TOOLFLEX®

Backlash-free, torsionally stiff and maintenance-free coupling

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 displacement caused by, as an example, inaccuracies in production, heat expansion, etc.

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1 Technical Data

Type S and M with thread for setscrew

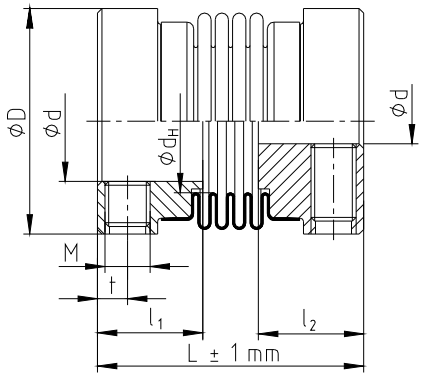


Illustration 1: TOOLFLEX® type S with thread for setscrew (type 1.1)

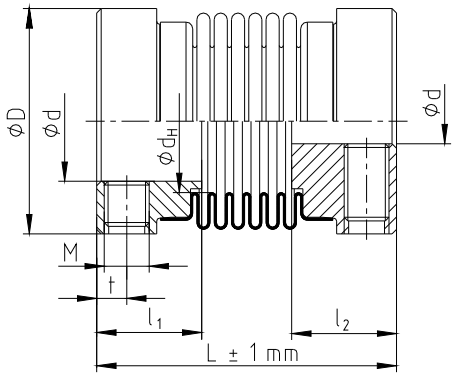


Illustration 2: TOOLFLEX® type M with thread for setscrew (type 1.1)

Table 1: dimensions – type S and M with thread for setscrew (type 1.1)

Hub material: aluminium; bellow material: stainless steel														
Size	Type [1) 2)]	Bellow torque T_{KN} [Nm]	Dimensions [mm]										Torsional stiffness C_T [Nm/rad]	Weight [5)] [kg]
			Finish bore [3)]		General				Setscrews					
			Min. d	Max. d	D	d_H	L	l_1; l_2	M	t	z [4)] number	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	1,3	390	0,005
	M						20 [2)]						300	0,006
9	S	1,5	4	10	20	12	21 [1)]	8	M3	2,2	2	1,3	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 shafts
2) Type M = 6 shafts
3) Bore F7.
   Keyway to DIN 6885, sheet 1 [JS9] from finish bore Ø6 mm on request.
4) Quantity each hub; from size 9: 2 x 120° offset.
5) Figures refer to the complete coupling with max. bores.

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

1 Technical Data

Type M with clamping hubs

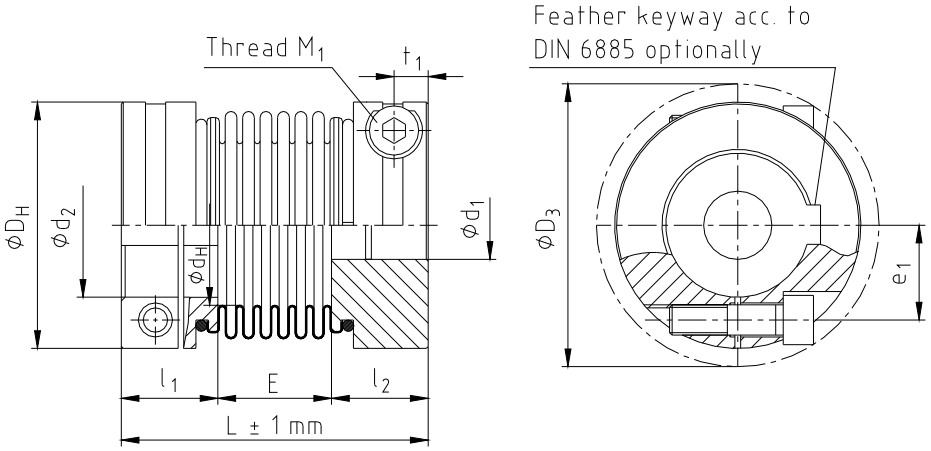


Illustration 3: TOOLFLEX® type M with clamping hubs

Table 2: dimensions – type M (6 shafts) 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 3: technical data – type M (6 shafts) with clamping hubs

Hub material: aluminium (hub size 55 and 65: steel); bellow material: stainless steel							
Size	Bellow torque T_{KN} [Nm]	Speed n [1] [rpm]	Moment of inertia [2] [$x10^{-6}kgm^2$]	Torsional 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	150	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. bores.
3) Hubs from steel welded with bellow.

1 Technical Data

Type S with clamping hubs

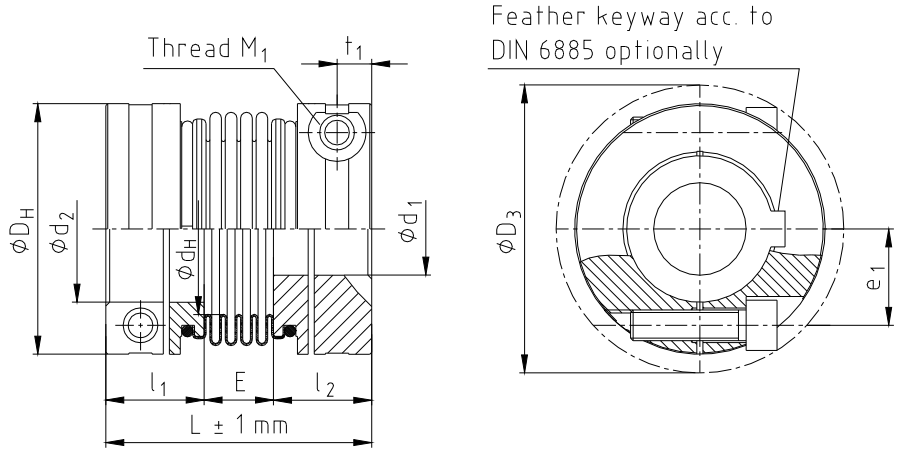


Illustration 4: TOOLFLEX® type S with clamping hubs

Table 4: dimensions – type S (4 shafts) 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 5: technical data – type S (4 shafts) with clamping hubs

Hub material: aluminium (hub size 55 and 65: steel); bellow material: stainless steel							
Size	Bellow torque T_{KN} [Nm]	Speed n [1] [rpm]	Moment of inertia [2] [$x10^{-6}kgm^2$]	Torsional 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	150	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. bores.
3) Hubs from steel welded with bellow.

1 Technical Data

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

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 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

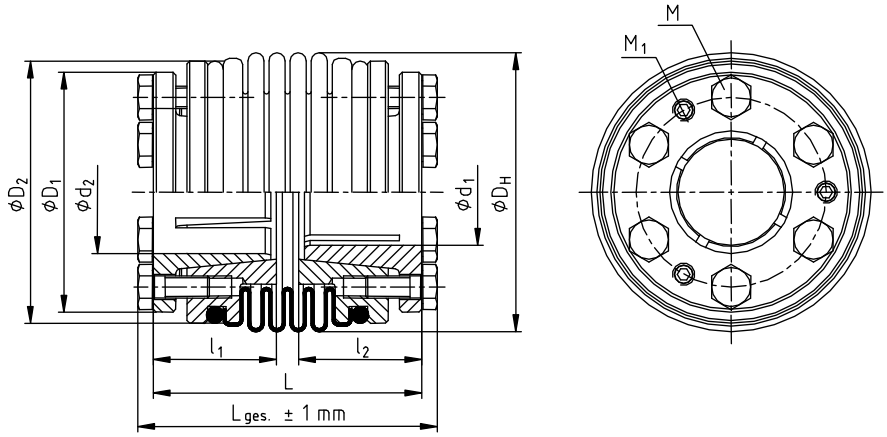


Illustration 5: TOOLFLEX® type KN (type 6.5) – example of drawing: type S-KN

Table 7: dimensions – type S-KN and M-KN

Hub material: aluminium; bellow material: stainless steel																	
Size	Type [1] [2]	Bellow torque T_{KN} [Nm]	Dimensions [mm]														
			Finish bore		General						Clamping screws			Pull-off thread			
			Min. d	Max. d	L	$L_{ges.}$	l_1, l_2	D_H	D_1	D_2	M	z number	T_A [Nm]	M_1	z number	T_{A1} [4] [Nm]
30	S	35	12	22	48 [1]	54 [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	150	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 shafts
2) Type M = 6 shafts
3) Hubs from 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} provided.

Table 8: transmittable torque of the taper ring hubs KN

Size	Bore range d and the corresponding transmittable torque T_R [Nm]																		
	Ø12	Ø14	Ø15	Ø16	Ø19	Ø20	Ø24	Ø25	Ø28	Ø30	Ø32	Ø35	Ø38	Ø40	Ø42	Ø45	Ø48	Ø50	Ø55
30	37	50	58	66	71	79													
38	52	71	81	92	130	103	149	161	202										
42		57	66	75	105	117	168	131	164	189	215	257							
45			129	147	208	230	332	230	288	331	376	451	531	589					
55 [3]			174	198	279	309	445	483	606	696	792	585	690	764	842	967	1101	1194	1445

The transmittable torques of the clamping connection take into account the max. fit clearance with bore H7/shaft fit k6. The torque is reduced in case of bigger fit clearance.

C A U T I O N !
For the assembly of the coupling onto hollow shafts it is necessary to check the permissible tensions and deformation (see chapter 4.3).

1 Technical Data

Type PI-S and PI-M

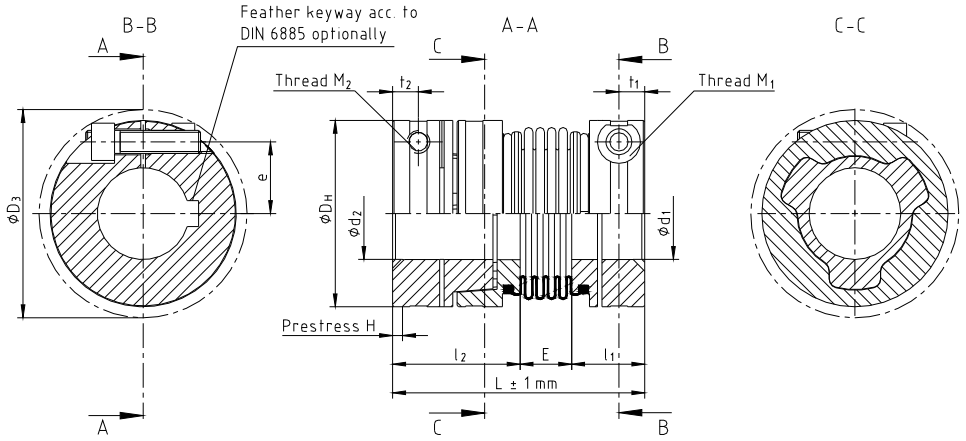


Illustration 6: TOOLFLEX® type PI – example of drawing: type S-PI

Table 9: dimensions – type PI-S and PI-M

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]							

Table 10: technical data – type PI-S and PI-M

Hub material: aluminium; bellow material: stainless steel								
Size	Type [1] [2]	Bellow torque T_{KN} [Nm]	Speed n [5] [1/min]	Moment of inertia [4] [$x10^{-6}kgm^2$]	Torsional 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	150	5750	1031	55000	132	738	0,93
	M			1127	41000	88	492	1,00

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

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

C A U T I O N !
For the assembly of the coupling onto hollow shafts it is necessary to check the permissible tensions and deformation (see chapter 4.3).

1 Technical Data

Type S-CF and M-CF

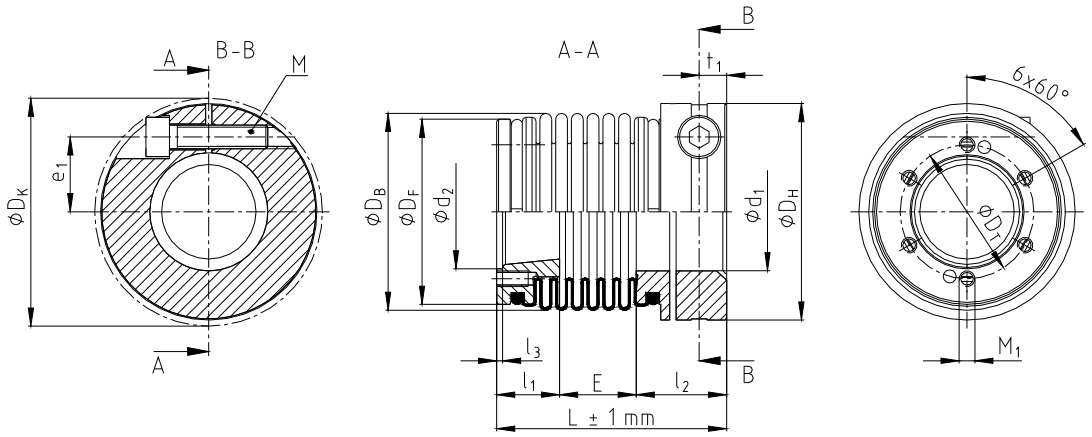


Illustration 7: TOOLFLEX® type CF – example of drawing: type M-CF

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	17 [1)]	56,0 [1)]	58,0	19	7	M6	10
	M						29 [2)]				26 [2)]	65,0 [2)]					
38	S	12	38	65	60,5	55,75	29 [1)]	1,5	18	25,5	18 [1)]	61,5 [1)]	72,6	25	9	M8	25
	M						36 [2)]				30 [2)]	73,5 [2)]					
42	S	14	42	70	66	62,95	36 [1)]	1,5	21	30	24 [1)]	75,0 [1)]	76,1	27	9	M8	25
	M						43 [2)]				35 [2)]	86,0 [2)]					
45	S	14	45	83	82	77	38 [1)]	1,5	23	32	22,5 [1)]	77,5 [1)]	89,0	30	11	M10	49
	M						49 [2)]				39 [2)]	94,0 [2)]					
55 [3)]	S	20	55	100	97	95	51 [1)]	1,5	28	40	31 [1)]	99,0 [1)]	106	37	14	M12	120
	M						68 [2)]				45 [2)]	113 [2)]					

Table 12: dimension 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		Bellow torque T_{KN} [Nm]	Speed n [4)] [1/min]	Torsional 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	150	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 shafts
2) Type M = 6 shafts
3) Hubs from steel welded with bellow.
4) With v = 25 m/s

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

C A U T I O N !
For the assembly of the coupling onto hollow shafts it is necessary to check the permissible tensions and deformation (see chapter 4.3).

1 Technical Data

Table 13: transmittable torque of the clamping hubs – type PI

Size	Bore range d and the corresponding transmittable 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

The transmittable torques of the clamping connection take into account the max. fit clearance with bore H7/shaft fit k6. The torque is reduced in case of bigger fit clearance.

Table 14: transmittable torque of the clamping hubs – type CF

Size	Bore range d and the corresponding transmittable 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 torques of the clamping connection take into account the max. fit clearance with bore H7/shaft fit k6. The torque is reduced in case of bigger fit clearance.

2 Hints

2.1 Coupling Selection

C A U T I O N !
To ensure a permanently smooth operation of the coupling a corresponding operating factor (see TOOLFLEX® catalogue) has to be taken into consideration with dimensioning, depending on the application. If the operating conditions (performance, speed, changes on engine and machine) change, the coupling selection must be checked again.
The transmissible torque of the shaft/hub connection must be checked by the orderer, and he is responsible for the same.

2.2 General Hints

Please read through these mounting instructions carefully before you set the coupling into operation.
Please pay special attention to the safety instructions!
The mounting instructions are part of your product. Please keep them carefully and close to the coupling.
The copyright for these mounting instructions remains with **KTR** Kupplungstechnik GmbH.

2.3 Safety and Advice Hints

STOP	**D A N G E R !**	**Danger of injury to persons.**
!	**C A U T I O N !**	**Damages on the machine possible.**
☞	**A T T E N T I O N !**	**Pointing to important items.**

2 Hints

2.4 General Hints of Danger

D A N G E R !
With assembly, operation and maintenance of the coupling it has to be made sure that the entire drive train is protected against unintentional engagement. You can be seriously hurt by rotating parts. Please make absolutely sure to read through and observe the following safety instructions.

- All operations on and with the coupling have to be performed taking into account "safety first".
- Please make sure to disengage the power pack before you perform your work.
- Protect the power pack against unintentional engagement, e. g. by providing hints at the place of engagement or removing the fuse for current supply.
- Do not touch the operation area of the coupling as long as it is in operation.
- Please protect the coupling against unintentional touch. Please provide for the necessary protection devices and caps.

2.5 Proper Use

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

- carefully read through the mounting instructions and understood them
- had technical training
- are authorized to do so by your company

The coupling may only be used in accordance with the technical data (see table 1 to 14 in chapter 1). Unauthorized modifications on the coupling design are not admissible. We do not take any warranty for resulting damages. To further develop the product we reserve the right for technical modifications.
The **TOOLFLEX®** described in here corresponds to the technical status at the time of printing of these mounting instructions.

3 Storage

Coupling components from steel (e. g. hubs) are supplied with preservation and may be stored in a dry place covered with a roof during 6 - 9 months. Couplings with aluminium components (e. g. hubs) and bellows from stainless steel are supplied without preservation.

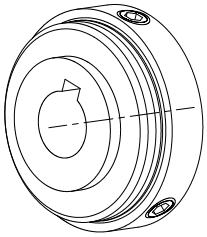
C A U T I O N !
Humid storage rooms are not suitable. Please make sure that there is no condensation. The best relative air humidity is under 65%.

4 Assembly

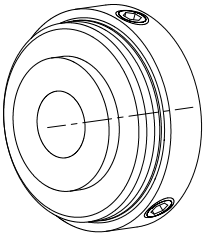
The coupling is supplied in assembled condition, including clamping screws and setscrews assembled. Before assembly the coupling has to be inspected for completeness.

4 Assembly

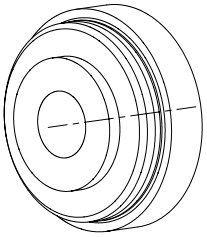
4.1 Hub Designs



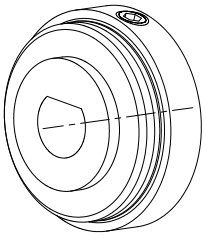
Type 1.0
with feather keyway and setscrew



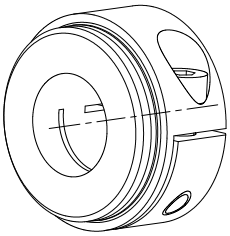
Type 1.1
without feather keyway with setscrew



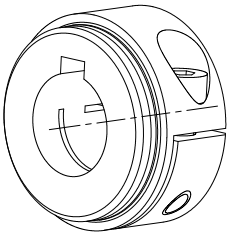
Type 1.2
without feather keyway without setscrew



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

4.2 Components of Couplings

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

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

1) quantity each hub; from size 9: 2 x 120° offset

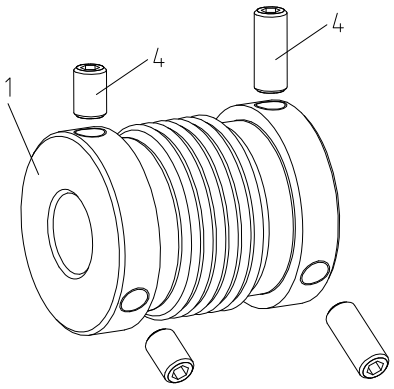


Illustration 8:
TOOLFLEX®
type S and M
(type 1.1)

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

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

1) quantity each hub

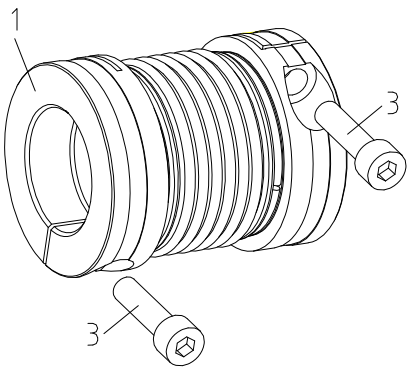


Illustration 9:
TOOLFLEX®
type S and M
(type 2.51.1)

4 Assembly

4.2 Components of Couplings

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

Component	Quantity	Designation
1	1	Bellow with 2 clamping hubs bordered/welded
2	2	Taper hub
3	6 1)	Clamping screws DIN EN ISO 4017
4	3 1)	Setscrews DIN EN ISO 4029

1) quantity each hub

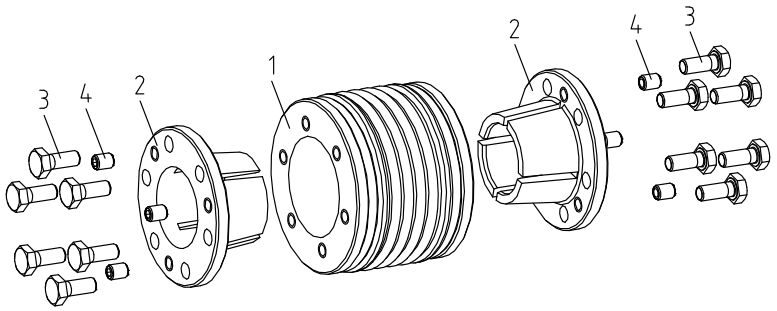


Illustration 10: TOOLFLEX® type S-KN and M-KN

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

Component	Quantity	Designation
1	1	Bellow with 1 clamping hub and 1 PI-plug-in hub (part 1) bordered
2	1	PI-clamping hub (part 2)
3	1 1)	Clamping screws DIN EN ISO 4762

1) quantity each clamping hub

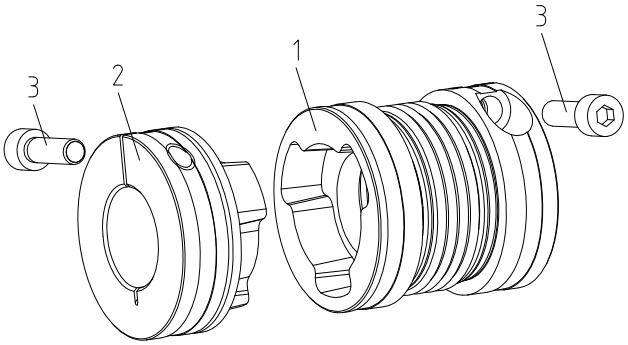


Illustration 11: TOOLFLEX® type PI-S and PI-M

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

Component	Quantity	Designation
1	1	Bellow with 1 taper ring and 1 clamping hub bordered/welded
3	1 1)	Clamping screws DIN EN ISO 4762

1) quantity each clamping hub

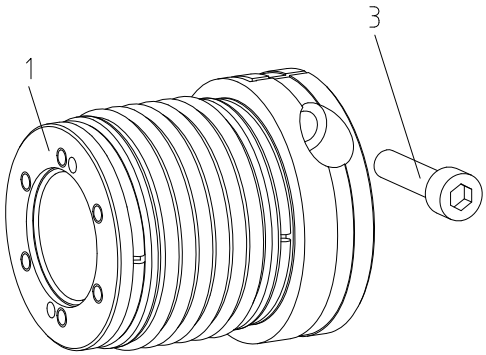


Illustration 12: TOOLFLEX® type S-CF and M-CF

4 Assembly

4.3 Assembly of the Type 1.1 and 2.5

A T T E N T I O N !
We recommend to check bores, shaft, keyway and feather key for dimensional accuracy before assembly. In addition we would recommend to review the overall length of the coupling. This dimension is necessary to align the coupling and may slightly deviate from the figures mentioned in the tables subject to production tolerances.

A T T E N T I O N !
Before mounting preservatives have to be removed from the bores. Moreover, the shaft ends have to be cleaned carefully, too.

C A U T I O N !
Please note the manufacturer's instructions regarding the use of detergents.

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

A T T E N T I O N !
Please make sure with the assembly of the coupling that the metal bellow is neither twisted, compressed nor damaged otherwise. If these remarks are not respected the coupling may be damaged and fail at an early stage. The fit backlash of the shaft-hub-connection should be between 0,01 mm and 0,05 mm.

C A U T I O N !
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 16 and 17 at the maximum. If this remark is not respected, the coupling may be damaged and fail at an early stage.

C A U T I O N !
The frictionally engaged transmittable torques of the clamping hubs (see table 6) depend on the bore diameter.

4 Assembly

4.4 Assembly of the Type KN (Type 6.5)

The power transmission of **TOOLFLEX® KN** is frictionally engaged. The necessary surface pressure is transmitted via the ring with internal taper to the taper hub and consequently to the shaft. The torques mentioned in table 8 take into account a combination of fit H7/k6. With a higher backlash of fit the torques mentioned in table 8 are reduced.

The stiffness and dimensions of the shafts (here specifically hollow shafts) have to be selected in a way 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:

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

Shearing stress on the internal shaft diameter for hollow shaft:

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

Shearing stress for solid shaft:

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

$R_{p0,2}$ = proof stress of shaft material [Nmm^2]
p_W = surface pressure hub/shaft [N/mm^2]
d_{iW} = internal diameter of hollow shaft [mm]
d = shaft diameter [mm]
C_W = d_{iW}/d

The required strength does not exist if the hollow shaft bore is bigger than the max. internal bore calculated or if the shearing stress exceeds the yield strength of the material. For a detailed calculation please contact the KTR engineering department.

The following process should be noted for the assembly:

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

A T T E N T I O N !
We recommend to check bores and shafts for dimensional accuracy before assembly. In addition we would recommend to review the overall length of the coupling. This dimension is necessary to align the coupling and may slightly deviate from the figures mentioned in the tables subject to production tolerances.

C A U T I O N !
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 be moved easily.
- 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) stepwise and evenly crosswise to the final tightening torque (T_A) mentioned in table 7. This process has to be repeated until the tightening torque is achieved with all clamping screws. Insert the shaft end of the driven machine into the TOOLFLEX® type KN and repeat the aforementioned process.

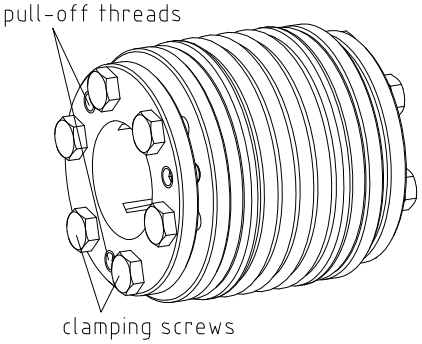


Illustration 13: assembly of the clamping ring hub type 6.5

4 Montage

4.4 Assembly of the Type KN (Type 6.5)

A T T E N T I O N !
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 invalid 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.

C A U T I O N !
If this assembly process is not respected, the setscrews may release and fly around. This may cause danger for body and life.

4.5 Disassembly of the Type KN (Type 6.5)

The following process should be noted for the disassembly:

Untighten the clamping screws evenly one after the other. Each screw may only be untightened by half a revolution for each cycle. Unscrew all clamping screws by 3 - 4 convolutions.

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

C A U T I O N !
If these hints are not observed, the operation of the coupling may be damaged.

In case of a repeated assembly the hub bore and shaft have to be cleaned and afterwards lubricated with a thin-bodied oil (e. g. Castrol 4 in 1 or Klüber Quietsch-Ex). The same applies for the taper surfaces of the 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.

C A U T I O N !
Oils and greases containing molybdenum disulfide or other high-pressure additives as well as internal lubricants must not be used.

4 Montage

4.6 Assembly of the Type PI

The following process should be noted for the assembly:

A T T E N T I O N !
Before assembly the mounting dimension of the coupling needs to be determined 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.
- 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) on the shaft on the gear side and the PI clamping hub (component 2) on the shaft on the motor side.
- Protect the clamping hubs by tightening the clamping screws by means of a torque key to the tightening torques T_A mentioned in table 9.
- Push the PI clamping hub in the PI plug-in hub to the mounting dimension determined before.

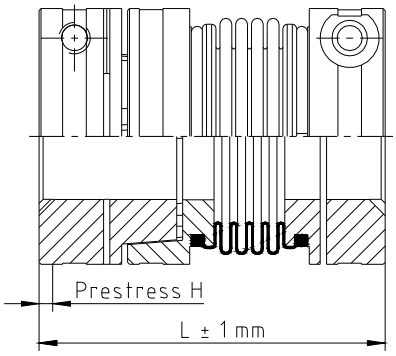


Illustration 14

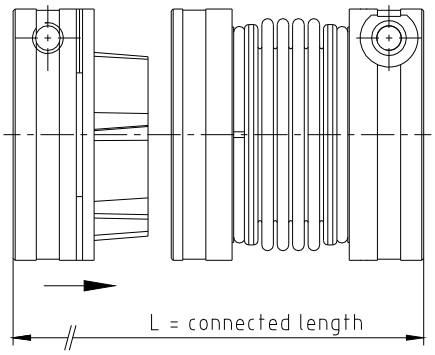


Illustration 15 (connected length)

A T T E N T I O N !
The pre-stress H of the bellow determined 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 pre-stress.

4.7 Remark for Remachining on the Coupling

C A U T I O N !
The orderer is responsible for all subsequently made machinings to pilot bored and to finish machined coupling parts. KTR does not assume any warranty claims resulting from insufficient refinish.

4.8 Displacements - Alignment of the Couplings

TOOLFLEX® compensates for displacements of the shafts to be connected as per table 15 or 16, respectively. Excessive misalignment may be caused by inaccurate alignment, production tolerances, heat expansion, shaft bending, twisting of machine frames, etc.

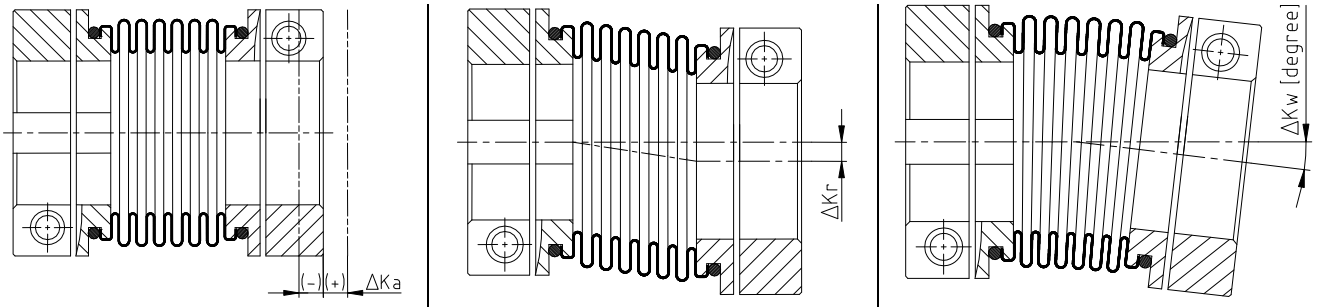
C A U T I O N !
In order to ensure a long service life of the coupling the shaft ends have to be aligned accurately. Please absolutely observe the displacement figures indicated (see tables 15 or 16). If the figures are exceeded, the coupling is damaged.
The more accurate the alignment of the coupling, the higher is its lifetime.

4 Assembly

4.8 Displacements - Alignment of the Couplings

Please note:

- The displacement figures mentioned in table 15 or 16, respectively, are maximum figures which must not arise at the same time. If radial and angular misalignment arise at the same time the amount of displacements must not exceed ΔK_r or ΔK_W , respectively.
- Please check with a dial gauge, ruler or feeler whether the permissible displacement figures of tables 15 or 16 can be observed.



Axial displacement | Radial displacement | Angular displacement

Illustration 16: displacements

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

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

Example for the misalignment combinations given in illustration 17:

Example 1:
ΔK_r = 30 %
ΔK_w = 70 %

Example 2:
ΔK_r = 60 %
ΔK_w = 40 %

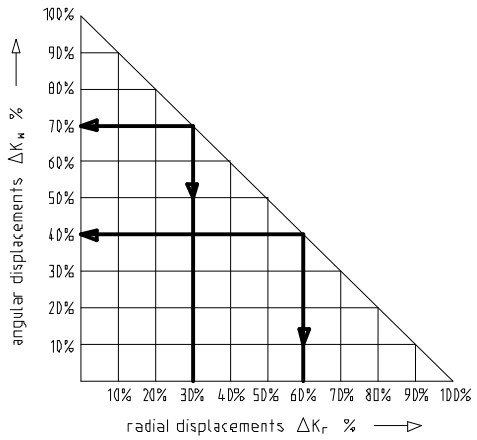


Illustration 17: combinations of displacement

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

4 Assembly

4.8 Displacements - Alignment of the Couplings

Table 15: displacement figures – type of 6 shafts

TOOLFLEX® size	5	7	9	12	16	20	30	38	42	45	55	65
Max. axial displacement [1] ΔKa [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 ΔKr [mm]	0,15	0,15	0,20	0,20	0,20	0,20	0,25	0,25	0,25	0,30	0,30	0,35
Max. angular displacement ΔKw [degree]	1,00	1,00	1,50	1,50	1,50	1,50	2,00	2,00	2,00	2,00	2,00	2,0

Table 16: displacement figures – type of 4 shafts

TOOLFLEX® size	5	7	9	12	16	20	30	38	42	45	55	65
Max. axial displacement [1] ΔKa [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 ΔKr [mm]	0,10	0,10	0,15	0,15	0,15	0,15	0,20	0,20	0,20	0,25	0,25	0,30
Max. angular displacement ΔKw [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

1) Does not apply for type PI

4.9 Spares Inventory, Customer Service Addresses

A basic requirement to guarantee the operational readiness 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.

☞ **A T T E N T I O N !**
KTR does not assume any liabilities or guarantees regarding the use of spare parts and accessories which are not provided by KTR and for the damages resulting herefrom.

5 Starting

Before putting the coupling into operation please check if the clamping screws in the hubs are tightened, check the alignment and the overall length L and correct, if necessary, and check all screw connections depending on the coupling type for the necessary tightening torques.

⚠ **C A U T I O N !**
If you note any irregularities at the coupling during operation, the drive unit must be turned off immediately. The cause of the breakdown must be found out with the table „Breakdowns“ and, if possible, be eliminated according to the proposals. The possible breakdowns mentioned can be hints only. To find out the cause all operating factors and machine components must be considered.

5 Starting

5.1 Breakdowns, Causes and Elimination

The below-mentioned errors can lead to an incorrect use of the TOOLFLEX® coupling. In addition to the stipulations in these operating and mounting instructions please make sure to avoid these errors.
The errors listed can only be clues to search for the errors. When searching for the error the adjacent components must be generally included.

General errors incorrect use

- Important data for the coupling selection was not forwarded.
- The calculation of the shaft/hub connection was not considered.
- Coupling parts with damage occurred during transport are assembled.
- The fits of the parts to be assembled are not coordinated with each other.
- Tightening torques are fallen below/exceeded.
- No original KTR parts (purchased parts) are used.
- Maintenance intervals are not observed.

Breakdowns	Causes	Elimination
Change of the running noises and/or occurring vibrations	Misalignment	1) Put the unit out of operation 2) Eliminate the reason for the misalignment (e. g. loose foundation bolts, 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)
	Loose screws for axial securement of hubs	1) Put the unit out of operation 2) Check alignment of coupling 3) Tighten the screws to secure the hubs and secure against self-loosening
Fracture of the bellow and/or the hub	Operating parameters do not correspond to the performance of the coupling	1) Put the unit out of operation 2) Check the operating parameters and select a larger coupling (consider installation space) 3) Assemble new coupling size 4) Check alignment
	Mistake in service of the unit	1) Put the unit out of operation 2) Change complete coupling 3) Check alignment 4) Instruct and train the service staff