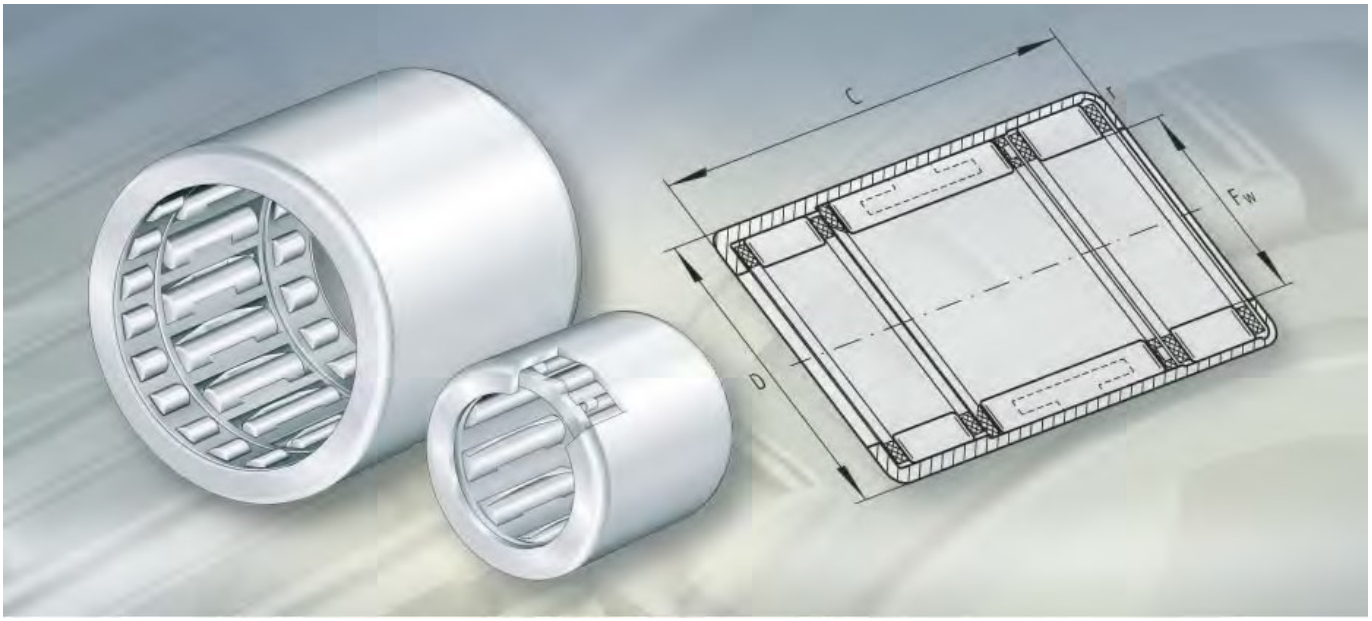


Drawn cup roller clutches

Drawn cup roller clutches

Without bearing arrangement

With or without knurling
With steel springs

HF

HF..-R

With or without knurling
With plastic springs

HF..-KF

HF..-KF-R

With bearing arrangement

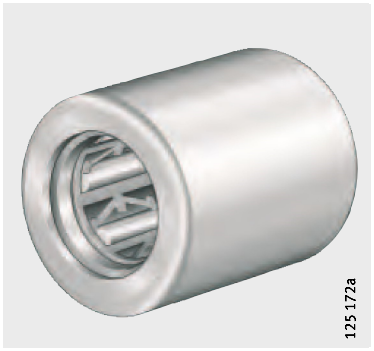
With or without knurling
With steel springs

HFL

HFL..-R

With or without knurling
With plastic springs

HFL..-KF



HFL..-KF-R

Drawn cup roller clutches

Features

Drawn cup roller clutches are one-way clutches comprising thin-walled, drawn outer rings with a series of ramps on the inside diameter, plastic cages, pressure springs and needle rollers. They can transmit high torques in one direction and are particularly compact in a radial direction. The roller clutches are available with and without bearing arrangements.

Drawn cup roller clutches give very precise indexing, since the individual spring loading of the needle rollers ensures continuous contact between the shaft, needle rollers and ramps. They allow high indexing frequencies due to their low mass and the resulting low moment of inertia of the clamping elements. They also have a low overrunning frictional torque.

Drawn cup roller clutches can be used in various applications such as indexing clutches, back-stopping clutches and overrunning clutches. In these cases, the drawn cup roller clutch performs an overrunning or locking function.

Drawn cup roller clutches without bearing arrangement

Roller clutches HF do not have a bearing arrangement and can only transmit torques.

Drawn cup roller clutches HF have steel pressure springs, while roller clutches HF..KF have plastic pressure springs.

In the case of drawn cup roller clutches without a bearing arrangement, concentricity to the shaft axis must be secured by additional rolling bearings or drawn cup roller clutches with a bearing arrangement must be used.

With knurling

Roller clutches with a knurled outside surface have the suffix R and are suitable for use with plastic housings.

The knurling covers all or part of the length of the drawn cup.

Drawn cup roller clutches

Drawn cup roller clutches with bearing arrangement

Roller clutches HFL have an integral plain or rolling bearing arrangement and can support torques as well as radial forces.

Drawn cup roller clutches HFL have steel pressure springs, roller clutches HFL..KF have plastic pressure springs.

With knurling

Roller clutches with a knurled outside surface have the suffix R and are suitable for use with plastic housings.

The knurling covers all or part of the length of the drawn cup.

Sealing

Drawn cup roller clutches are supplied open on both sides.

Lubrication

The roller clutches are greased using a lithium soap grease to GA26. In many cases, the initial greasing is sufficient to last the operating life of the bearings.

For applications with oil lubrication, roller clutches are available without greasing. These roller clutches are coated with a preservative. Further information on lubrication: see page 799.

Operating temperature

Drawn cup roller clutches are suitable for operating temperatures from –10 °C to +70 °C, restricted by the grease.

Suffixes

Suffixes for available designs: see table.

Available designs

Suffix	Description	Design
–	Steel pressure springs	Standard
KF	Plastic pressure springs	
R	Knurled outside surface	
RR	Drawn cup roller clutch with Corrotect® coating	Special design, available by agreement

Design and safety guidelines

Drawn cup roller clutches should not be used if a malfunction could lead to personal injury.

New applications, especially those involving extreme conditions, should first be verified by tests.

Correct functioning can only be guaranteed if the concentricity error between the support bearing and the shaft can be kept to a low value.

Limiting load

In the case of drawn cup roller clutches with plain bearings, the product of the actual speed n and the radial load F_r must not exceed the value stated for the limiting load $(F_r \cdot n)_{max}$.

The operating limits are determined by the limiting speeds stated in the dimension tables and the permissible radial load.

Indexing frequency and indexing accuracy

In order not to overload the roller clutch, the inertia of the entire system must be taken into consideration. The high indexing accuracy is due to the individual spring loading of the needle rollers, which ensures continuous contact between the shaft, needle rollers and clamping surface.

The indexing accuracy is influenced by the indexing frequency, lubrication, fitting tolerances, adjacent construction, elastic deformation of the adjacent parts and the drive method, either through the shaft or the housing. Optimum accuracy is achieved if the drive is via the shaft.

Transmissible torque

Transmission of torque requires a rigid housing. The transmissible torque is therefore dependent on the shaft and housing material, the shaft hardness, the wall thickness of the housing and the shaft and housing tolerances.

When calculating the torque, the maximum drive torque and the moment of inertia of the masses during acceleration must be taken into consideration.

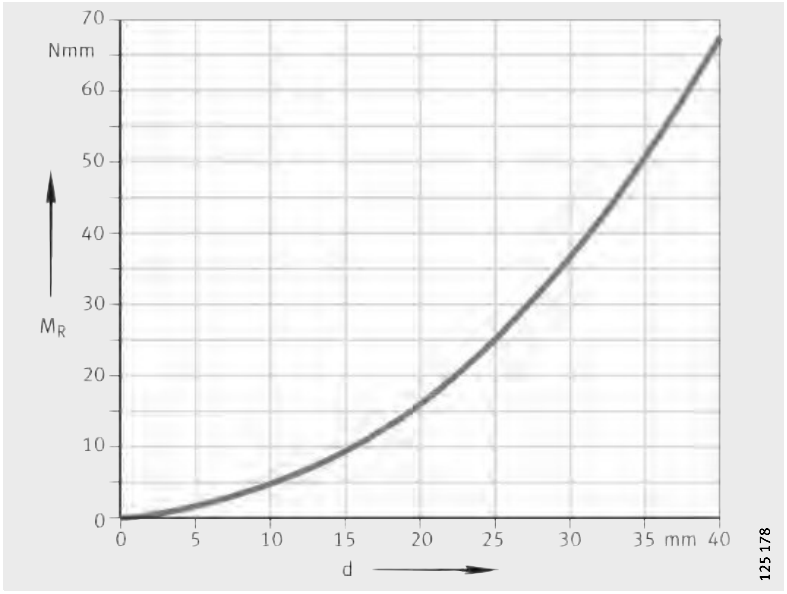
Frictional torque and frictional energy

The frictional torque curve is shown in *Figure 1*.

The frictional energy during idling is dependent on whether the shaft or the outer ring is rotating, *Figure 2*.

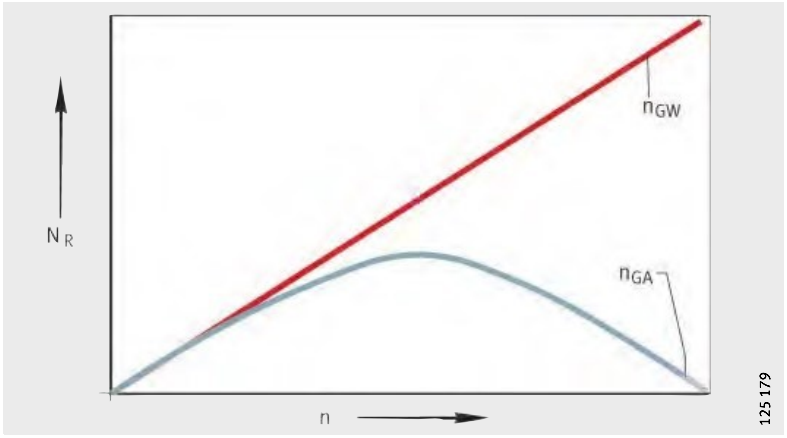
Rotating outer ring

If the outer ring rotates, the frictional energy increases with speed at first but then, due to the centrifugal force of the needle rollers, it decreases gradually towards zero. At this speed, there is no longer any frictional contact between the needle rollers and the shaft. Due to the increasing centrifugal force, the needle rollers lift from the shaft.



M_R = frictional torque during idling
d = shaft diameter

Figure 1
Frictional torque during idling, as a function of shaft diameter



n = speed
N_R = frictional torque during idling
n_{GA} = limiting speed with rotating outer ring
n_{GW} = limiting speed with rotating shaft

Figure 2
Frictional energy during idling, as a function of speed

Speeds

The limiting speeds n_{GW} and n_{GA} in the dimension tables are valid for oil and grease lubrication.

The limiting speed n_{GW} is valid for a rotating shaft, while n_{GA} is valid for a rotating outer ring.

Housing design

Design of housing bore

The accuracy of the locating bore essentially determines the geometrical accuracy of the drawn cup and thus the functioning of the clutch.

Housing bores must be chamfered to 15°.
The bore tolerances should be produced in accordance with the table and should have a surface quality R_a0,8.

The cylindricity tolerance of the housing bore in metal housings should be within the tolerance grade IT 5/2.

Tolerances for housing bore

Series	Springs	Bore Housing material		
		Steel Cast iron	Light metal	Max. bore in plastic[2]
HF, HFL	Steel	N6 (N7)[1]	R6 (R7)[1]	–
HF..-KF, HFL..-KF	Plastic	N7	R7	–
HF..-R, HFL..-R	Steel	–	–	$D_{-0,05}$
HF..-KF-R, HFL..-KF-R	Plastic	–	–	$D_{-0,05}$
HFL0606-KF-R, HFL0806-KF-R	Plastic	–	–	$D_{-0,05}$

1) The values in brackets can be used if the actual torque is no more than 50% of the permissible torque $M_{d\,per}$ (see dimension tables).

2) Guide values as a function of the plastic used.
Outside diameter D: see dimension tables.

Minimum wall thickness for metal housings

For metal housings, the maximum transmissible torque is determined as a function of the diameter ratio Q_A to *Figure 3* (steel housing) or to *Figure 4*, page 797 (aluminium housing), see calculation examples.

Guide values

Guide values for $Q_{A\,max}$ for steel and aluminium as housing materials are given in the table.

Housing material	Diameter ratio $Q_{A\,max}$
Steel	0,8
Aluminium	0,6

The comparative stress σ_V must not exceed the yield stress of the housing material.

Steel housing – calculation example

For drawn cup roller clutches HF0612, the maximum transmissible torque $M_{d\,per\,max}$ is determined as follows:

Drawn cup roller clutch	HF0612
Housing	Steel
Housing bore tolerance	N6, see table, page 795
Permissible housing stress ($R_{p0,2}$) σ_V	450 N/mm²
Diameter ratio Q_A of housing	0,9
Permissible torque $M_{d\,per}$	see dimension table, page 801

Calculation

$$M_{d\,per\,max} = 60\%\ M_{d\,per}$$
$$= 0{,}6 \cdot 1{,}76\ \text{Nm}$$
$$= 1{,}056\ \text{Nm}$$

Modulus of elasticity
E = 210 000 N/mm²

σ_V = comparative stress
$M_{d\,per}$ = permissible torque (see dimension tables for values)
$M_{d\,per\,max}$ = maximum transmissible torque
Q_A = diameter ratio of housing
D_{Ai} = housing bore
D_{Aa} = housing outside diameter

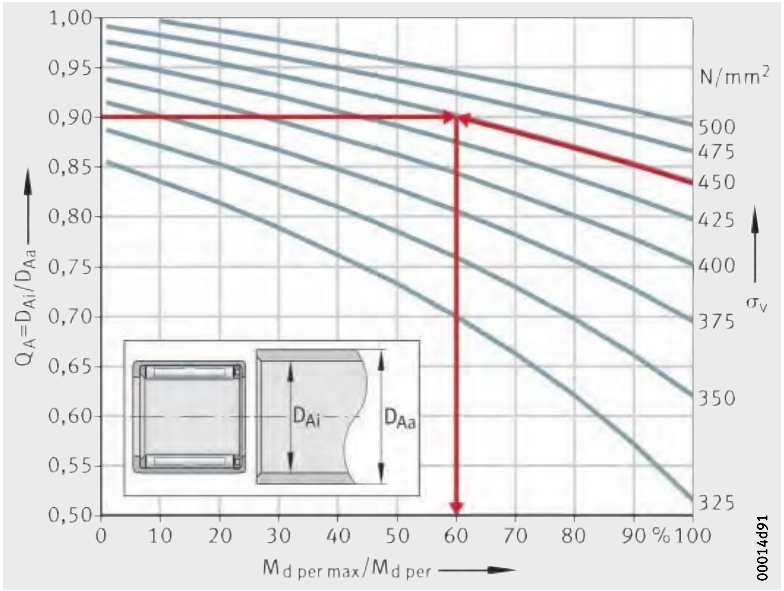


Figure 3
Steel housing

Aluminium housing – calculation example

For drawn cup roller clutch HF1616, the diameter ratio Q_A of the housing should be determined as follows:

Drawn cup roller clutch	HF1616
Housing	Aluminium
Housing bore tolerance	R6, see table, page 795
Permissible housing stress ($R_{p0,2}$) σ_v	250 N/mm²
Maximum transmissible torque $M_{d\ per\ max}$	10 Nm
giving $M_{d\ per\ max}/M_{d\ per}$	50%
Permissible torque $M_{d\ per}$	see dimension table, page 801

Diameter ratio

$Q_A \leqq 0{,}7 = D_{Aa} = \text{min. } 31{,}5$

Modulus of elasticity
$E = 70\,000$ N/mm²

σ_V = comparative stress
$M_{d\ per}$ = permissible torque (see dimension tables for values)
$M_{d\ per\ max}$ = maximum transmissible torque
Q_A = diameter ratio of housing
D_{Ai} = housing bore
D_{Aa} = housing outside diameter

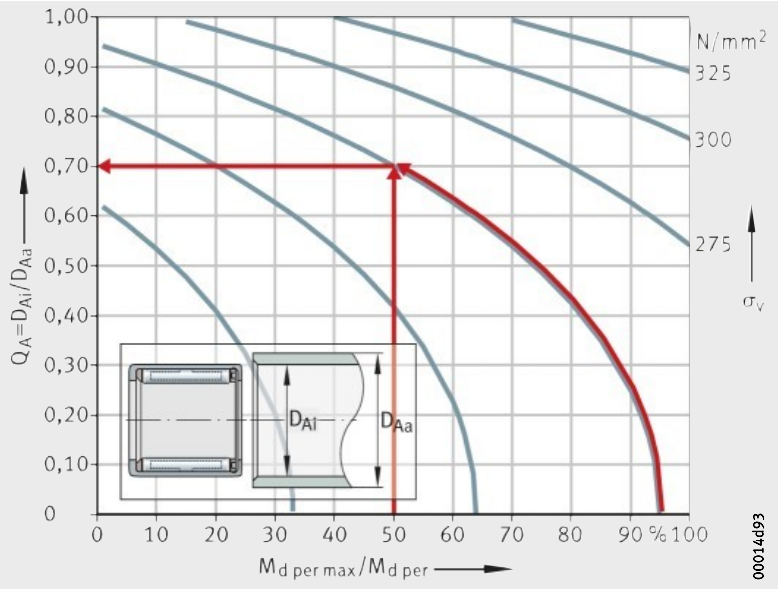


Figure 4
Aluminium housing

Minimum wall thickness for plastic housing

For plastic housings, drawn cup roller clutches with a partially or fully knurled outside surface should be used (suffix R).

The guide value for the minimum wall thickness of plastic housings is:

$$s_{min} \geqq D - F_w$$

s_{min} mm
Minimum wall thickness

D mm
Outside diameter of roller clutch

F_w mm
Enveloping circle.

Shaft design

The raceway on the shaft must be hardened and ground.
The surface hardness of the raceway must be 670 HV + 170 HV and the hardening depth CHD or SHD must be sufficiently large (CHD ≧ 0,3 mm).

The end face of the shaft must be chamfered to approx. 1 mm and 15°.

For design of the shaft, see table.

Shaft tolerance

Series	Springs	Shaft			
		Tolerance	Roughness max.	Roundness max.	Parallelism max.
HF, HFL	Steel	h5 (h6)[1]	R_a0,4 (R_Z2)	IT 3	IT 3
HF..-KF, HFL..-KF	Plastic	h8			
HF..-R, HFL..-R	Steel	h5 (h6)[1]			
HF..-KF-R, HFL..-KF-R	Plastic	h8			
HFL0606-KF-R, HFL0806-KF-R	Plastic	h9			

[1] The values in brackets can be used if the actual torque is no more than 50% of the permissible torque $M_{d\ per}$ (see dimension tables).

Axial location

Drawn cup roller clutches are pressed into the housing bore and require no further axial location (assuming compliance with the recommendations according to tables, page 795).

Sealing of the bearing position

If there is a risk of contamination, sealing rings or series G or SD should be fitted. The sealing rings are matched to the dimensions of the drawn cup roller clutches and can be combined with wider inner rings of series IR.

Lubrication

For general applications (mixed operation involving locking and overrunning), the Schaeffler initial greasing has proved effective.

In order to ensure optimum function, it may be necessary to use different lubricants. The suitability of the lubricant must be verified by means of tests.

For applications in which one operating condition (overrunning or locking) is heavily predominant, a special greasing should be used. In this case, please consult Schaeffler Application Engineering.

It is not possible to calculate the grease operating life or lubrication interval for drawn cup roller clutches.

If relubrication is carried out, oil should used for lubrication or a changeover to oil lubrication should generally be made.

At temperatures < -10 °C and speeds $> 0{,}7\ n_G$, recommendations on lubrication should be requested.

For temperatures above +70 °C, oil lubrication should be used. The oil level should be such that, when the drawn cup roller clutch is stationary and the axis is horizontal, it is immersed approx. $^1/_3$ in the oil bath.

Suitable oils are CL and CLP to DIN 51 517 or HL and HLP to DIN 51 524. Viscosity classes: see table.

Viscosity classes

Operating temperature	Viscosity class
+15 °C to +30 °C	ISO VG 10
+15 °C to +90 °C	ISO VG 32
+60 °C to +120 °C	ISO VG 100

Drawn cup roller clutches

Retention for transport

Drawn cup roller clutches are normally packed individually in the case of small quantities.

Where larger quantities are involved, drawn cup roller clutches are placed in a specific orientation in blister packaging and delivered in this form. The blister packaging serves to retain the parts in position during transport.

Installation using a fitting mandrel

Drawn cup roller clutches should only be pressed into the locating bore using a special fitting mandrel, see Drawn cup needle roller bearings, page 687. Attention must be paid to the clamping direction of the roller clutch. The clamping direction is indicated by an arrow on the end face of the drawn cup.

Pressing-in forces must never be directed through the rolling elements. Roller clutches should not be tilted during fitting.

Guidelines for fitting

Drawn cup roller clutches should be protected against dust, contaminants and moisture. Contaminants can impair the function and operating life of roller clutches.

Accuracy

The thin-walled outer rings adopt the dimensional and geometrical accuracy of the housing bore.

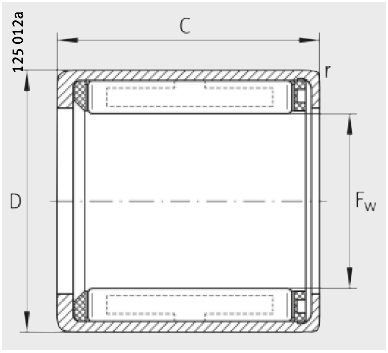
Enveloping circle

The enveloping circle is the inner inscribed circle of the needle rollers in clearance-free contact with the outer raceway.

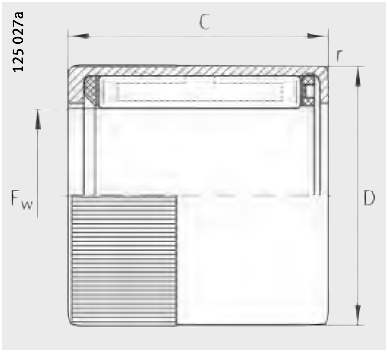
In drawn cup roller clutches with a rolling bearing arrangement, the enveloping circle F_w of the bearings once fitted (in the solid section ring gauge) is approximately in tolerance zone F8 (for values according to table Tolerances for housing bore, page 795, and table Shaft tolerance, page 798). Deviations for tolerance zone F8: see table, page 168.

Drawn cup roller clutches

Without
bearing arrangement
With or without knurling



HF, HF..-KF



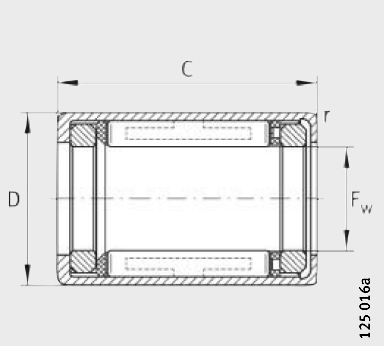
HF..-R, HF..-KF-R
With knurling

Dimension table · Dimensions in mm

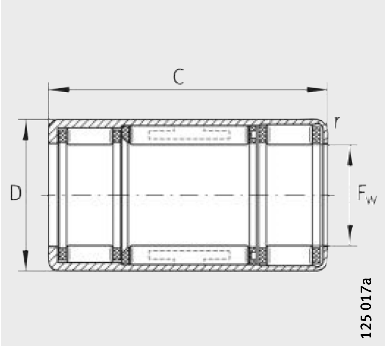
Spring design		Mass	Dimensions				Permissible torque	Limiting speeds		Drawn cup needle roller bearings for radial bearing arrangement
Plastic springs	Steel springs	m	F_w	D	C	r	$M_{d\ per}$	n_{GW}	n_{GA}	
Designation	Designation	≈g			–0,3	min.	Nm	min^{-1}	min^{-1}	Designation
HF0306-KF	–	1	**3**	6,5	6	0,3	0,18	45 000	8 000	**HK0306-TV**
HF0306-KF-R	–	1	**3**	6,5	6	0,3	0,06	45 000	8 000	**HK0306-TV**
HF0406-KF	–	1	**4**	8	6	0,3	0,34	34 000	8 000	**HK0408**
HF0406-KF-R	–	1	**4**	8	6	0,3	0,1	34 000	8 000	**HK0408**
HF0612-KF	**HF0612**	3	**6**	10	12	0,3	1,76	23 000	13 000	**HK0608**
HF0612-KF-R	**HF0612-R**	3	**6**	10	12	0,3	0,6	23 000	13 000	**HK0608**
HF0812-KF	**HF0812**	3,5	**8**	12	12	0,3	3,15	17 000	12 000	**HK0808**
HF0812-KF-R	**HF0812-R**	3,5	**8**	12	12	0,3	1	17 000	12 000	**HK0808**
HF1012-KF	**HF1012**	4	**10**	14	12	0,3	5,3	14 000	11 000	**HK1010**
–	**HF1216**	11	**12**	18	16	0,3	12,2	11 000	8 000	**HK1212**
–	**HF1416**	13	**14**	20	16	0,3	17,3	9 500	8 000	**HK1412**
–	**HF1616**	14	**16**	22	16	0,3	20,5	8 500	7 500	**HK1612**
–	**HF1816**	16	**18**	24	16	0,3	24,1	7 500	7 500	**HK1812**
–	**HF2016**	17	**20**	26	16	0,3	28,5	7 000	6 500	**HK2010**
–	**HF2520**	30	**25**	32	20	0,3	66	5 500	5 500	**HK2512**
–	**HF3020**	36	**30**	37	20	0,3	90	4 500	4 500	**HK3012**
–	**HF3520**	40	**35**	42	20	0,3	121	3 900	3 900	**HK3512**

Drawn cup roller clutches

With bearing arrangement
With or without knurling



HFL, HFL..-KF, plain bearing arr. (HFL0308-KF, HFL0408-KF, HFL0615-KF, HFL0615)



HFL, HFL..-KF, rolling bearing arr. ($F_w \geqq 8$ mm, $C \geqq 22$ mm), HFL0822-KF-R, HFL0822-R

Dimension table · Dimensions in mm

Spring design		Mass	Dimensions				Permissible torque
Plastic springs	Steel springs	m	F_w	D	C	r	$M_{d\ per}$
Designation	Designation	≈g			–0,3	min.	Nm
HFL0308-KF	–	1,4	**3**	6,5	8	0,3	0,18
HFL0308-KF-R	–	1,4	**3**	6,5	8	0,3	0,06
HFL0408-KF	–	1,6	**4**	8	8	0,3	0,34
HFL0408-KF-R	–	1,6	**4**	8	8	0,3	0,1
HFL0606-KF-R	–	1	**6**	10	6	0,3	0,5
HFL0615-KF	**HFL0615**	4	**6**	10	15	0,3	1,76
HFL0615-KF-R	**HFL0615-R**	4	**6**	10	15	0,3	0,6
HFL0806-KF-R	–	2	**8**	12	6	0,3	0,7
HFL0822-KF	**HFL0822**	7	**8**	12	22	0,3	3,15
HFL0822-KF-R	**HFL0822-R**	7	**8**	12	22	0,3	1
–	**HFL1022**	8	**10**	14	22	0,3	5,3
–	**HFL1226**	18	**12**	18	26	0,3	12,2
–	**HFL1426**	20	**14**	20	26	0,3	17,3
–	**HFL1626**	22	**16**	22	26	0,3	20,5
–	**HFL1826**	25	**18**	24	26	0,3	24,1
–	**HFL2026**	27	**20**	26	26	0,3	28,5
–	**HFL2530**	44	**25**	32	30	0,3	66
–	**HFL3030**	51	**30**	37	30	0,3	90
–	**HFL3530**	58	**35**	42	30	0,3	121

1) Attention!
Drawn cup roller clutches with plain bearing arrangement:
During operation, the product of the actual speed n and the radial load F_r must not exceed the value stated for the limiting load $(F_r \cdot n)_{max}$.
The operating limits are determined by the limiting speeds stated and the permissible radial load.

2) Drawn cup roller clutches with rolling bearing arrangement.

3) No arrow on end face.