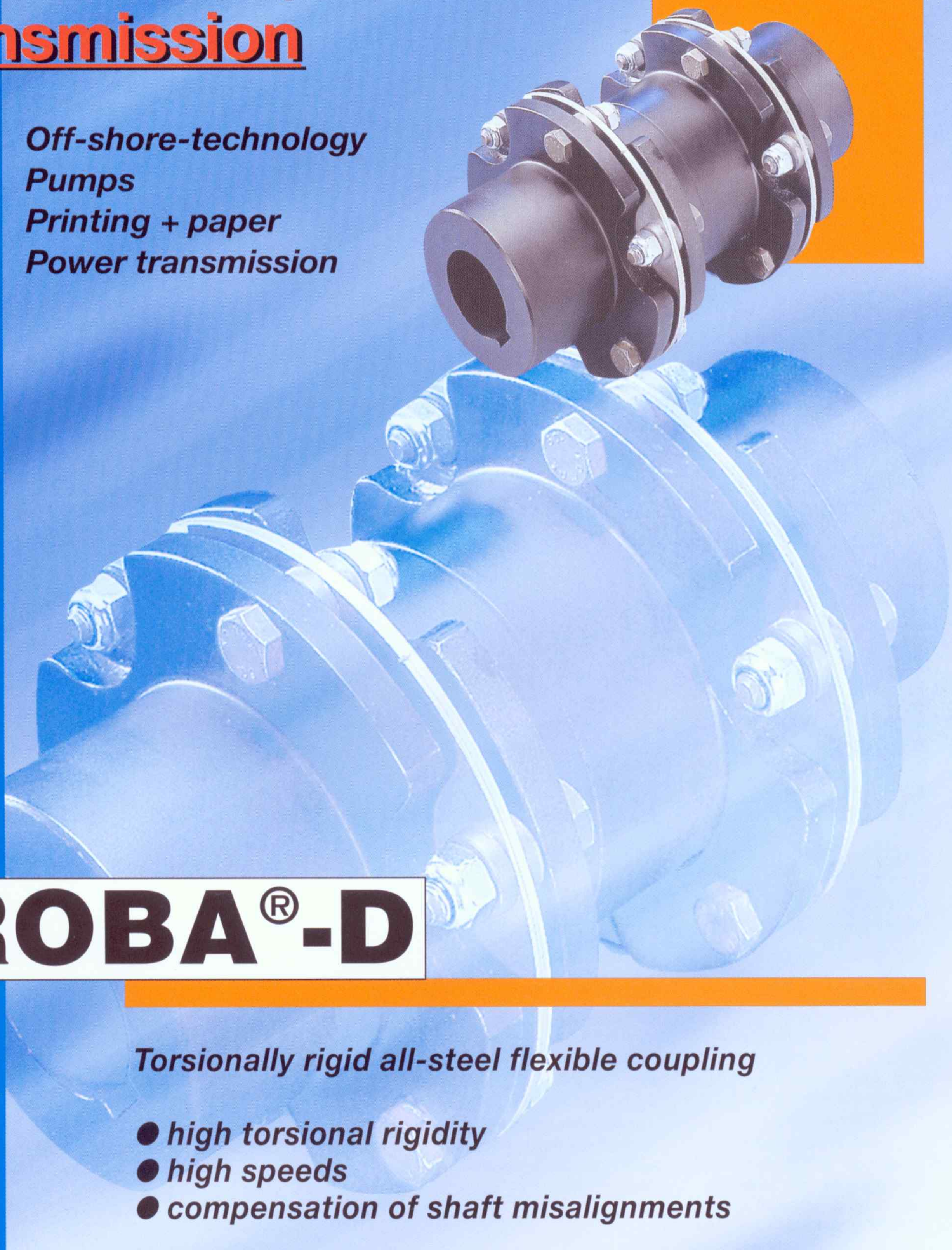
Reliable Torque Transmission

Off-shore-technology
Pumps
Printing + paper
Power transmission



ROBA®-D

Torsionally rigid all-steel flexible coupling

- *high torsional rigidity*
- *high speeds*
- *compensation of shaft misalignments*

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mayr®
power
transmission

Fig. 1

Application even under arduous conditions

ROBA®-D all-steel couplings guarantee reliable torque transmission even under the most difficult conditions, for example on oil platforms. ROBA®-D couplings are the ideal shaft connection for high speeds and existing shaft misalignments.

We made the German Lloyd inspect our ROBA®-D couplings thoroughly for use on marine applications, either on ships or in the Off-Shore industry. The type approval has been granted under the file No. 57479/85.

However, there are application possibilities for ROBA®-D couplings in other areas. One of the most important requirements in NC and CNC techniques and in synchronous drives in play free operation.

ROBA®-D – Safe torque transmission and compensation of shaft misalignments even under difficult conditions and applications.

Contents

Manufacturer's declaration

ROBA®-D couplings are not machines within the scope of the Machinery directive 98/37/EG, but components for installation into machines. An initial start up is prohibited until it has been noticed that the machinery or the equipment into which this product has been incorporated correspond to the EG-guide lines.

Safety regulations

- If the ROBA®-D-couplings have been modified or retrofitted.
- If the relevant standards of the security or mounting conditions are not observed.

Protective arrangements by the user

- Cover of moving elements for protection against squeezing and seizing.
- Replace self-locking hexagon nuts by new ones, in case the locking effect diminishes by repeated unscrewing and tightening.

Only qualified and well-trained specialists should work on the units to avoid any personnel and material damages.

With these safety regulations no claim on completeness is raised!

ROBA®-D – the brand name for torsionally rigid all-steel flexible couplings.

ROBA®-D couplings are used wherever a demand for a reliable torque transmission arises even in the case of high torques and existing shaft misalignments.

Our ROBA®-D couplings transmit torque safely and reliably even in the case of high speeds, compensating for axial, radial and / or angular shaft misalignments.

Shaft misalignment of the ROBA®-D coupling is compensated by flexible disc packs which are, however, torsionally rigid in circumferential direction.

The torque transmission being free of play is an essential condition for use in synchronously operating machines. The requirement for synchronous input and output components is due to the increasing demands of NC and CNC techniques and improving manufacturing methods. Therefore backlash-free torque transmission is of great importance.

ROBA®-D couplings are also suitable for reversing operations.

The hubs, couplings sleeves and flanges of the ROBA®-D couplings made of steel, the disc packs of stainless spring steel. Hence the name "ROBA®-D All-Steel Coupling".

Temperatures of up to 250° C will not affect these couplings due to the all-steel construction, which enables them to be used in high temperature environments and applications.

ROBA®-D couplings can be used in a great variety of power transmission applications due to their modular assembly principle. For instance on Off-Shore platforms or marine applications, when the German Lloyd type approval no. TGB 57479/85 was applied to Mayr ROBA®-D couplings.

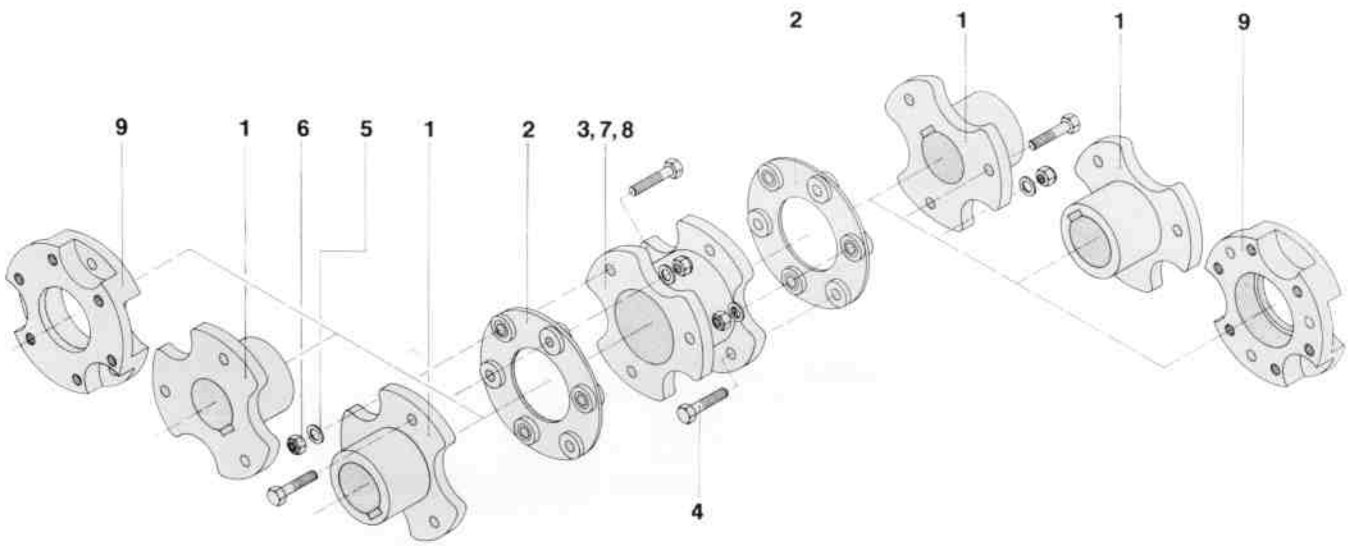


Fig. 2

Components

1 hub
2 disc pack
3 coupling sleeve 1
4 hexagon fitting bolt
5 washer
6 self-locking hexagon nut
7 coupling sleeve 0
8 coupling sleeve S (special length)
9 flange A

Function

ROBA®-D couplings connect driver and driven components (i.e. two shafts) and transmit torques. The discs are arranged in a ring or hexagonal form and are resilient in an axial direction and torsionally rigid in a circumferential direction. ROBA®-D couplings transmit torques completely backlash-free, even in the case of high speed synchronously operating machines. The single-jointed couplings compensate for axial and angular misalignments, radial shaft misalignments being additionally accepted by the double-jointed design.

Application – Designs

ROBA®-D couplings are used wherever a demand for a reliable and safe torque transmission arises in case of existing shaft misalignments. Since this coupling is absolutely free of play, it is also suitable for reversing operation. For a playfree shaft-hub connection ROBA®-D couplings may be supplied with shrink discs or locking elements (Figs. 3 and 4).

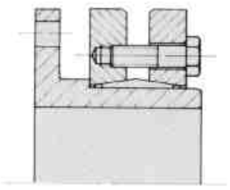


Fig. 3
Shrink discs

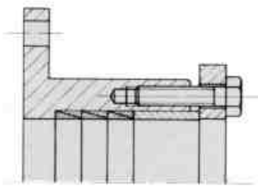


Fig. 4
Locking elements

ROBA®-D couplings can be used in all mounting positions. In case of long sleeves only the dead weight of the coupling must be absorbed by an integral vertical support.

The hubs, coupling sleeves and flanges are made of high-quality steel and zinc-phosphated as standard, i. e. they are protected against corrosion. The discs are made of stainless spring steel.

The ROBA®-D couplings are functional units due to their compact and enclosed design. Our proven ROBA®-slip hubs and EAS®-torque limiting clutches can be attached without problems.

Therefore, we have the best combination:

Torque transmission with overload protection.

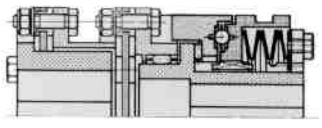


Fig. 5
EAS®-torsionally rigid – Torsionally rigid torque limiting clutch for connecting two shafts.

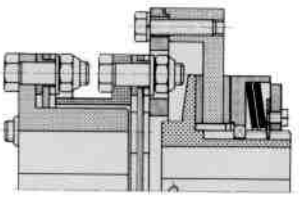


Fig. 6
ROBA®-LD torsionally rigid – Torsionally rigid slip hub for connecting two shafts.

The most important characteristics

- Safe, reliable torque transmission even at high speeds
- Compensation of axial, radial (not single-jointed design) and angular misalignments
- Playfree torque transmission
- Simple and fast assembly
- All-steel coupling - insensitive to temperatures up to 250 °C
- Modular system for the optimum solution
- Long service life - economic

Technical data

size	rated torque of the coupling T_{KN} [Nm]	shock torque of the coupling T_{KS} [Nm]	alternating torque T_{KW} [Nm]	max. speed 5) n_{max} rpm	permissible flexibility: axial 1) ΔK_a [mm]	angular 2) ΔK_w [°]	radial 1) ΔK_r [mm]: coupling sleeve 0	coupling sleeve 1
3	30	60	12	10700	0,6	1	—	0,90
5	50	100	20	9300	0,8	1	0,65	1,10
10	100	200	40	8400	1,0	1	0,70	1,25
20	200	400	80	6700	1,2	1	0,85	1,50
40	400	800	160	5900	1,4	1	1,00	1,85
63	630	1260	250	5100	1,4	1	—	2,10
100	1000	2000	400	4750	1,6	1	1,25	2,20
160	1600	3200	640	4300	1,8	1	1,25	2,20
200	2000	4000	800	4200	1,8	1	—	2,10
250	2500	5000	1000	4000	1,8	1	1,40	2,45
320	3200	6400	1280	3650	2,0	1	—	2,55
400	4000	8000	1600	3400	2,0	1	1,50	2,55
500	5000	10000	2000	3200	2,0	1	—	2,90
630	6300	12600	2500	2850	2,2	1	1,75	3,00
800	8000	16000	3200	2700	2,4	1	—	3,35
1100	11000	22000	4400	2300	2,6	1	—	3,80
1600	16000	32000	6400	2150	2,8	1	—	4,50

size	torsional spring rigidity $C_H \cdot 10^6$ [Nm/rad]: coupling sleeve 0 C_{H0}	coupling sleeve 1 C_{H1}	torsional spring rigidity $C_T \cdot 10^6$ [Nm/rad] disc pack	axial spring rigidity C_a [N/mm]: with 2 disc packs	with 1 disc pack	mass moments of inertia J [kgm²] and weights G [kg]: hub 4) J	hub G	coupling sleeve 0 J	coupling sleeve 0 G	coupling sleeve 1 J	coupling sleeve 1 G
3	—	0,4629	0,1450	80	160	0,00017	0,36	—	—	0,00027	0,34
5	2,0943	0,7480	0,1661	90	180	0,00043	0,64	0,00047	0,38	0,00055	0,48
10	3,2652	1,2408	0,1858	100	200	0,00082	0,95	0,00075	0,50	0,00097	0,65
20	5,5932	1,9272	0,5028	120	240	0,0025	1,9	0,0025	0,85	0,0030	1,05
40	6,7995	2,6840	0,5986	150	300	0,0051	3,0	0,0043	1,15	0,0053	1,5
63	—	3,9283	0,9798	200	400	0,0099	4,4	—	—	0,0097	2,4
100	13,250	4,930	1,3240	210	420	0,015	5,7	0,013	2,6	0,016	3,2
160	20,022	7,151	2,0541	230	460	0,022	6,7	0,021	3,3	0,025	4,2
200	—	9,341	5,9144	255	510	0,023	6,9	—	—	0,027	4,3
250	26,846	9,996	6,2278	260	520	0,031	8,4	0,029	3,2	0,034	4,35
320	—	14,031	9,6498	270	540	0,048	10,5	—	—	0,060	6,25
400	59,199	18,163	10,3585	280	560	0,066	13,0	0,069	5,6	0,078	7,15
500	—	25,426	11,3457	290	580	0,094	16,0	—	—	0,11	9,4
630	105,557	33,858	16,7889	300	600	0,14	19,0	0,16	9,4	0,18	12,4
800	—	43,595	18,1531	300	600	0,19	24,0	—	—	0,25	15,75
1100	—	53,89	31,3092	750	1500	0,40	36,0	—	—	0,53	27,5
1600	—	67,34	34,3345	1200	2400	0,64	50,0	—	—	0,80	35,0

size	mass moments of inertia J [kgm²] and weights G [kg]: flange A J	flange A G	disc pack 3) J	disc pack 3) G	coupling sleeve S: J with H_6 = 1000 mm	J per 1000 mm pipe	G with H_6 = 1000 mm	G per 1000 mm pipe	coupling sleeve S max. length H_6 [mm] between disc packs with n = 1500 rpm $H_{6\,max}$
3	0,00026	0,21	0,00014	0,13	0,00077	0,00041	2,84	2,29	1450
5	0,00052	0,33	0,00021	0,14	0,00240	0,00172	4,75	4,05	1800
10	0,00081	0,42	0,00028	0,15	0,00317	0,00172	5,48	4,05	1800
20	0,0029	1,1	0,0011	0,37	0,01297	0,0106	9,6	8,6	2300
40	0,0051	1,5	0,0016	0,41	0,01762	0,0106	11,7	8,6	2300
63	0,0100	2,2	0,0040	0,77	0,03945	0,0309	16,1	13,9	2650
100	0,0180	3,4	0,0065	1,1	0,0487	0,0309	18,3	13,9	2650
160	0,0280	4,4	0,013	1,9	0,0710	0,0481	20,2	16,2	2900
200	0,0320	4,8	0,019	2,6	0,0742	0,0481	20,7	16,2	2900
250	0,039	5,3	0,021	2,7	0,094	0,066	21,6	17,9	3050
320	0,067	7,3	0,035	3,8	0,126	0,066	22,2	17,9	3050
400	0,091	9,0	0,042	3,8	0,177	0,102	31,3	23,0	3200
500	0,13	11,5	0,051	4,0	0,227	0,102	37,0	23,0	3200
630	0,22	15,0	0,10	7,0	0,331	0,181	39,2	29,2	3500
800	0,30	18,0	0,12	7,1	0,430	0,181	47,9	29,2	3500
1100	—	—	0,30	13,0	0,834	0,403	63,9	46,9	3800
1600	—	—	0,37	13,5	1,133	0,544	71,1	51,9	4000

1) these values refer to couplings with 2 disc packs
2) these values refer to couplings with 1 disc pack
3) the mass moments of inertia and weights are valid for 1 disc pack with fitted screws and nuts
4) the mass moments of inertia and weights are valid for the mean bore ∅ d
5) valid for couplings with coupling sleeve 0 and coupling sleeve 1

Single-jointed couplings (compensation of axial and angular misalignments - radial misalignment must not occur)

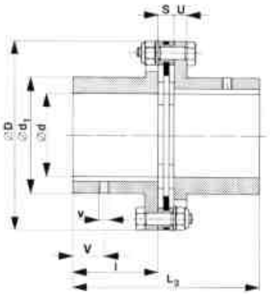


Fig. 7 type 910.470

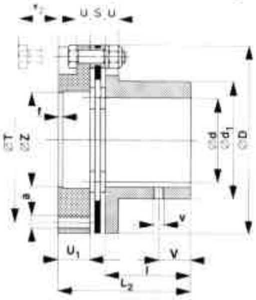


Fig. 8 type 910.271

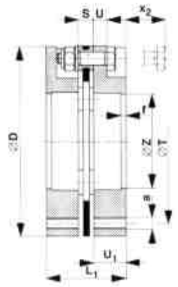


Fig. 9 type 910.072

Double-jointed couplings (compensation of axial, radial and angular misalignments)

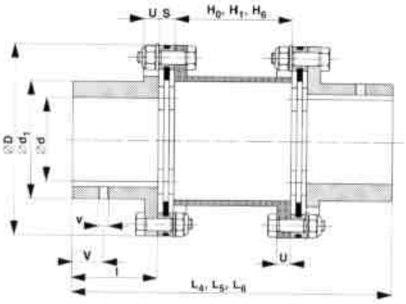


Fig. 10 type 911.400 - H_0, L_4 (coupling sleeve 0)
911.410 - H_1, L_5 (coupling sleeve 1)
911.460 - H_6, L_6 (coupling sleeve S)

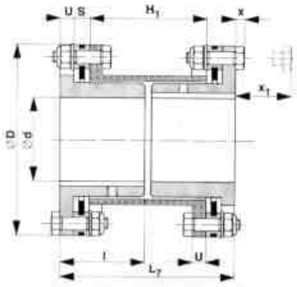


Fig. 11 type 911.310

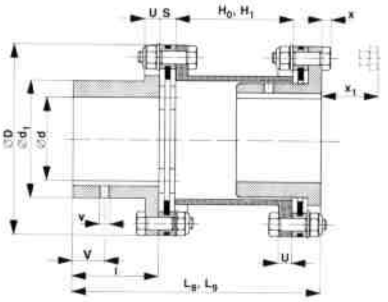


Fig. 12 type 911.500 - H_0, L_8 (coupling sleeve 0)
911.510 - H_1, L_9 (coupling sleeve 1)

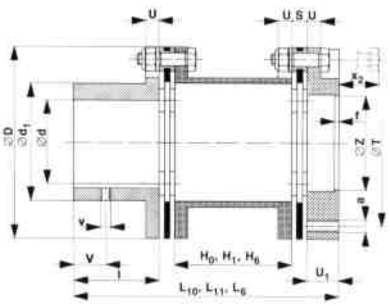


Fig. 13 type 911.201 - H_0, L_{10} (coupling sleeve 0)
911.211 - H_1, L_{11} (coupling sleeve 1)
911.261 - H_6, L_6 (coupling sleeve S)

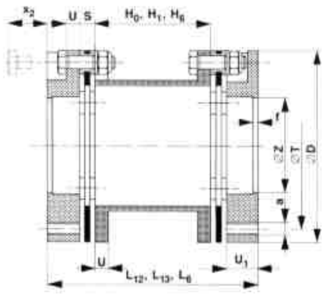


Fig. 14 type 911.002 - H_0, L_{12} (coupling sleeve 0)
911.012 - H_1, L_{13} (coupling sleeve 1)
911.062 - H_6, L_6 (coupling sleeve S)

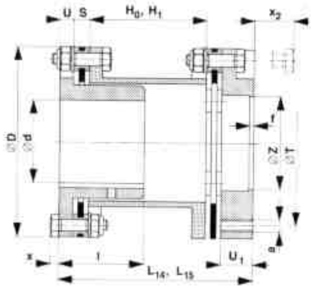


Fig. 15 type 911.101 - H_0, L_{14} (coupling sleeve 0)
911.111 - H_1, L_{15} (coupling sleeve 1)

Order example:

(ROBA®-D coupling, hubs with keyway)

To be included when ordering, please state:	size	type	bore ∅d H7	bore ∅d H7
Order No.:			hub 1 ∅	hub 2 ∅

- size: 3 ÷ 1600
- type: according to constructional design and coupling sleeve
- hub 1 ∅: according to size (possible bores on page 7 – dimension list)
- hub 2 ∅: according to size (possible bores on page 7 – dimension list)

Examples: 63 / 911.410 / hub 1 ∅ 75 / hub 2 ∅ 60 (see fig. 10)
40 / 911.111 / hub 1 ∅ 60 (see fig. 15)

Order example:

(ROBA®-D coupling with backlash-free shaft-hub-connection, see page 8)

To be included when ordering, please state:	size	type	bore $\varnothing d_2$, $\varnothing d_3$, $\varnothing d_w$	bore $\varnothing d_2$, $\varnothing d_3$, $\varnothing d_w$
Order No.:			hub 1 ∅	hub 2 ∅

- size: 3 ÷ 1600
- type: according to constructional design and coupling sleeve

(possible diameter on page 8 – dimension list)

- hub 2 ∅:
  - $\varnothing d_2$ for outer hub with locking elements
  - $\varnothing d_3$ for internal hub with locking elements
  - $\varnothing d_w$ for outer hub with shrink disc
- hub 1 ∅:
  - $\varnothing d_2$ for outer hub with locking elements
  - $\varnothing d_3$ for internal hub with locking elements
  - $\varnothing d_w$ for outer hub with shrink disc

Example: 63 / 911.410 / hub 1∅ d_2 55 / hub 2 ∅ d_3 60

Table of dimensions

size	a	D	d_{min}	d_{max}	d_1	f	H_0	H_1	H_6	L_1	L_2	L_3	L_4	L_5
3	6 × M6	80	8	28 1)	38	4	—	44	max. permissible length of coupling sleeve S on request	42	60	78	—	130
5	6 × M6	92	8	38 2)	52	4	28	54		42	65	88	124	150
10	6 × M6	102	12	45 3)	62	4	33	64		42	70	98	139	170
20	6 × M8	128	15	55	76	4	38	74		53	87	121	170	206
40	6 × M8	145	20	65	90	4	48	94		53	97	141	200	246
63	6 × M10	168	26	75	104	4	—	108		62	113	164	—	286
100	6 × M12	180	26	80	111	4	56	110		75	125	175	246	300
160	6 × M16	200	29	85	119	4	56	110		85	130	175	246	300
200	6 × M16	205	29	85	119	4	—	100		90	135	180	—	300
250	6 × M16	215	38	90	128	4	61	120		90	145	200	281	340
320	6 × M20	235	38	95	132	4	—	124		115	169	223	—	370
400	6 × M20	250	43	100	145	4	63	124		115	169	223	309	370
500	6 × M20	270	43	110	155	4	—	144		115	179	243	—	410
630	6 × M24	300	53	115	162	6	74	146		137	197	257	358	430
800	6 × M24	320	53	125	176	6	—	166		137	207	277	—	470
1100	—	380	71	145	200	—	—	186		—	—	322	—	540
1600	—	420	83	165	230	—	—	226		—	—	362	—	620

size	L_6	L_7	L_8	L_9	L_{10}	L_{11}	L_{12}	L_{13}	L_{14}	L_{15}	l	S	T	U	U_1
3	depends on the length of the coupling sleeve S, H_6 and the structural shape of the coupling	74	—	102	—	112	—	94	—	84	35	8 ± 0,2	68	7	17
5		84	91	117	101	127	78	104	68	94	40	8 ± 0,2	80	7	17
10		94	101	132	111	142	83	114	73	104	45	8 ± 0,2	90	7	17
20		114	124	160	136	172	102	138	90	126	55	11 ± 0,3	112	9	21
40		134	144	190	156	202	112	158	100	146	65	11 ± 0,3	128	9	21
63		154	—	220	—	235	—	184	—	169	75	14 ± 0,3	148	9	24
100		164	178	232	196	250	146	200	128	182	80	15 ± 0,4	158	12	30
160		166	179	233	201	255	156	210	134	188	80	15 ± 0,4	170	13	35
200		166	—	233	—	255	—	210	—	188	80	20 ± 0,4	175	13	35
250		186	204	263	226	285	171	230	149	208	90	20 ± 0,4	185	13	35
320		206	—	288	—	316	—	262	—	234	100	23 ± 0,5	199	18	46
400		206	227	288	255	316	201	262	173	234	100	23 ± 0,5	214	18	46
500		226	—	318	—	346	—	282	—	254	110	23 ± 0,5	234	18	46
630		240	263	335	298	370	238	310	203	275	115	27 ± 0,6	250	20	55
800		260	—	365	—	400	—	330	—	295	125	27 ± 0,6	270	20	55
1100		300	—	420	—	—	—	—	—	—	145	32 ± 0,7	—	25	—
1600		340	—	480	—	—	—	—	—	—	165	32 ± 0,7	—	25	—

size	V	v	x	x_1	x_2	Z^{H7}
3	13	M5 from ∅ 8 up to ∅ 28	4	29	19	40
5	15	M5 from ∅ 8 up to ∅ 38	4	29	19	50
10	17	M5 from ∅ 12 up to ∅ 30 / M6 above ∅ 30	4	29	19	60
20	20	M6	5,5	37,5	25,5	70
40	25	M6 from ∅ 20 up to ∅ 38 / M8 above ∅ 38	5,5	37,5	25,5	80
63	30	M6 from ∅ 26 up to ∅ 38 / M8 above ∅ 38	7	45	30	90
100	30	M6 from ∅ 26 up to ∅ 30 / M8 above ∅ 30 up to ∅ 44 / M10 above ∅ 44	8	53	35	90
160	30	M8 from ∅ 29 up to ∅ 44 / M10 above ∅ 44	10	60	38	100
200	30	M8 from ∅ 29 up to ∅ 44 / M10 above ∅ 44	10	65	43	100
250	35	M10 from ∅ 38 up to ∅ 50 / M12 above ∅ 50	10	65	43	110
320	35	M10 from ∅ 38 up to ∅ 50 / M12 above ∅ 50	13	83	55	120
400	38	M10 from ∅ 43 up to ∅ 50 / M12 above ∅ 50 up to ∅ 65 / M16 above ∅ 65	13	83	55	125
500	42	M10 from ∅ 43 up to ∅ 50 / M12 above ∅ 50 up to ∅ 65 / M16 above ∅ 65	13	83	55	130
630	45	M12 from ∅ 53 up to ∅ 65 / M16 above ∅ 65	15	95	60	150
800	50	M12 from ∅ 53 up to ∅ 65 / M16 above ∅ 65	15	95	60	160
1100	50	M16 from ∅ 71 up to ∅ 110 / M20 above ∅ 110	19	116	—	—
1600	60	M16 from ∅ 83 up to ∅ 110 / M20 above ∅ 110 up to ∅ 145 / M24 above ∅ 145	19	116	—	—

1) up to ∅ 23 keyway to DIN 6885/1, above ∅ 23 keyway to DIN 6885/3
2) up to ∅ 35 keyway to DIN 6885/1, above ∅ 35 keyway to DIN 6885/3
3) up to ∅ 42 keyway to DIN 6885/1, above ∅ 42 keyway to DIN 6885/3

subject to technical alterations

ROBA®-D hub with locking elements

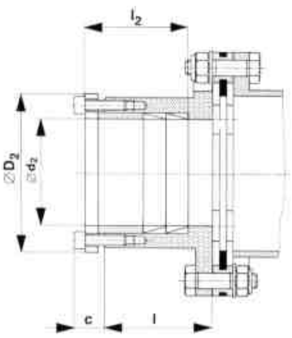


Fig. 16

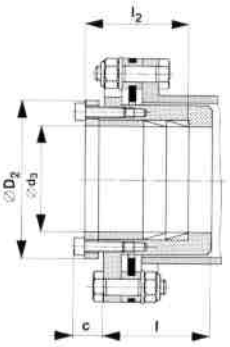


Fig. 17

ROBA®-D hub with shrink disc

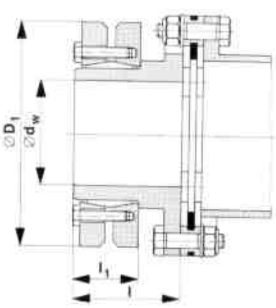


Fig. 18

Table of dimensions
Hub with locking elements

size	c 2)	D_2	d_2 / d_3 1)	l	l_2 2)
3	13	39	12 – 19	35	38
5	14	54	20 – 32	40	45
10	15	67	25 – 40	45	45
20	18	78	30 – 48	55	55
40	23	92	35 – 56	65	66
63	29	106	35 – 65	75	81
100	29	112	45 – 75	80	81
160	34	120	50 – 75	80	84

1) Possible diameter d_2 / d_3 =
12 / 13 / 14 / 15 / 16 / 17 / 18 / 19 / 20 / 22 / 24 / 25 / 28 / 30 / 32 / 35 / 36 / 38 / 40 / 42 / 45 / 48 / 50 / 55 / 56 / 60 / 63 / 65 / 70 / 71 / 75. (Bore fit H7)

2) Dimensions in an untensioned condition with biggest bore.

Backlash-free shaft-hub connections

The hubs are connected to the shaft via shrink discs or locking elements to obtain a torque transmission absolutely free of play.

The graphs shown above demonstrate the assembly of the hubs and the dimensions deviating from the standard design.

All further dimensions of the coupling sleeves, disc packs and flanges are on the dimension table, page 7.

Torque transmission with locking elements / shrink discs

In the case of a connection with locking elements the transmittable torque depends on the shaft diameter. The shock torque T_{KS} (see technical data, page 5) cannot be fully transmitted.

The highest torque occuring at the coupling must not be higher than the transmittable torque M, fig. 19.

The shock torque T_{KS} is transmitted safely with shrink disc connections for all the shaft diameters given in the dimension tables.

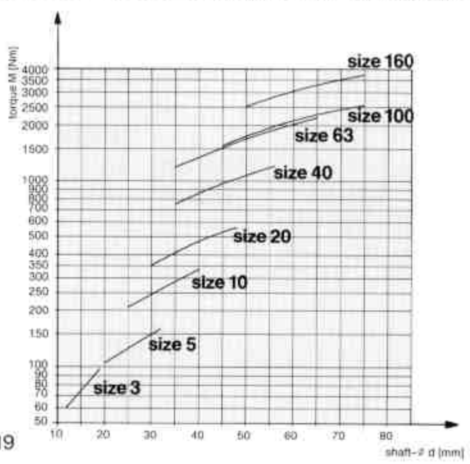


Fig. 19

Table of dimensions
Hub with shrink disc

size	D_1	d_w	l	l_1
20	72	30	55	27,5
	90	35/40	55	31,5
	115	45/50/55	55	34,5
40	90	35/40	65	31,5
	115	45/50/55/60	65	34,5
63	115	45/50/55/60	75	34,5
	145	65/70	75	38
	155	75	75	44,5
100	115	50	80	34,5
	138	55/60/65	80	38
	170	70/75/80	80	49,5
160	155	60/65/70/75	80	44,5
	170	80/85	80	49,5
200	155	60/65/70/75	80	44,5
	170	80/85	80	49,5
250	155	65	90	44,5
	170	70/75/80	90	49,5
	185	85/90	90	57
320	170	70/75/80/85	100	49,5
	185	90	100	57
400	185	75/80	100	57
	215	85/90/95/100	100	61
500	215	80	110	73
	215	85/90/95	110	61
	230	100/105/110	110	68,5
630	215	85/90	115	73
	230	95/100/105	115	68,5
	265	110/115	115	72,5
800	215	85/90	125	73
	230	95/100	125	82
	265	105/110	125	72,5
	290	115/120/125	125	81
1100	230	100	145	82
	265	105/110/115	145	88
	300	120/125/130/135	145	81
	330	140/145	145	96
1600	300	120/125/130	165	98
	330	135/140/145	165	96
	350	150/155/160/165	165	96

Recommended hub-shaft fit at ∅d_w *

∅ d_w above	to	fit	max. joining play [mm]
18	30	H6/j6	0,017
30	50	H6/j6	0,032
50	80	H6/j6	0,048
80	120	H7/g6	0,069
120	180	H7/g6	0,079

* please contact the factory in case of other hub-shaft fits.

Technical explanations

Delivery condition

ROBA®-D couplings are supplied loose. The hubs can be ordered either pilot bored or with finish bore and keyway to DIN 6885.

Designs with locking elements and shrink discs are available for backlash free shaft-hub connection.

Temperature resistance

Our ROBA®-D couplings are insensitive to temperatures up to 250° C due to the all-steel design.
In case of temperatures of more than 120° C the self-locking hexagon nuts supplied as standard must be exchanged by self-locking all-steel nuts according to DIN 6925.

Mounting position

ROBA®-D couplings are designed for horizontal mounting position.
If the coupling is installed vertically or in an angular position the dead weight of the coupling sleeve has to be supported in the case of long coupling sleeves (sleeve S), fig. 20. The vertical stud and flange in the hub and sleeve are supplied by our works.

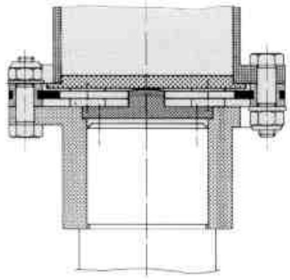


Fig. 20

Assembly

The hubs are located axially in the case of keyway connections via a set screw over the keyway or an axial locking screw and plate, the shaft being drilled and tapped to suit; fig. 21.

The disc pack must be fitted so that the element 2a (ring with its chamfer in the bore) lies on the side to the flange, fig. 22 (detail).

To avoid any distortion of the discs, the coupling must be fastened via head screws, i.e. hold hexagon nut and turn head screw.

The tightening torque is checked via the hexagon nut, i.e. hold head screw and turn hexagon nut.

The screw tightening torques and information for aligning the fitted coupling are in the installation and operating instruction for ROBA®-D couplings (B 9.0).

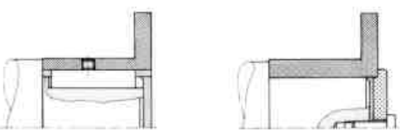


Fig. 21

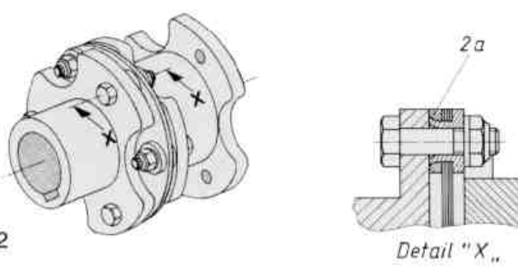


Fig. 22

Balancing

ROBA®-D couplings are balanced on customer requirements. Balancing is necessary on special spacer sleeves for high speeds although for the most applications balancing is not required.
The vibration free running of a drive or system depends upon the stiffness of the coupling, the position of the shaft bearings as well as the balancing quality of the coupling. It is not possible to state exact parameters when balancing is required, but the diagrams (figs. 23 and 24) give guide lines when we would suggest that the coupling components should be balanced.

For standard couplings

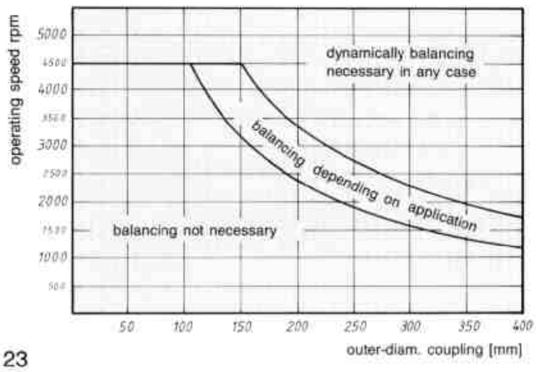


Fig. 23

For sleeve S (special length)

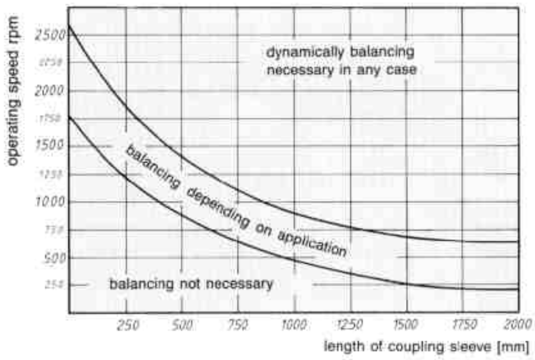


Fig. 24

Apart from sleeve "S" all coupling components are machined all over for use in the medium speed range as per VDI recommendation 2060, balancing quality Q 6,3.

It is possible to individually balance coupling components, and for particularly demanding applications, the complete coupling assembly will be balanced if required.

Only coupling and coupling components with finish bores can be balanced. When balancing is required we need details on the drive speed, quality of balancing and if the keyway is to be included.

Safety requirements

The ROBA®-D coupling rotating during operation must be protected by the user against unintentional contact. The lock nuts must be replaced with new self locking items if they have been loosened and tightened frequently.

Technical data for selecting the correct size

ROBA®-D single-jointed couplings compensate angular and axial shaft misalignments; double-jointed couplings compensate angular, axial and radial shaft misalignments.

You can find the max. permissible misalignment values in the technical data, page 5.

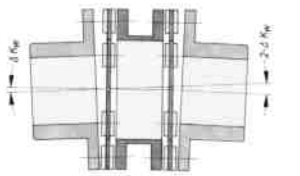


Fig. 25 angular misalignment

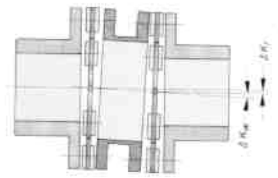


Fig. 26 radial misalignment (must not occur with single-jointed coupling)

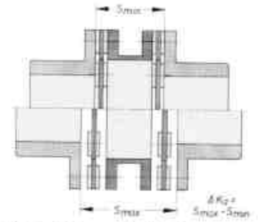


Fig. 27 axial displacement

How to select the coupling size

Determination of the load torque T_{LN} of the working machine:

$$T_{LN} = 9550 \cdot \frac{P_N}{n_N} \text{ [Nm]}$$

Preselection of the coupling size:

$T_{KN} \approx 2{,}5 \cdot T_{LN}$ [Nm]

The correct coupling size is selected with the calculated coupling rated torque T_{KN} (see technical data, page 5).

Examination of the selected coupling size:

$$T_{KN} \geqq T_{LN} \cdot f_A \cdot f_w \cdot f_t \cdot f_D \text{ [Nm]}$$

$$T_{KS} \geqq T_{LN} \cdot K \cdot f_w \cdot f_t \cdot f_D \text{ [Nm]}$$

Twisting of the coupling during operation:

$$\varphi = \frac{180}{\pi} \cdot \frac{1}{C_K} \cdot T_{LN} \text{ [°]}$$

$$\frac{1}{C_K} = z \cdot \frac{1}{C_T} + \frac{1}{C_H} \text{ [rad./Nm]}$$

P_N [kW]	=	power of the machine
n_N [rpm]	=	speed
T_{LN} [Nm]	=	load torque of the machine
T_{KN} [Nm]	=	rated load torque of the coupling (technical data, page 5)
T_{KS} [Nm]	=	shock torque of the coupling (technical data, page 5)
f_A [–]	=	application factor (figure 29)
f_w [–]	=	displacement factor (figure 30)
f_t [–]	=	temperature factor (figure 31)
f_D [–]	=	factor for direction of rotation
K [–]	=	shock factor (table 1)
φ [°]	=	twisting angle
C_K [Nm/rad.]	=	torsional spring rigidity of the coupling
C_T [Nm/rad.]	=	torsional spring rigidity of the disc pack (page 5)
C_H [Nm/rad.]	=	torsional spring rigidity of the sleeve (page 5)
z [–]	=	number of disc packs

Permissible shaft misalignments

The permissible shaft misalignments mentioned with the technical data, page 5, must not achieve the maximum value simultaneously.
If there are several kinds of misalignments at the same time, they affect each other, i. e. the permissible values of the misalignments depend on each other according to figure 28.

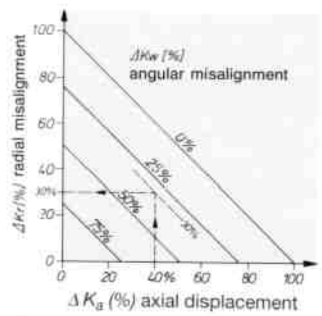


Fig. 28

Example:

ROBA®-D size 10, type 911.410
Existing axial displacement $\Delta V_a = 0{,}4$ mm
corresponds to 40 % of the permissible maximum value $\Delta K_a = 1$ mm.
Existing angular misalignement in the disc pack $\Delta V_w = 0{,}3°$
corresponds to 30 % of the permissible maximum value $\Delta K_w = 1°$.
i.e. permissible radial misalignment $\Delta V_r = 30$ % of the maximum value.
$\Delta K_r = 1{,}25$ mm.

Application factor f_A:

The application factor f_A, fig. 29, is a result of the corresponding construction of the drive, divided into three groups, and the load characteristic f_B from table 1, page 11.

The application factor f_A comprises of approx. 120 starts per day with a daily time of operation of 24 hours. If more starts are required, a higher application factor f_A must be selected.

Design of the drive unit:

Group I:
electric motors, steam turbines, hydraulic motors.

Group II:
reciprocating engines with more than two cylinders, water turbines.

Group III:
reciprocating engines with one or two cylinders.

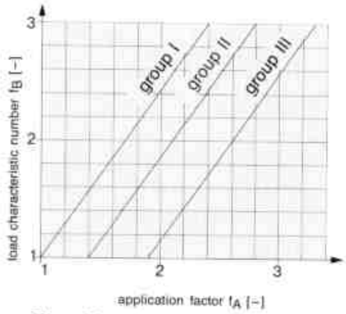


Fig. 29

Displacement factor f_w:

The displacement factor is a result of the complete shaft misalignment ΔV_{Wg} of a disc pack, fig. 30.

A radial misalignment will also produce an angular shaft misalignment (fig. 26).

Calculation of the complete shaft misalignment ΔV_{Wg} from angular misalignment ΔV_W and radial misalignment ΔV_r.

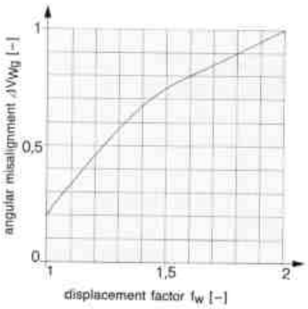


Fig. 30

$$\Delta V_{Wg} = \Delta V_W + \arcsin \frac{\Delta V_r}{H + S} \text{ [°]}$$

ΔV_{Wg} [°]	=	complete existing angular misalignment
ΔV_W [°]	=	existing angular misalignment
ΔV_r [mm]	=	existing radial misalignment

H [mm] = sleeve length of the coupling (page 7)

S [mm] = width of disc pack (page 7)

Temperature factor f_t:

The ROBA®-D couplings are independent of temperatures. The temperature factor f_t, however, must be considered with temperatures over 150° C when selecting the size (fig. 31).

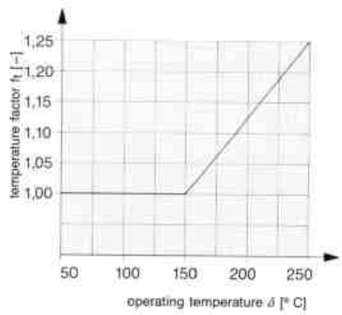


Fig. 31

Factor of direction of rotation f_D:

f_D = 1 direction of rotation is constant

f_D = 1,2 direction of rotation is changing

Load characteristics numbers f_B and shock factors K must be applied according to the type of machine

f_B	K	machine
2	4	construction machines
		Chemical industry
1,5	3,5	agitators (viscous liquids)
1,5	2,5	agitators (flooding liquids)
1,5	2,5	centrifuges
2	4	pipeline pumps
		Conveying plants
2	4	freight elevators
2	3,5	passenger elevators
1,5	3,5	conveyors
2	2,5	blowers, fans
1,5	3	generators
		Plastic processing
2,5	4	extruders
2	3	blenders
2	4	wood working machines
2	4	crane systems
		Metal working machines
2	3	machine tools
3	5	stamping machines, presses
		Food processing
3	4,5	mills
2	3	kneading machines
1,5	2	packaging machines

f_B	K	machine
		Paper machines
2	4	pulp grinders
2	3,5	calenders
2	4	suction rolls
		Pumps
1,8	3	centrifugal pumps
2	4,5	reciprocating pumps
2	3,5	positive-displacement pumps
		Compressors
2,5	4	reciprocating compressors
1,5	2,5	turbo compressors
		Rolling mills
3	5,5	shears
3	5	cold-rolling mills
2,5	4	wire drawing machines
3	5	continuous casting plants
2	2,5	**Washing machines**
		Nonmetallic minerals
3,5	6	mills, crushers
2	4	rotary furnaces

Table 1

Example for a calculation

Given data

drive unit	working machine
electric motor	gear pump
power P = 15 kW	power P_N = 13 kW
speed n = 1450 rpm	speed n_N = 1450 rpm

existing angular shaft misalignment $\Delta V_W = 0{,}2°$
existing radial shaft misalignment $\Delta V_r = 0{,}7$ mm
existing axial shaft displacement $\Delta V_a = 0$
ambient temperature = 100 °C
constant direction of rotation

Intended is a ROBA®-D type 911.410 (double-jointed coupling with two outer hubs and the sleeve 1).
Required: coupling size.

Determination of the load torque T_{LN} of the working machine:

$$T_{LN} = 9550 \cdot \frac{P_N}{n_N} \text{ [Nm]}$$

$$T_{LN} = 9550 \cdot \frac{13}{1450} = 85{,}6 \text{ [Nm]}$$

Preselection of the coupling size:

$T_{KN} \approx 2{,}5 \cdot T_{LN}$ [Nm]

$T_{KN} \approx 2{,}5 \cdot 85{,}6 = 214$ Nm

selected: ROBA®-D size 20 with a rated torque of the coupling T_{KN} = 200 Nm (see technical data, page 5)

Examination of the selected coupling size:

$T_{KN} \geqq T_{LN} \cdot f_A \cdot f_w \cdot f_t \cdot f_D$ [Nm]

$T_{KS} \geqq T_{LN} \cdot K \cdot f_w \cdot f_t \cdot f_D$ [Nm]

application factor f_A:
design of the drive unit: electric motor: group I
load characteristic f_B = 2 (table 1, positive-displacement pumps)
application factor f_A = 1,7 (fig. 29)

displacement factor f_w:

ΔV_w = 0,2° (indication) yields ΔV_w = 0,10° per disc pack
ΔV_r = 0,7 mm (indication)
H = 74 mm (length of the sleeve 1, page 7)
S = 11 mm (width of the disc pack, page 7)

$$\Delta V_{Wg} = \Delta V_w + \arcsin \frac{\Delta V_r}{H + S} \text{ [°]}$$

$$\Delta V_{Wg} = 0{,}10° + \arcsin \frac{0{,}7}{74+11} \text{ [°]}$$

$$\Delta V_{Wg} = 0{,}57°$$

displacement factor f_w = 1,3 (fig. 30)
temperature factor f_t = 1 (fig. 31)
factor of direction of rotation f_D = 1 (direction of rotation constant)
shock factor K = 3,5 (table 1, positive-displacement pumps)

$T_{KN} \geqq 85{,}6 \cdot 1{,}7 \cdot 1{,}3 \cdot 1 \cdot 1 = 189$ Nm
$T_{KS} \geqq 85{,}6 \cdot 3{,}5 \cdot 1{,}3 \cdot 1 \cdot 1 = 389{,}5$ Nm
T_{KN} = 200 Nm; T_{KS} = 400 Nm (technical data, page 5)

The calculated torques are smaller than the torque values from technical data. ROBA®-D size 20 is sufficient.

Twisting of the coupling during operation:

$$\varphi = \frac{180}{\pi} \cdot \frac{1}{C_K} \cdot T_{LN} \text{ [°]}$$

$$\frac{1}{C_K} = z \cdot \frac{1}{C_T} + \frac{1}{C_H} \left[\frac{\text{rad}}{\text{Nm}}\right]$$

z = 2 (coupling with 2 disc packs)
C_T = $0{,}5028 \cdot 10^6$ Nm/rad (technical data, page 5)
C_H = $1{,}9272 \cdot 10^6$ Nm/rad (technical data, page 5)
T_{LN} = 85,6 Nm

$$\frac{1}{C_K} = 2 \cdot \frac{1}{0{,}5028 \cdot 10^6} + \frac{1}{1{,}9272 \cdot 10^6} = 4{,}50 \cdot 10^{-6} \left[\frac{\text{rad}}{\text{Nm}}\right]$$

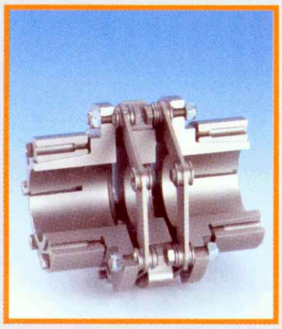
$$\varphi = \frac{180}{\pi} \cdot 4{,}50 \cdot 10^{-6} \cdot 85{,}6 = 0{,}02°$$

The coupling is twisting by 0,02° during operation.

Delivery Programme

Safety clutches/ torque limiters

- **EAS®-Compact/EAS®-NC**
  Backlash-free, positive safety clutches
- **EAS®-standard**
  Positive safety clutch with backlash
- **EAS®-overload/EAS®-elements**
  Modular overload clutch for heavy duty applications
- **EAS®-axial**
  Overload protection for linear movements
- **EAS®-Sp/EAS®-Sm/EAS®-Zr**
  Pneumatically or electromagnetically controlled torque limiting clutches with ON/OFF control
- **ROBA®-slip hubs**
  Load holding, friction type safety clutches



Shaft couplings

- **smartflex®**
  Precision shaft coupling for servo applications, direct drive systems and stepping motors
- **ROBA®-DX**
  Backlash-free, torsionally rigid flexible steel bellows coupling
- **ROBA®-ES**
  Backlash-free and flexible for vibratory critical drives
- **ROBA®-DS**
  Backlash-free, torsionally rigid and shock-proof all-steel flexible coupling
- **ROBA®-D**
  Backlash-free, torsionally rigid all steel flexible coupling

Electromagnetic brakes/clutches

- **ROBA-stop® safety brakes**
  Electromagnetic spring applied safety brakes
- **ROBA-stop®-M motor brakes**
  Electromagnetic spring applied safety brakes
- **ROBA-stop®-Z dual circuit fail safe brakes**
  Double security or double braking torque
- **ROBA®-quick brakes**
  Electromagnetic pole face brakes
- **ROBATIC®-clutches**
  Electromagnetic pole face clutches
- **ROBA®-takt**
  Clutch brake units

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