Metal bellows couplings

Product information / Design

Typical characteristics of metal bellows couplings

- Backlash-free transmission of torque
- High torsional stiffness, precision of transmission of rotational angle
- Different torsional stiffness
- Backlash-free shaft connection
- Small dimensions, low moment of inertia
- Compensation for radial, axial, and angular misalignment
- Free of wear, maintenance-free, no standstill period
- Not sensitive to temperatures between -30 °C and +100 °C, higher temperature ranges available on demand
- Simple and operationally safe assembly
- Economical and user-friendly due to modular system
- Nominal moments between 0.4 - 5000 Nm

Backlash-free, torsionally stiff metal bellows couplings are ready to install when delivered. The metal bellows are made of anti-corrosive steel, all other parts are manufactured from aluminum or steel and partly have an environmental friendly protective coating.

As a standard, the boreholes are equipped with a fitting in accordance with ISO-H7. For the shafts, we recommend an transition, e.g. H7/g6. When selecting other shaft fitting, the fitting should not exceed a maximum of 0.03 mm.

The power transmission between the coupling hub and the shaft occurs through compression and friction between the contact surfaces. Special attention must be paid to the tightening torque of the retaining screws as well as the perfect condition of the contact surfaces.

The contact surfaces must be free of oil and grease. Types with a keyway are available. The torques indicated in the lists of Technical Data can only be safely transferred if these points are complied with. Otherwise it would be necessary to make compromises.

The dimensioning in accordance with the torque

Metal bellows couplings are generally designed according to the nominal torque stated in the lists of the Technical Data below. The nominal torque must always be higher than the regularly transferred torque. This generally applies to the use of servo motors, whose acceleration moment in positive and negative directions is much higher than the nominal moment.

The use of metal bellows couplings which are put in controlled, high dynamic drives, the following dimensioning values have proven to be reliable in practice:

K = 1,5	for evenly shaped movements
K = 2	for unevenly shaped movements
K = 2,5 – 4	for jerky movements

For Servo drives within tool making machines, the values for K of 1.5 - 2 should be used.

In general, the following relationships apply:

$$T_{KN} \geq K \times T_{AS} \times \frac{J_{Mach}}{J_{Mot} + J_{Mach}} = [Nm]$$

Design

Design with consideration for dynamic torsional stiffness.

Although metal bellows couplings are backlash-free and torsion-rigid, it should not be overlocked that they link two rotating masses. In disadvantageous cases like torsion springs the couplings can effect a high stiffness. The hunting of the drives and the harmonic oscillation in the armature current of the motor, e.g. thyristor industrial drives with low pulse number must therefore never be within the range of the mechanical resonance frequency.

$$f_{res} = \frac{1}{2\pi} \sqrt{C_{T\,dyn} \times \frac{J_{Mot} + J_{Mach}}{J_{Mot} \times J_{Mach}}} = [Hz]$$

In practice the resonance frequency "f_{res}" must be twice as large as the excitation frequency of the drive.

For most normal drives, e.g. NC-machine tool, this will be between 150 and 350 Hz.

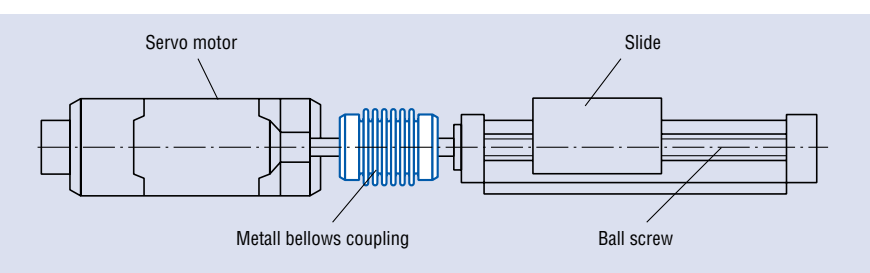
In the development of metal bellows couplings this factor was given special consideration. The dynamic torsional stiffness $C_{T\,dyn}$ was selected so that it would not be within the range of clearance diameter from most applications. Various levels of torsional stiffness are available as standard versions.

We would be pleased to design your metal bellows couplings for you. Feel free to use our experience and know-how for your success.

Speak to us.

Sample calculation

Application of a metal bellows coupling in a machine tool drive



Drive related data

Servo motor 1 FT 5104

Maximum torque T_{AS} = 160 Nm
Moment of inertia
$J_{Mot} = 18.3 \times 10^{-3}$ kgm²

Output-data

Machine tool

Moment of inertia of ball screw and slide $J_{Mach} = 17 \times 10^{-3}$ kgm²

The low moment of inertia of the metal bellows coupling is disregarded. K = Load factor, impulse factor selected for this drive K = 2

Design according to torque:

$$T_{KN} \geq K \times T_{AS} \times \frac{J_{Mach}}{J_{Mot} + J_{Mach}} = 2 \times 160\ Nm \times \frac{17 \times 10^{-3}\ Kgm^2}{(18{,}3 + 17) \times 10^{-3}\ Kgm^2} = 154\ Nm$$

Coupling selection: AKD 200, T_{KN} = 200 Nm, $C_{T\,dyn} = 116 \times 10^3$ Nm/rad.

The metal bellows coupling is sufficiently dimensioned, since 200 Nm ≥ 154 Nm.

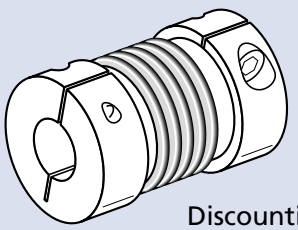
Design according to resonance frequency:

$$f_{res} = \frac{1}{2\pi} \times \sqrt{C_{T\,dyn} \times \frac{J_{Mot} + J_{Mach}}{J_{Mot} \times J_{Mach}}} = \frac{1}{2\pi} \times \sqrt{116000\ Nm/rad \times \frac{0{,}0183 + 0{,}017\ Kgm^2}{0{,}0183 \times 0{,}017\ Kgm^2}} = 578\ Hz$$

The arithmetic calculation is clearly much higher than the expected resonance frequency.

Summary of type series

Series DK – miniature



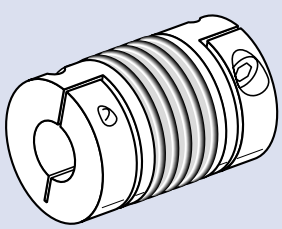
Discountinued model

To connect two shafts, backlash-free shaft-hub connection using collet clamps. For torques between 0.10 – 10 Nm.

Technical data and dimensions

Page 8

Series DKN – miniature

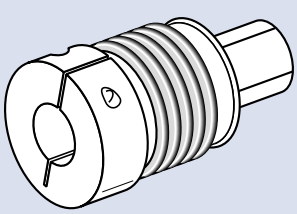


To connect two shafts, backlash-free shaft-hub connection using collet clamps. For torques between 0.40 – 10 Nm.

Technical data and dimensions

Page 9

Series DK/S – miniature

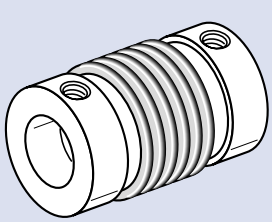


To connect two shafts, backlash-free shaft-hub connection using a collet clamp and an expanding clamp.
For torques between 0.40 – 10 Nm.

Technical data and dimensions

Page 10

Series EK – miniature

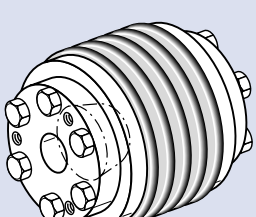


To connect two shafts, backlash-free shaft-hub connection using set screws.
For torques between 0.10 – 10 Nm.

Technical data and dimensions

Page 11

Series AK



Inner conical hub

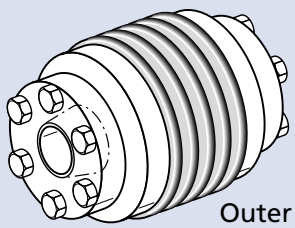
To connect two shafts, backlash-free shaft-hub connection using conical hubs. For torques between 30 – 5000 Nm.

Technical data and dimensions

Page 12

Summary of type series

Series AK/SB



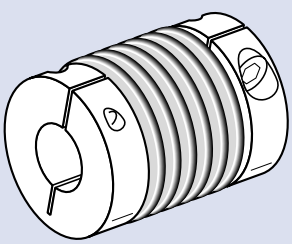
Outer conical hub

To connect two shafts, backlash free shaft-hub connection using outer conical hubs, contracting disc, no releasing screw required, release during dismantling. For torques between 18 – 5000 Nm.

Technical data and dimensions

Page 13

Series AKD

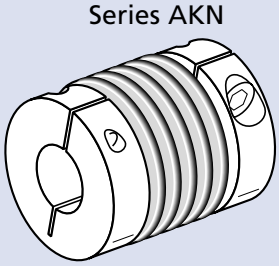


To connect two shafts, backlash free shaft-hub connection using collet clamps. For torques between 18 – 500 Nm.

Technical data and dimensions

Page 14

Series AKN

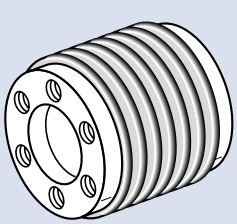


Same as Series AKD but with shorter length and higher torsional stiffness. For torques between 18 – 500 Nm.

Technical data and dimensions

Page 15

Series CK

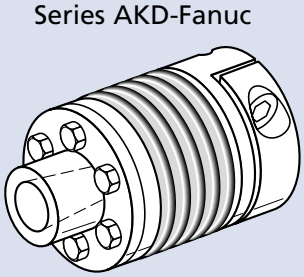


Variable installation element for mounting of hubs, flanged shafts, flanges, etc. For torques between 18 – 5000 Nm.

Technical data and dimensions

Page 16

Series AKD-Fanuc



Appropriate coupling for Fanuc AC motors. Shorter installation models available. For torques between 18 – 60 Nm.

Technical data and dimensions

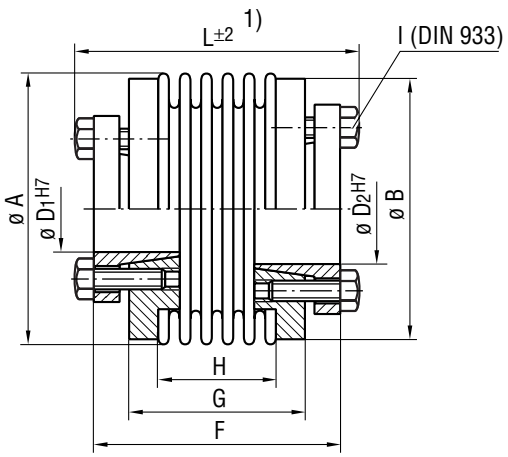
Page 17

User-friendly solutions

Page 18

Metal bellows couplings

Series AK with conical hubs



Technical Data – Series AK

TYPE			30	60	80	150	200	300	500	800	1400	3000	5000
Nominal moment	(Nm)	T_{KN}	30	60	80	150	200	300	500	800	1400	3000	5000
Torsional stiffness	(10^3 Nm/rad)	$C_{T\,dyn}$	36 / 26	73 / 49	126 / 74	151 / 101	173 / 116	499 / 280	310	758	1266	2800	4800
Radial spring	(N/mm)	C_r	718 / 222	1125 / 333	1218 / 403	2030 / 601	2531 / 450	6328 / 1470	972	512	706	2950	4920
Axial spring	(N/mm)	C_a	48 / 27	91 / 53	84 / 53	147 / 86	147 / 85	284 / 153	86	186	278	310	510
Moment of inertia	(10^{-3} Kgm²)	J	0.15	0.4	0.8	0.8	1.5	4.0	7.2	26.1	26.1	48	62
Tightening torque of retaining screws	(Nm)	M_A	4.5	8.5	10	14	14	18	26	45	80	85	210
Weight	(ca. kg)	m	0.4	0.8	1.3	1.3	1.6	3.4	4.2	8.5	8.5	15	21
Max. approved misalignment													
- radial	(mm)	ΔK_r	0.1 / 0.2	0.1 / 0.2	0.2 / 0.2	0.2 / 0.2	0.2 / 0.2	0.2 / 0.2	0.2	0.2	0.2	0.2	0.2
- axial	(mm)	ΔK_a	0.4 / 0.5	0.4 / 0.5	0.4 / 0.5	0.4 / 0.5	0.4 / 0.5	0.4 / 0.5	1.0	1.0	1.0	1.0	1.0
- angular	(degree)	ΔK_w	1.0 / 1.5	1.0 / 1.5	1.0 / 1.5	1.0 / 1.5	1.0 / 1.5	1.0 / 1.5	1.5	1.5	1.5	1.5	1.5
Max. rotating speed at V = 30 m/s	(rpm)	n_{max}	11000	9100	7000	7000	6700	5200	4600	3700	3700	2800	2800

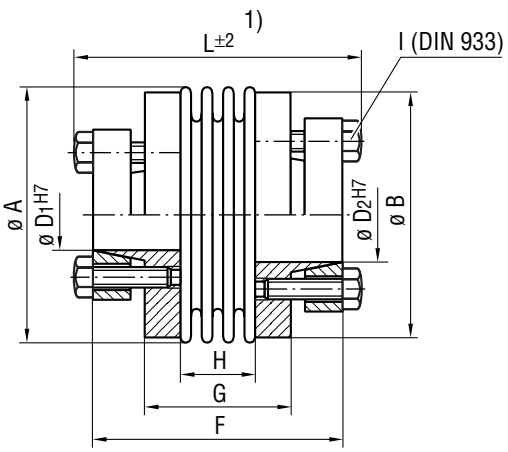
Dimensions (mm) – Series AK

TYPE	30	60	80	150	200	300	500	800	1400	3000	5000
L±2	52 / 60	63 / 73	80 / 91	80 / 92	80 / 93	91 / 104	113	170	170	206	206
Ø A	56	66	82	82	90	110	122	157	157	157	208
Ø B	52	63	80	80	85	110	122	152	152	152	190
Ø D_1^{H7} / Ø D_2^{H7}											
- min.	12	15	20	20	20	25	35	50	50	55	60
- max.	20	25	35	35	40	50	55	70 2)	70 2)	75 2)	85 2)
F	45 / 53	55 / 65	72 / 83	72 / 84	72 / 85	80 / 93	102	150	150	190	186
G	29 / 37	37 / 47	50 / 61	50 / 62	50 / 63	54 / 67	72	110	110	150	146
H	16/24	21/31	24/36	24/36	25/37	29/40	40	84	84	84	94
l (DIN 933)	6 x M5	6 x M6	6 x M6	6 x M6	6 x M6	6 x M8	6 x M8	6 x M16	6 x M16	6 x M12	6 x M16

1) Keep space for the releasing screws. 2) Larger bores on request. 3) Stainless steel version also available.

Metal bellows couplings

Series AK/SB with outer conical hubs – release during dismantling



Technical Data – Series AK/SB

TYPE			18	30	60	150	200	300	500	800	1400	3000	5000
Nominal moment	(Nm)	T_{KN}	18	30	60	150	200	300	500	800	1400	3000	5000
Torsional stiffness	(10^3 Nm/rad)	$C_{T\,dyn}$	8 /6	36 / 26	73 / 49	151 / 101	173 / 116	499 / 280	310	758	1266	2800	4800
Radial spring	(N/mm)	C_r	204 / 86	718 / 222	1125 / 333	2030 / 601	2531 / 450	6328 / 1470	972	512	706	2950	4920
Axial spring	(N/mm)	C_a	52 /39	48 / 27	91 / 53	147 / 86	147 / 85	284 / 153	86	186	278	310	510
Moment of inertia	(10^{-3} Kgm²)	J	0.1	0.15	0.4	0.8	1.5	4	14	48	48	54	136
Tightening torque of retaining screws	(Nm)	M_A	5.9	5.9	8.7	15	15	25	36	85	115	125	210
Weight	(ca. kg)	m	0.3	0.4	0.8	1.3	1.6	3.4	4	7.5	7.5	16	27
Max. approved misalignment													
- radial	(mm)	ΔK_r	0.1 / 0.2	0.1 / 0.2	0.1 / 0.2	0.2 / 0.2	0.2 / 0.2	0.2 / 0.2	0.2	0.2	0.2	0.2	0.2
- axial	(mm)	ΔK_a	0.4 / 0.5	0.4 / 0.5	0.4 / 0.5	0.4 / 0.5	0.4 / 0.5	0.4 / 0.5	1.0	1.0	1.0	1.0	1.0
- angular	(degree)	ΔK_w	1.0 / 1.5	1.0 / 1.5	1.0 / 1.5	1.0 / 1.5	1.0 / 1.5	1.0 / 1.5	1.5	1.5	1.5	1.5	1.5
Max. rotating speed at V = 30 m/s	(rpm)	n_{max}	12700	1100	9100	7000	6700	5200	4600	3700	3700	2800	2800

Dimensions (mm) – Series AK/SB

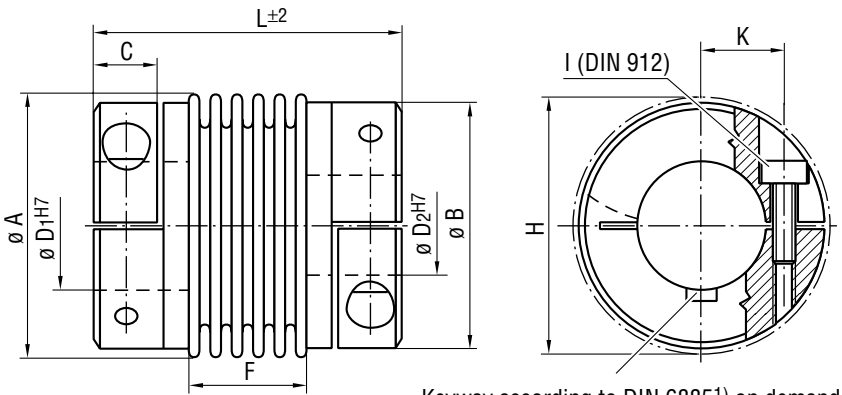
TYPE	18	30	60	150	200	300	500	800	1400	3000	5000
L ±2	65 / 73	60 / 68	80 / 90	98/110	98/110	111/122	135	180	180	220	245
Ø A	45	56	66	82	90	110	122	157	157	157	208
Ø B	45	52	65	80	85	110	122	152	152	152	190
Ø D_1^{H7} / Ø D_2^{H7}											
- min.	9	12	15	20	20	25	35	50	50	55	60
- max.	15	20	32	35	42	50	55	70	70	75	85
F	58 / 66	53 / 61	73 / 83	90 / 102	90 / 102	100/111	124	164	164	204	225
G	38 / 46	31 /39	37 / 47	50 / 62	51 / 63	56 / 67	72	110	110	146	146
H	24 / 32	16 / 24	21 / 31	24 / 36	25 / 37	29 / 40	40	84	84	84	94
I (DIN 933)	4 x M5	6 x M5	6 x M5	6 x M6	6 x M6	6 x M8	6 x M8	6 x M12	6 x M12	6 x M12	6 x M16

1) Keep space for the releasing screws.

2) Stainless steel version also available.

Metal bellows couplings

Series AKD with collet clamp



Keyway according to DIN 6885[1] on demand

Technical Data – Series AKD

TYPE			18	30	60	80	150	200	300	500
Nominal moment	(Nm)	T_{KN}	18	30	60	80	150	200	300	500
Torsional stiffness	(10^3 Nm/rad)	$C_{T\,dyn}$	6	26	49	74	101	116	280	310
Radial spring	(N/mm)	C_r	86	222	333	403	601	450	1470	972
Axial spring	(N/mm)	C_a	39	27	53	53	86	85	153	86
Moment of inertia	(10^{-3} Kgm²)	J	0.08	0.1 / 0.16	0.3 / 0.5	1.4 / 2.3 / 2.8	1.4 / 2.3 / 2.8	2.6 / 4.2	4.6 / 6.2	9
Tightening torque of retaining screws	(Nm)	M_A	6 / 6	15 / 12	40 / 30	60 / 55 / 50	80 / 70 / 50	100 / 80	110 / 90	145
Weight	(ca. kg)	m	0.2	0.2 / 0.3	0.5 / 0.6	1.7 / 2.1 / 2.3	1.7 / 2.1 / 2.3	2.5 / 3.3	3.4 / 4.1	4.9
Max. approved misalignment										
- radial	(mm)	ΔK_r	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
- axial	(mm)	ΔK_a	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1
- angular	(degree)	ΔK_w	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Max. rotating speed at V = 30 m/s	(rpm)	n_{max}	12700	10200	8600	6800	6800	6300	5900	4900

Dimensions (mm) – Series AKD

TYPE	18	30	60	80	150	200	300	500
L±2	71	73	89	103	104	113	115	122
Ø A	45	56	66	82	82	90	110	112
Ø B	45	47 / 56	57 / 66	68 / 80 / 84	68 / 80 / 84	80 / 90	90 / 96	110
C	12	15	19.5	21.5	21.5	25.5	28	29.5
Ø D_1^{H7} / Ø D_2^{H7} 2)								
- min.	10 / 20	10 / 20	14 / 23	20 / 28 / 35	20 / 28 / 35	25 / 32	32 / 40	40
- max.	20 / 25	20 / 25	23 / 35	28 / 35 / 40	28 / 35 / 40	32 / 42	40 / 45	60
F	32	24	31	35	36	37	40	40
I	M5	M6	M8	M10	M10	M12	M12	M12
K	17.5	16 / 20	20 / 24	24 / 27 / 28	24 / 27 / 28	26 / 31	32 / 35	40
H (parasitic disturbance)	48	56	70	84	84	93	102	108

Hubs 18 to 60 made of aluminum, Hubs 80 to 500 made of steel, other materials available on request.

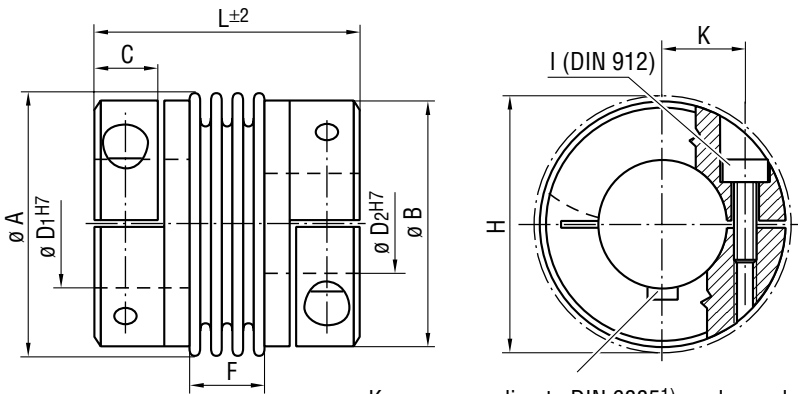
1) Tolerance of keyway: Standard JS9.

2) Smaller Ø possible for lower torque of transmission.

3) Stainless steel version also available.

Metal bellows couplings

Series AKN with retaining hub and increased torsional stiffness



Keyway according to DIN 6885[1] on demand

Technical Data – Series AKN

TYPE			18	30	60	80	150	200	300	500
Nominal moment	(Nm)	T_{KN}	18	30	60	80	150	200	300	500
Torsional stiffness	(10^3 Nm/rad)	$C_{T\,dyn}$	8	36	73	126	151	173	499	680
Radial spring	(N/mm)	C_r	204	718	1125	1218	2030	2531	6328	8800
Axial spring	(N/mm)	C_a	52	48	91	84	147	147	284	105
Moment of inertia	(10^{-3} Kgm²)	J	0.08	0.1 / 0.16	0.3 / 0.5	1.4/2.3/2.8	1.4/2.3/2.8	2.6 / 4.2	4.6 / 6.2	9
Tightening torque of retaining screws	(Nm)	M_A	6 / 6	15 / 12	40 / 30	60 / 55 / 50	80 / 70 / 50	100 / 80	110 / 90	145
Weight	(ca. kg)	m	0.2	0.2 / 0.3	0.5 / 0.6	1.7/2.1/2.3	1.7/2.1/2.3	2.5 / 3.3	3.4 / 4.1	4.8
Max. approved misalignment										
- radial	(mm)	ΔK_r	0.2	0.1	0.1	0.2	0.2	0.2	0.2	0.2
- axial	(mm)	ΔK_a	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.5
- angular	(degree)	ΔK_w	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Max. rotating speed at V = 30 m/s	(rpm)	n_{max}	12700	10200	8600	6800	6800	6300	5900	4900

Dimensions (mm) – Series AKN

TYPE	18	30	60	80	150	200	300	500
L±2	63	65	78	91	91	100	102	110
Ø A	45	56	66	82	82	90	110	122
Ø B	45	47 / 56	57 / 66	68 / 80 / 84	68 / 80 / 84	80 / 90	90 / 96	110
C	12	15	19.5	21.5	21.5	25.5	28	29.5
Ø D_1^{H7} / Ø D_2^{H7}								
- min.	10 / 20	10 / 20	14 / 23	20 / 28 / 35	20 / 28 / 35	25 / 32	32 / 40	40
- max.	20 / 25	20 / 25	23 / 35	28 / 35 / 40	28 / 35 / 40	32 / 42	40 / 45	60
F	24	16	20	24	24	24	27	28
I	M5	M6	M8	M10	M10	M12	M12	M12
K	17.5	16 / 20	20 / 24	24 / 27 / 28	24 / 27 / 28	26 / 31	32 / 35	40
H (clearance diameter)	48	56	70	84	84	93	102	108

Hubs 18 to 60 made of aluminum, Hubs 80 to 500 made of steel, other materials available on request.

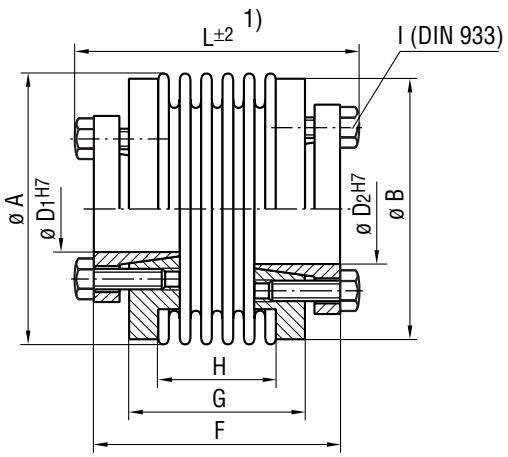
1) Tolerance of keyway: Standard JS9.

2) Smaller ø possible for lower torque of transmission.

3) Stainless steel version also available.

Metal bellows couplings

Series AK with conical hubs



Technical Data – Series AK

TYPE			30	60	80	150	200	300	500	800	1400	3000	5000
Nominal moment	(Nm)	T_{KN}	30	60	80	150	200	300	500	800	1400	3000	5000
Torsional stiffness	(10^3 Nm/rad)	$C_{T\,dyn}$	36 / 26	73 / 49	126 / 74	151 / 101	173 / 116	499 / 280	310	758	1266	2800	4800
Radial spring	(N/mm)	C_r	718 / 222	1125 / 333	1218 / 403	2030 / 601	2531 / 450	6328 / 1470	972	512	706	2950	4920
Axial spring	(N/mm)	C_a	48 / 27	91 / 53	84 / 53	147 / 86	147 / 85	284 / 153	86	186	278	310	510
Moment of inertia	(10^{-3} Kgm²)	J	0.15	0.4	0.8	0.8	1.5	4.0	7.2	26.1	26.1	48	62
Tightening torque of retaining screws	(Nm)	M_A	4.5	8.5	10	14	14	18	26	45	80	85	210
Weight	(ca. kg)	m	0.4	0.8	1.3	1.3	1.6	3.4	4.2	8.5	8.5	15	21
Max. approved misalignment													
- radial	(mm)	ΔK_r	0.1 / 0.2	0.1 / 0.2	0.2 / 0.2	0.2 / 0.2	0.2 / 0.2	0.2 / 0.2	0.2	0.2	0.2	0.2	0.2
- axial	(mm)	ΔK_a	0.4 / 0.5	0.4 / 0.5	0.4 / 0.5	0.4 / 0.5	0.4 / 0.5	0.4 / 0.5	1.0	1.0	1.0	1.0	1.0
- angular	(degree)	ΔK_w	1.0 / 1.5	1.0 / 1.5	1.0 / 1.5	1.0 / 1.5	1.0 / 1.5	1.0 / 1.5	1.5	1.5	1.5	1.5	1.5
Max. rotating speed at V = 30 m/s	(rpm)	n_{max}	11000	9100	7000	7000	6700	5200	4600	3700	3700	2800	2800

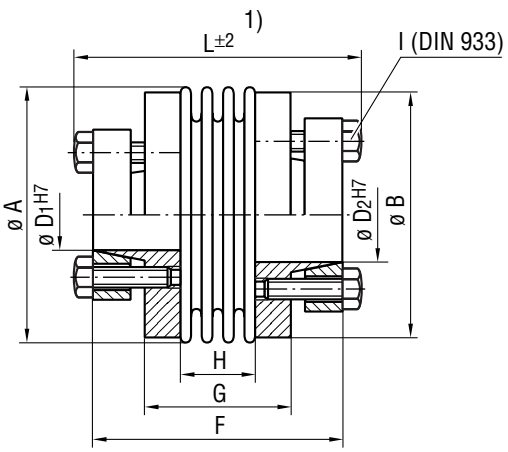
Dimensions (mm) – Series AK

TYPE	30	60	80	150	200	300	500	800	1400	3000	5000
L±2	52 / 60	63 / 73	80 / 91	80 / 92	80 / 93	91 / 104	113	170	170	206	206
Ø A	56	66	82	82	90	110	122	157	157	157	208
Ø B	52	63	80	80	85	110	122	152	152	152	190
Ø D_1^{H7} / Ø D_2^{H7}											
- min.	12	15	20	20	20	25	35	50	50	55	60
- max.	20	25	35	35	40	50	55	70 2)	70 2)	75 2)	85 2)
F	45 / 53	55 / 65	72 / 83	72 / 84	72 / 85	80 / 93	102	150	150	190	186
G	29 / 37	37 / 47	50 / 61	50 / 62	50 / 63	54 / 67	72	110	110	150	146
H	16/24	21/31	24/36	24/36	25/37	29/40	40	84	84	84	94
l (DIN 933)	6 x M5	6 x M6	6 x M6	6 x M6	6 x M6	6 x M8	6 x M8	6 x M16	6 x M16	6 x M12	6 x M16

1) Keep space for the releasing screws. 2) Larger bores on request. 3) Stainless steel version also available.

Metal bellows couplings

Series AK/SB with outer conical hubs – release during dismantling



Technical Data – Series AK/SB

TYPE			18	30	60	150	200	300	500	800	1400	3000	5000
Nominal moment	(Nm)	T_{KN}	18	30	60	150	200	300	500	800	1400	3000	5000
Torsional stiffness	(10^3 Nm/rad)	$C_{T\,dyn}$	8 /6	36 / 26	73 / 49	151 / 101	173 / 116	499 / 280	310	758	1266	2800	4800
Radial spring	(N/mm)	C_r	204 / 86	718 / 222	1125 / 333	2030 / 601	2531 / 450	6328 / 1470	972	512	706	2950	4920
Axial spring	(N/mm)	C_a	52 /39	48 / 27	91 / 53	147 / 86	147 / 85	284 / 153	86	186	278	310	510
Moment of inertia	(10^{-3} Kgm²)	J	0.1	0.15	0.4	0.8	1.5	4	14	48	48	54	136
Tightening torque of retaining screws	(Nm)	M_A	5.9	5.9	8.7	15	15	25	36	85	115	125	210
Weight	(ca. kg)	m	0.3	0.4	0.8	1.3	1.6	3.4	4	7.5	7.5	16	27
Max. approved misalignment													
- radial	(mm)	ΔK_r	0.1 / 0.2	0.1 / 0.2	0.1 / 0.2	0.2 / 0.2	0.2 / 0.2	0.2 / 0.2	0.2	0.2	0.2	0.2	0.2
- axial	(mm)	ΔK_a	0.4 / 0.5	0.4 / 0.5	0.4 / 0.5	0.4 / 0.5	0.4 / 0.5	0.4 / 0.5	1.0	1.0	1.0	1.0	1.0
- angular	(degree)	ΔK_w	1.0 / 1.5	1.0 / 1.5	1.0 / 1.5	1.0 / 1.5	1.0 / 1.5	1.0 / 1.5	1.5	1.5	1.5	1.5	1.5
Max. rotating speed at V = 30 m/s	(rpm)	n_{max}	12700	1100	9100	7000	6700	5200	4600	3700	3700	2800	2800

Dimensions (mm) – Series AK/SB

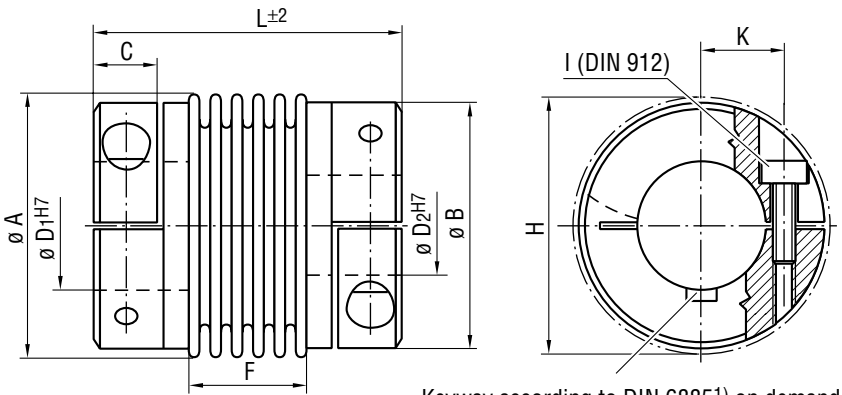
TYPE	18	30	60	150	200	300	500	800	1400	3000	5000
L ±2	65 / 73	60 / 68	80 / 90	98/110	98/110	111/122	135	180	180	220	245
Ø A	45	56	66	82	90	110	122	157	157	157	208
Ø B	45	52	65	80	85	110	122	152	152	152	190
Ø D_1^{H7} / Ø D_2^{H7}											
- min.	9	12	15	20	20	25	35	50	50	55	60
- max.	15	20	32	35	42	50	55	70	70	75	85
F	58 / 66	53 / 61	73 / 83	90 / 102	90 / 102	100/111	124	164	164	204	225
G	38 / 46	31 /39	37 / 47	50 / 62	51 / 63	56 / 67	72	110	110	146	146
H	24 / 32	16 / 24	21 / 31	24 / 36	25 / 37	29 / 40	40	84	84	84	94
I (DIN 933)	4 x M5	6 x M5	6 x M5	6 x M6	6 x M6	6 x M8	6 x M8	6 x M12	6 x M12	6 x M12	6 x M16

1) Keep space for the releasing screws.

2) Stainless steel version also available.

Metal bellows couplings

Series AKD with collet clamp



Keyway according to DIN 6885[1] on demand

Technical Data – Series AKD

TYPE			18	30	60	80	150	200	300	500
Nominal moment	(Nm)	T_{KN}	18	30	60	80	150	200	300	500
Torsional stiffness	(10^3 Nm/rad)	$C_{T\,dyn}$	6	26	49	74	101	116	280	310
Radial spring	(N/mm)	C_r	86	222	333	403	601	450	1470	972
Axial spring	(N/mm)	C_a	39	27	53	53	86	85	153	86
Moment of inertia	(10^{-3} Kgm²)	J	0.08	0.1 / 0.16	0.3 / 0.5	1.4 / 2.3 / 2.8	1.4 / 2.3 / 2.8	2.6 / 4.2	4.6 / 6.2	9
Tightening torque of retaining screws	(Nm)	M_A	6 / 6	15 / 12	40 / 30	60 / 55 / 50	80 / 70 / 50	100 / 80	110 / 90	145
Weight	(ca. kg)	m	0.2	0.2 / 0.3	0.5 / 0.6	1.7 / 2.1 / 2.3	1.7 / 2.1 / 2.3	2.5 / 3.3	3.4 / 4.1	4.9
Max. approved misalignment										
- radial	(mm)	ΔK_r	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
- axial	(mm)	ΔK_a	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1
- angular	(degree)	ΔK_w	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Max. rotating speed at V = 30 m/s	(rpm)	n_{max}	12700	10200	8600	6800	6800	6300	5900	4900

Dimensions (mm) – Series AKD

TYPE	18	30	60	80	150	200	300	500
L±2	71	73	89	103	104	113	115	122
Ø A	45	56	66	82	82	90	110	112
Ø B	45	47 / 56	57 / 66	68 / 80 / 84	68 / 80 / 84	80 / 90	90 / 96	110
C	12	15	19.5	21.5	21.5	25.5	28	29.5
Ø D_1^{H7} / Ø D_2^{H7} 2)								
- min.	10 / 20	10 / 20	14 / 23	20 / 28 / 35	20 / 28 / 35	25 / 32	32 / 40	40
- max.	20 / 25	20 / 25	23 / 35	28 / 35 / 40	28 / 35 / 40	32 / 42	40 / 45	60
F	32	24	31	35	36	37	40	40
I	M5	M6	M8	M10	M10	M12	M12	M12
K	17.5	16 / 20	20 / 24	24 / 27 / 28	24 / 27 / 28	26 / 31	32 / 35	40
H (parasitic disturbance)	48	56	70	84	84	93	102	108

Hubs 18 to 60 made of aluminum, Hubs 80 to 500 made of steel, other materials available on request.

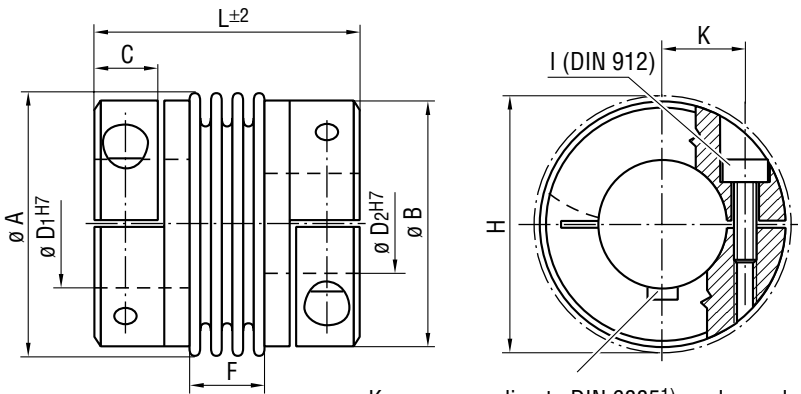
1) Tolerance of keyway: Standard JS9.

2) Smaller Ø possible for lower torque of transmission.

3) Stainless steel version also available.

Metal bellows couplings

Series AKN with retaining hub and increased torsional stiffness



Keyway according to DIN 6885[1] on demand

Technical Data – Series AKN

TYPE			18	30	60	80	150	200	300	500
Nominal moment	(Nm)	T_{KN}	18	30	60	80	150	200	300	500
Torsional stiffness	(10^3 Nm/rad)	$C_{T\,dyn}$	8	36	73	126	151	173	499	680
Radial spring	(N/mm)	C_r	204	718	1125	1218	2030	2531	6328	8800
Axial spring	(N/mm)	C_a	52	48	91	84	147	147	284	105
Moment of inertia	(10^{-3} Kgm²)	J	0.08	0.1 / 0.16	0.3 / 0.5	1.4/2.3/2.8	1.4/2.3/2.8	2.6 / 4.2	4.6 / 6.2	9
Tightening torque of retaining screws	(Nm)	M_A	6 / 6	15 / 12	40 / 30	60 / 55 / 50	80 / 70 / 50	100 / 80	110 / 90	145
Weight	(ca. kg)	m	0.2	0.2 / 0.3	0.5 / 0.6	1.7/2.1/2.3	1.7/2.1/2.3	2.5 / 3.3	3.4 / 4.1	4.8
Max. approved misalignment										
- radial	(mm)	ΔK_r	0.2	0.1	0.1	0.2	0.2	0.2	0.2	0.2
- axial	(mm)	ΔK_a	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.5
- angular	(degree)	ΔK_w	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Max. rotating speed at V = 30 m/s	(rpm)	n_{max}	12700	10200	8600	6800	6800	6300	5900	4900

Dimensions (mm) – Series AKN

TYPE	18	30	60	80	150	200	300	500
L±2	63	65	78	91	91	100	102	110
Ø A	45	56	66	82	82	90	110	122
Ø B	45	47 / 56	57 / 66	68 / 80 / 84	68 / 80 / 84	80 / 90	90 / 96	110
C	12	15	19.5	21.5	21.5	25.5	28	29.5
Ø D_1^{H7} / Ø D_2^{H7}								
- min.	10 / 20	10 / 20	14 / 23	20 / 28 / 35	20 / 28 / 35	25 / 32	32 / 40	40
- max.	20 / 25	20 / 25	23 / 35	28 / 35 / 40	28 / 35 / 40	32 / 42	40 / 45	60
F	24	16	20	24	24	24	27	28
I	M5	M6	M8	M10	M10	M12	M12	M12
K	17.5	16 / 20	20 / 24	24 / 27 / 28	24 / 27 / 28	26 / 31	32 / 35	40
H (clearance diameter)	48	56	70	84	84	93	102	108

Hubs 18 to 60 made of aluminum, Hubs 80 to 500 made of steel, other materials available on request.

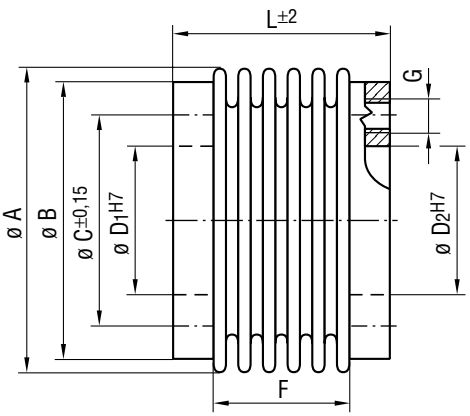
1) Tolerance of keyway: Standard JS9.

2) Smaller ø possible for lower torque of transmission.

3) Stainless steel version also available.

Metal bellows couplings

Series CK for flange mounting



Technical Data – Series CK

TYPE			18	30	60	80	150	200	300	500	800	1400	3000	5000
Nominal moment	(Nm)	T_{KN}	18	30	60	80	150	200	300	500	800	1400	3000	5000
Torsional stiffness	(10^3 Nm/rad)	$C_{T\,dyn}$	8 / 6	39 / 26	73 / 49	126 / 74	150 / 101	173 / 116	499 / 280	310	758	1266	2800	4800
Radial spring	(N/mm)	C_r	204 / 86	718 / 222	1125 / 330	1218 / 403	2030 / 601	2531 / 450	6328/1470	972	512	706	2950	4920
Axial spring	(N/mm)	C_a	52 / 39	48 / 27	91 / 53	84 / 53	147 / 86	147 / 85	284 / 153	86	186	278	310	510
Moment of inertia	(10^{-3} Kgm²)	J	0.05	0.09	0.3	0.67	0.84	1.48	3.75	5.1	10.6	10.6	10.6	62
Weight	(ca. kg)	m	0.2 / 0.25	0.2 / 0.3	0.3 / 0.4	0.6 / 0.7	0.65 / 0.75	1.0 / 1.15	1.6 / 1.8	1.8	2.9	2.9	2.9	16
Max. approved misalignment														
- radial	(mm)	ΔK_r	0.2	0.1 / 0.2	0.1 / 0.2	0.2 / 0.2	0.2 / 0.2	0.2 / 0.2	0.2 / 0.2	0.2	0.2	0.2	0.2	0.2
- axial	(mm)	ΔK_a	0.5	0.4 / 0.5	0.4 / 0.50	0.4 / 0.5	0.4 / 0.5	0.4 / 0.5	0.4 / 0.5	1.0	1.0	1.0	1.0	1.0
- angular	(degree)	ΔK_w	1.5	1.0 / 1.5	1.0 / 1.5	1.0 / 1.5	1.0 / 1.5	1.0 / 1.5	1.0 / 1.5	1.5	1.5	1.5	1.5	1.5
Max. rotating speed at V = 30 m/s	(rpm)	n_{max}	13900	11000	9000	7100	7100	6600	5200	4600	3700	3700	3700	3000

Dimensions (mm) – Series CK

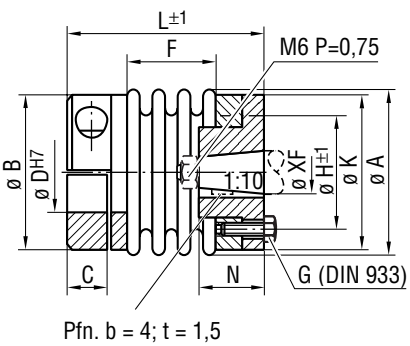
TYPE	18	30	60	80	150	200	300	500	800	1400	3000	5000
L±2	36 / 44	30 / 37	41 / 51	51 / 61	52 / 62	51 / 63	47 / 67	73	130	130	135	145
Ø A	45	56	66	82	82	90	110	122	157	157	157	208
Ø B	41	52	63	80	80	86	110	122	152	152	152	208
Ø C	31	37	46	62	62	62	80	94	110	110	110	130
Ø D_1^{H7} / Ø D_2^{H7} 1)	22	28	38	50	50	50	65	70	85	85	85	100
F	24 / 32	16 / 24	21 / 31	24 / 35	24 / 36	24 / 37	28 / 41	41	87	87	84	94
G	6 x M5	6 x M5	6 x M6	6 x M6	6 x M6	6 x M6	6 x M8	6 x M8	6 x M16	6 x M16	6 x M16	6 x M16
Thread depth	6	7	10	13	13	13	13	16	18	18	22	25

1) Other bore diameters available on request. 2) Stainless steel version also available.

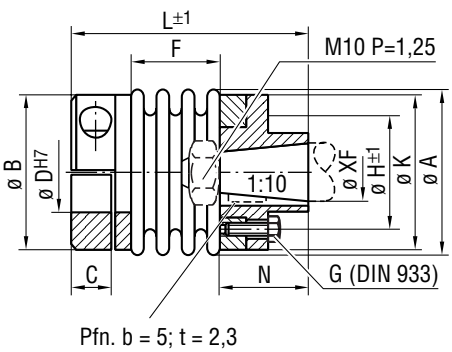
Metal bellows couplings

Series AKD-Fanuc

Series 18



Series 30 – 60



Technical Data – Series AKD-Fanuc

TYPE			18/54 … XF11	18/62 … XF11	30/70 … XF16	30/78 … XF16	60/78 … XF16	60/89 … XF16
Ø A			45	45	56	56	66	66
Ø B			45	45	56	56	66	66
C		from/to	12	12	15	15	19	19
Ø D^{H7}	2)	from/to	10 – 20	10 – 20	14 – 25	14 – 25	14 – 28	14 – 28
L			54	62	70	78	78	89
F			24	32	16	24	20	31
N			16	16	29	29	29	29
Ø H			31	31	37	37	46	46
G (DIN 912)			M5	M5	M6	M6	M8	M8
Ø K			45	45	52	52	63	63
XF			11	11	16	16	16	16
Nominal moment	(Nm)	T_{KN}	18	18	30	30	60	60
Moment of inertia	(kg cm²)	J	0.75	0.75	2.35	2.35	4.85	4.85
Weight	(Kg)	m	0.25	0.25	0.5	0.5	0.75	0.75
Torsional stiffness	(Nm/rad)	$C_{T\,dyn}$	7.5 x 10^3	5.5 x 10^3	36 x 10^3	26 x 10^3	73 x 10^3	49 x 10^3
Max. approved misalignment								
- radial	(mm)	ΔK_r	0.1	0.2	0.1	0.2	0.1	0.2
- axial	(mm)	ΔK_a	0.4	0.5	0.4	0.5	0.4	0.5
- angular	(degree)	ΔK_w	1	1.5	1	1.5	1	1.5
Max. rotating speed at V = 30 m/s	(rpm)	n_{max}	13900	13900	11000	11000	9000	9000

Selection table – Series AKD-Fanuc

Motortyp 1) Fanuc		Model 2-OS	Model 1-OS	Model OS	Model 5S	Model OL	Model 5L	Model 6L
Coupling type		AKD18/54XF11	AKD18/62XF11	AKD30/78XF16	AKD60/89XF16	AKD30/70XF16	AKD30/70XF16	AKD60/78XF16
Bores D_1 (mm)	from/to	10 – 20	10 – 20	14 – 25	14 – 28	14 – 25	14 – 25	14 – 25
M_{RAT-T}		1	2	2.9	6	2.9	5.9	8.8
M_{MAX-T}		7.8	16	26	53	11.8	24	47

1) Other motor types on demand.

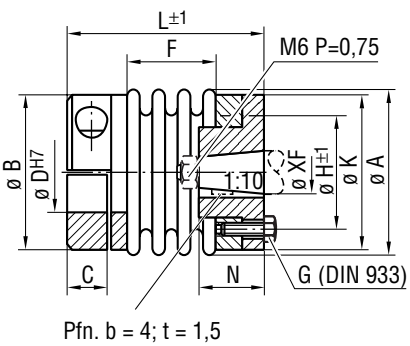
2) Keyway according to DIN 6885[1)] alternatively on demand.

3) Stainless steel version also available.

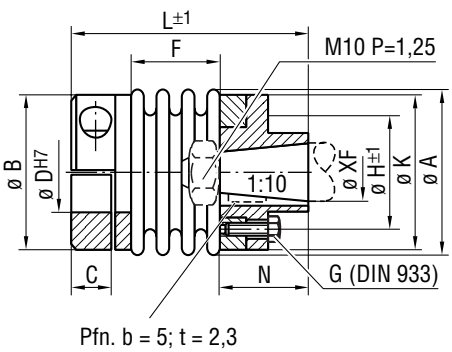
Metal bellows couplings

Series AKD-Fanuc

Series 18



Series 30 – 60



Technical Data – Series AKD-Fanuc

TYPE			18/54 … XF11	18/62 … XF11	30/70 … XF16	30/78 … XF16	60/78 … XF16	60/89 … XF16
Ø A			45	45	56	56	66	66
Ø B			45	45	56	56	66	66
C		from/to	12	12	15	15	19	19
Ø D^{H7}	2)	from/to	10 – 20	10 – 20	14 – 25	14 – 25	14 – 28	14 – 28
L			54	62	70	78	78	89
F			24	32	16	24	20	31
N			16	16	29	29	29	29
Ø H			31	31	37	37	46	46
G (DIN 912)			M5	M5	M6	M6	M8	M8
Ø K			45	45	52	52	63	63
XF			11	11	16	16	16	16
Nominal moment	(Nm)	T_{KN}	18	18	30	30	60	60
Moment of inertia	(kg cm²)	J	0.75	0.75	2.35	2.35	4.85	4.85
Weight	(Kg)	m	0.25	0.25	0.5	0.5	0.75	0.75
Torsional stiffness	(Nm/rad)	$C_{T\,dyn}$	7.5 x 10^3	5.5 x 10^3	36 x 10^3	26 x 10^3	73 x 10^3	49 x 10^3
Max. approved misalignment								
- radial	(mm)	ΔK_r	0.1	0.2	0.1	0.2	0.1	0.2
- axial	(mm)	ΔK_a	0.4	0.5	0.4	0.5	0.4	0.5
- angular	(degree)	ΔK_w	1	1.5	1	1.5	1	1.5
Max. rotating speed at V = 30 m/s	(rpm)	n_{max}	13900	13900	11000	11000	9000	9000

Selection table – Series AKD-Fanuc

Motortyp 1) Fanuc		Model 2-OS	Model 1-OS	Model OS	Model 5S	Model OL	Model 5L	Model 6L
Coupling type		AKD18/54XF11	AKD18/62XF11	AKD30/78XF16	AKD60/89XF16	AKD30/70XF16	AKD30/70XF16	AKD60/78XF16
Bores D_1 (mm)	from/to	10 – 20	10 – 20	14 – 25	14 – 28	14 – 25	14 – 25	14 – 25
M_{RAT-T}		1	2	2.9	6	2.9	5.9	8.8
M_{MAX-T}		7.8	16	26	53	11.8	24	47

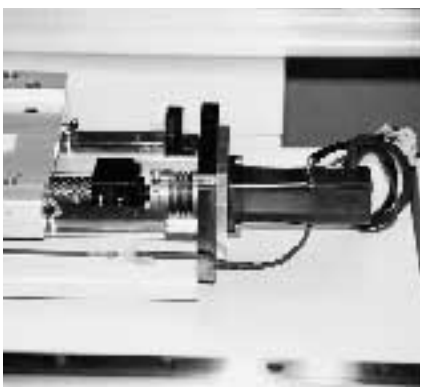
1) Other motor types on demand.

2) Keyway according to DIN 6885[1)] alternatively on demand.

3) Stainless steel version also available.

Metal bellows couplings

Sample applications

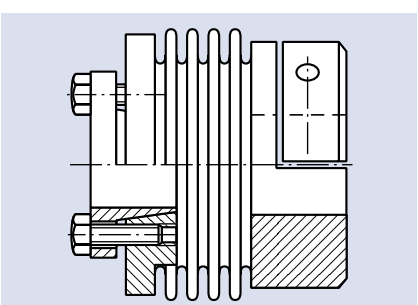


Series DKN
Application – Linear actuator

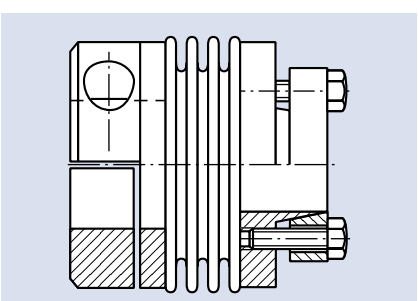
Series AK
Application – Gantry robot

Series AKN
Application – servo-drive / milling machine

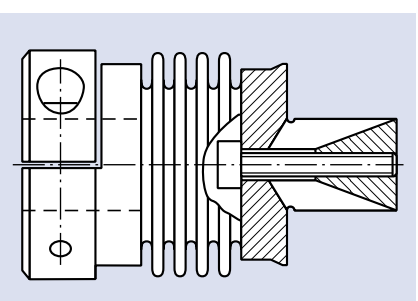
Variable Series



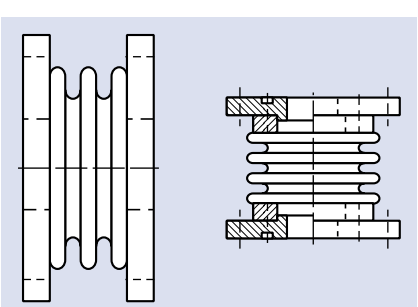
Series AK/AKD
Model with collet clamp and inner conical hub



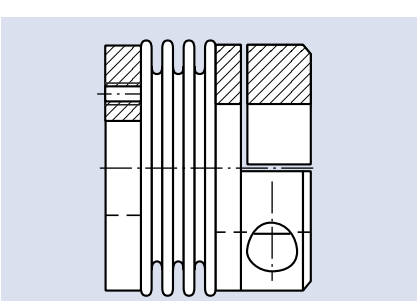
Series AKD/AK/SB
Model with collet clamp and outer conical hub



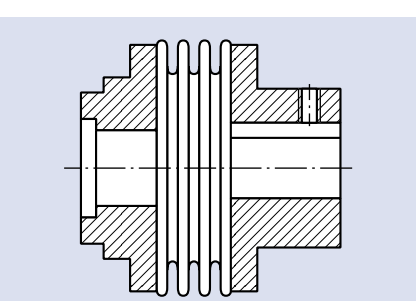
Series AKN/S
Model with collet and expanding clamps



Series CK
With special flange



Series AKD/CK
Model with collet clamp and flange



Series AKN-XX
Model with special hub on both sides

Metal bellows couplings

Assembly instructions

Assembly

Clean shaft ends and bores in hubs, degrease and check the tolerances.

Insert both shaft trunks into the hubs of the metal bellows coupling, and firmly tighten the screws, after examining the axial installation dimensions.

The tightening torque of the screws and the maximum approved misalignment should not be exceeded (refer to list of Technical Data).

Alignment

Figure 10 illustrates the individual types of misalignment.

The fitted metal bellows coupling must now be aligned. Please check the values indicated in the lists of Technical Data.

If several types of misalignment appear simultaneously, then each of the individual values should not be exceeded. Moreover, they should be aligned.

The total of the real misalignments in percentage of the maximum value should not exceed 100%. Figure 9 shows how to regulate.

The more precise the alignment, the more reserves are available to handle additional misalignments for operation. This will have an advantageous effect on the service life, balance quality, and the accuracy of transmission.

If several types of misalignment occur at once, then the values must be lower than each of the maximum values.

Dismantling

After loosening the backlash-free shaft-hub connections, the drive can be pulled apart and the metal bellows coupling can be removed.

Conical bushings for Series AK are forced off with a hexagonal socket screw.

Please ask for our detailed assembly instructions.

Figure 9: Compensating for misalignment

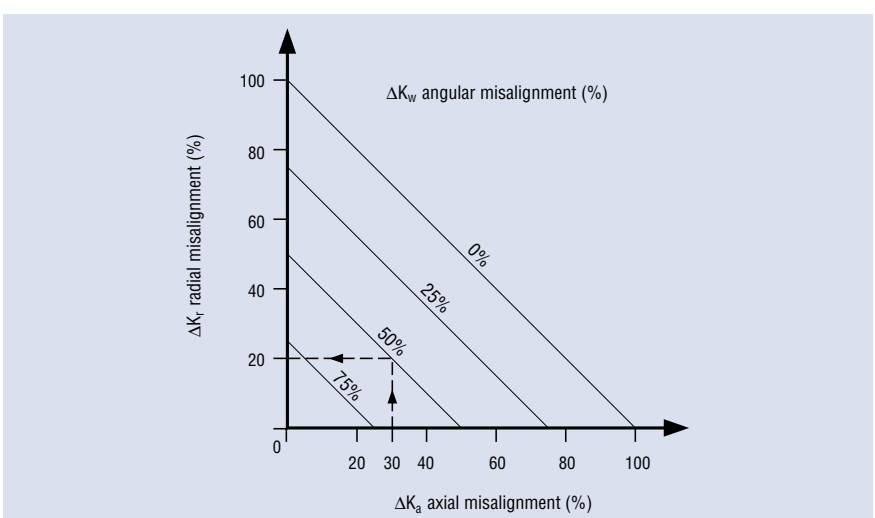
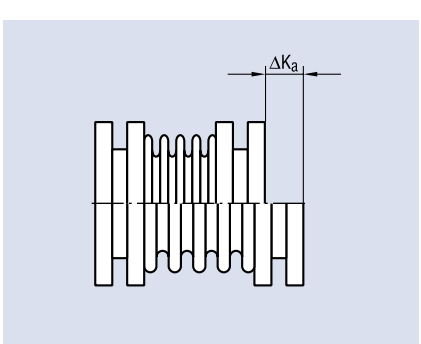
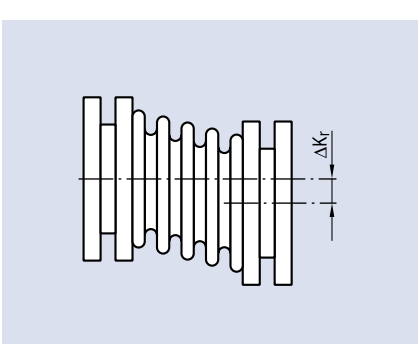


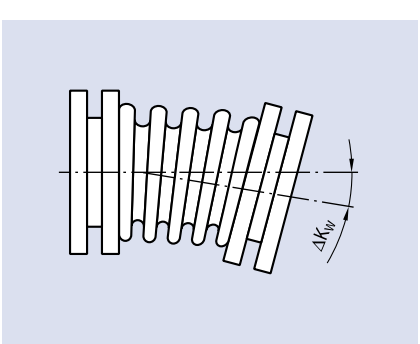
Figure 10: Types of misalignment



axial



radial



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