

High-carbon chromium bearing steel is used for needle rollers. The needle rollers are ground and polished after heat treatment. The surface hardness is 60 to 65 HRC.

Needle rollers are provided as rolling elements or pins for operation directly on the shaft.

1. Shape of needle rollers

The standard shape of needle rollers has a flat surface on its end face (referred to as F type). Crowned contact surfaces are also available (suffix code: E) and can reduce the edge load on the rollers. Excessive edge load on rollers can result in premature failure. Contact NTN Engineering for more information.

Table 1 End face shape

Type	Designation	Shape
F	Flat surface	

2. Needle roller part number composition

The needle roller part number is composed of a model code (end face type), a dimension code [diameter (D_w) x length (L_w)], and a suffix code (Refer to Fig. 1).

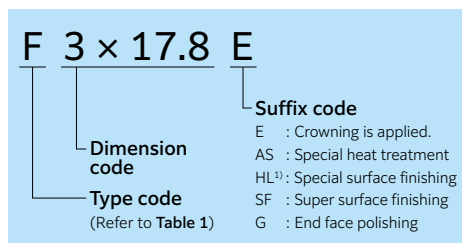


Fig. 1

1) For HL, contact NTN Engineering.

3. Accuracy of needle rollers

The dimensional accuracy of needle rollers is maintained in accordance with JIS B 1506 (Rolling bearings—Rollers). (Refer to Table 2)

Table 2 Accuracy of needle rollers Unit: μm

Characteristics	Tolerance and tolerance values
Tolerance of average value of diameter D_w	0 to -10
Mutual tolerance of lot diameter D_w (max.)	2
Roundness of diameter D_w , diameter variation in flat surface	1.0 ($L_w/D_w \leq 6$) 1.5 ($L_w/D_w > 6$)
Tolerance of length L_w	h13
Accuracy class	Class 2

Needle rollers are separated into groupings of $2\mu\text{m}$ ranges based on the diameter of the roller and are separately packaged to maintain consistency between supplied rollers. Depending on the tolerance range, the needle rollers are classified by label colors such as red, black, and blue, and then delivered.

Bearing rollers in packages having different label colors must not be mixed.

Table 3 Diameter dimensional tolerance and classification of needle rollers

Label color	Tolerance range (μm)	Classification
Red	0 to -2	Standard
Navy	-1 to -3	
Blue	-2 to -4	
Black	-3 to -5	
White	-4 to -6	
Gray	-5 to -7	Sub standard
Green	-6 to -8	
Brown	-7 to -9	
Yellow	-8 to -10	

4. Application of needle rollers

When a full complement needle roller bearing is made with a standard needle roller, the shaft diameter (d), the housing bore diameter (D), the circumferential clearance (ΔC), and the radial internal clearance (Δr) are calculated from the needle roller diameter (D_w) and the number of rollers (Z) (see Fig. 2).

The minimum value of the circumferential clearance (ΔC) is calculated by Equation (1). The radial internal clearance (Δr) is selected based on the shaft diameter and the usage conditions using section "E. Needle roller bearings 2.4 Solid type needle roller bearings Table 9 (E-7)" as guidance. Full complement needle roller bearings generally require a larger radial inner clearance than a needle roller bearing with cage.

$$\Delta C = (0.005 \sim 0.020) \times Z \text{ mm} \text{ (minimum value) } \dots\dots\dots (1)$$

The minimum value of the housing bore diameter (D) and the maximum value of the shaft diameter (d) are calculated from Equations (2) and (3).

$$D = \frac{1}{\sin\left(\frac{\pi}{Z}\right)} \cdot \left(D_w + \frac{\Delta C}{Z}\right) + D_w \text{ mm} \text{ (minimum value) } \dots\dots\dots (2)$$

$$d = D - 2D_w - \Delta r \text{ mm} \text{ (maximum value) } \dots\dots\dots (3)$$

In order to retain the needle rollers in the housing using the keystone method, the maximum value of the housing bore diameter (D) is calculated from the minimum value of the roller diameter ($D_{w \text{ min}}$) and the number of rollers (Z) using Equation (4) (see Fig. 3). Factor K is shown in Table 4.

$$D = K \cdot D_{w \text{ min}} \text{ mm (maximum value) } \dots (4)$$

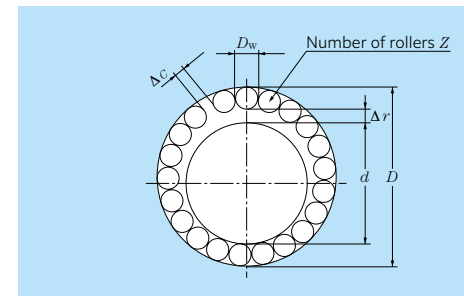


Fig. 2

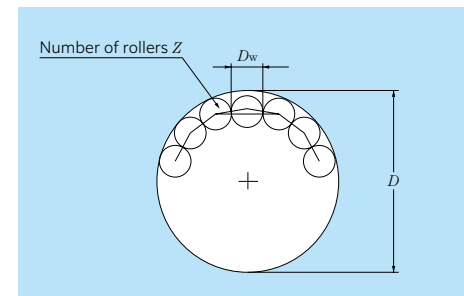
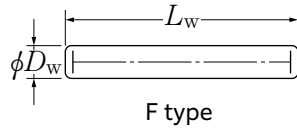


Fig. 3

Table 4 Values of factor K

Z	K	Z	K
8	3.6763333	17	6.4536463
9	3.9709394	18	6.7689303
10	4.2727719	19	7.0846088
11	4.5789545	20	7.4006100
12	4.8879667	21	7.7168786
13	5.1989251	22	8.0333713
14	5.5112799	23	8.3500534
15	5.8246707	24	8.6668970
16	6.1388508	25	8.9838796

F type



d 1.5 ~ 4.5mm

Boundary dimensions mm	Number	Mass kg (approx.) 1 000 pieces	
			D_w
1.5	5.8	F1.5 × 5.8	0.080
	6.8	F1.5 × 6.8	0.090
	7.8	F1.5 × 7.8	0.104
	9.8	F1.5 × 9.8	0.131
	11.8	F1.5 × 11.8	0.159
	13.8	F1.5 × 13.8	0.186
2	6.8	F2 × 6.8	0.158
	7.8	F2 × 7.8	0.183
	9.8	F2 × 9.8	0.232
	11.8	F2 × 11.8	0.281
	13.8	F2 × 13.8	0.330
	15.8	F2 × 15.8	0.379
	17.8	F2 × 17.8	0.428
19.8	F2 × 19.8	0.477	
2.5	7.8	F2.5 × 7.8	0.284
	9.8	F2.5 × 9.8	0.351
	11.8	F2.5 × 11.8	0.438
	13.8	F2.5 × 13.8	0.514
	15.8	F2.5 × 15.8	0.591
	17.8	F2.5 × 17.8	0.668
	19.8	F2.5 × 19.8	0.745
	21.8	F2.5 × 21.8	0.821
23.8	F2.5 × 23.8	0.898	
3	9.8	F3 × 9.8	0.556
	11.8	F3 × 11.8	0.671
	13.8	F3 × 13.8	0.784
	15.8	F3 × 15.8	0.897
	17.8	F3 × 17.8	1.01
	19.8	F3 × 19.8	1.12
	21.8	F3 × 21.8	1.23
	23.8	F3 × 23.8	1.34
	25.8	F3 × 25.8	1.45
27.8	F3 × 27.8	1.56	

Boundary dimensions mm	Number	Mass kg (approx.) 1 000 pieces	
			D_w
3.5	11.8	F3.5 × 11.8	0.849
	13.8	F3.5 × 13.8	1.00
	15.8	F3.5 × 15.8	1.15
	17.8	F3.5 × 17.8	1.30
	19.8	F3.5 × 19.8	1.45
	21.8	F3.5 × 21.8	1.60
	23.8	F3.5 × 23.8	1.75
	25.8	F3.5 × 25.8	1.90
	29.8	F3.5 × 29.8	2.20
	31.8	F3.5 × 31.8	2.35
34.8	F3.5 × 34.8	2.58	
4	13.8	F4 × 13.8	1.27
	15.8	F4 × 15.8	1.50
	17.8	F4 × 17.8	1.70
	19.8	F4 × 19.8	1.89
	21.8	F4 × 21.8	2.09
	23.8	F4 × 23.8	2.26
	25.8	F4 × 25.8	2.48
	27.8	F4 × 27.8	2.68
	29.8	F4 × 29.8	2.87
	31.8	F4 × 31.8	3.07
	34.8	F4 × 34.8	3.31
37.8	F4 × 37.8	3.62	
39.8	F4 × 39.8	3.82	
4.5	17.8	F4.5 × 17.8	2.11
	19.8	F4.5 × 19.8	2.36
	21.8	F4.5 × 21.8	2.61
	23.8	F4.5 × 23.8	2.86
	25.8	F4.5 × 25.8	3.11
	29.8	F4.5 × 29.8	3.62
	31.8	F4.5 × 31.8	3.87
	34.8	F4.5 × 34.8	4.25
	37.8	F4.5 × 37.8	4.63
	39.8	F4.5 × 39.8	4.88
44.8	F4.5 × 44.8	5.51	

d 5mm

Boundary dimensions mm	Number	Mass kg (approx.) 1 000 pieces	
			D_w
5	19.8	F5 × 19.8	2.89
	21.8	F5 × 21.8	3.20
	23.8	F5 × 23.8	3.52
	25.8	F5 × 25.8	3.82
	29.8	F5 × 29.8	4.45
	31.8	F5 × 31.8	4.74
	34.8	F5 × 34.8	5.11
	37.8	F5 × 37.8	5.55
	39.8	F5 × 39.8	5.85
	49.8	F5 × 49.8	7.33