TOOLFLEX®

Backlash-free, torsionally stiff and maintenance-free coupling

Type S with setscrew

Type M with setscrew

Type S with clamping hubs

Type M with clamping hubs

Type KN (Taper hubs)

Type PI

Type CF

TOOLFLEX® is a backlash-free, torsionally stiff and maintenance-free metal bellow-type coupling designed to be used on machine tools, positioning systems, indexing tables as well as planetary and worm gears. It is able to compensate for shaft misalignment, for example caused by manufacturing inaccuracies, thermal expansion, etc.

Table of contents

1 Technical data 3

2 Advice 11

2.1 General advice 11
2.2 Safety and advice symbols 11
2.3 General hazard warnings 12
2.4 Intended use 12
2.5 Coupling selection 12

3 Storage, transport and packaging 13

3.1 Storage 13
3.2 Transport and packaging 13

4 Assembly 13

4.1 Types of hubs 13
4.2 Components of the couplings 14
4.3 Advice on remachining 15
4.4 Assembly types of hubs 1.0, 1.1, 1.2, 1.3, 2.5 and 2.6 16
4.5 Assembly of the type KN (type of hub 6.5) 17
4.6 Assembly of type PI 18
4.7 Displacements - alignment of the coupling 19

5 Start-up 21

6 Breakdowns, causes and elimination 21

7 Disposal 22

8 Maintenance and service 22

9 Spares inventory, customer service addresses 22

1 Technical data

Type S and M with setscrew

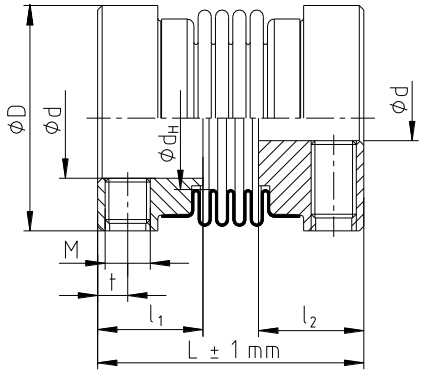


Illustration 1: TOOLFLEX® type S with setscrew (type 1.1)

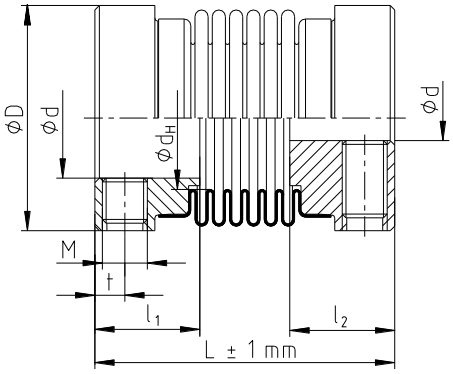


Illustration 2: TOOLFLEX® type M with setscrew (type 1.1)

Table 1: Dimensions - type S and M with setscrew (type 1.1)

Hub material: aluminium; bellow material: stainless steel														
Size	Type [1] [2]	Torque of bellow T_{KN} [Nm]	Dimensions [mm]										Torsion stiffness C_T [Nm/rad]	Weight [5] [kg]
			Finish bore [3]		General				Setscrew					
			Min. d	Max. d	D	d_H	L	l_1, l_2	M	t	z No. [4]	T_A [Nm]		
5	S	0.1	2	5	10	6	15 [1]	6	M2	1.8	1	0.35	97	0.0027
	M						17 [2]						75	0.003
7	S	1.0	3	8	15	9	18 [1]	7	M3	2.0	1	0.6	390	0.005
	M						20 [2]						300	0.006
9	S	1.5	4	10	20	12	21 [1]	8	M3	2.2	2	0.6	750	0.010
	M						24 [2]						580	0.011
12	S	2.0	5	14	25	16	27.5 [1]	11	M4	2.8	2	1.5	1270	0.017
	M						31 [2]						980	0.019
16	S	5.0	6	18	32	20	37 [1]	13	M5	4.0	2	2	4500	0.046
	M						41 [2]						3050	0.049
20	S	15	6	25	40	27	42 [1]	15	M5	5.0	2	2	9600	0.076
	M						49 [2]						6600	0.082

1) Type S = 4 layers
2) Type M = 6 layers
3) Bore F7.
   Keyway to DIN 6885, sheet 1 [JS9] from finish bore Ø6 mm on request.
4) Number each hub, from size 9: 2 x 120° offset.
5) Figures refer to the complete coupling with max. bore.

Circumferential speed $v_{max.}$ = 25 m/s

1 Technical data

Type S with clamping hubs

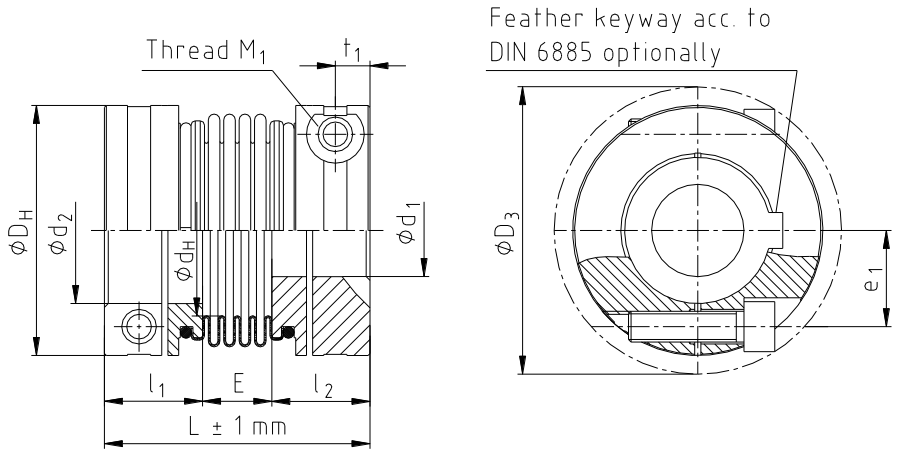


Illustration 3: TOOLFLEX® type S with clamping hubs

Table 2: Dimensions - type S (4 layers) with clamping hubs

Hub material: aluminium (hub size 55 and 65: steel); bellow material: stainless steel												
Size	Dimensions [mm]											
	Finish bore		General					Clamping screws DIN EN ISO 4762				
	Min. d	Max. d	L	l_1, l_2	E	D_H	d_H	M_1	D_3	t_1	e_1	T_A [Nm]
7	3	7	24.0	9.0	6.0	15	9	M2	16.5	3.2	5.0	0.37
9	3	9	29.0	11.0	7.0	20	12	M2.5	21.5	3.5	7.1	0.76
12	4	12	34.5	13.0	8.5	25	16	M3	26.5	4	8.5	1.34
16	5	16	45.0	17.0	11.0	32	20	M4	35.0	5	12.0	2.9
20	8	20	55.0	21.5	12.0	40	27	M5	43.5	6	14.5	6
30	10	30	63.0	23.0	17.0	55	33	M6	58.0	7	19.0	10
38	12	38	69.0	25.5	18.0	65	42	M8	72.6	9	25.0	25
42	14	42	84.0	30.0	24.0	70	46	M8	76.1	9	27.0	25
45	14	45	86.5	32.0	22.5	83	58	M10	89.0	11	30.0	49
55 [3]	20	55	111.0	40.0	31.0	100	73	M12	106.0	14	37.0	120
65 [3]	30	65	126.0	45.0	36.0	125	95	M14	127.2	15	45	185

Table 3: Technical data - type S (4 layers) with clamping hubs

Hub material: aluminium (hub size 55 and 65: steel); bellow material: stainless steel							
Size	Torque of bellow T_{KN} [Nm]	Speed n [1] [rpm]	Moment of inertia [2] [x10^{-6}kgm^2]	Torsion stiffness C_T [Nm/rad]	Axial spring stiffness [N/mm]	Radial spring stiffness [N/mm]	Weight [2] [kg]
7	1	31800	0.26	390	-	-	0.007
9	1.5	23800	0.97	750	-	-	0.014
12	2	19100	2.6	1270	-	-	0.025
16	5	14900	9	4500	43	138	0.06
20	15	11950	30	9600	63	189	0.12
30	35	8700	114	17800	97	233	0.24
38	65	7350	245	37400	108	318	0.35
42	95	6820	396	54700	120	499	0.49
45	170	5750	931	95800	132	738	0.8
55 [3]	340	4800	4996	144100	160	894	3.2
65 [3]	600	3850	13318	322740	212	1365	5.5

1) With v = 25 m/s
2) Figures refer to the complete coupling with max. bore.
3) Hubs made of steel welded with bellow.

1 Technical data

Type M with clamping hubs

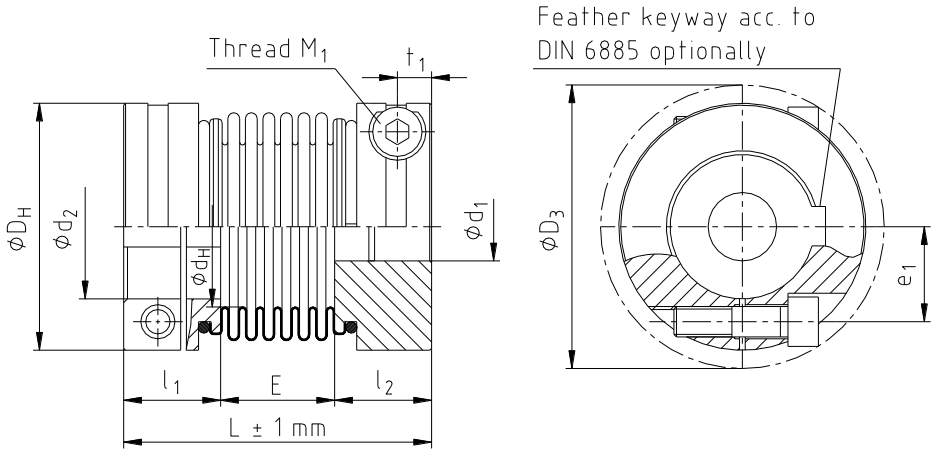


Illustration 4: TOOLFLEX® type M with clamping hubs

Table 4: Dimensions - type M (6 layers) with clamping hubs

Hub material: aluminium (hub size 55 and 65: steel); bellow material: stainless steel												
Size	Dimensions [mm]											
	Finish bore		General					Clamping screws DIN EN ISO 4762				
	Min. d	Max. d	L	l_1, l_2	E	D_H	d_H	M_1	D_3	t_1	e_1	T_A [Nm]
7	3	7	26	9.0	8	15	9	M2	16.5	3.2	5.0	0.37
9	3	9	32	11.0	10	20	12	M2.5	21.5	3.5	7.1	0.76
12	4	12	38	13.0	12	25	16	M3	26.5	4	8.5	1.34
16	5	16	49	17.0	15	32	20	M4	35.0	5	12.0	2.9
20	8	20	62	21.5	19	40	27	M5	43.5	6	14.5	6
30	10	30	72	23.0	26	55	33	M6	58.0	7	19.0	10
38	12	38	81	25.5	30	65	42	M8	72.6	9	25.0	25
42	14	42	95	30.0	35	70	46	M8	76.1	9	27.0	25
45	14	45	103	32.0	39	83	58	M10	89.0	11	30.0	49
55 [3]	20	55	125	40.0	45	100	73	M12	106.0	14	37.0	120
65 [3]	30	65	142	45.0	52	125	95	M14	127.2	15	45	185

Table 5: Technical data - type M (6 layers) with clamping hubs

Hub material: aluminium (hub size 55 and 65: steel); bellow material: stainless steel							
Size	Torque of bellow T_{KN} [Nm]	Speed n [1] [rpm]	Moment of inertia [2] [x10^{-6}kgm^2]	Torsion stiffness C_T [Nm/rad]	Axial spring stiffness [N/mm]	Radial spring stiffness [N/mm]	Weight [2] [kg]
7	1	31800	0.3	300	-	-	0.008
9	1.5	23800	1.0	580	-	-	0.015
12	2	19100	2.7	980	-	-	0.03
16	5	14900	10	3050	29	92	0.06
20	15	11950	32	6600	42	126	0.14
30	35	8700	123	14800	65	155	0.31
38	65	7350	262	24900	72	212	0.45
42	95	6820	427	36500	80	333	0.52
45	170	5750	1020	64000	88	492	1.13
55 [3]	340	4800	5118	96100	107	598	3.3
65 [3]	600	3850	13727	226550	135	910	5.6

1) With v = 25 m/s
2) Figures refer to the complete coupling with max. bore.
3) Hubs made of steel welded with bellow.

1 Technical data

Table 6: Friction torques and surface pressure of clamping hubs types 2.5 - type S and M

Size	7	9	12	16	20	30	38	42	45	55	65
Clamping screw M_1	M2	M2.5	M3	M4	M5	M6	M8	M8	M10	M12	M14
Dimension t_1	3.2	3.5	4	5	6	7	9	9	11	14	15
Dimension e_1	5.0	7.1	8.5	12.0	14.5	19	25	27	30	37	45
Dimension Ø D_3	16.5	21.5	26.5	35.0	43.5	58.0	72.6	76.1	89.0	106	127.2
Tightening torque T_A [Nm]	0.37	0.76	1.34	2.9	6	10	25	25	49	120	185
Bore Ø	Transmittable friction torque of clamping hub [Nm] Surface pressure [N/mm²]										
Ø3	0.84	1.87									
	92.1	164.6									
Ø4	0.91	1.98	3.48								
	55.8	98.0	172.3								
Ø5	0.97	2.09	3.65	8.5							
	38.2	66.1	115.5	189.5							
Ø6	1.04	2.20	3.81	8.8							
	28.3	48.3	83.8	136.1							
Ø7	1.10	2.31	3.98	9.1							
	22.1	37.3	64.3	103.3							
Ø8		2.41	4.14	9.4	17.6						
		29.9	51.3	81.7	113.2						
Ø9		2.52	4.31	9.7	18.1						
		24.7	42.1	66.5	91.9						
Ø10			4.48	9.9	18.6	32.4					
			35.4	55.5	76.4	133.2					
Ø11			4.64	10.2	19.1	33.1					
			30.4	47.2	64.7	112.4					
Ø12			4.81	10.5	19.5	33.8					
			26.4	40.8	55.8	96.4					
Ø14				11.1	20.5	35.1	79.2	84.2	145		
				31.7	43.0	73.6	143.9	121.2	196.8		
Ø15				11.4	21.0	35.8	80.4	85.4	147		
				28.3	38.3	65.4	127.3	107.1	173.7		
Ø16				11.7	21.4	36.5	81.7	86.6	149		
				25.5	34.4	58.6	113.6	95.5	154.7		
Ø19					22.9	38.5	85.4	90.3	155		
					26.0	43.8	84.2	70.6	114.1		
Ø20					23.3	39.2	86.6	91.6	157	381	
					24.0	40.3	77.1	64.6	104.2	198.0	
Ø24						41.9	91.6	96.5	165	397	
						29.9	56.6	47.3	76.0	143.4	
Ø25						42.5	92.8	97.8	167	401	
						28.0	52.9	44.1	70.9	133.5	
Ø28						44.6	96.5	102	173	413	
						23.4	43.8	36.5	58.5	109.6	
Ø30						45.9	99.0	104	177	421	720
						21.0	39.2	32.6	52.1	97.4	141.5
Ø32							102	106	181	429	732
							35.3	29.3	46.8	87.2	126.4
Ø35							105	110	187	442	750
							30.6	25.4	40.4	75.0	108.3
Ø38							109	114	193	454	768
							26.9	22.2	35.4	65.4	94.1
Ø40								116	197	462	780
								20.5	32.6	60.0	86.2
Ø42								119	200	470	792
								19.0	30.1	55.4	79.4
Ø45									206	482	810
									27.0	49.5	70.7
Ø48										494	828
										44.6	63.6
Ø50										502	840
										41.8	59.4
Ø55										523	870
										35.9	50.9
Ø60											900
											44.2
Ø65											930
											38.9

1 Technical data

Type S-KN and M-KN

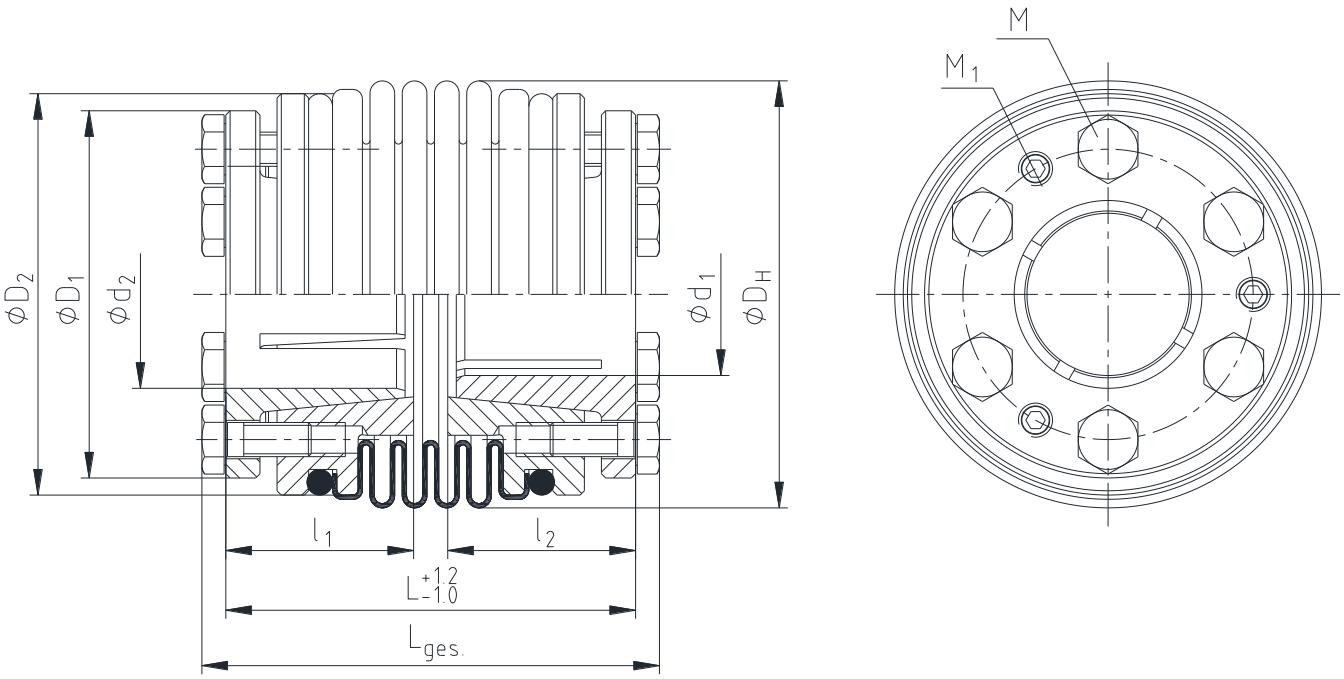


Illustration 5: TOOLFLEX® type KN (type 6.5) - example of drawing: type S-KN

Table 7: Dimensions - type S-KN and M-KN

Hub material: steel; bellow material: stainless steel																	
Size	Type [1] [2]	Torque of bellow T_{KN} [Nm]	Dimensions [mm]														
			Finish bore		General						Clamping screws			Tack thread		
			Min. d	Max. d	L	L_{total}	l_1, l_2	D_H	D_1	D_2	M	z No.	T_A [Nm]	M_1	z No.	T_{A1} [4] [Nm]
30	S	35	12	22	48 [1]	53 [1]	22	50.0	43	47	M4	12	2.9	M4	6	1.2
	M				57 [2]	63 [2]										
38	S	65	12	28	56 [1]	63 [1]	26	60.5	52	56	M5	12	6	M5	6	1.4
	M				68 [2]	75 [2]										
42	S	95	14	35	64 [1]	71 [1]	29	66.0	60	63	M5	12	6	M5	6	1.4
	M				75 [2]	82 [2]										
45	S	170	15	40	74.5 [1]	82.5 [1]	34	82.0	68	77	M6	12	14	M6	6	3
	M				91 [2]	99 [2]										
55 [3]	S	340	15	56	95.5 [1]	106 [1]	40	97.0	95	95	M8	12	35	M8	6	6
	M				109 [2]	120 [2]										

1) Type S = 4 layers
2) Type M = 6 layers
3) Hubs made of steel welded with bellow.
4) After assembly of the clamping screws (M) tighten the pull-off thread (M_1) at the tightening torque T_{A1} specified.

1 Technical data

Table 8: Transmittable friction torque of taper hub KN

Size	30	38	42	45	55
Clamping screw M	M4	M5	M5	M6	M8
Number z (each taper hub)	6	6	6	6	6
Tightening torque T_A [Nm]	2.9	6	6	14	35
Bore Ø d_1	Transmittable friction torque of taper hub [Nm] Surface pressure [N/mm²]				
Ø12	37	52			
	106.7	132.7			
Ø14	50	71	57		
	106.7	132.7	92.3		
Ø15	58	81	66	129	174
	106.7	132.7	92.3	166.0	183.2
Ø16	66	92	75	147	198
	106.7	132.7	92.3	166.0	183.2
Ø19	71	130	105	208	279
	81.7	132.7	92.3	166.0	183.2
Ø20	79	103	117	230	309
	81.7	95.2	92.3	166.0	183.2
Ø24		149	168	332	445
		95.2	92.3	166.0	183.2
Ø25		161	131	230	483
		95.2	66.3	106.1	183.2
Ø28		202	164	288	606
		95.2	66.3	106.1	183.2
Ø30			189	331	696
			66.3	106.1	183.2
Ø32			215	376	792
			66.3	106.1	183.2
Ø35			257	451	585
			66.3	106.1	113.2
Ø38				531	690
				106.1	113.2
Ø40				589	764
				106.1	113.2
Ø42					842
					113.2
Ø45					967
					113.2
Ø48					1101
					113.2
Ø50					1194
					113.2
Ø55					1445
					113.2

The transmittable friction torques of the clamping connection consider the max. fitting tolerance with shaft clearance H7/k6 bore. The friction torque is reduced with bigger fitting tolerances.

With the assembly of the coupling onto hollow shafts it is necessary to check the permissible tensions and deformation (see chapter 4.5).

1 Technical data

Type S-PI and M-PI

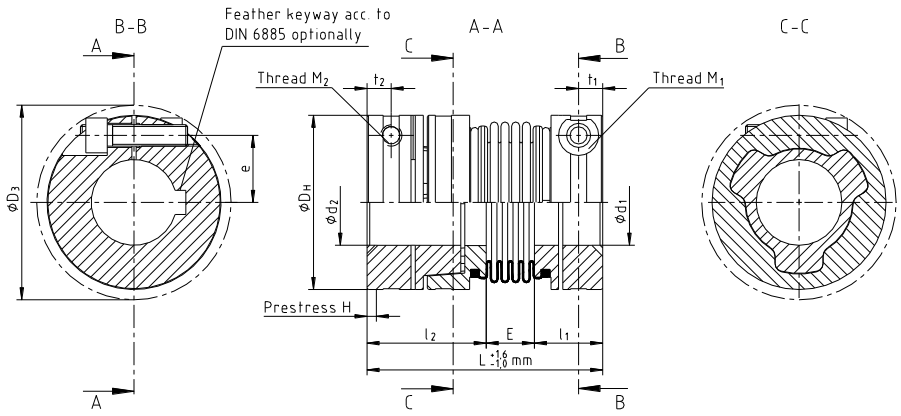


Illustration 6: TOOLFLEX® type PI - example of drawing: type S-PI

Table 9: Dimensions - type S-PI and M-PI

Hub material: aluminium; bellow material: stainless steel															
Size	Type [1] [2]	Dimensions [mm]													
		Finish bore			General						Clamping screws				
		Min. d_1, d_2	Max. d_1	Max. d_2	L [3]	l_1	l_2	E	D_H	H	M_1, M_2	D_3	e	t_1, t_2	T_A [Nm]
20	S	8	20	20	67.0 [1]	21.5	33.5	12 [1]	40	0.5 - 1.0	M5	43.5	14.5	6	6
	M				74.0 [2]			19 [2]							
30	S	10	30	28	73.5 [1]	23.0	33.5	17 [1]	55	0.5 - 1.0	M6	58.0	19.0	7	10
	M				82.5 [2]			26 [2]							
38	S	12	38	32	87.5 [1]	25.5	44.0	18 [1]	65	0.5 - 1.5	M8	72.6	25.0	9	25
	M				99.5 [2]			30 [2]							
42	S	14	42	35	93.0 [1]	30.0	39.0	24 [1]	70	0.5 - 1.5	M8	76.1	25.0	9	25
	M				104.0 [2]			35 [2]							
45	S	14	45	42	96.0 [1]	32.0	41.5	22.5 [1]	83	0.5 - 1.5	M10	89.0	30.0	11	49
	M				112.5 [2]			39 [2]							
55	S	20	55	55	136.0	40.0	58.5	31	100	0.5 - 1.5	M12	106.0	37.0	14	120
	M				143.5			45.0							

Table 10: Technical data - type S-PI and M-PI

Hub material: aluminium; bellow material: stainless steel								
Size	Type [1] [2]	Torque of bellow T_{KN} [Nm]	Speed n [5] [rpm]	Moment of inertia [4] [$x10^{-6}kgm^2$]	Torsion stiffness C_T [Nm/rad]	Axial spring stiffness [N/mm]	Radial spring stiffness [N/mm]	Weight [4] [kg]
20	S	15	11950	37	6600	63	189	0.15
	M			38	4900	42	126	0.16
30	S	35	8700	140	11500	97	233	0.29
	M			145	10200	65	155	0.31
38	S	65	7350	329	21500	108	318	0.50
	M			346	15100	72	212	0.52
42	S	95	6820	396	31500	120	499	0.49
	M			427	22000	80	333	0.52
45	S	170	5750	1031	55000	132	738	0.93
	M			1127	41000	88	492	1.00
55	S	340	4800	6150	144100	160	894	3.80
	M			6270	96100	107	598	3.90

1) Type S = 4 layers
2) Type M = 6 layers
3) When being plugged in
4) Figures refer to the complete coupling with max. bore.
5) With v = 25 m/s

Transmittable friction torques of clamping hub - for type PI see table 13.

With the assembly of the coupling onto hollow shafts it is necessary to check the permissible tensions and deformation (see chapter 4.5).

1 Technical data

Type S-CF and M-CF

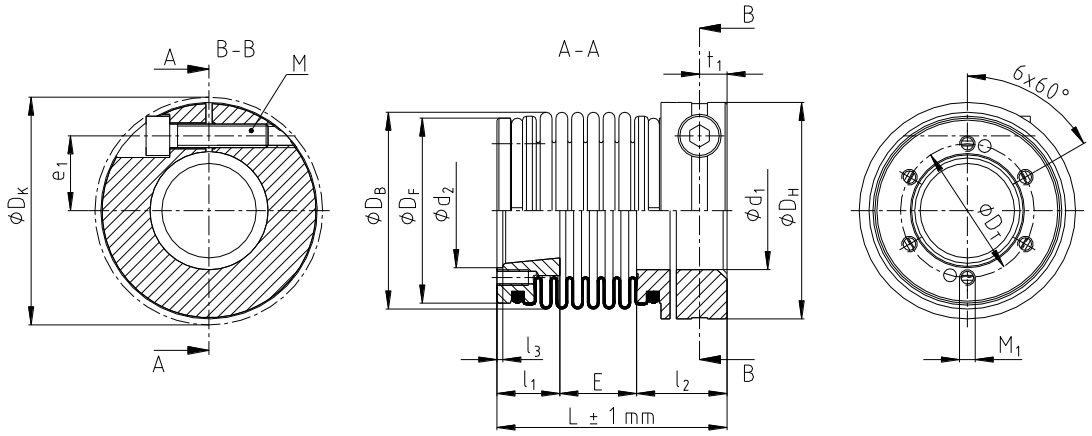


Illustration 7: TOOLFLEX® type CF - example of drawing: type M-CF

Table 11: Dimensions - type S-CF and M-CF

Hub material: aluminium (hub size 55: steel); bellow material: stainless steel																		
Size	Type [1) 2)]	Dimensions [mm]																
		Finish bore		General									Clamping screws					
		$d_{1\ min.}$	$d_{1\ max.}$	D_H	D_B	D_F	d_2 H7	l_3	l_1	l_2	E	L	D_K	e_1	t_1	M	T_A [Nm]
30	S	10	30	55	50	47	25 [1)]	1.5	16	23	10.5 [1)]	49.5 [1)]	58.0	19	7	M6	10
	M						29 [2)]				19.5 [2)]	58.5 [2)]					
38	S	12	38	65	60.5	55.75	29 [1)]	1.5	18	25.5	11 [1)]	54.5 [1)]	72.6	25	9	M8	25
	M						36 [2)]				23 [2)]	66.5 [2)]					
42	S	14	42	70	66	62.95	36 [1)]	1.5	21	30	15 [1)]	66.0 [1)]	76.1	27	9	M8	25
	M						43 [2)]				26 [2)]	77.0 [2)]					
45	S	14	45	83	82	77	38 [1)]	1.5	23	32	14.5 [1)]	69.5 [1)]	89.0	30	11	M10	49
	M						49 [2)]				31 [2)]	86.0 [2)]					
55 [3)]	S	20	55	100	97	95	51 [1)]	1.5	28	40	23.5 [1)]	91.5 [1)]	106	37	14	M12	120
	M						68 [2)]				37 [2)]	105 [2)]					

Table 12: Dimensions of flange and technical data - type S-CF and M-CF

Hub material: aluminium (hub size 55: steel); bellow material: stainless steel								
Size	Type [1) 2)]	Dimensions [mm]		Technical data				
		Flange		Torque of bellow T_{KN} [Nm]	Speed n [5)] [rpm]	Torsion stiffness C_T [Nm/rad]	Axial spring stiffness [N/mm]	Radial spring stiffness [N/mm]
		D_T	M_1					
30	S	30	M4	35	8700	14800	97	233
	M	34					65	155
38	S	35	M5	65	7350	24900	108	318
	M	42					72	212
42	S	42	M5	95	6820	36500	120	499
	M	49					80	333
45	S	45	M6	170	5750	64000	132	738
	M	56					88	492
55 [3)]	S	60	M8	340	4800	96100	160	894
	M	78					107	598

1) Type S = 4 layers
2) Type M = 6 layers
3) Hubs made of steel welded with bellow.
4) With v = 25 m/s

Transmittable friction torques of clamping hub - for type CF see table 14.

With the assembly of the coupling onto hollow shafts it is necessary to check the permissible tensions and deformation (see chapter 4.5).

1 Technical data

Table 13: Transmittable friction torque of the clamping hub - type PI

Size	Bore range d and the corresponding transmittable friction torque T_R [Nm]																			
	Ø8	Ø9	Ø10	Ø11	Ø12	Ø14	Ø15	Ø16	Ø18	Ø19	Ø20	Ø24	Ø25	Ø28	Ø30	Ø32	Ø35	Ø38	Ø40	Ø42
20	17.6	18.1	18.6	19.1	19.5	20.5	21.0	21.4	22.4	22.9	23.3									
30			32.4	33.1	33.8	35.1	35.8	36.5	37.8	38.5	39.2	41.9	42.5	44.6	45.9					
38						79.2	80.4	81.7	84.2	85.4	86.6	91.6	92.8	96.5	99.0	102				
42						79.2	80.4	81.7	84.2	85.4	86.6	91.6	92.8	96.5	99.0	102	105			
45						145	147	149	153	155	157	165	167	173	177	181	187	193	197	200
55												397	401	413	421	429	442	454	462	470

The transmittable friction torques of the clamping connection consider the max. fitting tolerance with shaft clearance H7/k6 bore. The friction torque is reduced with bigger fitting tolerances.

Table 14: Transmittable friction torques of the clamping hub - type CF

Size	Bore range d and the corresponding transmittable friction torque T_R [Nm]																			
	Ø10	Ø11	Ø12	Ø14	Ø15	Ø16	Ø18	Ø19	Ø20	Ø24	Ø25	Ø28	Ø30	Ø32	Ø35	Ø38	Ø40	Ø42	Ø45	Ø50	Ø55
30		33.1	33.8	35.1	35.8	36.5	37.8	38.5	39.2	41.9	42.5	44.6	45.9								
38							84.2	85.4	86.6	91.6	92.8	96.5	99.0	102	105	109					
42				84.2	85.4	86.6	89.1	90.3	91.6	96.5	97.8	102	104	106	110	114	116	119			
45									157	165	167	173	177	181	187	193	197	200	206		
55										397	401	413	421	429	442	454	462	470	482	502	523

The transmittable friction torques of the clamping connection consider the max. fitting tolerance with shaft clearance H7/k6 bore. The friction torque is reduced with bigger fitting tolerances.

2 Advice

2.1 General advice

Please read through these operating/assembly instructions carefully before you start up the coupling.
Please pay special attention to the safety instructions!
The operating/assembly instructions are part of your product. Please store them carefully and close to the coupling.

2.2 Safety and advice symbols

Warning of personal injury

This symbol indicates notes which may contribute to preventing bodily injuries or serious bodily injuries that may result in death.

Warning of product damages

This symbol indicates notes which may contribute to preventing material or machine damage.

General advice

This symbol indicates notes which may contribute to preventing adverse results or conditions.

Warning of hot surfaces

This symbol indicates notes which may contribute to preventing burns with hot surfaces resulting in light to serious bodily injuries.

2 Advice

2.3 General hazard warnings

With assembly, operation and maintenance of the coupling it has to be made sure that the entire drive train is secured against accidental switch-on. You may be seriously hurt by rotating parts. Please make absolutely sure to read through and observe the following safety indications.

- All operations on and with the coupling have to be performed taking into account "safety first".
- Please make sure to switch off the power pack before you perform your work on the coupling.
- Secure the power pack against accidental switch-on, e. g. by providing warning signs at the place of switch-on or removing the fuse for current supply.
- Do not reach into the operating area of the coupling as long as it is in operation.
- Please secure the coupling against accidental contact. Please provide for the necessary protection devices and covers.

2.4 Intended use

You may only assemble, operate and maintain the coupling if you

- have carefully read through the operating/assembly instructions and understood them
- had technical training
- are authorized by your company

The coupling may only be used in accordance with the technical data (see chapter 1). Unauthorized modifications on the coupling design are not admissible. We will not assume liability for any damage that may arise. In the interest of further development we reserve the right for technical modifications.
The **TOOLFLEX®** described in here corresponds to the technical status at the time of printing of these operating/assembly instructions.

2.5 Coupling selection

To ensure a permanently smooth operation of the coupling a corresponding operating factor (see catalogue drive technology "TOOLFLEX®") has to be taken into consideration with dimensioning, depending on the application.
If the operating conditions (performance, speed, modifications on engine and machine) change, the coupling selection must be reviewed.
The transmittable torque of the shaft-hub-connection must be reviewed by the customer and is subject to his responsibility.

3 Storage, transport and packaging

3.1 Storage

Coupling components made of steel (e. g. hubs) are supplied in preserved condition and can be stored at a dry and covered place for 6 - 9 months. Couplings with aluminium components (e. g. hubs) and bellows from stainless steel are supplied in preserved condition.

Humid storage rooms are not suitable.
Please make sure that condensation is not generated. The best relative air humidity is less than 65 %.

3.2 Transport and packaging

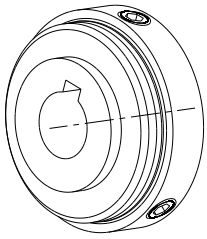
In order to avoid any injuries and any kind of damage always make use of proper transport and lifting equipment.

The couplings are packed differently each depending on size, number and kind of transport. Unless otherwise contractually agreed, packaging will follow the in-house packaging specifications of KTR.

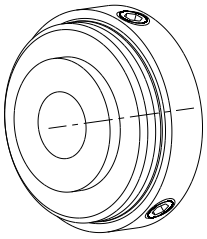
4 Assembly

The coupling is supplied in assembled condition, including clamping screws or setscrews assembled. Before assembly the coupling has to be inspected for completeness.

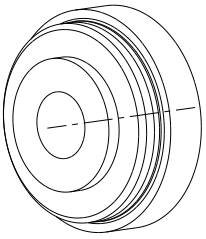
4.1 Types of hubs



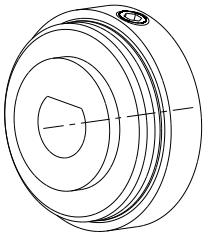
Type 1.0
with feather keyway and setscrew



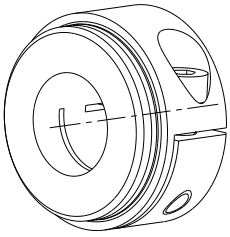
Type 1.1
without feather keyway, with setscrew



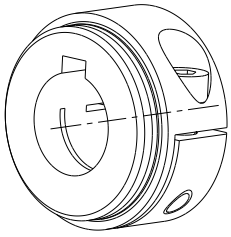
Type 1.2
without feather keyway, without setscrew



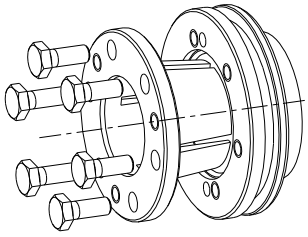
Type 1.3
with spline bore



Type 2.5
clamping hub, double slotted, without feather keyway



Type 2.6
clamping hub, double slotted, with feather keyway



Type 6.5
taper hub KN

4 Assembly

4.2 Components of the couplings

Components of TOOLFLEX®, type S and M with setscrew (type 1.1)

Component	Number	Description
1	1	Bellow with 2 hubs glued/bordered
4	1 [1)]	Setscrews DIN EN ISO 4029

1) Number each hub, from size 9: 2 x 120° offset.

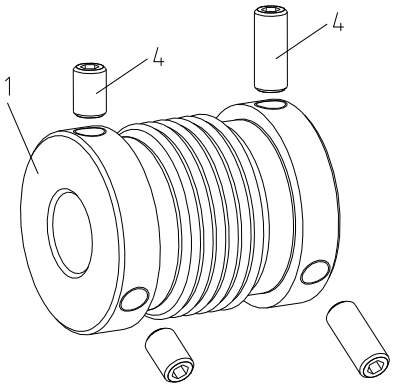


Illustration 8: TOOLFLEX® type S and M (type 1.1)

Components of TOOLFLEX®, type S and M with clamping hubs (type 2.5)

Component	Number	Description
1	1	Bellow with 2 clamping hubs glued/bordered/ welded
3	1 [1)]	Clamping screws DIN EN ISO 4762

1) Number each hub

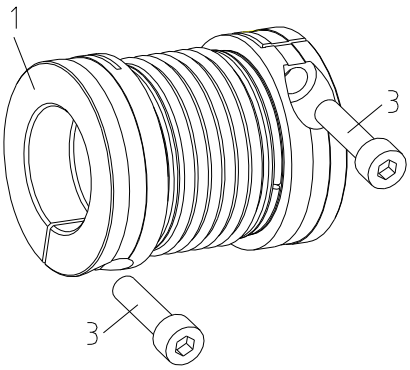


Illustration 9: TOOLFLEX® type S and M (type 2.5)

Components of TOOLFLEX®, type S-KN and M-KN (type 6.5)

Component	Number	Description
1	1	Bellow with 2 taper rings bordered/welded
2	2	Taper hub
3	6 [1)]	Clamping screws DIN EN ISO 4017
4	3 [1)]	Setscrews DIN EN ISO 4029

1) Number each hub

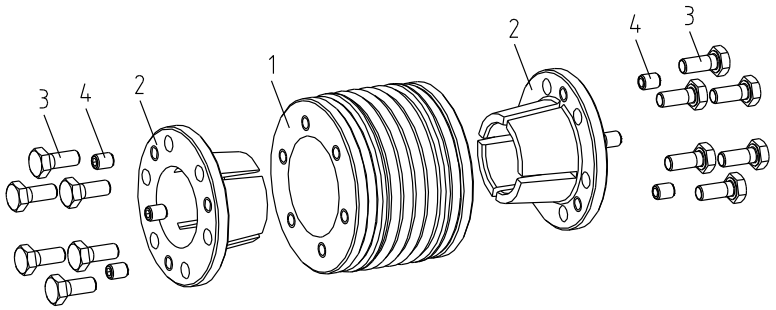


Illustration 10: TOOLFLEX® type S-KN and M-KN

4 Assembly

4.2 Components of the couplings

Components of TOOLFLEX®, type S-PI and M-PI

Component	Number	Description
1	1	Bellow with 1 clamping hub and 1 PI-plug-in hub (part 1) bordered
2	1	Clamping hub PI (component 2)
3	1 [1)]	Clamping screws DIN EN ISO 4762

1) Number each clamping hub

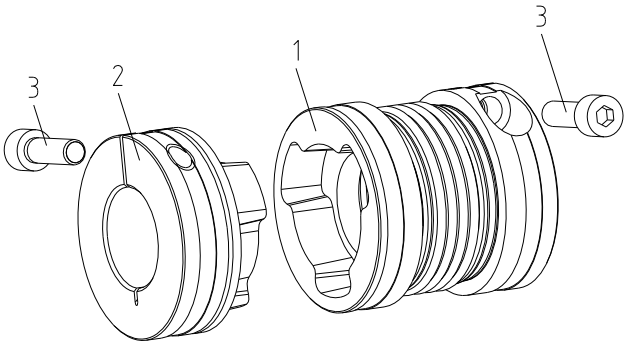


Illustration 11: TOOLFLEX® type S-PI and M-PI

Components of TOOLFLEX®, type S-CF and M-CF

Component	Number	Description
1	1	Bellow with 1 taper ring and 1 clamping hub bordered/welded
3	1 [1)]	Clamping screws DIN EN ISO 4762

1) Number each clamping hub

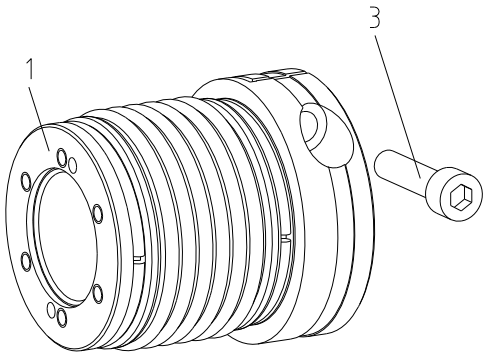


Illustration 12: TOOLFLEX® type S-CF and M-CF

4.3 Advice on remachining

The customer bears the sole responsibility for all machining processes performed subsequently on unbored or pilot bored as well as finish machined coupling components and spare parts. KTR does not assume any warranty claims resulting from insufficient remachining.

4 Assembly

4.4 Assembly types of hubs 1.0, 1.1, 1.2, 1.3, 2.5 and 2.6

We recommend to inspect bores, shaft, keyway and feather key for dimensional accuracy before assembly. In addition we recommend to review the overall length of the coupling. This dimension is necessary to align the coupling and may slightly deviate from the figures specified in the tables subject to production tolerances.

Before starting with the assembly preserving agents have to be removed from the bores. Moreover, the shaft ends have to be cleaned carefully, too.

Please note the manufacturer's instructions regarding the use of detergents.

- Lightly oil the shafts before assembly (e. g. with Castrol 4 in 1, Klüber Quietsch-Ex or WD 40). Oils and greases with lubricants (e. g. MoS_2) must not be used.
- Unscrew the setscrews or clamping screws.
- Insert the shaft ends of driving and driven machine into the TOOLFLEX® coupling. Please make sure that the shafts covers the overall length of the hub (dimension l_1, l_2 or l_3, l_4 from table 1, 2, 4 or 6).
- Shift the power packs in axial direction until the distance dimension L is achieved. If the power packs are already firmly assembled, shifting the coupling axially on the shafts allows for setting the distance dimension L.
- Secure the hubs by tightening the setscrews or clamping screws, respectively, at the tightening torques T_A mentioned in tables 1, 2, 4 or 6.

Please make sure with the assembly of the coupling that the metal bellow is neither twisted, compressed nor damaged otherwise. If this remark is not respected, the coupling may be damaged and fail at an early stage. The clearance fit of the shaft-hub-connection should be between 0.01 mm and 0.05 mm.

The tightening torque T_A (depending on the coupling type see table 1, 2, 4 or 6) must not be exceeded during the assembly. During the assembly or disassembly, respectively, the metal bellow may be deformed two times the figure of the displacement figures mentioned in tables 15 and 16 at the maximum. If this remark is not respected, the coupling may be damaged and fail at an early stage.

The transmittable friction torques of the clamping hubs (see table 6) depend on the bore diameter.

4 Assembly

4.5 Assembly of the type KN (type of hub 6.5)

The power transmission with **TOOLFLEX® KN** is frictionally engaged. The surface pressure required is transmitted via a ring with internal taper to the taper hub with external taper and consequently to the shaft. The friction torques specified in table 8 consider a fit pair H7/k6. With a bigger fit clearance the friction torques specified in table 8 are reduced.

The strength and dimensions of the shafts (here specifically hollow shafts) have to be dimensioned such that sufficient safety against plastic deformation is ensured. This may roughly be reviewed as per the following criterion.

For clamping connections with hollow shafts the required internal diameter of the hollow shaft d_{iW} is calculated based on the following formula:

$$d_{iW} \leq d \cdot \sqrt{\frac{R_{p0,2} - 2 \cdot p_W}{R_{p0,2}}} \quad [mm]$$

Shear stress on the internal shaft diameter for hollow shaft:

$$\sigma_{tiW} \approx - \frac{2 \cdot p_W}{1 - C_W^{\,2}} \quad [N/mm^2]$$

Shear stress for solid shaft:

$$\sigma_{tW} = - p_W \quad [N/mm^2]$$

$R_{p0.2}$ = yield strength of shaft material [N/mm²]
p_W = surface pressure of hub/shaft [N/mm²]

d_{iW} = internal diameter of hollow shaft [mm]
d = shaft diameter [mm]
C_W = d_{iW} / d

The strength required is not provided if the hollow shaft bore exceeds the max. internal bore calculated or if the shear stress exceeds the yield strength of the material.
For a detailed calculation please contact KTR's engineering department.

- Clean the hub bore and shaft and afterwards lubricate with a thin-fluid oil (e. g. Castrol 4 in 1, Klüber Quietsch-Ex or WD 40).

☞ **We recommend to inspect bores and shafts for dimensional accuracy before assembly. In addition we recommend to review the overall length of the coupling. This dimension is necessary to align the coupling and may slightly deviate from the figures specified in the tables subject to production tolerances.**

⚠ **Oils and greases containing molybdenum disulfide or other high-pressure additives as well as internal lubricants must not be used.**

- Untighten the clamping screws slightly and pull the taper hub slightly out of the ring so that the taper hub can easily be moved.
- Push the TOOLFLEX® type KN onto the shaft of the driving machine. Please make sure that the overall clamping area is fully used.
- Tighten the clamping screws (M) evenly crosswise step by step to the tightening torque T_A specified in table 7. Repeat this process until all clamping screws have reached the tightening torque. Insert the shaft end of the driven machine into the TOOLFLEX® type KN coupling and repeat the steps mentioned above.

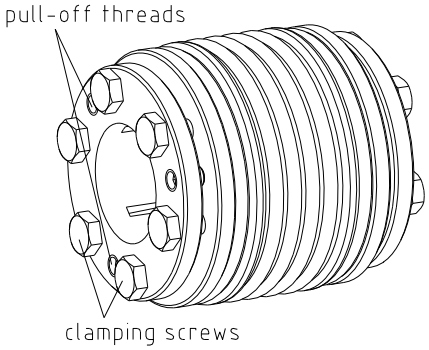


Illustration 13: Assembly
of the clamping ring hub type 6.5

4 Assembly

4.5 Assembly of the type KN (type of hub 6.5)

By tightening the clamping screws the metal bellow (component 1) is moved axially. Subject to this effect it has to be made sure that a taper hub (component 2) is fully assembled first and afterwards the assembly of the second hub is started with. As a result an impermissible twisting of the metal bellow in axial direction is avoided.

- Afterwards tighten the setscrews (M_1) of the pull-off threads at the tightening torque T_A mentioned in table 7.

If this assembly process is not respected, the setscrews may release and fly around. This may cause danger for body and life.

Disassembly:

Unscrew the clamping screws evenly one after another. During every revolution every screw may only be unscrewed by half a turn. Unscrew all clamping screws by 3 - 4 pitches.

Afterwards tighten the setscrews of the pull-off threads stepwise and evenly crosswise. Please repeat this process until the taper hub releases.

If these hints are not observed, the operation of the coupling may be affected.

If the assembly is repeated the bore of the hub and shaft have to be cleaned and afterwards lubricated with a thin-fluid oil (e. g. Castrol 4 in 1, Klüber Quietsch-Ex or WD 40). The same applies for the taper surfaces of taper hub and clamping ring. Before it is possible to assemble the hubs again it is necessary to unscrew the setscrews (component 4) until they are flush with the outside of the taper hub.

Oils and greases containing molybdenum disulfide or other high-pressure additives as well as internal lubricants must not be used.

4.6 Assembly of type PI

Before assembly the mounting dimension of the coupling needs to be specified to make sure that the pre-load dimension H (table 9) is achieved after assembly of the coupling (see illustration 14).

- Stick the coupling together without backlash and without axial pressure.

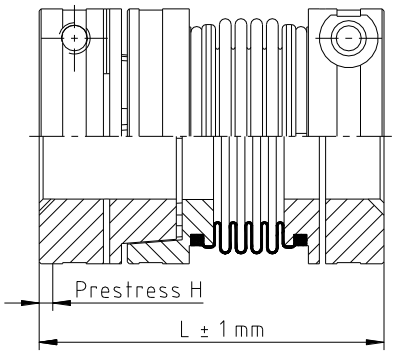


Illustration 14

4 Assembly

4.6 Assembly of type PI

- Measure the length L (see illustration 15) connected of the coupling and determine the mounting dimension (L - H = mounting dimension).
- Push the bellow along with the clamping hub and PI plug-in hub (component 1) onto the shaft on the gear side and the PI clamping hub (component 2) onto the shaft on the motor side.
- Secure the clamping hub by tightening the clamping screws by means of a torque key at the tightening torques T_A specified in table 9.
- Push the PI clamping hub in the PI plug-in hub to the mounting dimension determined before.

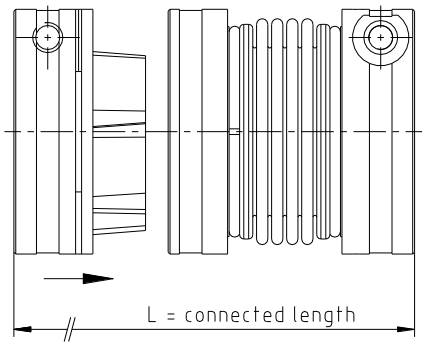


Illustration 15

The prestress H of the bellow specified before the assembly needs to be clearly perceptible. In this way we will realize the backlash-free torque transmission. The maximum permissible displacement figures are not reduced by the prestress.

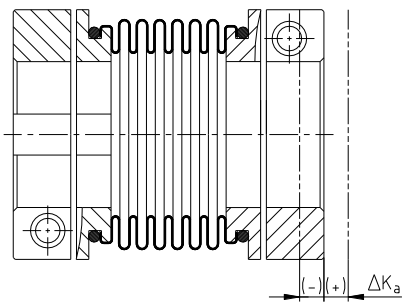
4.7 Displacements - alignment of the coupling

The **TOOLFLEX®** compensates for displacements generated by the shafts to be combined as shown in table 15 or 16. Excessive misalignment may be generated by inaccurate alignment, production tolerances, thermal expansion, shaft deflection, twisting of machine frames, etc.

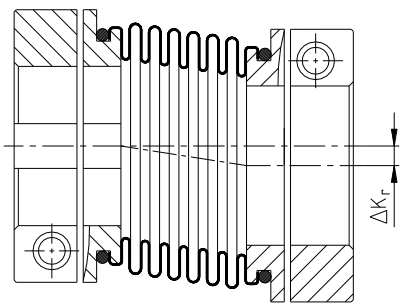
In order to ensure a long service life of the coupling, the shaft ends have to be accurately aligned.
Please absolutely observe the displacement figures specified (see table 15 or 16). If the figures are exceeded, the coupling will be damaged.
The more accurate the alignment of the coupling, the longer is its service life.

Please note:

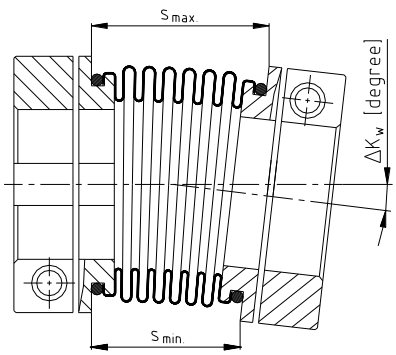
- The displacement figures specified in table 15 or 16 are maximum figures which must not arise in parallel. If radial and angular displacement occurs at the same time, the sum of the displacement figures must not exceed ΔK_r or ΔK_w.
- Please inspect with a dial gauge, ruler or feeler whether the permissible displacement figures specified in table 15 or 16 are observed.



Axial displacements



Radial displacements



Angular displacements

Illustration 16: Displacements

$L_{adm.} = L + \Delta K_a$ [mm]

$\Delta K_w = S_{max.} - S_{min.}$ [mm]

4 Assembly

4.7 Displacements - alignment of the coupling

Examples of the displacement combinations specified in illustration 17:

Example 1:
$\Delta K_r = 30\%$
$\Delta K_w = 70\%$

Example 2:
$\Delta K_r = 60\%$
$\Delta K_w = 40\%$

$$\Delta K_{total} = \Delta K_r + \Delta K_w \leq 100\ \%$$

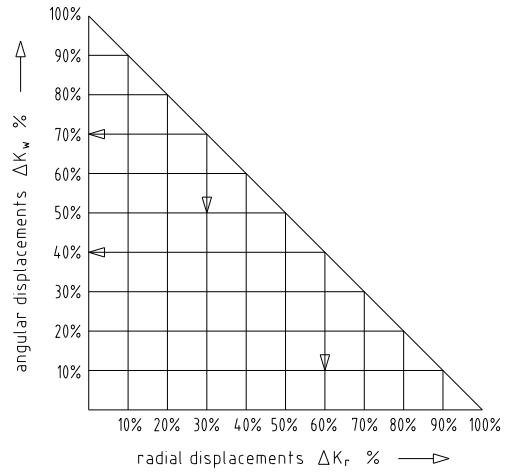


Illustration 17: Combinations of displacement

Table 15: Displacement figures - type with 4 layers

Size	5	7	9	12	16	20	30	38	42	45	55	65
Max. axial displacement [1] ΔK_a [mm]	± 0.30	± 0.30	± 0.35	± 0.40	± 0.30	± 0.40	± 0.50	± 0.60	± 0.60	± 0.90	± 1.00	± 1.00
Max. radial displacement ΔK_r [mm]	0.10	0.10	0.15	0.15	0.15	0.15	0.20	0.20	0.20	0.20	0.25	0.30
Max. angular displacement ΔK_w [degree]	0.70	0.70	1.00	1.00	1.00	1.00	1.50	1.50	1.50	1.50	1.50	1.50
Max. angular displacement ΔK_w [mm]	0.12	0.18	0.30	0.40	0.50	0.70	1.40	1.70	1.80	2.10	2.60	3.20

Table 16: Displacement figures - type with 6 layers

Size	5	7	9	12	16	20	30	38	42	45	55	65
Max. axial displacement [1] ΔK_a [mm]	± 0.40	± 0.40	± 0.50	± 0.60	± 0.50	± 0.60	± 0.80	± 0.80	± 0.80	± 1.00	± 1.00	± 2.00
Max. radial displacement ΔK_r [mm]	0.15	0.15	0.20	0.20	0.20	0.20	0.25	0.25	0.25	0.25	0.30	0.35
Max. angular displacement ΔK_w [degree]	1.00	1.00	1.50	1.50	1.50	1.50	2.00	2.00	2.00	2.00	2.00	2.00
Max. angular displacement ΔK_w [mm]	0.17	0.25	0.50	0.60	0.80	1.00	1.90	2.20	2.40	2.90	3.40	4.30

1) Does not apply for type PI

5 Start-up

Before start-up of the coupling, please inspect the tightening of the clamping screws in the hubs, the alignment and the overall dimension L and adjust, if necessary, and also inspect all screw connections for the tightening torques specified.

If you note any irregularities with the coupling during operation, the drive unit must be switched off immediately. The cause of the breakdown must be specified by means of the table „Breakdowns“ and, if possible, be eliminated according to the proposals. The potential breakdowns specified can be hints only. To find out the cause all operating factors and machine components must be considered.

6 Breakdowns, causes and elimination

The below-mentioned failures can lead to a use of the **TOOLFLEX®** coupling other than intended. In addition to the specifications given in these operating/assembly instructions make sure to avoid such failures.
The errors listed can only be clues to search for the failures. When searching for the failure the adjacent components must generally be considered.

General failures with use other than intended

- Important data for the coupling selection were not forwarded.
- The calculation of the shaft-hub-connection was not considered.
- Coupling components with damage occurred during transport are assembled.
- The clearance of the components to be assembled is not coordinated with one another.
- Tightening torques have been fallen below/exceeded.
- No original **KTR** components (purchased parts) are used.
- Maintenance intervals are not observed.

Breakdowns	Causes	Elimination
Different operating noise and/or vibrations occuring	Misalignment	1) Set the unit out of operation 2) Eliminate the reason for the misalignment (e. g. loose foundation bolts/housing screws, break of the engine fixing, heat expansion of unit components → change of the assembly dimension s of the coupling, missing or improper centering of housing)
	Screws for axial fastening of hubs working loose	1) Set the unit out of operation 2) Inspect alignment of coupling 3) Tighten the screws to fasten the hubs and secure against working loose
Fracture of the bellow and/or the hub	Operating parameters do not meet with the performance of the coupling	1) Set the unit out of operation 2) Review the operating parameters and select a bigger coupling (consider mounting space) 3) Assemble new coupling size 4) Inspect alignment
	Operating error of the unit	1) Set the unit out of operation 2) Replace complete coupling 3) Inspect alignment 4) Instruct and train the service staff

7 Disposal

In respect of environmental protection we would ask you to dispose of the packaging or products on termination of their service life in accordance with the legal regulations and standards that apply, respectively.

- **Metal**
  Any metal components have to be cleaned and disposed of by scrap metal.

8 Maintenance and service

TOOLFLEX® is a maintenance-free coupling. We recommend to perform a visual inspection on the coupling **at least once a year**. Please pay special attention to the condition of the bellow of the coupling.

- Since the flexible machine bearings of the driving and driven side settle during the course of load, please inspect the alignment of the coupling and re-align the coupling, if necessary.
- The coupling parts have to be inspected for damages.
- The screw connections have to be inspected visually.

Having started up the coupling the tightening torques of the screws have to be inspected during the usual inspection intervals.

9 Spares inventory, customer service addresses

A basic requirement to ensure the readiness for use of the coupling is a stock of the most important spare parts on site.

Contact addresses of the KTR partners for spare parts and orders can be obtained from the KTR homepage at www.ktr.com.

KTR does not assume any liability or warranty for the use of spare parts and accessories which are not provided by KTR and for the damages which may incur as a result.