylinder and the end plate. Its effectiveness had been proven by endurance tests. This can reduce the cost of the whole system as a result of reduction in the lubrication mechanism in the system and also reduce the running cost as a result of reduction in the man-hours for lubricational maintenance.

In addition, grease is prepacked in the external cylinder as standard, so that maintenance free operation for even longer time is achieved.

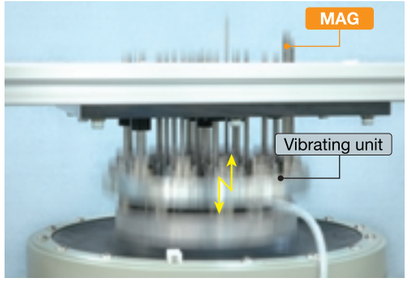
※The above is described on the assumption of the general service life of the system. Lubricant may be required depending on the operating conditions.

### For Vertical axis

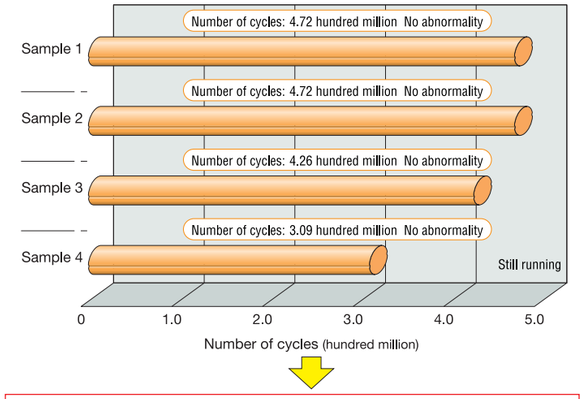
Endurance test supposing a chip mounter

Test conditions

| | | |
|---|---|---|
| Model No. | MAG8 | |
| Lubricating condition | With C-Sleeve<br>Without grease prepacked | |
| Test method | Vibration test machine | |
| Operating conditions | Mounting attitude | Vertical shaft |
| | Maximum speed | 860 mm/s |
| | Acceleration | 10 G |
| | Cycle | 18.2 Hz |
| | Stroke length | 15 mm |




Test result




At vertical shaft and super high tact operation, the product can endure at the total number of reciprocating motions of 2 hundred million without any trouble only with the oil prepacked in the C-Sleeve.
Maintenance free operation equivalent to the period of 10 years has been achieved in the test conditions supposing the operating conditions for general chip mounters.

In these severe operating conditions, maintenance free operation has been achieved by the total number of reciprocating motions of more than **2 hundred million cycles.**

### For Horizontal axis

For general machine use

Supported by our tests in various different conditions, maintenance free operation for the running distance of **20,000 km or more** has been verified in the operating conditions of high speed and long stroke.





## Ecology

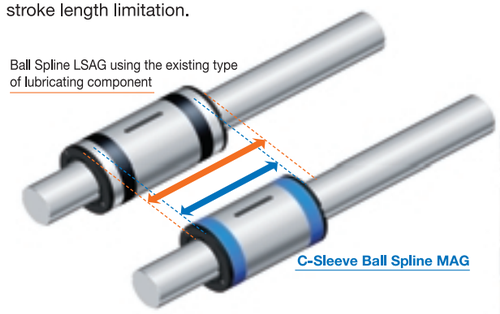
Regarding the prepacked lubricant in the C-Sleeve, only the amount of lubricant required to maintain the lubrication performance of the rolling guide is supplied, so that a small amount of lubricant is consumed even for a long-time running while keeping the lubrication performance.

## Smooth

C-Sleeve Linear Ball Spline MAG does not generate sliding friction unlike the lubricating component that is mounted on the outer side of the external cylinder in contact with the spline shaft.
The product provides good follow-up performance to driving force and contributes to energy saving as a result of the improvement of accuracy and reduction of wear loss.

## Compact

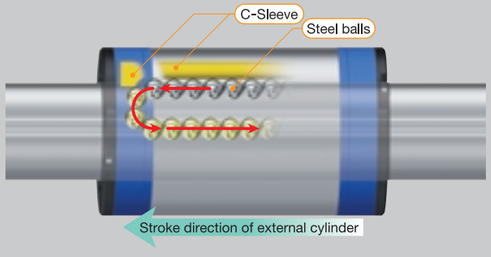
C-Sleeve Linear Ball Spline MAG incorporates the lubricating component, C-Sleeve, in the external cylinder, so that the length of external cylinder stays unchanged unlike a type in which the lubricating component is mounted externally. This makes it is possible to replace IKO LSAG by MAG without any space and stroke length limitation.




## Lubricant supply mechanism of C-sleeve system

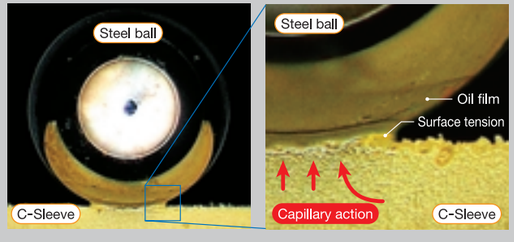
### The circulation of the steel balls distributes lubricant.

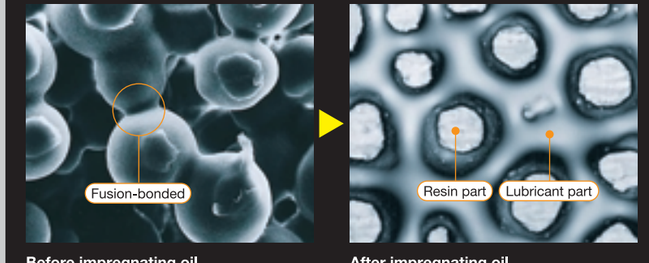
Lubricant is supplied directly to the steel balls. As the steel balls circulate, the lubricant is distributed to the loading area along the spline shaft. This results in adequate lubrication being properly maintained in the loading area for a long time.




### Lubricant is deposited directly to the surface of the steel balls.

The surface of C-Sleeve is always covered with the lubricant. Lubricant is continuously supplied to the surface of steel balls by surface tension in the contact of C-Sleeve surface and steel balls. New oil permeates automatically from the core of C-Sleeve to the internal surface that comes in contact with steel balls .




**Before impregnating oil**
Resin particles are strongly fusion bonded.

**After impregnating oil**
*(Capillary lubrication structure)*
Lubricant is retained in cavities amongst resin particles.

Capillary system **IKO** has developed is a new type lubrication. It is a porous resin sleeve or plate with steel backing formed by sintering fine resin powder and impregnating a large amount of lubrication oil in its open pores. Capillary system always supplies proper amount of lubrication oil to the cylindrical rollers and lubrication condition of the raceway can be kept well for long period of time.

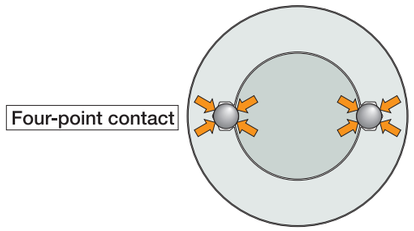
1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

# Features of C-Sleeve Linear Ball Spline MAG 2

## *In spite of its compact design, high rigidity and high accuracy have been achieved.*

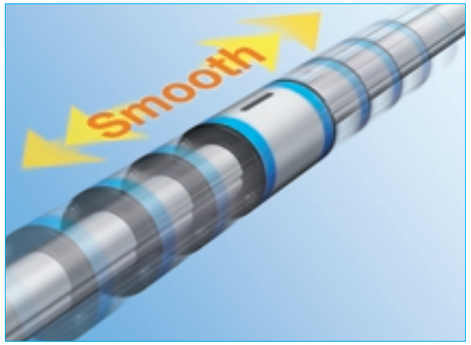
### High rigidity and compactness

Large-diameter steel balls are arranged in two rows and are in four-point contact with the raceways. With this structure, this is a high-rigidity and compact-sized Ball Spline. C-Sleeve Linear Ball Spline MAG adopts a unique steel ball retaining method requiring no ball retainer, and has a small external diameter of external cylinder for the shaft diameter.



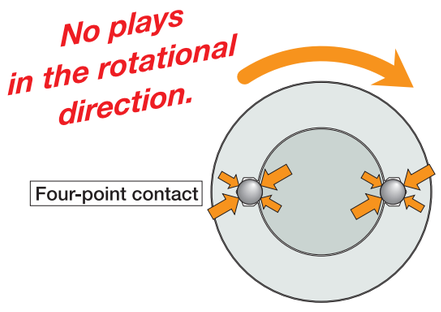

### Low-friction smooth motion

The steel ball re-circulating routes are optimally designed through thorough analysis. High-speed operation can thus be achieved with low friction and smooth linear motion.




### Accurate positioning is possible

By applying a proper preload, the clearance in the rotational direction can be eliminated ensuring accurate positioning.




### Easy handling

This product has a safe structure that prevents steel balls from falling off from the external cylinder even if the external cylinder is removed from the spline shaft. It can also be easily mounted to machines or systems.

### High accuracy and a small number of potential errors

The simple two-row four-point contact structure offers a small number of potential errors and enhances the dimensional accuracy between rows to the highest level. In Ball Spline, the external cylinder and the spline shaft are put under strict dimensional control. Thus, the interchangeable specification has been achieved at a high level of interchangeability.





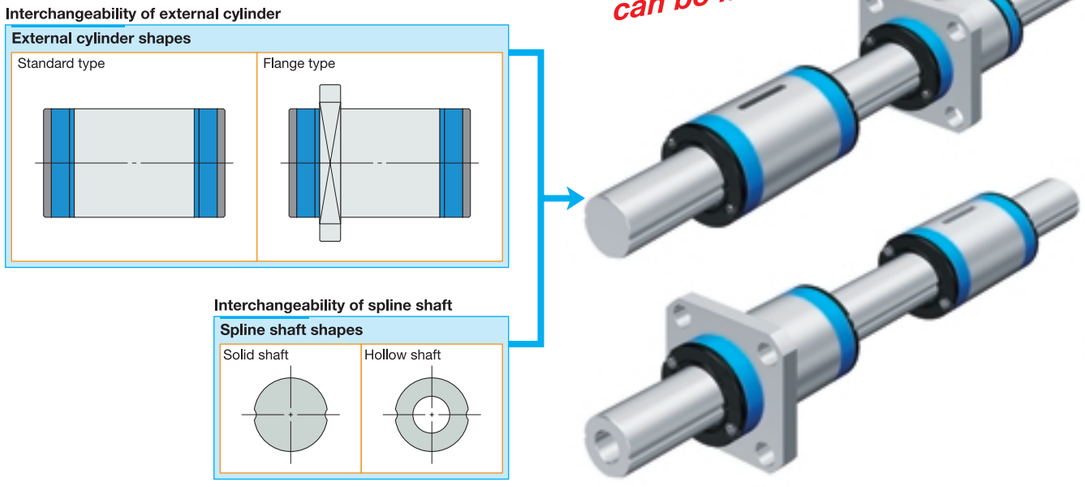
# Features of C-Sleeve Linear Ball Spline MAG 3

## *Ultimate interchangeable system, interchangeable specification.*

1. The external cylinder and the spline shaft can be ordered separately and a single unit can be delivered.
2. The product type, accuracy, and preload type can be combined freely. This is a high-level interchangeable system product.
3. This is the product customer can order for the least quantity when needed, and its delivery time is short.


### Interchangeability of external cylinder

Two types of external cylinder shapes, standard type and flange type, are available.
Both types can be mounted on one spline shaft.




### Interchangeability in accuracy classes

Two classes of accuracy, common class and high class are prepared, which can be used for the applications requiring high running accuracy.

### Interchangeability in preload classes

Highly accurate dimensional control owing to a simple structure has made it possible to realize the interchangeability in preloaded external cylinders. The product can be used for the applications requiring higher rigidity.

1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

# Identification Number

The specification of C-Sleeve Linear Ball Spline MAG is indicated by the identification number, consisting of a model code, a size, a part code, a preload symbol, a classification symbol, an interchangeable code, and any supplemental codes.

**Interchangeable specification**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| External cylinder only | MAG | | 10 | C1 | | $T_1$ | H | S2 | /N |
| Spline shaft only (1) | LSAG | T | 10 | | R200 | | H | S2 | |
| Assembled set | MAG | T | 10 | C1 | R200 | $T_1$ | H | S2 | /N |

**Non-interchangeable specification**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Assembled set | MAG | T | 10 | C1 | R200 | $T_1$ | H | | /N |

1 Series
2 Shape of spline shaft — Model code
3 Size of rolling guide — Size
4 Number of external cylinders
5 Length of spline shaft — Part code
6 Preload — Preload symbol
7 Accuracy class — Classification symbol
8 Interchangeable specification — Interchangeable code
9 Optional specification — Supplemental code

Note (1) : In case ordering spline shaft only, model code should be changed as LSAG (Solid shaft) or LSAGT (Hollow shaft).





## 1 Series

| | |
|---|---|
| C-Sleeve Linear Ball Spline MAG Standard type | : MAG |
| C-Sleeve Linear Ball Spline MAG Flange type | : MAGF |

For applicable models and sizes, see Table 1.
For the model code of a spline shaft of C-Sleeve Linear Way MAG, indicate LSAG (T) regardless the external cylinder model to be combined.

## 2 Shape of spline shaft

| | |
|---|---|
| Solid shaft | : No symbol |
| Hollow shaft | : T |

## 3 Size of rolling guide

5, 6, 8, 10, 12

For applicable models and sizes, see Table 1.

***Table 1 Models and sizes of C-Sleeve Linear Ball Spline MAG***

| Size \ Model | Standard model MAG | Flanged model MAGF |
|---|---|---|
| 5 | ☆ | ☆ |
| 6 | ☆ | ☆ |
| 8 | ☆ | ☆ |
| 10 | ☆ | ☆ |
| 12 | ☆ | ☆ |

Remark : ☆ marks are also applicable to interchangeable specification.

## 4 Number of external cylinder

| | |
|---|---|
| Assembled set | : C○ |
| External cylinder only | : C1 |

For an assembled set, indicate the number of external cylinder assembled on one spline shaft. For an interchangeable external cylinder only, "C1" is indicated.

## 5 Length of spline shaft

| | |
|---|---|
| Assembled set | : R○ |
| Spline shaft only | : R○ |

Indicate the length of spline shaft in mm. For standard and maximum length, see dimension table from page 17.

## 6 Preload

| | |
|---|---|
| Standard | : No symbol |
| Light preload | : $T_1$ |

Specify this item for an assembled set or an interchangeable external cylinder. Applicable preload and size are shown in Table 3. For detail of preload amount, see Table 6 on page 13.

## 7 Accuracy class

| | |
|---|---|
| Ordinary | : No symbol |
| High class | : H |
| Precision class | : P |

The precision class (P) applies to non-interchangeable specification only.
For interchangeable specification products, assemble external cylinder and a spline shaft of the same accuracy class. For details of accuracy classes, see page 11 to 12.

## 8 Interchangeable specification

Interchangeable code : S2

External cylinder and spline shaft can be supplied separately by interchangeable code S2.

## 9 Optional specification

/N, /S

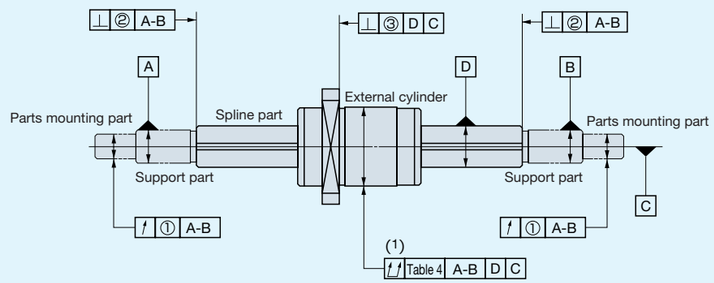
For applicable optional specifications, see Table 7 on page 13.

1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

# Accuracy

The accuracy of IKO C-Sleeve Linear Ball Spline MAG is shown in Table 2 and the accuracy of spline shaft is shown in Table 3 and 4.

***Table 2 Accuracy of C-Sleeve Linear Ball Spline MAG***




unit : μm

| Model number | Relative to axial line of supporting part of spline shaft | | | | | | ③Perpendicularity of mounting surface of flange relative to axial line of spline shaft(3) | | |
|---|---|---|---|---|---|---|---|---|---|
| | ①Radial runout of outer periphery of parts mounting part(2) | | | ②Perpendicularity of spline part end face(2) | | | | | |
| | Ordinary (No symbol) | High (H) | Precision(4) (P) | Ordinary (No symbol) | High (H) | Precision(4) (P) | Ordinary (No symbol) | High (H) | Precision(4) (P) |
| MAG 5 | 33 | 14 | 8 | 22 | 9 | 6 | 27 | 11 | 8 |
| MAG 6 | 33 | 14 | 8 | 22 | 9 | 6 | 27 | 11 | 8 |
| MAG 8 | 33 | 14 | 8 | 22 | 9 | 6 | 27 | 11 | 8 |
| MAG 10 | 41 | 17 | 10 | 22 | 9 | 6 | 33 | 13 | 9 |
| MAG 12 | 41 | 17 | 10 | 22 | 9 | 6 | 33 | 13 | 9 |

Note(1) : Applicable when measured by using external cylinder for measurement.
(2) : Applicable when the shaft ends are finished.
(3) : Applicable to the flange type.
(4) : Applicable to the non-interchangeable specification.
Remark : The table shows representative model numbers only but is applicable to all other models in the same size.

***Table 3 Twist of grooves with respect to effective length of the spline part***

unit : μm

| Accuracy class | Ordinary (No symbol) | High (H) | Precision(1) (P) |
|---|---|---|---|
| Allowable value | 33 | 13 | 6 |

Note(1) : Applicable to non-interchangeable specification
Remarks : The values are applicable to any given length of 100 mm over the effective length of the spline part.

***Table 4 Total radial runout of axial line of spline shaft*** unit : μm

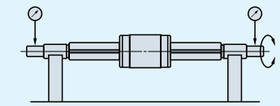
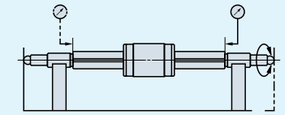
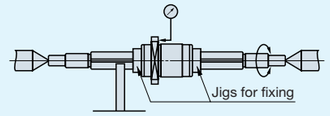
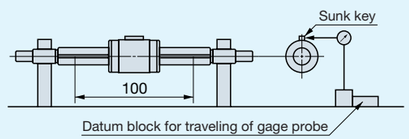
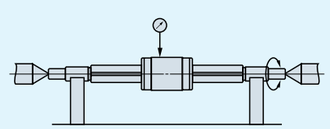
| Overall length of spline shaft mm | | MAG 5 MAG 6 MAG 8 | | | MAG 10 MAG 12 | | |
|---|---|---|---|---|---|---|---|
| over | incl. | Ordinary (No symbol) | High (H) | Precision(1) (P) | Ordinary (No symbol) | High (H) | Precision(1) (P) |
| — | 200 | 72 | 46 | 26 | 59 | 36 | 20 |
| 200 | 315 | 133 | 89 | 57 | 83 | 54 | 32 |
| 315 | 400 | 185 | 126 | 82 | 103 | 68 | 41 |
| 400 | 500 | 236 | 163 | 108 | 123 | 82 | 51 |
| 500 | 630 | — | — | — | 151 | 102 | 65 |
| 630 | 800 | — | — | — | 190 | 130 | 85 |

Note(1) : Applicable to non-interchangeable specification.
Remark : The table shows representative model numbers only but is applicable to all other models in the same size.





***Table 5 Measuring method of accuracy***

| Measuring item | Measuring method | Illustration of measuring method |
|---|---|---|
| (1) Radial runout of periphery of parts mounting part relative to axial line of supporting part of spline shaft. (See Table 2, ①) | While supporting the spline shaft at its supporting parts, place dial gage probes to the outer peripheral faces of the parts mounting part, and measure the runout from one rotation of the spline shaft. |  |
| (1) Perpendicularity of spline end face relative to axial line of supporting part of alpine shaft (See Table 2,②) | While supporting the spline shaft at its supporting parts an at one spline shaft end, place a dial gage probe to the spline end face and measure runout from one rotation of the spline shaft. |  |
| Perpendicularity of mounting surface of flange relative to axial line of spline shaft (See Table 2,③) | While supporting the spline shaft at both center holes and at the outer peripheral face of the spline shaft adjacent to the external cylinder, and while fixing the external cylinder to the spline shaft, place a dial gage probe to the mounting surface of the flange of the external cylinder and measure the perpendicularity from runout caused by one rotation of the spline shaft. |  |
| Twist of grooves with respect to effective length of the spline part (See Table 3) | Fix and support the spline shaft. Then apply a unidirectional torsion moment on the external cylinder (for measurement purpose), before placing a dial gage probe to the side face of the sunk key attached on the external cylinder. Measure runout when the external cylinder and the gage probe have traveled together 100mm on any effective part of the spline shaft. However, the gage probe should be applied as near as possible to the outer periphery of the external cylinder. |  |
| Total radial runout of axial line of spline shaft (See Table 4) | While supporting the spline shaft at its supporting parts or at both center holes, place a dial gage probe to the external peripheral face of the external cylinder (for measurement purpose), and measure runout at several positions in the axial direction while turning the spline shaft one rotation. Use the maximum value. |  |

Note(1) : This accuracy is applicable when special machining is done to the shaft ends.

1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

# Preload

The average amount of preload for C-Sleeve Linear Ball Spline MAG is shown in Table 6.

***Table 6 Preload***

| Item / Preload class | Symbol | Preload amount (N) | Application |
|---|---|---|---|
| Standard | (No symbol) | 0(1) | · Smooth and precise motion |
| Light preload | $T_1$ | 0.02 $C_0$ | · Minimum vibration<br>· Load is evenly balanced<br>· Smooth and precise motion |

Note(1) : Zero or minimal amount of preload
Remarks : $C_0$ means basic static load rating.

# Optional specification

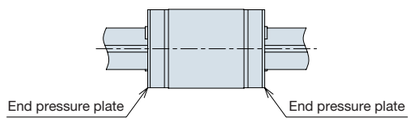
In C-Sleeve Linear Ball Spline MAG, optional specifications in Table 7 are available.
When a optional specification is required, add the applicable supplemental code to the end of the identification number. If a combination of special specifications (/N and /S) is necessary, arrange supplemental codes in alphabetical order.
(Ex : /NS)

***Table 7 Special specifications***

| Special specifications | Supplemental code | Applicable size |
|---|---|---|
| No end seal | /N(1) | 5~12 |
| Stainless steel spline shaft | /S(2) (3) | 5~12 |

Note(1) : Applicable to interchangeable external cylinder and assembled set
(2) : Applicable to non-interchangeable specification
(3) : Not applicable to the hollow shaft.

### No end seal /N




End seals at both ends of external cylinder are replaced by steel pressure plate. It does not contact to spline shaft in order to reduce frictional resistance. This is not effective for dust protection.

### Stainless steel spline shaft /S

The material of the solid spline shaft is changed to stainless steel. The load rating will be a value obtained by multiplying the load rating for the high carbon steel spline shaft by a factor of 0.8.





# Load Rating and Life

## Basic dynamic load rating *C*

The basic dynamic load rating is defined as a constant load both in direction and magnitude under which a group of identical C-Sleeve Linear Ball Spline MAG is individually operated and 90% of those in the group can travel $50\times10^3$m free from material damage due to rolling contact fatigue.

## Basic static load rating $C_0$

The basic static load rating is defined as a static load that gives a prescribed constant contact stress at the center of the contact area between rolling elements and raceways receiving the maximum load. Generally, the basic static load rating is used in combination with the static safety factor.

## Dynamic rated torque *T*

The dynamic rated torque is defined as a rotational torque (See Fig.2) constant both in magnitude and direction under which 90% of a group of the same C-Sleeve Linear Ball Spline MAG can travel $50\times10^3$m without suffering from material damage due to rolling contact fatigue when they are individually operated.

## Static rated torque and Static rated moment $T_0$, $T_X$, $T_Y$

The static rated torque and static rated moment are defined as a static torque or static moment which gives a prescribed constant contact stress at the center of the contact area between the steel ball and raceway receiving the maximum load when a torque or moment (See Fig.2) is loaded. They are the allowable limit torque or moment that permits normal rolling motion. Generally, they are used in combination with the static safety factor.

## Load direction and Load rating

Since the load ratings of C-Sleeve Linear Ball Spline MAG given in the dimension table are for upward/downward load, they must be corrected for the load direction for lateral load. The corrected basic dynamic load ratings and basic static load ratings are shown in Table 8.

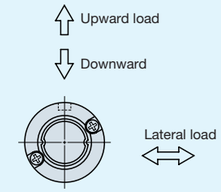



***Fig.1 Load direction***

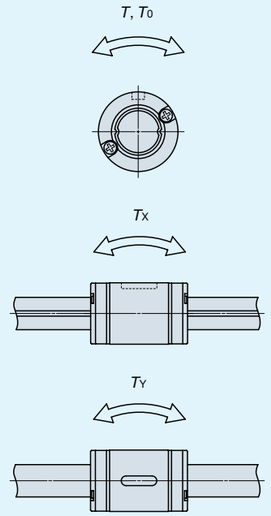



***Fig.2 Direction of dynamic rated torque, static rated torque and static rated moment***

***Table 8 Conversion factor by load direction***

| Load direction / Size | Upward and downward load | | Lateral load | |
|---|---|---|---|---|
| | Basic dynamic load rating | Basic static load rating | Basic dynamic load rating | Basic static load rating |
| 5~12 | *C* | $C_0$ | 1.47*C* | 1.73$C_0$ |

1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

# Load Rating and Life

## Life

The rating life of C-Sleeve Linear Ball Spline MAG is obtained from the following formula.

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

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

where, $L$ : Rating life, $10^3$m
$C$ : Basic dynamic load rating, N
$T$ : Dynamic rated torque, N・m
$P$ : Theoretically calculated radial load, N
$M$ : Theoretically calculated torque, N・m

If the stroke length and the number of strokes per minute are given, the life in hours can be obtained from the following formula.

$$L_h=\frac{10^6 L}{2Sn_1\times 60} \quad \cdots\cdots(3)$$

where, $L_h$ : Rating life in hours, hours
$S$ : Stroke length, mm
$n_1$ : Number of strokes per minute, cpm

## Static safety factor

When excessive large or heavy loads are applied on C-Sleeve Linear Ball Spline MAG, local permanent deformation will be made on balls or raceways, resulting in deterioration in running performance. In general, the allowable loads depend on the operating conditions and the requirements in the application, and the margin of safety is determined considering the above factors.

The static safety factor, fs, can be obtained from the following formula. General values of this factor are shown in Table 9.

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

$$f_s=\frac{T_0}{M_0} \quad \cdots\cdots(5)$$

where, $f_s$ : Static safety factor
$C_0$ : Basic static load rating, N
$P_0$ : Static radial load, N
$T_0$ : Static rated torque, N・m
$M_0$ : Static torque (maximum torque), N・m

***Table 9 Static safety factor***

| Operating conditions | $f_s$ |
|---|---|
| Operation with vibration and/or shocks | 5 ～ 7 |
| High operating performance is required. | 4 ～ 6 |
| Normal operation | 3 ～ 5 |

## Load factor

Due to vibration and/or shocks during machine operation, the actual load on each rolling guide becomes greater in many cases than the theoretically calculated load. The applied load is generally calculated by multiplying the theoretically calculated load by the load factor shown in Table 10.

***Table 10 Load factor***

| Operating conditions | $f_w$ |
|---|---|
| Smooth operation free from vibration and/or shock | 1 ～ 1.2 |
| Normal operation | 1.2 ～ 1.5 |
| Operation with vibration and/or shocks | 1.5 ～ 3 |

# Spline Shaft

Moment of inertia of sectional area and section modulus of the spline shaft are shown in Table 11.

***Table 11 Moment of inertia of sectional area and section modulus***

| Model number | Moment of inertia of sectional area mm⁴ | | Sectional modulus mm³ | |
|---|---|---|---|---|
| | Solid shaft | Hollow shaft | Solid shaft | Hollow shaft |
| MAG 5 | 29 | 29 | 12 | 12 |
| MAG 6 | 61 | 61 | 21 | 21 |
| MAG 8 | 190 | 190 | 49 | 49 |
| MAG10 | 470 | 460 | 95 | 94 |
| MAG12 | 990 | 960 | 170 | 160 |

Remark : The table shows representative model numbers only but is applicable to all models of the same size.

# Lubrication and Dust Protection

Quality lithium-soap base grease containing extreme pressure additive (ALVANIA EP grease 2 -Shell-) is pre-packed in IKO C-Sleeve Linear Ball Spline MAG. Additionally, C-Sleeve (Capilube sleeve) is placed in the recirculation path, thereby extending the re-lubrication (greasing) interval time and maintenance for a long period.

C-Sleeve Linear Ball Spline MAG does not have oil hole and grease nipple. If re-lubrication is necessary, please put grease on raceway part of spline shaft.

Product is dust protected by special rubber seals. However, if large amount of fine contaminants are present, or if large particles of foreign matter such as dust or chips may fall, it is recommended to provide protective dust covers such as bellows for the entire linear motion mechanism.





# Precautions for use

**❶Fit of external cylinder**

Generally, transition fit (J7) is applied between the external cylinder of C-Sleeve Linear Ball Spline MAG and the housing bore. When high accuracy and high rigidity are not required, clearance fit (H7) may also be applicable.

**❷Standard mounting example of C-Sleeve Ball Spline MAG**

Fig.3 shows standard mounting methods of external cylinder.

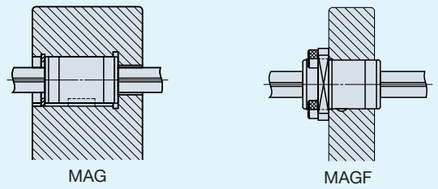



***Fig.3 Mounting example of external cylinder***

**❸Additional machining of spline shaft**

The high carbon steel spline shaft is hardened by induction hardening. When additional machining on the shaft end is needed, make sure that the maximum diameter of the shaft end machining part does not exceed the dimension $d_1$ shown in the dimension tables. Spline shafts with special end shapes can be prepared upon request. Consult IKO for further information.

**❹Multiple external cylinders in close contact**

When using multiple external cylinders in close distance to each other, actual load may be greater than the calculated load depending on the accuracy of the mounting surfaces and the reference mounting surfaces of the machine. It is suggested in such cases to assure a greater load than the calculated load. For C-Sleeve Ball Spline MAG, the key grooves of the external cylinders are aligned before delivery, when two or more external cylinders are assembled on a single spline shaft and two or more keys are used to fix the external cylinders in the rotational direction.

**❺Operating temperature**

The maximum operating temperature should not exceed 80℃.

# Precautions for mounting

**❶When mounting multiple sets at the same time**

In interchangeable specification, assemble an external cylinder and a spline shaft with the same interchangeable code “S2”. In non-interchangeable product, use an assembly of external cylinder and spline shaft as delivered without changing the combination.

**❷Assembling an external cylinder and spline shaft**

When assembling the external cylinder on the spline shaft, correctly fit the raceway grooves of the external cylinder to that of the spline shaft and move the external cylinder gently in parallel direction. Rough handling may cause damaging seals or dropping steel balls. Non-interchangeable specification products are already assembled so as to provide the best accuracy when the IKO marks of external cylinder and spline shaft face the same direction. (see Fig.4)

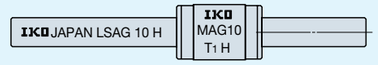



***Fig.4 Assembly direction of the external cylinder***

**❸Mounting the external cylinder**

When press-fitting the external cylinder to the housing, assemble them correctly by using a press and a suitable jig fixture, etc. (See Fig.5)

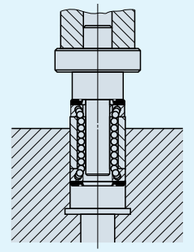
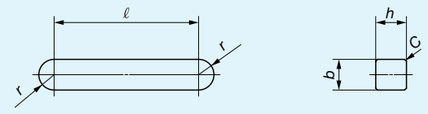


***Fig.5 Press-fitting of the external cylinder***

**❹Attached keys for the external cylinder**

The sunk keys shown in Table 12 are provided with the external cylinder.

***Table 12 Dimensions and tolerance of attached key***




unit : mm

| Model number | b | Tolerance | h | Tolerance | ℓ | r | C |
|---|---|---|---|---|---|---|---|
| MAG 5 | 2 | +0.016 +0.006 | 2 | 0 −0.025 | 3.8 | 1 | 0.16～0.25 |
| MAG 6 | | | | | 5.8 | | |
| MAG 8 | 2.5 | | 2.5 | | | 1.25 | |
| MAG10 | 3 | | 3 | | 7.8 | 1.5 | |
| MAG12 | | | | | 11.8 | | |

Remark : The table shows representative model numbers only but is applicable to all other models in the same size.

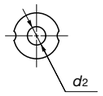
1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

IKO

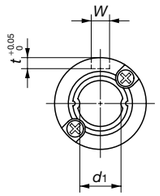
# C-Sleeve Linear Ball Spine MAG

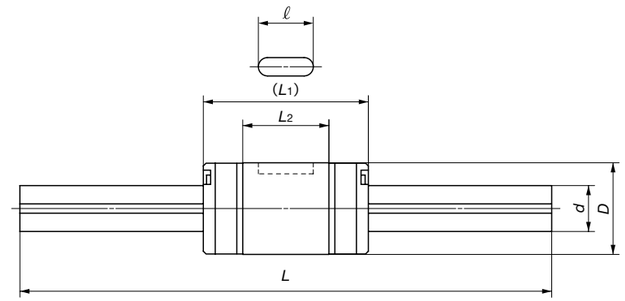
Standard type

**MAG • MAGT**




Bore dia. of hollow shaft of MAGT



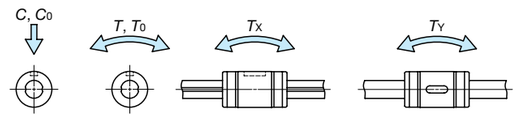

| Model number | Interchangeable | Mass (Ref.) g | | Dimension and tolerance of external cylinder mm | | | | | | | | Dimension of spline shaft mm | | | | | | Basic dynamic load rating(3) | Basic static load rating(3) | Dynamic torque rating(3) | Static torque rating(3) | Static moment rating(3) | | Model number |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | External cylinder | Spline shaft (per 100mm) | D | Tolerance | L1 | L2 | W | Tolerance | t | ℓ | d | Tolerance | | d1(1) | d2 | L(2) | Maximum length | C N | C0 N | T N・m | T0 N・m | TX N・m | TY N・m | |
| MAG 5 | ☆ | 4.8 | 14.9 | 10 | 0 −0.009 | 18 | 9.4 | 2 | +0.014 0 | 1.2 | 6 | 5 | 0 −0.012 | | 4.2 | — | 100 150 | 200 | 587 | 641 | 1.8 | 1.9 | 1.0 | 1.8 | MAG 5 |
| MAGT 5 | ☆ | | 12.4 | | | | | | | | | | | | | 2 | | | | | | | 7.9 | 13.6 | MAGT 5 |
| MAG 6 | ☆ | 8.9 | 19 | 12 | 0 −0.011 | 21 | 12.4 | 2 | +0.014 0 | 1.2 | 8 | 6 | 0 −0.012 | | 5.2 | — | 150 200 | 300 | 711 | 855 | 2.5 | 3.0 | 1.7 | 3.0 | MAG 6 |
| MAGT 6 | ☆ | | 16.5 | | | | | | | | | | | | | 2 | | | | | | | 11.7 | 20.3 | MAGT 6 |
| MAG 8 | ☆ | 15.9 | 39 | 15 | 0 −0.011 | 25 | 14.6 | 2.5 | +0.014 0 | 1.5 | 8.5 | 8 | 0 −0.015 | | 7 | — | 150 200 250 | 500 | 1 190 | 1 330 | 5.5 | 6.2 | 3.3 | 5.6 | MAG 8 |
| MAGT 8 | ☆ | | 33 | | | | | | | | | | | | | 3 | | 400 | | | | | 22.0 | 38.1 | MAGT 8 |
| MAG 10 | ☆ | 31.5 | 60.5 | 19 | 0 −0.013 | 30 | 18.2 | 3 | +0.014 0 | 1.8 | 11 | 10 | 0 −0.015 | | 8.9 | — | 200 300 | 600 | 1 880 | 2 150 | 10.9 | 12.5 | 7.0 | 12.1 | MAG 10 |
| MAGT 10 | ☆ | | 51 | | | | | | | | | | | | | 4 | | | | | | | 41.5 | 71.9 | MAGT 10 |
| MAG 12 | ☆ | 44 | 87.5 | 21 | 0 −0.013 | 35 | 23 | 3 | +0.014 0 | 1.8 | 15 | 12 | 0 −0.018 | | 10.9 | — | 200 300 400 | 800 | 2 180 | 2 690 | 14.8 | 18.3 | 10.6 | 18.3 | MAG 12 |
| MAGT 12 | ☆ | | 66 | | | | | | | | | | | | | 6 | | | | | | | 59.1 | 102 | MAGT 12 |

Note(1) : Dimension $d_1$ indicates the maximum diameter when machining is done at the shaft ends.

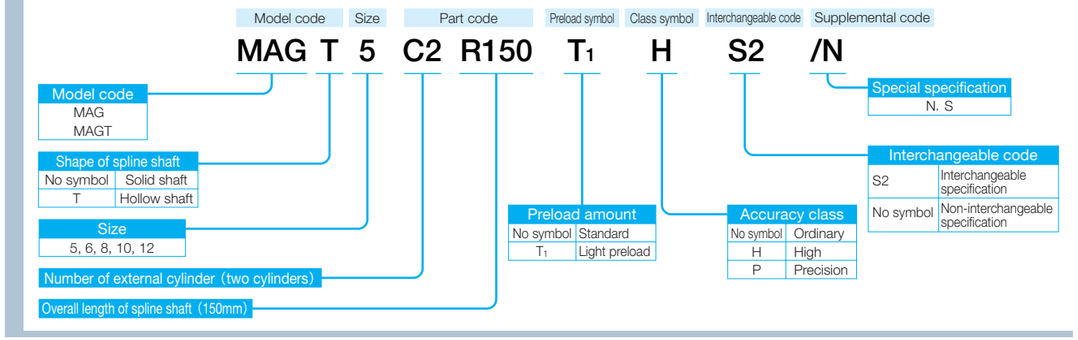
(2) : Lengths indicated are standard length. Spline shafts in different lengths are also available. Simply indicate the necessary length of spline shaft (mm) in the identification number.

(3) : The directions of dynamic load rating ($C$), basic static load rating ($C_0$), dynamic torque rating ($T$) and static torque/moment rating ($T_0$, $T_X$ and $T_Y$) are shown in the sketches below. The upper values in the $T_X$ and $T_Y$ columns apply to one external cylinder, and the lower values apply to two external cylinders in close contact.

Remark : The mark ☆ indicates that interchangeable specification products are available.




## Example of identification number of assembled set



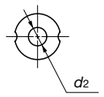



1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

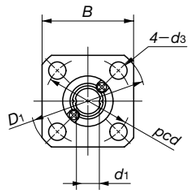
# C-Sleeve Linear Ball Spine MAG

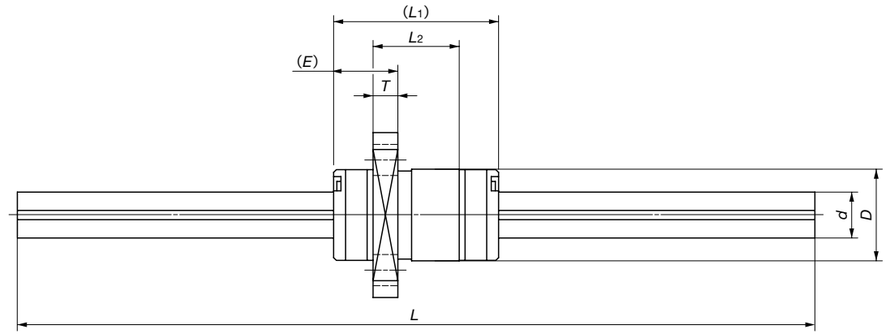
Flange type

**MAGF • MAGFT**




Bore dia. of hollow shaft of MAGT



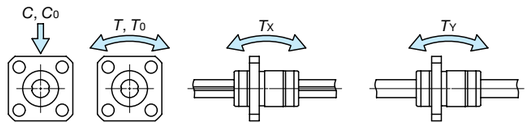

| Model number | Interchangeable | Mass (Ref.) g | | Dimension and tolerance of external cylinder mm | | | | | | | | | | Dimension of spline shaft mm | | | | | | Basic dynamic load rating(3) | Basic static load rating(3) | Dynamic torque rating(3) | Static torque rating(3) | Static moment rating(3) | | Model number |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | External cylinder | Spline shaft (per 100mm) | D | Tolerance | L1 | L2 | D1 | B | E | T | PCD | d3 | d | Tolerance | | d1(1) | d2 | L(2) | Maximum length | C N | C0 N | T N・m | T0 N・m | TX N・m | TY N・m | |
| MAGF 5 | ☆ | 8.9 | 14.9 | 10 | 0 −0.009 | 18 | 9.4 | 23 | 18 | 7 | 2.7 | 17 | 3.4 | 5 | 0 −0.012 | | 4.2 | — | 100 150 | 200 | 587 | 641 | 1.8 | 1.9 | 1.0 | 1.8 | MAGF 5 |
| MAGFT 5 | ☆ | | 12.4 | | | | | | | | | | | | | | | 2 | | | | | | | 7.9 | 13.6 | MAGFT 5 |
| MAGF 6 | ☆ | 13.9 | 19 | 12 | 0 −0.011 | 21 | 12.4 | 25 | 20 | 7 | 2.7 | 19 | 3.4 | 6 | 0 −0.012 | | 5.2 | — | 150 200 | 300 | 711 | 855 | 2.5 | 3.0 | 1.7 | 3.0 | MAGF 6 |
| MAGFT 6 | ☆ | | 16.5 | | | | | | | | | | | | | | | 2 | | | | | | | 11.7 | 20.3 | MAGFT 6 |
| MAGF 8 | ☆ | 23.5 | 39 | 15 | 0 −0.011 | 25 | 14.6 | 28 | 22 | 9 | 3.8 | 22 | 3.4 | 8 | 0 −0.015 | | 7 | — | 150 200 250 | 500 | 1 190 | 1 330 | 5.5 | 6.2 | 3.3 | 5.6 | MAGF 8 |
| MAGFT 8 | ☆ | | 33 | | | | | | | | | | | | | | | 3 | | 400 | | | | | 22.0 | 38.1 | MAGFT 8 |
| MAGF 10 | ☆ | 45 | 60.5 | 19 | 0 −0.013 | 30 | 18.2 | 36 | 28 | 10 | 4.1 | 28 | 4.5 | 10 | 0 −0.015 | | 8.9 | — | 200 300 | 600 | 1 880 | 2 150 | 10.9 | 12.5 | 7.0 | 12.1 | MAGF 10 |
| MAGFT 10 | ☆ | | 51 | | | | | | | | | | | | | | | 4 | | | | | | | 41.5 | 71.9 | MAGFT 10 |
| MAGF 12 | ☆ | 59 | 87.5 | 21 | 0 −0.013 | 35 | 23 | 38 | 30 | 10 | 4 | 30 | 4.5 | 12 | 0 −0.018 | | 10.9 | — | 200 300 400 | 800 | 2 180 | 2 690 | 14.8 | 18.3 | 10.6 | 18.3 | MAGF 12 |
| MAGFT 12 | ☆ | | 66 | | | | | | | | | | | | | | | 6 | | | | | | | 59.1 | 102 | MAGFT 12 |

Note(1) : Dimension $d_1$ indicates the maximum diameter when machining is done at the shaft ends.

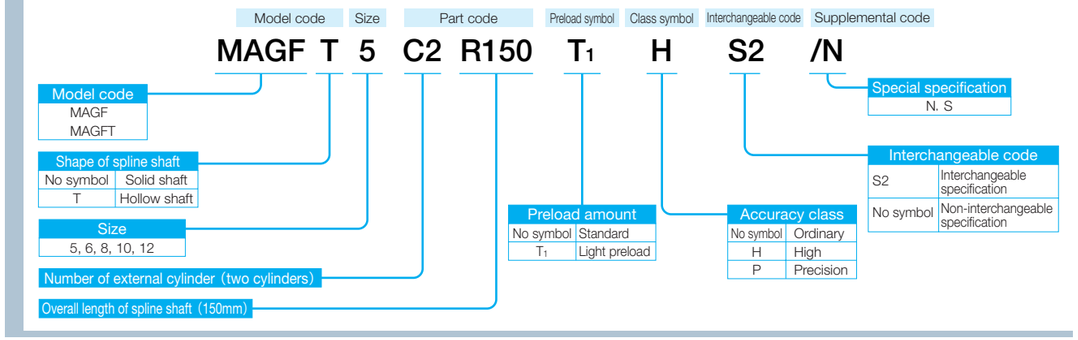
(2) : Lengths indicated are standard length. Spline shafts in different lengths are also available. Simply indicate the necessary length of spline shaft (mm) in the identification number.

(3) : The directions of dynamic load rating ($C$), basic static load rating ($C_0$), dynamic torque rating ($T$) and static torque/moment rating ($T_0$, $T_X$ and $T_Y$) are shown in the sketches below. The upper values in the $T_X$ and $T_Y$ columns apply to one external cylinder, and the lower values apply to two external cylinders in close contact.

Remark : The mark ☆ indicates that interchangeable specification products are available.




## Example of identification number of assembled set






1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

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***ISO 9001 & 14001 Quality system registration certificate***

ISO 9001 Certified
ISO 14001 Certified