IKO

NEEDLE ROLLER CAGES
FOR ENGINE CONNECTING RODS

- ● **Needle Roller Cages for Big End**
- ● **Needle Roller Cages for Small End**

■ *Structure and Features*

IKO Needle Roller Cages for Engine Connecting Rods are bearings for use in engine connecting rods. These bearings have superior performance proven in high performance engines of racing motor cycles, and are widely used in small motor vehicles, motor cycles, outboard marines, snow mobiles, high-speed compressors, etc. and also in general-purpose engines.

Bearings for engine connecting rods are used under extremely severe and complex operating conditions such as heavy shock loads, high speeds, high temperatures and stringent lubrication.

Needle Roller Cages for Engine Connecting Rods are lightweight, and have high load ratings and high rigidity as well as superior wear resistance to withstand these severe conditions.
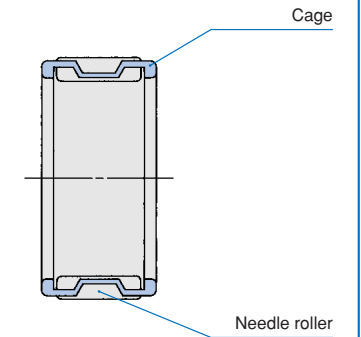
■ *Types*

In Needle Roller Cages for Engine Connecting Rods, the types shown in Table 1 are available.

Table 1 Types
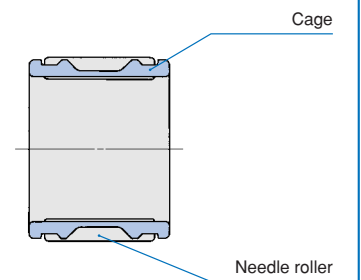
Type	For big end	For small end
Model code	KT ··· EG	KTV ··· EG

**Structures of Needle Roller Cages
for Engine Connecting Rods**

KT···EG

Cage

Needle roller

KTV···EG

Cage
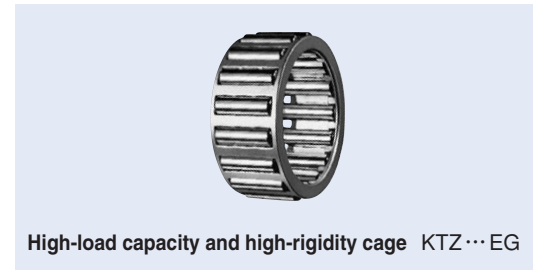
Needle roller

C

KT···EG
KTV···EG

Needle Roller Cages for Big End   KT···EG

These roller cages are subjected to acceleration and deceleration during their rotating and epicyclic motion due to crank shaft rotation. To withstand such conditions, they are made of a special alloy and are light-weight with high rigidity.

They are guided on their outer periphery surface with superior lubricating properties.

For the purpose of using them under severe conditions such as high rotational speed and stringent lubrication, bearings plated with non-ferrous metals are also available on request.

High-load capacity and high-rigidity cages to be used for racing motor cycles (See the photo bellow.), split needle cages for solid (one-piece) type crank-shafts and other special specification cages of various types are also available. Please consult **IKO** when required.

High-load capacity and high-rigidity cage KTZ···EG

Needle Roller Cages for Small End   KTV···EG

These roller cages oscillates at high speeds within a limited loading zone under heavy shock loads. Thus, these cages are designed to be lightweight and have high rigidity with a well-balanced structure. In these cages, a number of needle rollers having a small diameter are incorporated to reduce the rolling contact stress in the loading zone.
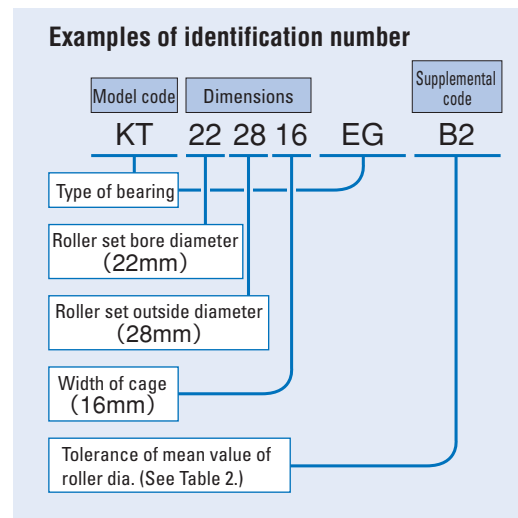
Needle Roller Cages for Small End are classified into two types, the outer surface guide type and the inner surface guide type. This classification is shown in the table of dimensions.

In the outer surface guide type, the cage is guided by the sliding contact between the inner surface of the connecting rod and the outer surface of the cage.

In the inner surface guide type, the cage is guided by the sliding contact between the outer surface of the pin and the inner surface of the cage.

■ Identification Number

The identification number of Needle Roller Cages for Engine Connecting Rods consists of a model code, dimensions and any supplemental codes as shown below.

Examples of identification number

Model code	Dimensions				Supplemental code
KT	22	28	16	EG	B2

- Type of bearing
- Roller set bore diameter (22mm)
- Roller set outside diameter (28mm)
- Width of cage (16mm)
- Tolerance of mean value of roller dia. (See Table 2.)

■ Accuracy

The diameter tolerances of needle rollers of Needle Roller Cages for Engine Connecting Rods are classified as shown in Table 2. When the classification symbol is not indicated in the identification number, the classification symbol "B2" is applied.

The tolerance of the cage width B_c is $-0.2 \sim -0.4$ mm. But cages with marks in the B_c column in the dimension tables are manufactured with the following width tolerances.

● : $0 \sim -0.2$ mm   ■ : $-0.1 \sim -0.3$ mm

Table 2 Tolerances of needle roller diameter   unit: μm

Class	Classification symbol[1]	Tolerance of mean value of roller dia. [2]
Standard	B 2	$0 \sim -2$
	B 4	$-2 \sim -4$
Semi-standard	B 6	$-4 \sim -6$
	B 8	$-6 \sim -8$
	B10	$-8 \sim -10$

Notes [1] The classification symbol is indicated at the end of the identification number.
[2] Tolerances for circularity are based on JIS B 1506:2005 (Rolling bearings - Rollers).

■ Clearance

Radial internal clearances are selected according to the type of engine and the operating conditions (rotational speed, load, lubricating conditions, etc.). If a bearing is used with an inadequate clearance, bearing troubles such as seizure, early flaking and noise increase may occur, leading to an engine failure. Therefore, it is necessary to select the clearance carefully according to test results and experience.

Recommended radial internal clearances are shown in Table 3. When operating at high speeds, it is recommended to select the upper limit of the clearance.

■ Fit

To obtain the recommended clearance shown in Table 3, it is general practice to match a connecting rod, crank pin or piston pin and needle roller cage of suitable tolerances for assembly.

■ Precautions for Use

When designing a connecting rod, crank pin and piston pin, the following precautions should be taken, because the raceways are subjected to loads under extremely severe conditions.

❶ **Material**

It is recommended to use carburizing steel because the raceways are subjected to fluctuating loads with frequent and heavy shock loads. Generally, chromium molybdenum steel is used. Nickel chromium molybdenum steel is also used.

❷ **Hardness**

The recommended surface hardness of the raceway is $697 \sim 800$HV ($60 \sim 64$HRC). While the effective hardening depth differs depending on the applications, the general value is $0.6 \sim 1.2$ mm.

❸ **Surface roughness**

To minimize initial wear and to extend life, it is recommended that the surface roughness of the crank pin and piston pin be 0.1μmR_a or less, and the surface roughness of the connecting rod large end and small end bores be 0.2μmR_a or less.

❹ **Accuracy**

Circularity and cylindricity of connecting rod, piston pin and crank pin are as shown in Table 4.

❺ **Parallelism and torsional accuracy of connecting rod bores**

$L \pm 0.02$ mm and $E \pm 0.02$ mm shown in Fig. 1 indicate the parallelism and torsional accuracy between the big end and small end bores of the connecting rod, respectively. The tolerance range is 0.04 mm or less per 100 mm in case of a general-purpose engine and 0.02 mm or less for a high-speed engine such as a racing motorcycle engine. When these accuracy conditions are not satisfied, the axial forces on the needle roller cage and connecting rod will increase, directly leading to a failure such as seizure. Careful consideration is required.

**Table 3 Recommended radial internal clearance**   unit: μm

Shaft dia. mm		Big end	Small end
Over	Incl.		
—	18	$(d_p - 6) \sim d_p$	$3 \sim 15$
18	30	$(d_p - 8) \sim d_p$	
30	40	$(d_p - 12) \sim d_p$	

Remark d_p is obtained using the following formula for roller pitch circle diameter in millimeters, and changing the unit from millimeters to micrometers.

Roller pitch circle dia. = $\dfrac{F_w + E_w}{2}$

Example   KT 222814 EG for big end
Recommended clearance is; $17 \sim 25 \mu$m

Table 4 Accuracy of connecting rod, piston pin and crank pin   unit: μm

Range of dia. mm		Crank pin diameter d_1 Piston pin diameter d_2		Big end bore D_1 Small end bore D_2	
Over	Incl.	Circularity MAX.	Cylindricity MAX.	Circularity MAX.	Cylindricity MAX.
—	18	1	2	2	3
18	30	2	3	3	4
30	40	3	4	4	5

Remark   Refer to Fig.1 for the dimension symbols.

Fig.1

C
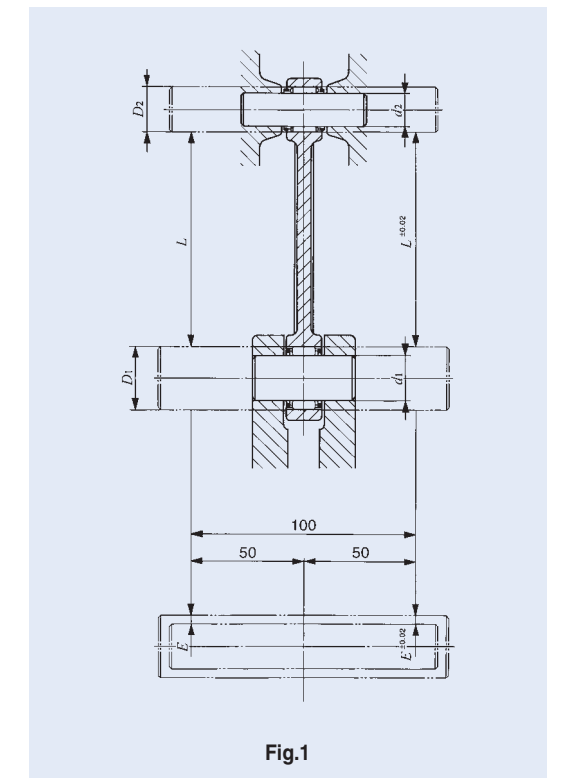
KT···EG
KTV···EG

NEEDLE ROLLER CAGES FOR ENGINE CONNECTING RODS

Needle Roller Cages for Big End

KT···EG

Shaft dia. 8 — 32mm

Shaft dia. mm	Identification number	Mass (Ref.) g	Boundary dimensions mm			Basic dynamic load rating C N	Basic static load rating C0 N
			F_w	E_w	B_c		
8	KT 8128 EG	2.1	8	12	8	3 280	2 660
10	KT 101410 EG	3.2	10	14	10	4 900	4 680
12	KT 121610 EG	3.8	12	16	10	5 650	5 890
12	KT 121710 EG	5.3	12	17	10	6 670	6 380
14	KT 14199.7 EG	5.7	14	19	9.7	6 120	5 880
14	KT 141910 EG	5.7	14	19	10	6 640	6 530
15	KT 15199 EG	4.2	15	19	9	5 790	6 460
15	KT 152010 EG	6.1	15	20	10	7 100	7 260
16	KT 162211.5 EG	9.5	16	22	■11.5	9 550	9 660
16	KT 162212 EG	9.7	16	22	12	10 500	10 900
18	KT 182210 EG	5.7	18	22	10	7 500	9 560
18	KT 182411.6 EG	11	18	24	■11.6	10 600	11 500
18	KT 182412 EG	11	18	24	12	11 800	13 100
20	KT 202612 EG	12	20	26	12	12 400	14 300
20	KT 202614 EG	13.8	20	26	14	13 000	15 200
20	KT 202814 EG	20	20	28	●14	15 700	16 100
22	KT 222814 EG	14.9	22	28	14	13 600	16 600
22	KT 222816 EG	17.5	22	28	16	15 700	19 800
22	KT 222912 EG	15.2	22	29	12	12 900	14 000
22	KT 223215 EG	30	22	32	15	21 300	21 500
23	KT 232913 EG	14.9	23	29	13	12 800	15 600
24	KT 243015 EG	17.9	24	30	15	14 200	18 000
24	KT 243016 EG	18.2	24	30	16	16 300	21 500
24	KT 243120 EG	28	24	31	20	20 800	26 400
30	KT 303818 EG	35.5	30	38	18	24 900	32 600
32	KT 324220 EG	54	32	42	20	31 900	39 400

Needle Roller Cages for Small End

KTV···EG

Shaft dia. 9 — 18mm

Shaft dia. mm	Identification number	Mass (Ref.) g	Boundary dimensions mm			Basic dynamic load rating C N	Basic static load rating C0 N	Cage guide type
			F_w	E_w	B_c			
9	KTV 91211.5 EG	2.8	9	12	●11.5	3 900	4 070	Outer surface guide
9	KTV 91214 EG	3.5	9	12	14	4 440	4 810	Inner surface guide
10	KTV 101316 EG	4.5	10	13	16	4 400	4 880	Inner surface guide
10	KTV 101410 EG	3.8	10	14	10	4 520	4 220	Inner surface guide
10	KTV 101411 EG	4.1	10	14	11	5 060	4 880	Outer surface guide
10	KTV 101412.5 EG	4.8	10	14	●12.5	5 590	5 540	Inner surface guide
10.5	KTV 10.51415 EG	5.1	10.5	14	15	5 710	6 270	Outer surface guide
12	KTV 121514.3 EG	4.3	12	15	●14.3	5 840	7 390	Outer surface guide
12	KTV 121613 EG	5.6	12	16	13	7 020	7 800	Outer surface guide
12	KTV 121615.5 EG	6.8	12	16	●15.5	7 600	8 600	Outer surface guide
14	KTV 141812 EG	6	14	18	12	6 780	7 760	Inner surface guide
14	KTV 141816.5 EG	8.2	14	18	16.5	9 180	11 500	Outer surface guide
14	KTV 141822 EG	10.8	14	18	●22	9 950	12 600	Inner surface guide
16	KTV 162019 EG	10.6	16	20	19	10 800	14 600	Outer surface guide
16	KTV 162022 EG	12.7	16	20	22	11 400	15 700	Inner surface guide
18	KTV 182223.5 EG	14.9	18	22	■23.5	13 000	19 300	Inner surface guide
18	KTV 182321 EG	16.4	18	23	21	14 400	18 900	Inner surface guide

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