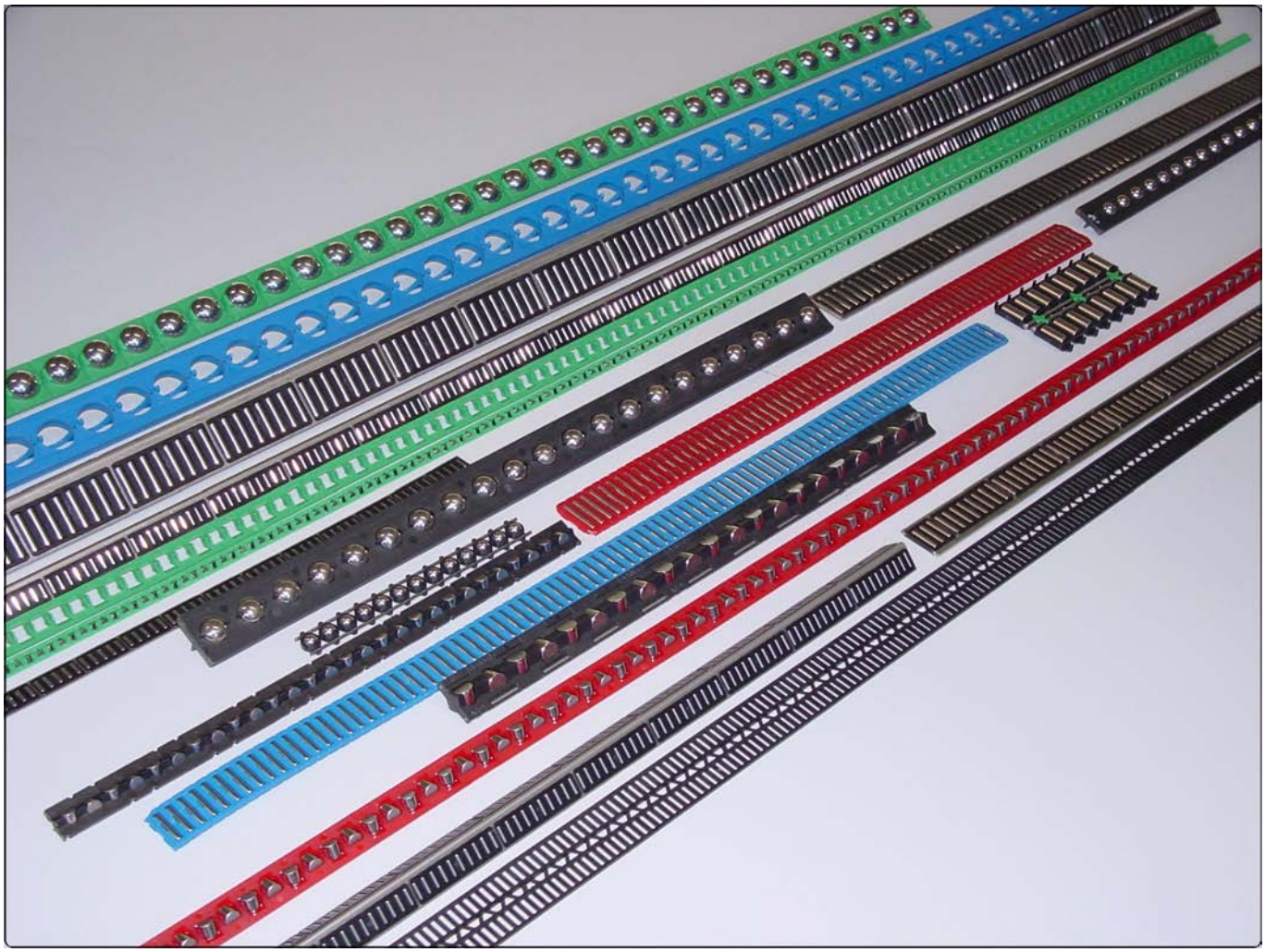
# Linear ball cages



## Standard range

Publication LLK 100 E
09/2004

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**Description of the product**

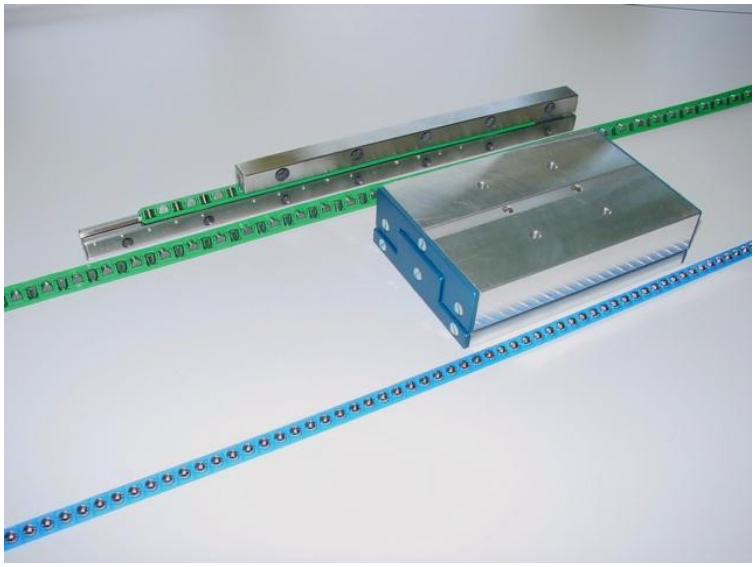
Since 1986, KMF has developed roller bearing components especially for track systems and here special cages for all types of roller bodies, such as balls, rollers and needle rollers. The main customers are reputable roller bearing and linear system manufacturers in Europe and overseas, who use the KMF standard range or the results of joint development.

There are products of this development work which will have a positive effect on linear and rotary movement for decades.

While rotating roller bearings have been used in modern industry for more than 100 years, roller bearings for linear movement and industrial linear system manufacturers are relatively recent.

It was noticeable at the start of KMF`s activities that the well-known linear system manufacturers did not want to or could not use the positive results of plastic cages of roller bearing manufacturers. Expensive mechanically produced metal cages were the main components of many units. They had neither roller guides nor suitable roller supports, which were already standard in the roller bearing industry.

**Plastic cage taps for linear bearings in metre lengths**



Only the manufacturing process developed by KMF, the manufacture of cage tapes in metre lengths, could be used by linear system manufacturers.

Two row, angled needle cages and cross roller cages in compound construction (steel / plastic), two row plastic flat needle cages as an alternative to FF ...ZW (dovetail elements) and flat ball cages with steel reinforcement belong to the development of KMF, as do the current and popular ball chain with slot guides, which were introduced by KMF in 1987.
Development engineers and decision-makers in the linear industry very quickly noticed the great advantages, so that within a very short period of time, whole series of cages were designed and manufactured.

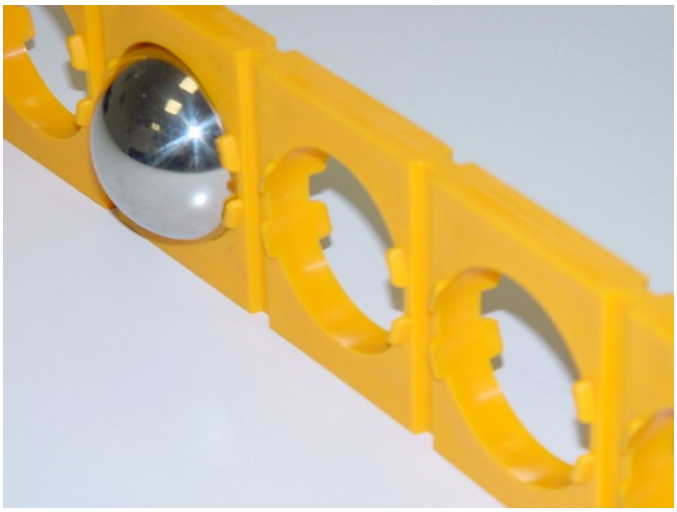
The LLK 100 linear bearing cage publication shows the current standard range and examples of special developments.

# Linear ball cages
General

**Shape**

KMF linear bearing cages for balls, rollers or needle rollers are basically guided by roller bodies. The rollers are held in pockets. They can be manufactured in any length.

**Rollers are guided and held in pockets**



The basic material for KMF linear bearing cages is injection moulded polyamide PA 12, POM or PA 12 GF (reinforced with glass fibres).

The plastic cage can be additionally stiffened by reinforcement with steel inserts in the linear longitudinal direction, so-called supports. The stiffening can be done by fixed compounding (sprayed support) or combination (clipped on support).

The ball pockets can be made with one-sided ball surround or partial surround. This prevents the balls from falling out.

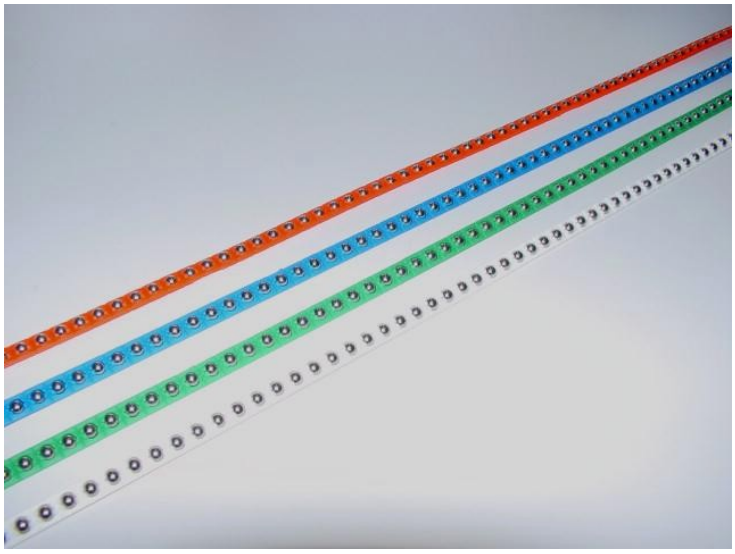
**Summary of advantages**

- Improved running properties and high running speeds from ball guides and supports
- Low mass of plastic or compound plastic cages
- Suitability of plastic compound cages for vertical position for adjacent, emerging cages
- Optimum roller division for higher strength and stiffness
- Individual cutting for any length
- Corrosion resistant and resistant to most solvents and alkalis and weak organic acids
- Ecconomic supply in metre length
- Large reduction in costs compared with mechanically produced metal cages or those produced without machining.
- Combined cages are very suitable for the production of several rows of flat cages and they offer a cheap alternative when repairing guides.

**Material**

The main feature in the development of the KMF linear bearing cages, apart from precision, was to find a suitable material, which with various GF additives, fulfils and even improves important functional requirements for linear movements.

**Colouring is possible,**
**at customer`s request**



As material for KMF linear bearing cages, a thermoplastic material is preferred. Injection moulded polyamide PA 12 is a poly-condensation product of Laurinlactam.
Polyamide PA 12 with the smallest water absorption and a density of 1,01 is the easiest polyamide obtainable. As technical plastic, this material has the following favourable properties for cage tapes

- High strength together with high toughness
- Excellent abrasion and smoothness properties
- Chemical properties, eg: resistance to petrol, grease and oil
- Excellent behaviour at low temperatures
- Good stability of dimensions
- Low water absorption

With these properties, the basic material polyamide PA 12 meets many requirements made of roller or ball cage tapes for linear systems.

The general thermal, electrical and mechanical properties of the cage material used by KMF are listed in the following datasheet.

All the test data were measured on test samples that had been stored for two weeks in a standard climate (23°C / 50% relative humidity).

# Linear ball cages

Polyamide injection moulded (PA 12 / PA 12 GF30)

| Basic types | | | | PA 12 | PA 12 GF30 |
|---|---|---|---|---|---|
| Melting temperature DSC max. | | °C | dry | 178 | 178 |
| Density | DIN 53479 | kg/dm³ | dry | 1.01 | 1.22 |
| Water absorption 23° / 50% RF | DIN 53417 | % | -- | 0.7 | 0.5 |
| in water at 23°C | DIN 53495 | % | -- | 1.5 | 1.1 |
| linear moulding reduction | | % | -- | 0.8 / 2.0 | 0.1 / 1.0 |
| Shape maintenance ISO 75<br>0.46 N/mm² (B) | DIN 53461 | °C | after storage | 150 | 170 |
| 1.82 N/mm² (A) | | °C | 5 hours at 150° | 50 | 163 |
| Vicat softening temperature<br>9.81 N (A) | DIN 53460 | °C | dry | 170 | 172 |
| 49.05 N (B) | | °C | dry | 135 | 170 |
| Linear coeff. of expansion | DIN 52328 | $K^{-1}$ | dry | $12 \cdot 10^{-5}$ | $8 \cdot 10^{-5}$ |
| Max. permanent temp.<br>of use | | °C | -- | 80 | 90 |
| Short term temperature of use | | °C | -- | 140 | 150 |
| Specific through resistance | DIN 53482 | Ω cm | dry cond. | $10^{13}$ | $10^{13}$ |
| Breakdown strength (elec) | DIN 53481 | kV/mm | dry cond. | 38 | 40 |
| Creep current strength stage KC | DIN 53480 | V | dry cond. | > 600 | > 600 |
| Yield stress | DIN 53455 | N/mm²<br>N/mm² | dry<br>cond. | --<br>40 | --<br>-- |
| Extension at yield | DIN 53455 | %<br>% | dry<br>cond. | --<br>8 | --<br>-- |
| Tearing strength | DIN 53455 | N/mm²<br>N/mm² | dry<br>cond. | --<br>60 | --<br>105 |
| Extension when tearing | DIN 53455 | %<br>% | dry<br>cond. | --<br>275 | --<br>5 |
| Tensile elastic modulus | DIN 53457 | N/mm²<br>N/mm² | dry<br>cond. | --<br>1100 | --<br>5900 |
| 3,5% bending stress | DIN 53452 | N/mm²<br>N/mm² | dry<br>cond. | --<br>35 | --<br>130 |
| Shore hardness D | DIN 53505 | -- | dry<br>cond. | --<br>67 | --<br>77 |
| Impact toughness at –40°C | DIN 53453 | kJ/m²<br>kJ/m² | dry<br>cond. | --<br>-- | --<br>55 |
| Impact toughness | DIN 53453 | kJ/m²<br>kJ/m² | dry<br>cond. | --<br>-- | --<br>60 |
| Notch impact toughness (Charpy) | DIN 53453 | kJ/m²<br>kJ/m² | dry<br>cond. | --<br>10 | --<br>20 |
| Notch impact toughness (Charpy)<br>at –40°C | DIN 53453 | kJ/m²<br>kJ/m² | dry<br>cond. | --<br>6 | --<br>15 |

### Temperature

Roller bearing and linear bearing manufacturers who use our cage tapes made of plastic have determined the suitability of the material by internal investigations and have safely included them in their catalogues.

For the material PA 12 for continuous operation, the limit is 90° to 100°C and for short periods of use the permitted temperature is 100° to 120°C.

Glass fibre reinforced PA 12 (30% GF) has a limit in continuous use of 100 to 110°C and for short periods of use of 120° to 130°C.

For short term use, 300 to 500 hours are allowed for the material PA 12 and 500 to 1000 hours for the material PA 12 GF.

The actual heat resistance of the material to the occurrence of embrittlement is considerably higher.

**The limiting temperatures of roller bearing cages in the standard version in continuous operation are –40°C and +100°C and for short periods of operation up to +120°C.**

### Vacuum

One can say about using our cages under vacuum, that in a vacuum, low molecular parts can evaporate. According to the experts, the proportion of these parts is very small and it has no effect on the mechanical properties of the cage material.

### Argon (inert gas)

According to various tests on the material, it is 100% resistant to argon.

### Halogen gas

Halogen gases are based on bromine or chlorine.

As halogen gases are very aggressive, the use of our cages made of PA 12 and PA 12 GF material is unsuitable for them.

Halogen gases cause changes in dimension and a reduction in the mechanical properties.

**Linear bearing cages for roller guides**


| | |
|---|---|
| 1 | Roller circumferential shoe with circumferential cage KKVK |
| 2 | V/M guide rails with angled flat cage KKVR |
| 3 | Roller guide Gr. 3 with cross roller cage KKXL |
| 4 | Roller guide Gr. 9 with cross roller cage KKXV |
| 5 | V/M guide rails with angled flat cage KKHW |
| 6 | Roller guide Gr. 6 with cross roller cage KKXV |
| 7 | Flat guide with flat needle cage KKVR |
| 8 | Cross roller guide Gr. 9 with flat ball cage KKVK |
| 9 | Cross roller guide Gr. 1,5 with cross roller cage KKXL |
| 10 | Miniature roller table Gr. 2 with cross roller cage KKXL |

# Linear bearing cage KKLK

Series KKLK ball cage tape filled with balls

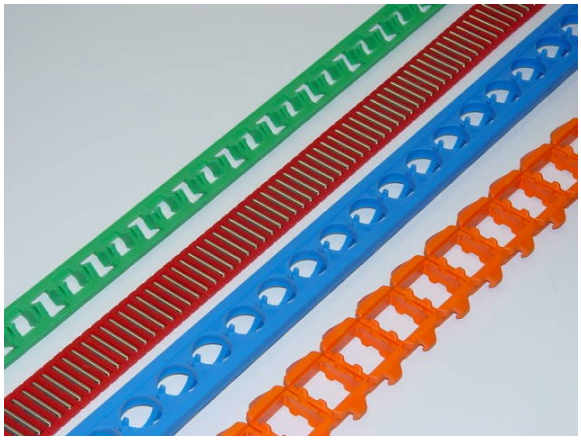
## General

Linear ball cages of series KKLK are pure plastic cage tapes which were mostly taken from the standard range (roller bearing cages) for the linear area. The cage tapes are made in metre lengths and are specially made by a separate tempering process for linear applications in greater lengths.

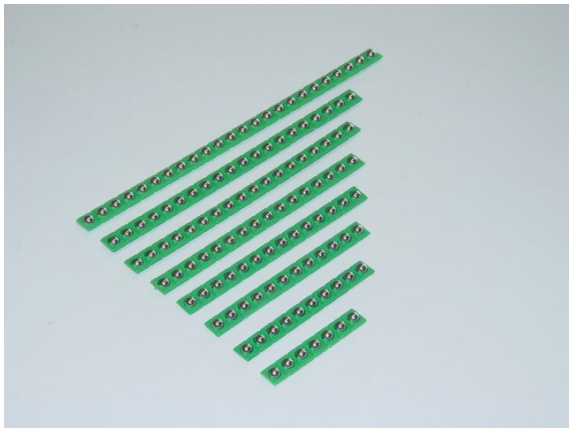
Ball cages of series KKLK have ball pockets with ball guides and supports. They are offered including the balls, in metre lengths or ready to install. The standard balls for filled linear ball cages are made according to DIN 5401 / Grade 15 (Class 2) of 100 Cr6 material. Variants made of other materials, eg: corrosion-resistant steel (X46Cr13 / 1.4034) or plastic (POM) or ceramic ($AL_2O_3$) are also possible.

## Further options

KMF cage tapes for roller bearing and linear systems from the stanard range are coloured according to the manufacturer`s choice. For large quantities and call-up orders, special colours can be considered. Different colours are useful if different sorts of rollers are in use and these require quick allotment in assembly, or if different materials (chromium steel and stainless steel balls) are optically indistinguishable.



Differently coloured linear cages



Linear ball cages in different lengths ready to instal

KMF supply ready-to-install linear bearing cages, but prefer and advise many customers to use conventional „metre length“ to cut up themselves. For ecconomic and logistical reasons, the manufacturing and supplied lengths are between 1000 and 1500 mm.

If longer lengths are required, these must be discussed with the manufacturer.

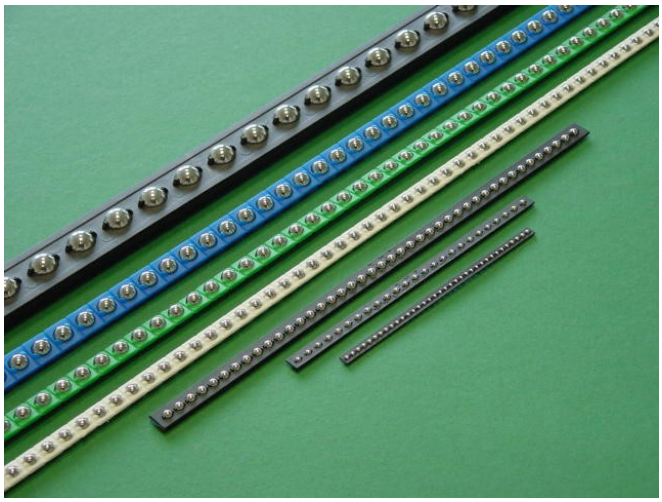
## Example of order / inquiry

| KKLK 060 | / | 18 | 200 off |
|---|---|---|---|
| type incl. balls | | no. of ball pockets | quantity off |

| KKLK 060 | 100 metres |
|---|---|
| type incl. balls | quantity in metres or number off for cutting off yourself (1 m = 1 off) |

# Linear bearing cages KKLK

Series KKLK ball cage tapes filled with balls



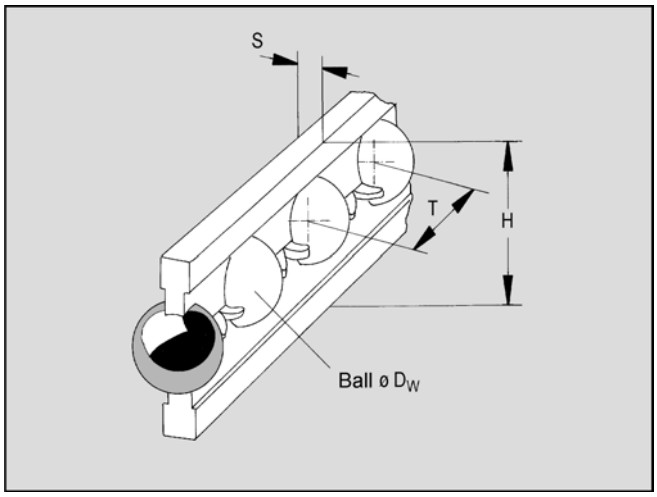



**Table of dimensions** [dimensions in mm]

| KMF-type 1) | Ball Ø $D_W$ | [inch] | H | S | T | HLG |
|---|---|---|---|---|---|---|
| **KKLK 015/...** | 1,500 | | 3,5 | 0,45 | 2,2 | 80 2) |
| **KKLK S16/...** | 1,588 | 1/16 | 3,1 | 0,50 | 2,2 | 85 2) |
| **KKLK 016/...** | 1,588 | 1/16 | 3,5 | 0,50 | 2,2 | 85 2) |
| **KKLK 020/...** | 2,000 | | 5,0 | 0,75 | 3,9 | 102 2) |
| **KKLK 021/...** | 2,000 | | 5,0 | 0,75 | 3,0 | MW |
| **KKLK 023/...** | 2,381 | 3/32 | 6,0 | 0,80 | 3,6 | MW |
| **KKLK 030/...** | 3,000 | | 7,0 | 1,00 | 4,2 | 180 2) |
| **KKLK 031/...** | 3,000 | | 7,0 | 1,00 | 4,2 | MW |
| **KKLK S32/...** | 3,175 | 1/8 | 4,4 | 0,70 | 4,2 | MW |
| **KKLK 032/...** | 3,175 | 1/8 | 7,0 | 1,00 | 4,2 | MW |
| **KKLK 039/...** | 3,969 | 5/32 | 6,3 | 1,30 | 5,8 | MW |
| **KKLK 040/...** | 4,000 | | 6,3 | 1,30 | 5,8 | MW |
| **KKLK 047/...** | 4,762 | 3/16 | 8,0 | 1,50 | 6,8 | MW |
| **KKLK 050/...** | 5,000 | | 8,0 | 1,50 | 6,8 | MW |
| **KKLK 060/...** | 6,000 | | 9,0 | 1,60 | 7,8 | MW |
| **KKLK 063/...** | 6,350 | 1/4 | 9,0 | 1,60 | 7,8 | MW |
| **KKLK 079/...** | 7,938 | 5/16 | 12,0 | 2,00 | 12,0 | MW |
| **KKLK 080/...** | 8,000 | | 12,0 | 2,00 | 12,0 | MW |
| **KKLK 090/...** | 9,000 | | 15,0 | 2,00 | 11,5 | MW |
| **KKLK 095/...** | 9,525 | 3/8 | 12,6 | 2,50 | 12,0 | MW |
| **KKLK 100/...** | 10,000 | | 13,2 | 2,50 | 12,5 | MW |
| **KKLK 110/...** | 11,000 | | 13,7 | 2,50 | 14,0 | MW |
| **KKLK 111/...** | 11,112 | 7/16 | 13,7 | 2,50 | 14,0 | MW |
| **KKLK 127/...** | 12,700 | 1/2 | 22,0 | 3,50 | 16,0 | MW |

1) Other dimensions on request

MW = metre length

2) Material POM

For linear bearing cages with limited manufacturing length (HLG) from individual tools, the material POM (polyacetalene) is used.
The most important thermal properties are
- keeping its shape up to 105°C
- melting temperature 177°C
- linear coefficient of thermal expansion ($1x10^{-5}$) 10,4 for –40°C to 30°C (complete datasheet on request)

# Linear bearing cages KKLK 101

Series KKLK 101 linear ball cages

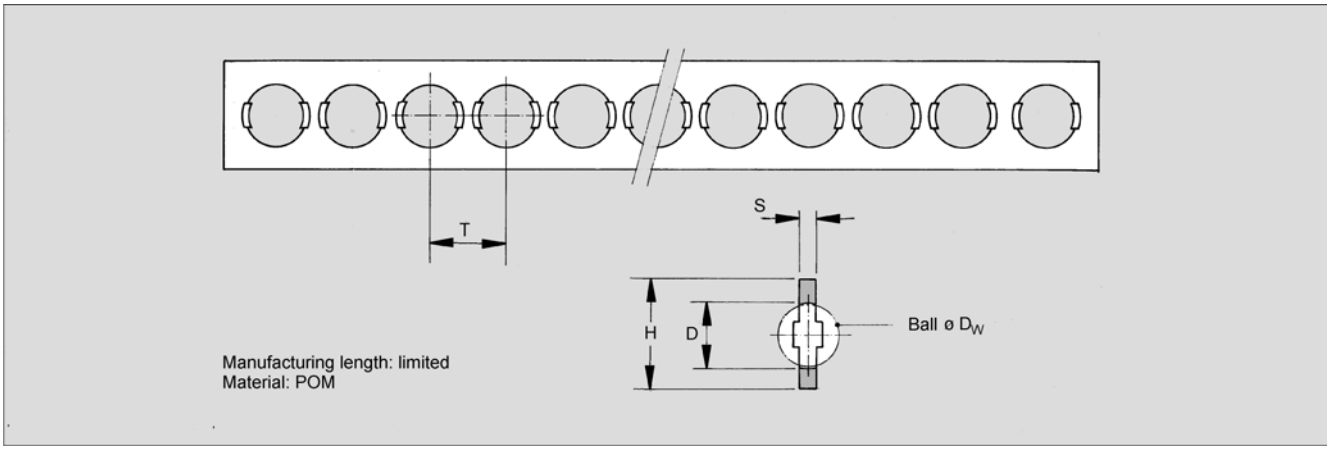



**Table of dimensions** [dimensions in mm]

| KMF type 1) | ball Ø $D_W$ | (inch) | H | S | T | D | HLG | No. of balls each |
|---|---|---|---|---|---|---|---|---|
| **KKLK 101-01** | 1,500 | | 3,5 | 0,45 | 2,2 | 1,6 | ~ 80 | 35 |
| **KKLK 101-016** | 1,588 | 1/16 | 3,5 | 0,50 | 2,2 | 1,7 | ~ 85 | 38 |
| **KKLK 101-S16** | 1,588 | 1/16 | 3,1 | 0,50 | 2,2 | 1,7 | ~ 85 | 38 |
| **KKLK 101-02** | 2,000 | | 5,0 | 0,75 | 3,9 | 2,1 | ~102 | 25 |
| **KKLK 101-03** | 3,000 | | 7,0 | 1,00 | 4,2 | 3,1 | ~180 | 42 |

1) Other dimensions on request

The linear ball cages of series KKLK 101 are plastic flat cages. The ball pockets have a ball support. The cags are produced with a limited manufacturing length (HLG) and cannot be obtained in metre lengths. They are supplied without balls and with a minimum quantity of 100 off.
Linear ball cages with limited manufacturing length are made of the material POM (polyacetalene). The most important properties are keeping its shape up to 105°C and a linear thermal coefficient of expansion of 10,4 x $10^{-5}$, determined over a temperature range of –40°C to 30°C. The complete material data of mechanical, thermal and electrial properties can be obtained on request. For cages of this type filled with balls see page 9 (KKLK).

**Example of order / inquiry**

| KKLK 101 - 03 | / | 500 off |
|---|---|---|
| type for ball Ø 3 not filled with balls | | quantity off |

# Linear bearing cages KKVK

Series KKVK compound ball cage

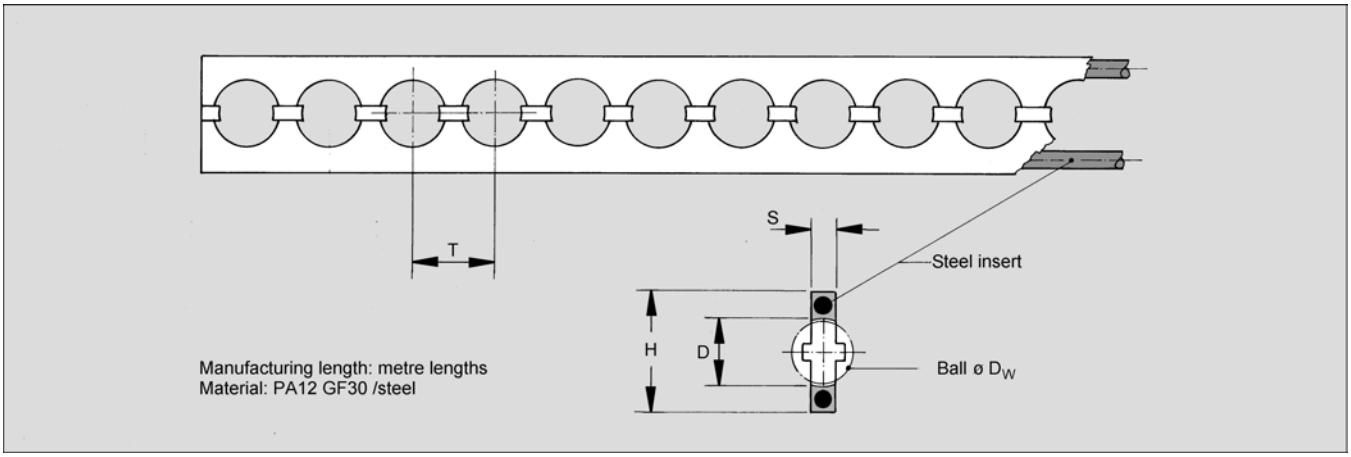



**Table of dimensions** [dimensions in mm]

| KMF-type 1) without balls | KMF-type with balls | ball Ø $D_W$ | H | S | T | D | No. of balls per metre |
|---|---|---|---|---|---|---|---|
| **KKVK 111-06** | **KKVK-06** | 6 | 14 | 2,5 | 9,0 | 6,2 | 111 |
| **KKVK 112-09** | **KKVK-09** | 9 | 20 | 3,5 | 14,0 | 9,2 | 71 |
| **(KKVK 113-12) 2)** | **(KKVK-12) 2)** | 12 | 20 | 4,0 | 15,5 | 12,2 | 64 |

1) Other dimensions on request
2) Expiring type, alternative is shown on page 12 – KKAK 12...L

Linear bearing cages of series KKVK are plastic flat cages with integrated steel inserts. They are manufactured by a special compound technology in metre lengths.
The standard manufacturing lengths of linear bearing cages of compound construction are 1400 mm. Due to the two steel inserts, which act as stiffening of the plastic flat cage, the latter can easily be used vertically.

The ball pockets are made so that the balls can only be pressed into the pockets from one side. The opposite side has a partial surround of the ball bodies, so that they cannot fall out on this side.

Possible supplies
- metre lengths without balls (minimum 50 metres)
- cut to length filled with balls (no minimum limit)
- metre lengths with balls for cutting oneself (no minimum limit)

**Example of order / inquiry**

| | | | |
|---|---|---|---|
| KKVK 111 - 06 | / | | 50 metres |
| type without balls | | | quantity in metres |
| KKVK - 06 | / | 59 | 20 off |
| type incl. balls | | no. of ball pockets | quantity ready for use |
| KKVK - 06 | | | 100 metres |
| type incl. balls | | | quantity in metres |

# Linear bearing cages KKAK ...L

Series KKAK ...L ball flat cage

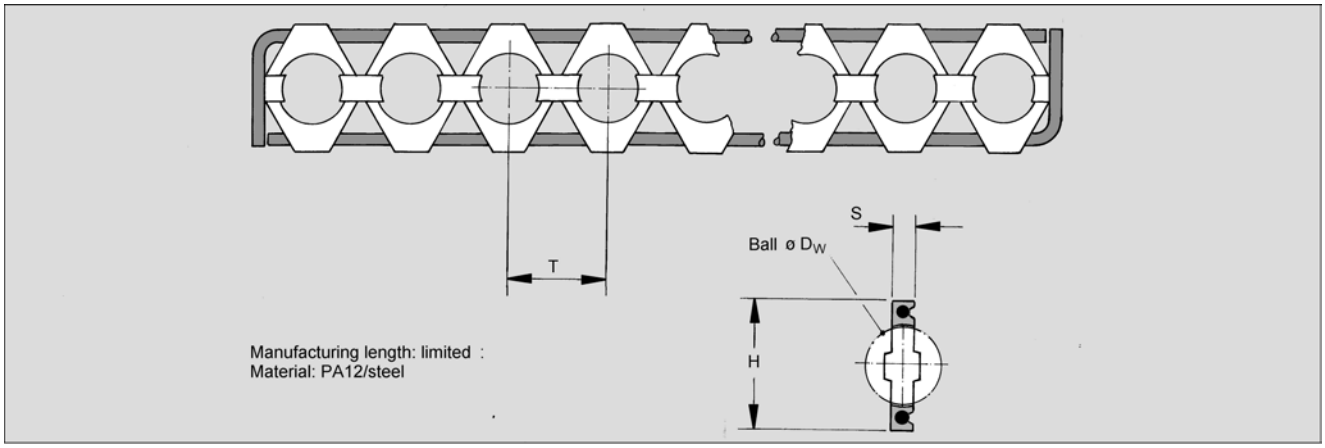



**Table of dimensions** [dimensions in mm]

| KMF type 1) | balls Ø $D_w$ | (inch) | H | S | T |
|---|---|---|---|---|---|
| **KKAK 6 ...L** | 6,000 | | 13 | 3,0 | 9,0 |
| **KKAK 9,525 ...L** | 9,525 | 3/8 | 20 | 3,5 | 20,0 |
| **KKAK 11 ...L** | 11,000 | | 19 | 4,0 | 14,5 |
| **KKAK 11,906 ...L** | 11,906 | 15/32 | 20 | 5,0 | 15,5 |
| **KKAK 12 ...L** | 12,000 | | 20 | 5,0 | 15,5 |
| **KKAK 14 ...L** | 14,000 | | 21 | 6,0 | 17,0 |

1) Other dimensions on request

Linear bearing cages of series KKAK ...L are guided and held ball flat cages. The cages are so-called combination cages and consists of precision steel wires (supports) which are completed by clipped on cage tapes. By using curved supports it is possible to produce ball segment cages, eg: for curved guides with restricted range. The combination shape is suitable for producing multi-row versions. The steel supports ensure the necessary stiffening of the ball flat cage and improve the running behaviour in vertical operation. The cages are produced individually to length and are supplied filled with balls. The ends of the cage can be configured differently (see examples of variants).

### Example of order / inquiry

While referring to type KKAK ...L the order or inquiry should contain as much detail as possible. Apart from the ball size, to produce a tender the planned length of cage, no. off and the desired end variant are required.

# Linear bearing cages KKAK ...L

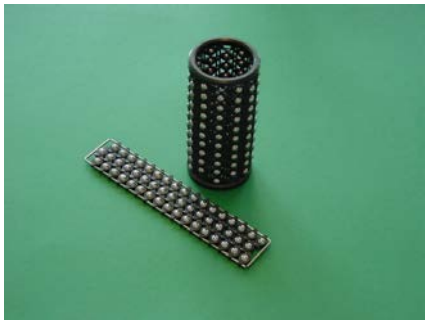
Series KKAK ...L / examples of variants

**Example of variant / longitudinal closure**

**Example of variant / multi-row cages**

**Ball box**

**Example of variant / mulit-row cages**



**Cage segments**

# Linear bearing cages KKNK 104

Series KKNK 104, linear ball mesh

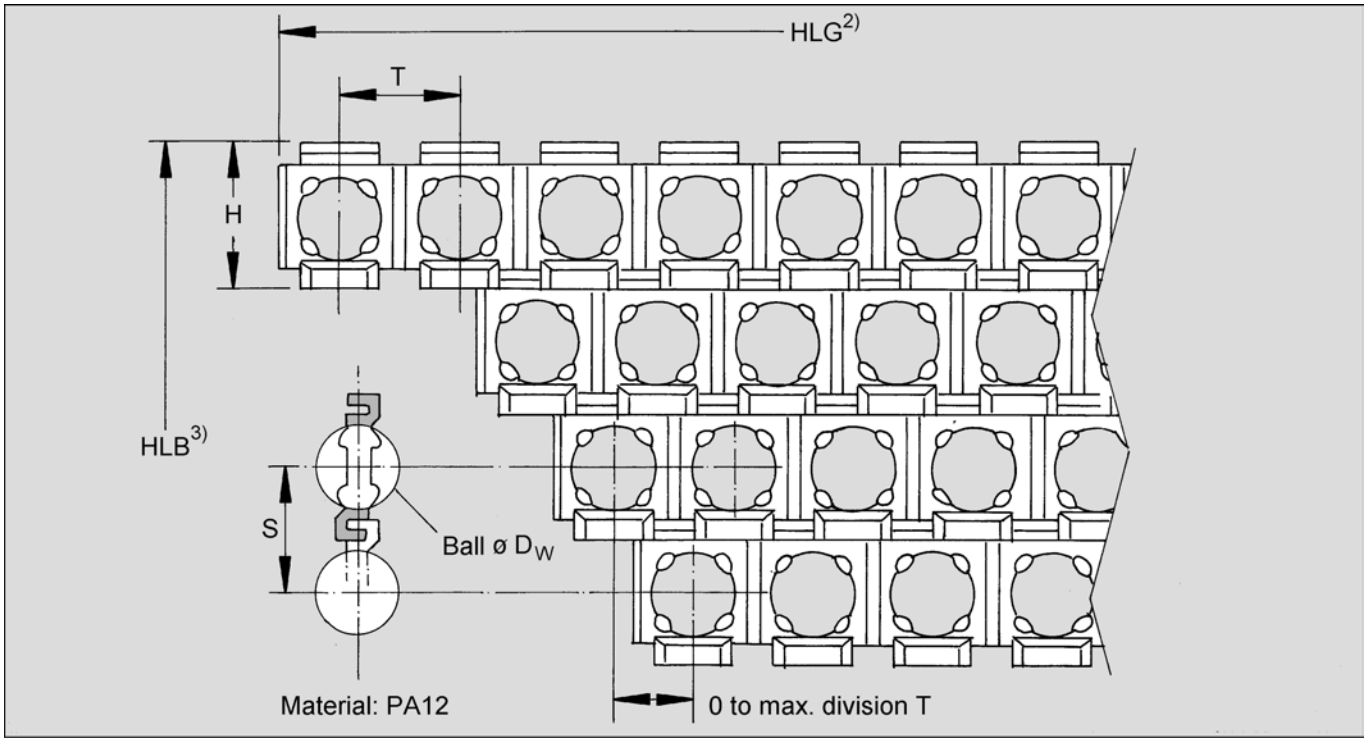



**Table of dimensions** [dimensions in mm]

| KMF-type 1) without balls | KMF-type with balls | ball Ø $D_w$ | H | S | T | No. of balls |
|---|---|---|---|---|---|---|
| **KKNK 104-03** | **KKNK-03** | 3,00 | 6,20 | 4,80 | 4,50 | 222 |
| **KKNK 104-04** | **KKNK-04** | 4,00 | 7,40 | 6,45 | 5,75 | 173 |
| **KKNK 104-05** | **KKNK-05** | 5,00 | 9,30 | 7,95 | 6,75 | 148 |
| **KKNK 104-06** | **KKNK-06** | 6,00 | 11,00 | 9,55 | 7,75 | 129 |

1) Other types on request
2) HLG = manufacturing length unlimited
3) HLB = manufacturing widths unlimited

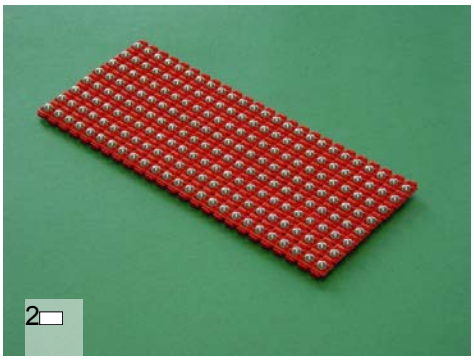
Linear bearing cages of series KKNK 104 are single row plastic cage tapes, which can be manufactured in unlimited lengths and unlimited widths.
The individual rows are connected by clipping together along the wide side of the cage tape.

The clipping does not produce a firm connection of rows, but is only used for positioning of the ball mesh and the different shapes. Ball networks are mainly used for unordered movements in different directions.

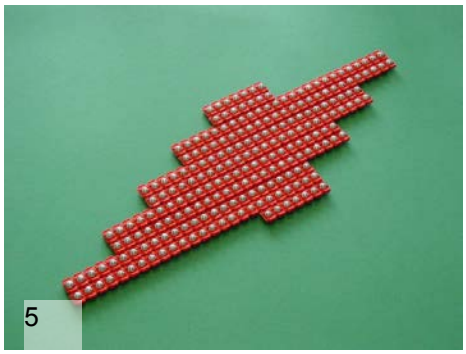
### Possibilities of supply

KMF cage tapes of series KKNK 104 for producing ball networks are supplied in metre lengths. As the shape of the ball networks and their applications are very different, detailed inquiries are necessary.

**Shapes (examples)**



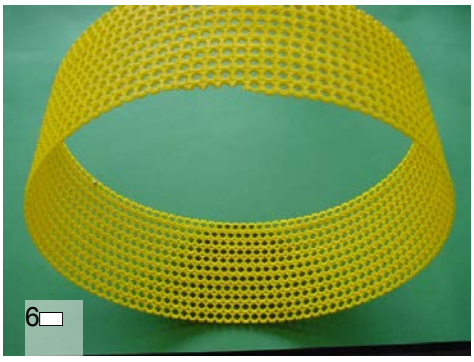




Fig. 1 Ball mesh of curved shape as ball box for simultaneous linear and rotary movement, diameter from about 50 mm

Fig. 2 Ball mesh of rectangular or square shape for linear longitudinal and lateral movement

Bild 3 Ball mesh of circular shape for circular and linear movement

Fig. 4, 5 and 6 Special shapes according to the application.

# Linear bearing cages KKXL-01 / 02

Series KKXL-01/02, cross roller cages

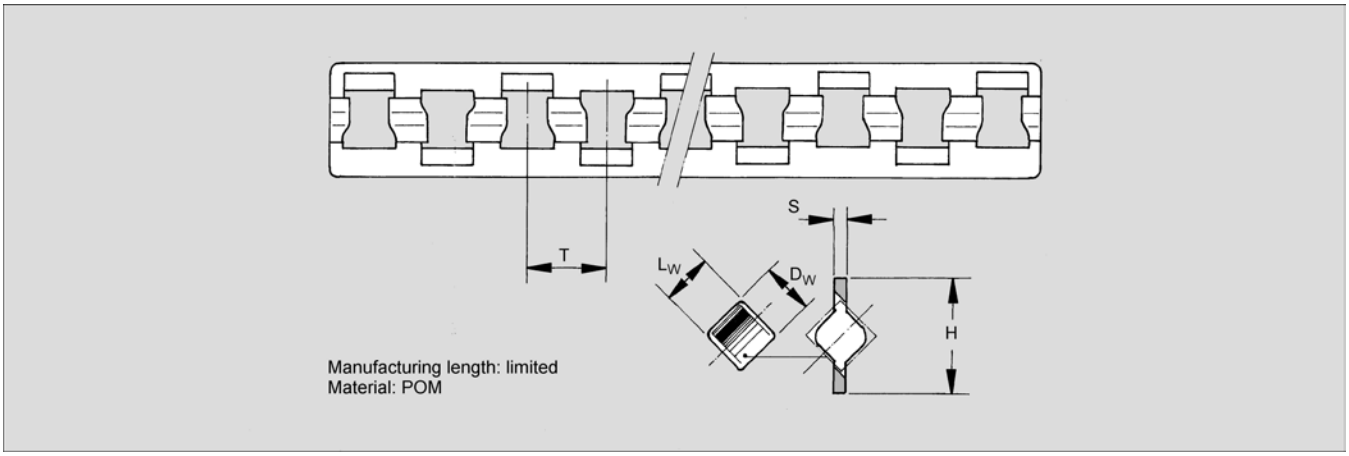



**Table of dimensions** [dimensions in mm]

| KMF-type 1) | roller Ø $D_W$ x $L_W$ | H | S | T | HLG | No. of rollers each |
|---|---|---|---|---|---|---|
| **KKXL-01** | **1,5 x 1,4** | 3,8 | 0,5 | 3 | 75 | 24 |
| **KKXL-02** | **2,0 x 1,8** | 5,5 | 0,7 | 4 | 100 | 24 |
| | | | | | | |

1) Other dimensions on request

Linear cross roller cages of series KKXL-01/02 are plastic cages. The roller pockets have a roller support. The cages are produced with a limited manufacturing length (HLG) and therefore cannot be obtained in metre lengths. They are supplied without rollers and with a minimum quantity of 100 off. The rollers can be supplied separately. For other details of cylindrical rollers type KZR 110 see page 28 (rollers).

Linear bearing cages with limited manufacturing length are made of the material POM (polyacetalene). The most important thermal properties are keeping its shape up to 105°C and a linear thermal coefficient of expansion of 10,4 x $10^{-5}$ in a temperature range of –40°C to 30°C. The complete material data of mechanical, thermal and electrical properties can be supplied on request.

**Example of order / inquiry**

| | | |
|---|---|---|
| KKXL-01 | / | 200 off |
| type for roller Ø 1,5 without rollers | | quantity |

associated cylindrical rollers (see page 28 – rollers)

| | | |
|---|---|---|
| KZR 110-1,5 | / | 4.800 off |
| roller Ø 1,5 x 1,4 | | quantity |

# Linear bearing cages KKXL-03 / 06 / 09

Series KKXL-03 / 06 / 09, cross roller tape

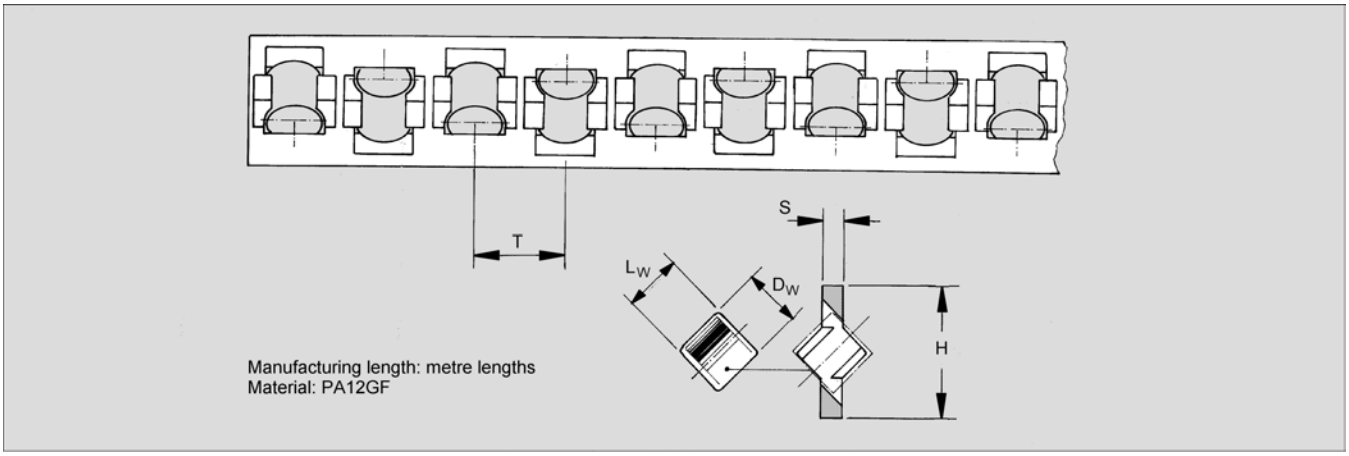



**Table of dimensions** [dimensions in mm]

| KMF-type 1) without rollers | KMF-type with rollers | roller Ø $D_W$ x $L_W$ | H | S | T | No. of rollers per metre |
|---|---|---|---|---|---|---|
| **KKXL 030** | **KKXL-03** | 3 x 2,8 | 7 | 1,00 | 5,0 | 200 |
| **KKXL 060** | **KKXL-06** | 6 x 5,8 | 14 | 2,00 | 8,5 | 118 |
| **KKXL 090** | **KKXL-09** | 9 x 8,8 | 20 | 3,00 | 14,0 | 71 |
| **KKAC 020** | **KKAC-02** | 2 x 1,8 | 5 | 0,75 | 3,9 | 250 |

1) Other dimensions on request

Linear bearing cages of series KKAC-02 and KKXL-03 / 06 / 09 are plastic cage tapes for cylindrical rollers in cross arrangement (cross rollers). They are produced in metre lengths, where the standard lengths are 1000mm.
The cross roller cage tapes are filled with rollers and offered without rollers. The rollers can be supplied separately. For further details of cylindrical rollers see page 28 (rollers).

Possibilities of supply
- metre lengths without rollers, minimum quantity KKXL 030 – 250 m / KKXL 060 – 100 m / KKXL 090 – 50 m / KKAC 020 – 50 m
- ready to fit, filled with rollers (no minimum limit)
- metre lengths with roller, to cut up oneself (no minimum limit)

**Example of order / inquiry**

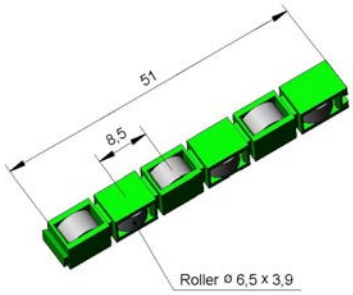
| | | | |
|---|---|---|---|
| KKXL 030 | / | | 250 off |
| type without rollers | | | quantity or metres (1m = 1 off) |
| KKXL-03 | / | 18 | 30 off |
| type incl. rollers | | no off roller pockets | quantity no. off ready to fit |
| KKXL-03 | | | 100 metres |
| type incl. rollers | | | quantity metres or no. off |

for cutting off oneself
(1m = 1 off)

# Linear-crossroller cage KKBN

with „SLIPLESS-System SLS“ Type KKBN 06 SLS

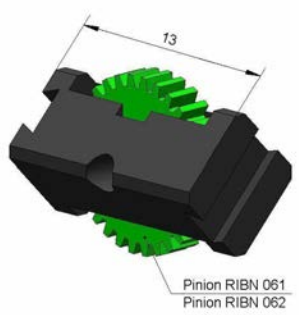
## Crossroller-cagesegment



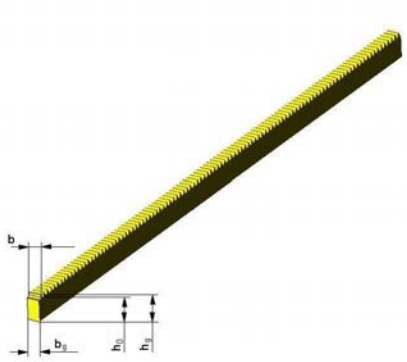

| **Table of dimensions** [dimensions in mm] | | | |
|---|---|---|---|
| **Crossroller-cagesegment** | | | |
| **KMF type** | **Cyl.-roller 1) $D_W$ x $L_W$** | **Pitch T** | **Length L** |
| KKBN 060 | Ø 6,5 x 3,9 | 8,5 | 51 |
| KKBN 040 | Ø 4,0 x 2,8 | 6,0 | 36 |

1) Cyl.-rollers sort. G1 (see page 28 – rolling elements)

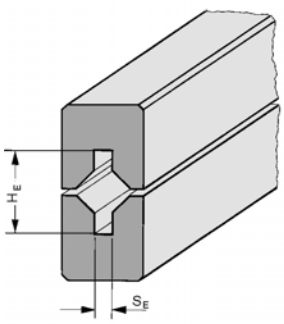
## Pinion pocket




## Gear rack




## Fitted dimensions




| **Table of dimensions** [dimensions in mm] | | | |
|---|---|---|---|
| **Pinion** (straight-fluted) | | | |
| **KMF type** | | **RIBN 061** | **RIBN 062** |
| Divided circle-Ø | $d_{01}$ | 9,0 | 9,0 |
| Modulus | m | 0,3 | 0,3 |
| Number of tooth | Z | 30,0 | 30,0 |
| Crown line-Ø | $d_k$ | 9,6 | 9,6 |
| Width of tooth | b | 1,0 | 2,0 |
| Pressure angle | α | 20° | 20° |
| **Material** | | Plastic POM | Plastic POM Brass MS58 |
| **Gear rack** (straight fluted) | | | |
| **KMF type** | | **ZABN 061** | **ZABN 062** |
| High | $h_o$ | 1,4 | 3,7 |
| Total High | $h_g$ | 1,7 | 4,0 |
| Length | L | 100,0 2) | 250,0 1) |
| Modulus | m | 0,3 | 0,3 |
| Width of tooth | b | 1,0 | 2,0 |
| Total width | $b_g$ | 1,55 | 2,0 |
| Pressure angle | α | 20° | 20° |
| **Material** | | Plastic PA 6.6 GF | Plastic PA 6.6 GF Brass MS58 |

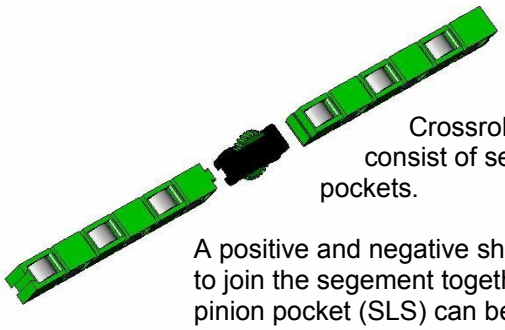
| **Fitted dimensions** | | | |
|---|---|---|---|
| **Gear rack** | **Pinion** | **$H_E$** | **$S_E$** |
| ZABN 061 | RIBN 061 | 12,05 | 1,60 |
| ZABN 062 | RIBN 062 | 16,70 | 2,00 |

1) Gear rack made of plastic TN can be supplied in every length even ≧ 250 mm.
Gear rack made of brass MS can only be supplied with a length of 250 mm.
2) Gear rack can only be supplied in plastic TN with a max. length of 100 mm.

# Linear-crossroller cage KKBN

with „SLIPLESS-System SLS“ Type KKBN 06 SLS

**Cagesegment + pinion pocket + cagesegment = KKBN 06 SLS**



Crossroller cages type series KKBN consist of segments, having 6 alternate roller pockets.

A positive and negative shaped „dovetail“ sliding connection enables to join the segement together to the required insert length. The pinion pocket (SLS) can be integrated in the cage segments due to this connection style. SLS is a standard for the size 06 (other dimensions on request).

The cagesegments are avaiable without rollers or filled with rollers ready to install . Minimum quantities have to be considered.

## Example of order / inquiry

**Crossroller cage-cagesegment filled with 6 cyl.-rollers Ø 6,5 x 3,9**

Designation KKBN 06 / 6 Quantity 100 off

- Size of cyl.-rollers
- Cylinder-roller 6,5 x 3,9
- Cage type series

**Crossroller cage-cagesegment filled with 6 cyl.-rollers Ø 6,5 x 3,9 Stainless Steel (SS)**

Designation KKBN 06 / 6 SS Quantity 100 off

**Crossroller-cagesegment not filled**

Designation KKBN 060 Quantity 500 off

- For cylinder-roller 6,5 x 3,9
- Cage type series

## Example of order / inquiry

with pinion RIBN 062 and gear rack ZABN 062

**Crossroller cage ready to ins**

Designation KKBN 062 / 1

**Crossroller cage ready to install with cylinder-rollers Ø 6,5 x 3,9 corrosion resistant steel (SS)**

Designation KKBN 062 / 12 SLS TN SS Quantity 100 off

**Matching gear rack**

Designation ZABN 062 / 2

# Linear bearing cages KLBF

Series KLBF, flat roller cage

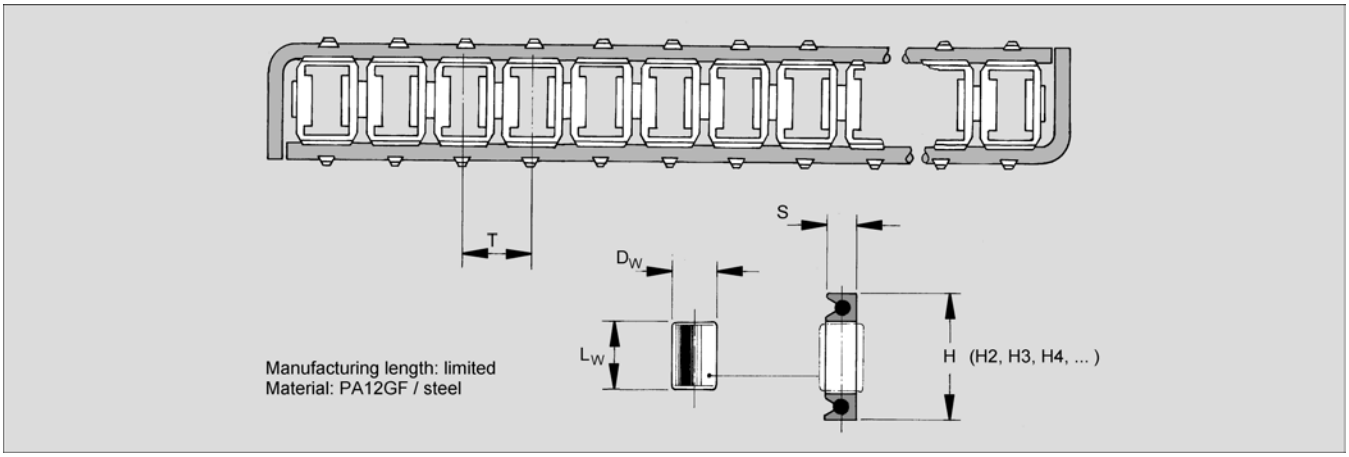



**Table of dimensions** [dimensions in mm]

| KMF-type 1) | roller Ø $D_W$ x $L_W$ | H | S | T | cage height 2) 2 row H2 | 3 row H3 | 4 row H4 |
|---|---|---|---|---|---|---|---|
| **KLBF 4015** | 4 x 8 | 15 | 3,0 | 7,5 | 27,0 | 39,0 | 51,0 |
| **KLBF 5015** | 5 x 8 | 15 | 3,5 | 8,0 | 27,0 | 39,0 | 51,0 |
| **KLBF 7025** | 7 x 14 | 25 | 5,0 | 11,0 | 45,5 | 65,5 | 85,5 |
| **KLBF 18036 3)** | 18 x 18 | 36 | 10,0 | 23,0 | --- | --- | --- |

1) Other dimensions on request
2) Any number of rows of rollers can be added
3) Not suitable for mulit-rows

Linear bearing cages of series KLBF are guided and held flat roller cages. The cages are so-called combination cages and consist of precision steel wires (supports), which are made into flat roller cages by clipped on cage tapes. Using curved supports, it is possible to produce roller segment cages, eg: for curved guides with restricted range. Combination shapes are also suitable for producing mult-row versions. The steel supports ensure the necessary stiffening of the flat roller cage and improve the running in vertical operation. The cages are produced individually for the required length and supplied filled with rollers. The ends of the cage can be configured differently (see example of variants).

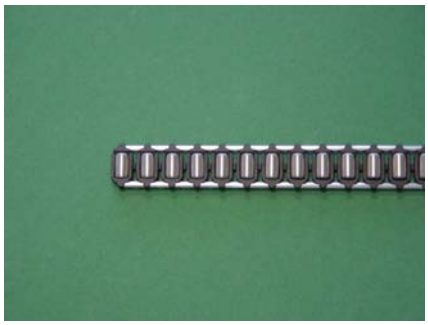
### Example of order / inquiry

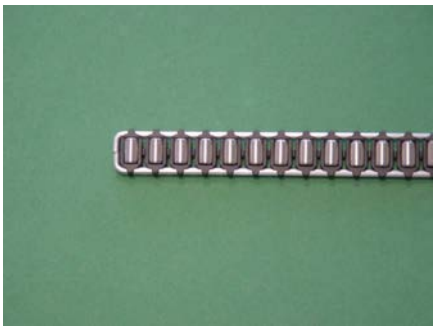
While referring to type KLBF, the order or inquiry should be made with as much details as possible. Apart from stating the type, for making a tender the planned length of cage, number off and the required end closure variant are required.

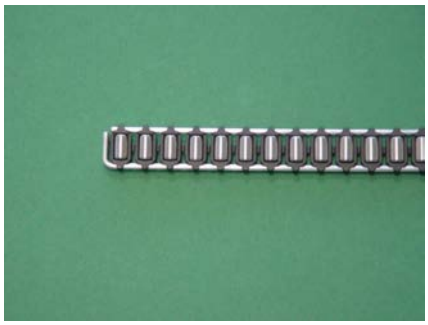
# Linear bearing cages KLBF

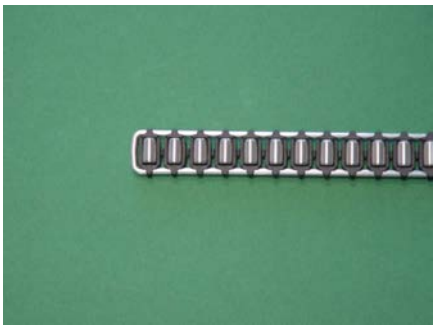
Series KLBF / examples of variants

**Variant example / longitudinal closure**

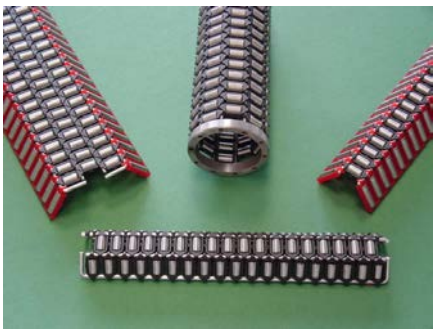




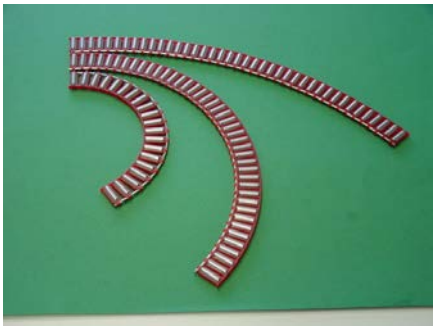




**Variant example / multi-row cages**



**Variant example / cage segments**



# Linear bearing cage KLBF 5020 / KLBF 5020 ZW

Series KLBF 5020/ KLBF 5020... ZW flat roller cage

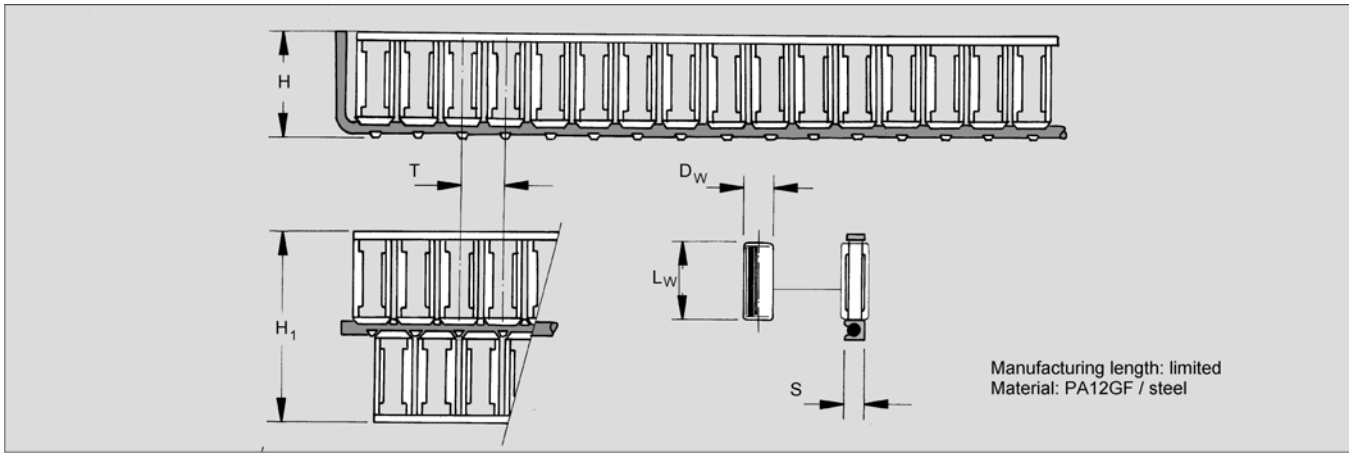



**Table of dimensions** [dimensions in mm]

| KMF-type 1) | roller Ø $D_W$ x $L_W$ | H | S | T | No. of rollers per metre |
|---|---|---|---|---|---|
| **KLBF 5020** | 5,0 x 15,0 | 20 | 3,5 | 8 | 125 |
| | | | | | |

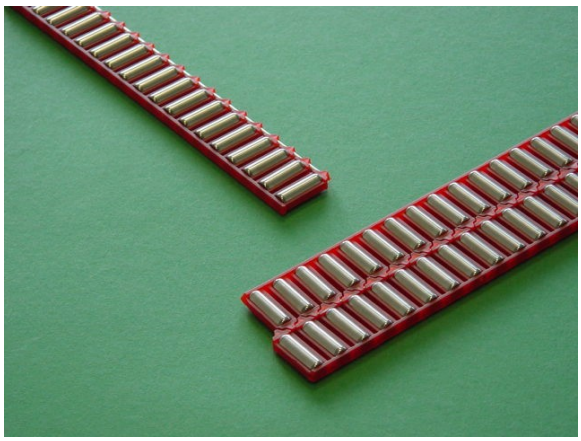
**Table of dimensions** [dimensions in mm]

| KMF-type 1) | roller Ø $D_W$ x $L_W$ | $H_1$ | S | T | No. of rollers per metre |
|---|---|---|---|---|---|
| **KLBF 5020 ZW** | 5,0 x 15,0 | 37 | 3,5 | 8 | 250 |
| | | | | | |

1) Other dimensions on request

Linear bearing cages of series KLBF 5020 and KLBF 5020 ZW are guided and held flat roller cages. The cages are combination cages and consist of a precision steel wire together with a roller cage tape to form a single row flat cage.

The cage can be expanded into a two row flat roller cage (ZW) by connecting another row. Other possible combinations are only possible together with type KLBF 5015, see also example of variant on page 21.
The cages are supplied to the customer`s data ready to fit, including cylindrical rollers.



**Example of order / inquiry**

While referring to type KLBF 5020 (ZW), the inquiry should contain as much detail as possible. We recommend that you consult us about further possible combinations.

# Linear bearing cage KKFF

Series KKFF needle roller- / flat roller cage

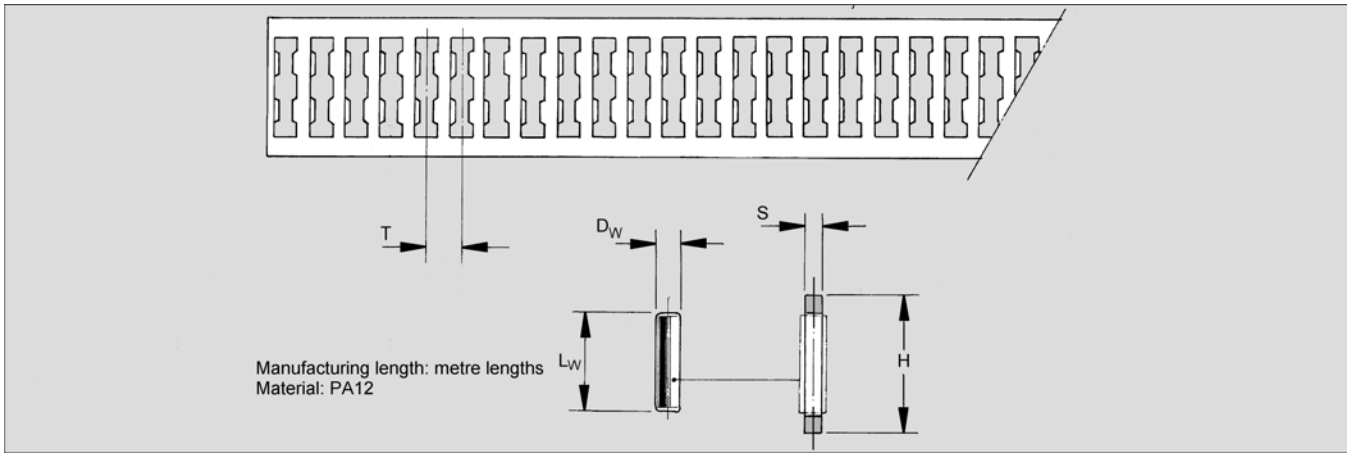


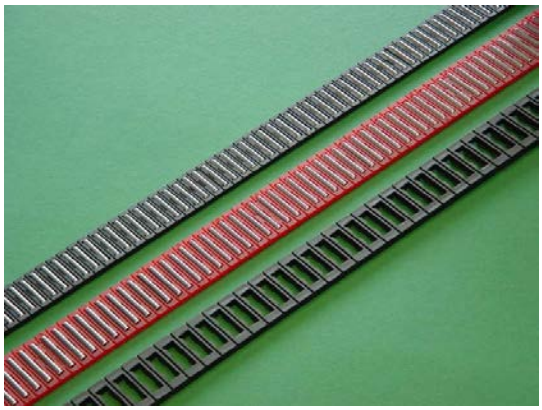

**Table of dimensions** [dimensions in mm]

| KMF-type 1) | needle roller Ø $D_W$ x $L_W$ | H | S | T | no. of needle rollers per metre |
|---|---|---|---|---|---|
| **KKFF 1510** | 1,5 x 7,8 | 10 | 1,1 | 2,9 | 344 |
| **KKFF 2518** | 2,5 x 13,8 | 18 | 2,0 | 4,8 | 208 |
| **KKFF 3020** | 3,0 x 15,8 | 20 | 2,5 | 5,2 | 192 |
| **KKFF 4030** | 4,0 x 23,8 | 30 | 3,0 | 7,0 | 142 |
| **KKFF 5010** | 5,0 x 5,0 | 10 | 2,5 | 7,5 | 133 |
| **KKFF 5023** | 5,0 x 15,0 | 23 | 3,5 | 8,0 | 125 |
| **KKFF 5035** | 5,0 x 27,8 | 35 | 3,5 | 9,0 | 111 |
| **KKFF 10016** | 10,0 x 10,0 | 16 | 2,5 | 13,0 | 77 |
| **KKFF 12040** | 12,0 x 30,0 | 40 | 5,0 | 16,0 | 62 |
| **KKFF 16028** | 16,0 x 16,0 | 28 | 4,0 | 22,0 | 45 |

1) Other dimensions on request

Linear bearing cages of series KKFF are one row plastic cage tapes for rollers or needle rollers. The cage tapes are made in metre lengths and have roller supports.

Possibilities of supply
- ready to fit, cut, filled with rollers / needle rollers (no minimum quantity limit)
- metre lengths filled with rollers, for cutting up oneself (no minimum quantity limit)



**Example of order / inquiry**

| KKFF 3020 | / | 100 metres |
|---|---|---|
| type incl. needle rollers | | quantity in metres for cutting up oneself |

| KKFF 3020 | / | 0490 | 20 off |
|---|---|---|---|
| type incl. needle rollers | | length of cage 490 mm | quantity ready to fit |

# Linear bearing cage KKHW

Series KKHW, angled flat cage

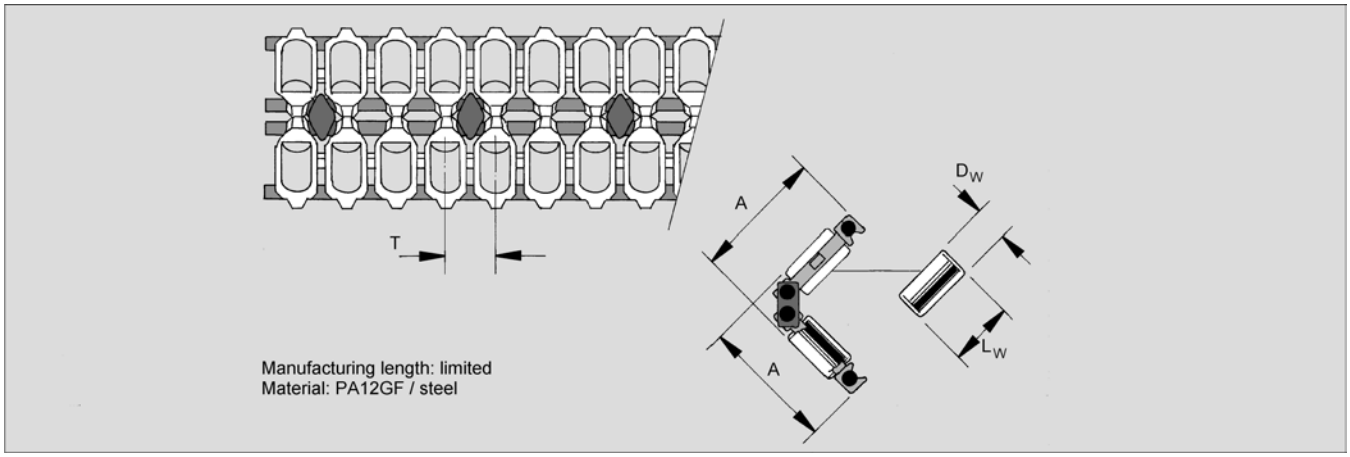


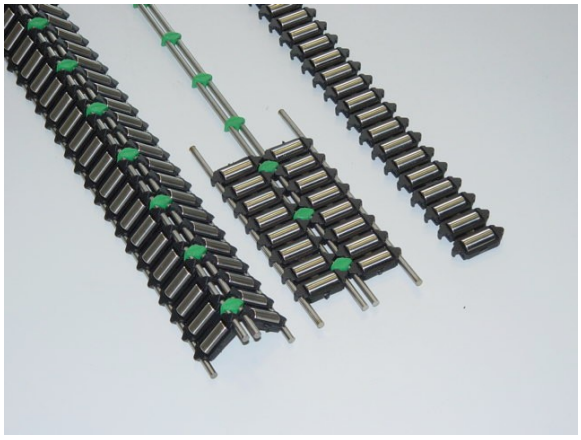

**Table of dimensions** [dimensions in mm]

| KMF-type 1) | roller Ø $D_W$ x $L_W$ | A | T | No. of rollers per metre |
|---|---|---|---|---|
| **KKHW 7030** | 7 x 14 | 30 | 11 | 180 |
| | | | | |

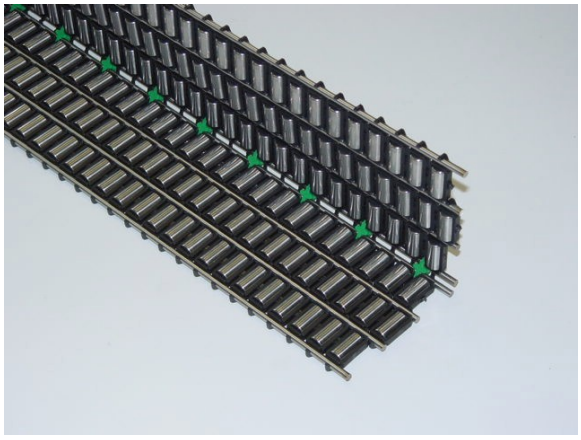
1) Other dimensions on request

Linear bearing cages of series KKHW are single row flat roller cages which are made into angled flat cages by a special support element with fixings. The angle is preferably 90°, but can set to any desired angle.

The shank lengths A with a spacing of 20 mm can be expanded so several row angled flat cages. Angled flat cages are manufactured according to the customers requirements and are supplied ready to fit including rollers.



two row flat cage angled as angled flat cage

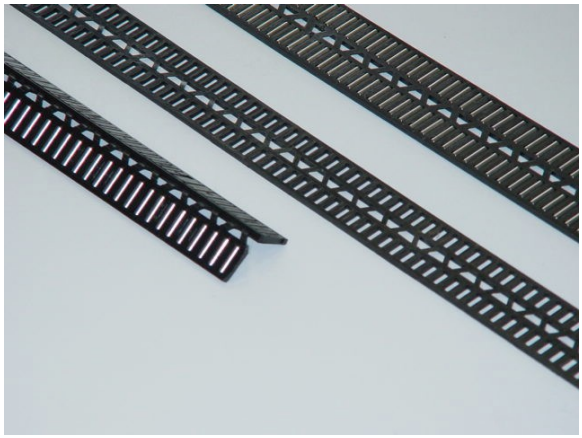


mult-row angled flat cage with spacing of 20 mm can be expanded in any number of rows.

# Special linear bearing cage KKLR

Series KKLR, angled flat cage

Linear cage type KKLR are two row needle flat cages made of plastic. The cage tapes are made in metre lengths and have roller supports. The shanks of the two rows can easily be bent to any angle (preferably 90°) by the special shaping of the middle part. One can produce one row flat cages in metre lengths by separating the two rows.



The angled flat cages shown are KMF developments for certain customers. They are therefore not contained in the standard range and are protected for the customers

KMF will state where to obtain the cages and possible alternatives, on request.

# Special linear bearing cages KKVR

Series KKVR, angled flat cage

Linear bearing cages types KKVR are two row angled flat cages with combined materials of steel / plastic. They are made in metre lengths by a special compound technique. The basic supports are angled, corrosion-resistant steel strips with punched out openings. The openings are made so that the injected plastic pockets can be separated anywhere. Any length can therefore be produced, without any waste.
The linear bearing cages have a rigid angled shank (preferably 90°) and are suitable for vertical use in this version.

The angled flat cages shown are KMF developments for certain customers. They are therefore not contained in the standard range and are protected for the customers.

KMF will state where to obtain the cages and possible alternatives, on request.

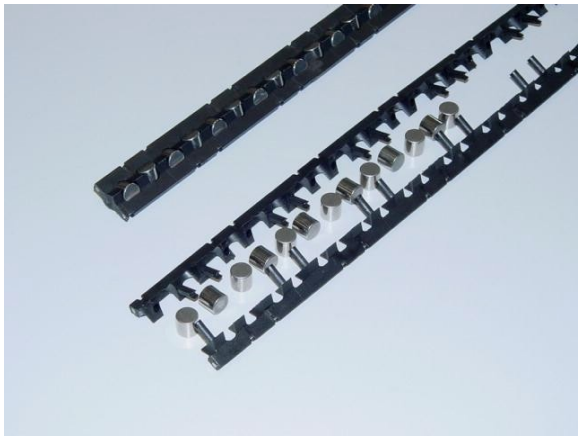
# Special linear bearing cage KKXV

Series KKXV, cross roller cage

Linear bearing cages type KKXV consist of two identical cage tapes, which are made compounded of steel / plastic. The two identical cage halves have a special shape, which makes it possible to produce a cross roller cage of unlimited length by snapping them together.

The steel inserts act to stiffen the glass fibre reinforced plastic basic material and therefore permit running in vertical operation.

The shape permits surrounding the cross cylindrical rollers, so that absolute guidance and support is provided. It is not possible to release the rollers from the cage without destroying it.



horizontally divided cross roller cage
and the two identical halves with rollers

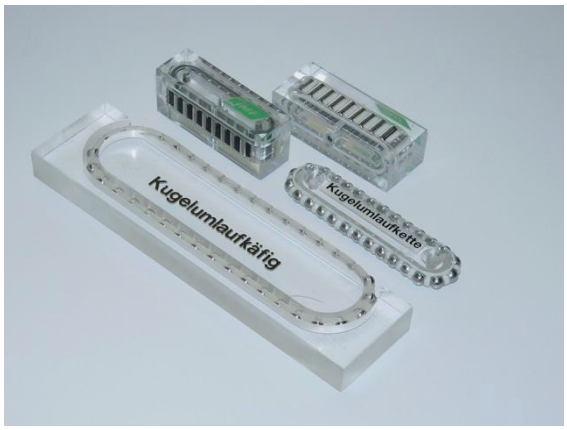
vertically divided cross roller cage and the
two identical halves with rollers

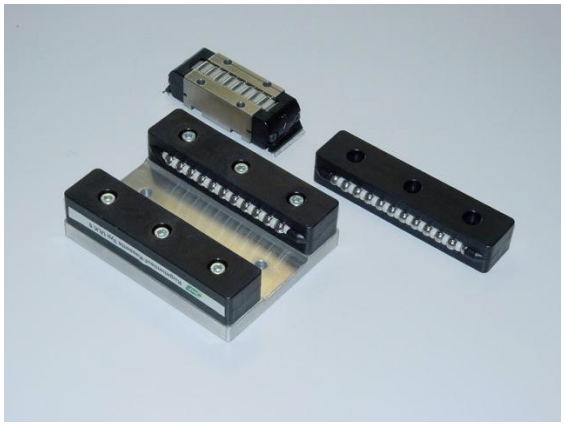
The cross roller cages type KKXV and KMF developments for certain customers. They are therefore not contained in the standard range and are protected for the customers.
KMF will state where they can be obtained and possible alternatives, on request.

# Special linear bearing cages KKUK, KKUX, KKU

Enclosed cages

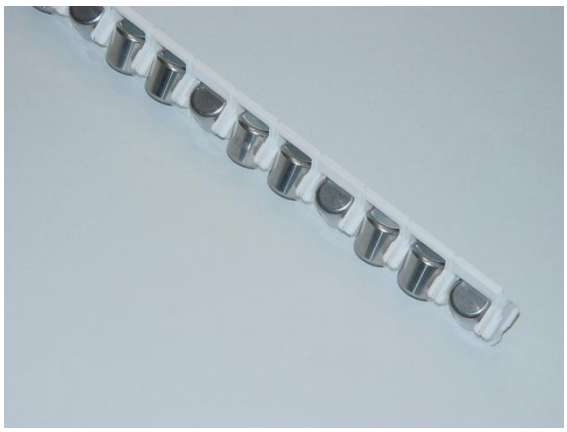
Enclosed cages for balls (KKUK), cross rollers (KKUX) or rollers (KKUR) are originally spacers that hold the rollers spaced and which are combined into ball or roller chains.
The ball and roller chains prevent the opposite rotation of the rollers at the point of contact (contact friction) and contribute considerably to lower noise of the enclosed unit. They reduce wear and permit higher running speeds.



# Special linear bearing cages

Further examples



Linear cross roller cage
Arrangement of rollers 2:1
(2 support rollers / 1 holding roller)

Ball surround bush
closed and open

### Cylindrical rollers KZR 110 / KZR 104

Cross rollers of series KZR 110 / KZR 104 are mainly used for cross roller flat guides. They are cylindrical rollers, whose length (LW) is slightly less than their diameter (DW). Cross rollers are used in KMF standard linear cross roller cages of quality G1 (assortment 0,001 mm). These rollers can be obtained separately according to the following table.

**Table of dimensions** [dimensions in mm]

| KMF-type 1) | Diameter Ø $D_w$ | Length $L_w$ | Circularity | Assortment | Minimum quantity off |
|---|---|---|---|---|---|
| **KZR 110-1,5** | 1,5 | 1,4 | ≦ 0,0005 | 0,001 | 2000 |
| **KZR 110-2,0** | 2,0 | 1,8 | ≦ 0,0005 | 0,001 | 2000 |
| **KZR 110-3,0** | 3,0 | 2,8 | ≦ 0,0005 | 0,001 | 5000 |
| **KZR 110-6,0** | 6,0 | 5,8 | ≦ 0,0010 | 0,001 | 5000 |
| **KZR 110-9,0** | 9,0 | 8,8 | ≦ 0,0010 | 0,001 | 1500 |
| **KZR 110-12,0** | 12,0 | 11,8 | ≦ 0,0010 | 0,001 | 600 |
| **KZR 104-4,0** | 4,0 | 2,8 | ≦ 0,0005 | 0,001 | 2000 |
| **KZR 104-6,5** | 6,5 | 3,9 | ≦ 0,0005 | 0,001 | 5000 |

1) Other dimensions on request
Standard material 100Cr6 (1.3505) hardness 58-65 HRc and corrosion-resistant steel X46Cr13 (1.4034)

### KUG balls

All precision steel balls according to DIN, ISO and AFBMA can be supplied. The ball quality according to DIN 5401 / Grade 15 (Class 2) with 100Cr6 material (hardness 60-66 HRc) is used as standard for KMF linear cages, eg: series KKLK or KKVK. Different qualities from the standard (material, quality, etc) on request.

### NRB needle rollers

All needle rollers according to DIN, ISO and AFBMA can be supplied. The needle roller quality according to DIN 5402 / Grade 2 with 100Cr6 material, hardness 59-65 HRc is used as standard for KMF needle roller cages, eg: series KKFF or KLBF. Needle rollers type NRB have a flat ends of so-called B shape.
Other needle rollers with different qualities and materials are available.

### Special rollers

Rollers of special shapes are made to customer`s specifications. These rollers are also made in small quantities.

This offer is used for producing new running track systems or with special material requirements.

# Product information
Survey

**Product information**

## Linear guide systems
## Light, quiet and resistant to corrosion

| | |
|---|---|
| **Profilschienen - Führung** | **Typ PSF 6** |
| **Laufrollen - Führung** | **Typ LRF 6** |
| **Flüster – Laufrollen - Führung** | **Typ FLF 6** |
| **Kugelumlaufführung** | **Typ KUF 6** |
| **Laufrollen - Segmentführung** | **Typ LSF 6** |
| **Flüster – Laufrollen - Segmentführung** | **Typ FLS 6** |
| **Laufrollen - Kreisführung** | **Typ LKF 6** |
| **Flüster – Laufrollen - Kreisführung** | **Typ FLK 6** |

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KMF Kunststoff-Metall-Formteile GmbH

**Product information**

## Light and quiet, straight
## In arcs and circles

Neue KMF-Profilschienenführungen in Hybridtechnik

**Kugelumlaufführung**
Typ KUF 6

bestehend aus:
Kugelumlaufwagen Typ KUWA 6-80-100
Hohlraum-Profillaufschiene Typ HRPS 6-500

**Flüster-Laufrollen-Segmentführung**
Typ FLS 6

bestehend aus:
Laufrollenwagen Typ LRWK 6-180-30
Hohlraum-Segmentschiene Typ HRSS 6-180-80

**Flüster-Laufrollen-Kreisführung**
Typ FLK 6

bestehend aus:
Laufrollenwagen Typ LRWK 6-180-30
Hohlraum-Kreisschiene Typ HRKS 6-360

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KMF Kunststoff-Metall-Formteile GmbH

**Product information**

## Light and corrosion-resistant
## Hollow profile running rails

Neue KMF Hohlraum – Profillaufschiene in Hybridtechnik

Hohlraum – Kreisschiene Typ HRKS 6
Hohlraum – Profillaufschiene Typ HRPS 6
Hohlraum – Segmentschiene Typ HRSS 6

Profillaufschiene Typ PSXC 06

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Druckschrift DKL 100
10/2001

Druckschrift DKL 100
10/2001

**Product information**

## Light and corrosion-resistant
## Hollow profile running rails

Neue KMF Hohlraum – Profillaufschiene in Hybridtechnik

**Hohlraum – Profillaufschiene**
Typ HRPS 6

bestehend aus:

| | |
|---|---|
| Profillaufschiene | Typ PSXC 06 |
| Befestigungselemente | Typ BE 6 |
| Abstandshalter | Typ AH 6 |
| Endstücke | Typ ES 6 |
| Befestigungsschrauben | |

**Hohlraum-Segmentschiene**
Typ HRSS 6

bestehend aus:

| | |
|---|---|
| Profillaufschiene | Typ PSXC 06 |
| Befestigungselemente | Typ BE 6 |
| Abstandshalter | Typ AH 6 |
| Endstücke | Typ ES 6 |
| Befestigungsschrauben | |

**Hohlraum - Kreisschiene**
Typ HRKS 6

bestehend aus:

| | |
|---|---|
| Profillaufschiene | Typ PSXC 06 |
| Befestigungselemente | Typ BE 6 |
| Abstandshalter | Typ AH 6 |

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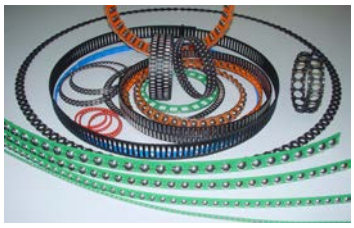
# Printed matter
Survey

## Ball bearing cages



Standard range

Publication WLK 100 E
09/2004

Druckschrift DKL 100
10/2001

## Radial - and axial needle roller and cage assemblies

## Axial bearing washers

Type series KKBF
Type series AXK
Type series ASS
Type series KEBF
Type series ASXK
Type series SKE

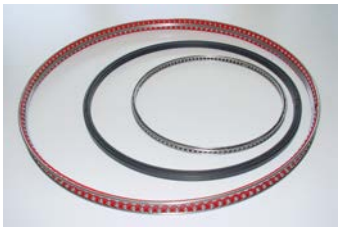
Publication UFT 100 E
09/2004

## SLIM - SPLIT - BEARING

Type series PBXU
Type series PBXC
Type series PBAC
Type series PFXC
Type series PFAC
Type series HFXD
Type series PBDV

Publication DRL 100 E
09/2004

## Wire ball bearing



Type series KVE
Type series MVE
Type series ZVE
Type series KER
Type series KED
Type series DFX
Type series DSE

Publication DKL 100 E
10/2004

## Bearing assembly

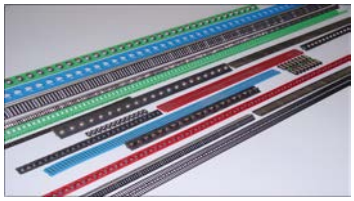
Special range

Publication DVS 100 E
02/2002

## Construction elements

Publication WKE 100 E
10/2001

## Linear ball cages



Standard range

Publication LLK 100 E
09/2004

## Linear motion products

Type series PSF 6
Type series LRF 6
Type series FLF 6
Type series KUF 6
Type series LSF 6
Type series FLS 6
Type series LKF 6
Type series FLK 6

Publication LFS 100
08/2002

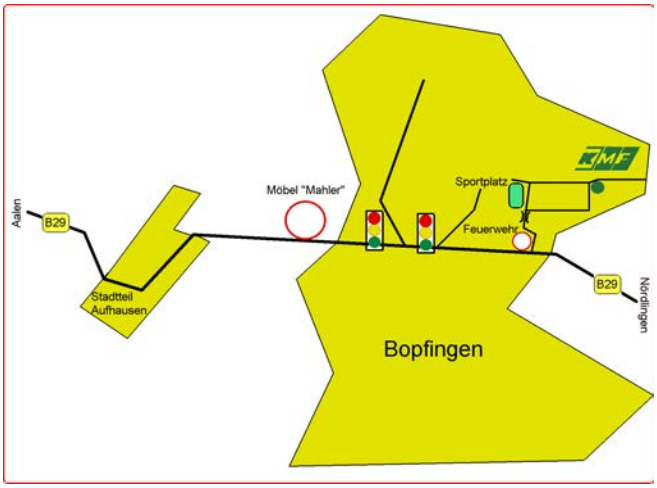
## Roller - bearing assembly

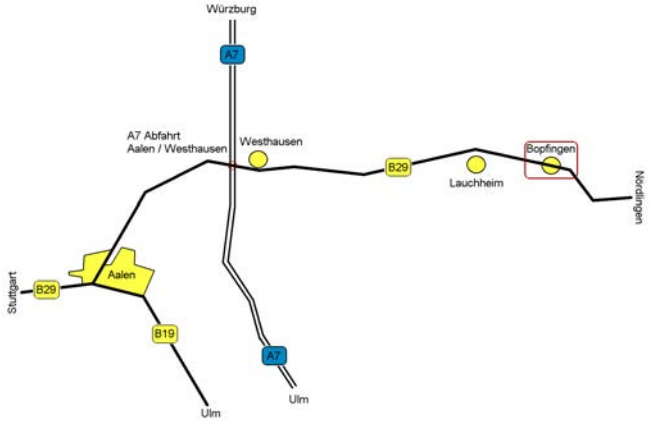

Type series LFDV

# Directions to find firm ...

**... Starting from the B29**
**in the Nördlingen direction**

Shortly after entering the place, turn right at the Fire Station, then after 30 m, turn left again, follow the street, pass the Sports Stadium, turn right to the Postweg,
we are 200 m along on the right hand side.




**... Starting from the A7 exit Aalen / Westhausen**

take the B29 in the Nördlingen direction.
Shortly before the exit to the Fire Station, turn left, then after 30 m, turn left again, follow the street, pass the Sports Stadium, turn right to the Postweg,
we are 200 m along on the right hand side.

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