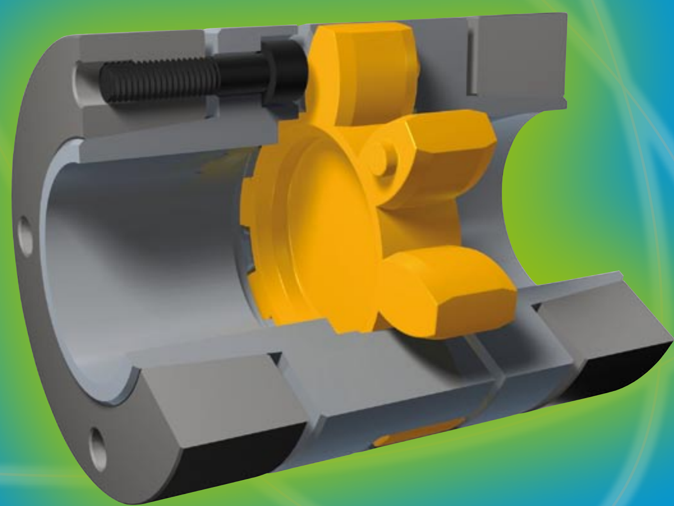
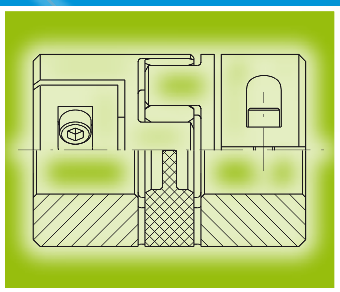
your reliable partner

ROBA®-ES

Backlash-free flexible shaft coupling





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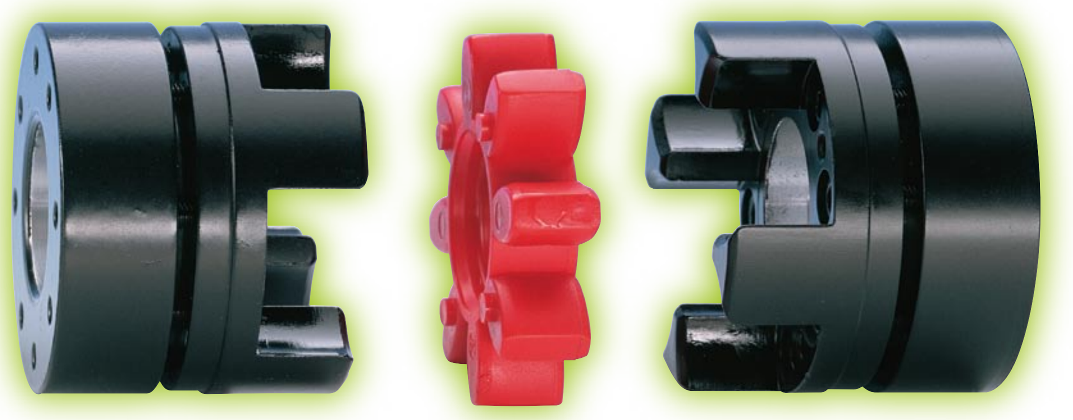
mayr® your reliable partner

ROBA®-ES

for smooth running in vibration-critical drive systems

A flexible coupling in high-precision servo axes?
This concept is not a contradiction in terms, as the ROBA®-ES coupling convinces customers even in critical applications with backlash-free torque transmission, ideal rigidity and optimum vibration damping.

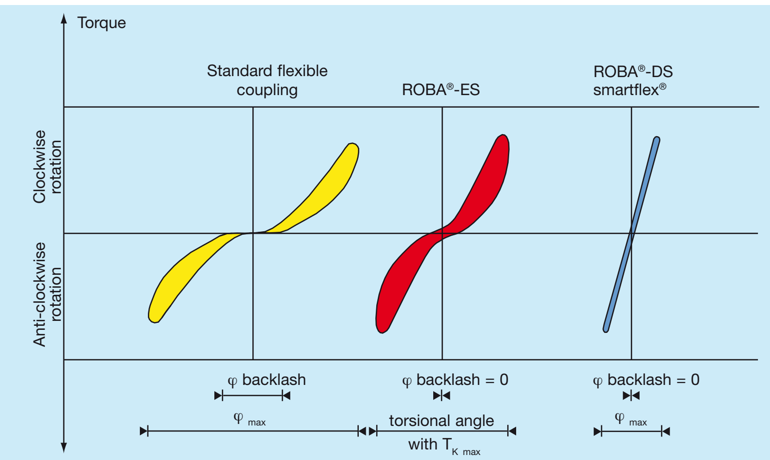


ROBA®-ES, the alternative to torsionally rigid shaft couplings.

- ❑ Backlash-free torque transmission due to pre-tensioned star-shaped elastomer element through which hardness, rigidity and damping behaviour can be varied.
- ❑ Compensation of radial, axial and angular shaft misalignments.
- ❑ Simple plug-in installation, maintenance-free function, agent resistance and temperature resistance guarantee highest operational safety.

ROBA®-ES - flexible and backlash-free
smartflex® - torsionally rigid and backlash-free

Backlash is the angular tolerance between the input and the output, also known as torsional backlash. Many conventional flexible couplings are subject to backlash due to their construction type.



The mayr®-couplings ROBA®-ES, smartflex® and ROBA®-DS Type series transmit the torque backlash-free.

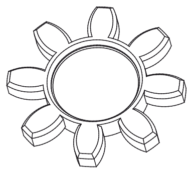
The couplings differ in damping behaviour and torsional rigidity:

- ❑ The ROBA®-ES is torsionally rigid and can damp vibrations to a small extent. Its torsional rigidity is 2 to 4 times higher than a toothed belt drive.
- ❑ The smartflex® and ROBA®-DS are torsionally rigid all-metal couplings. They feature the smallest torsional angle at maximum torque. Due to the transmission element design in steel, they have no damping characteristics.

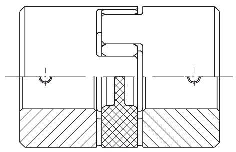
ROBA®-ES couplings are also available in ATEX design according to the directive 94/9 EC (ATEX 95).

ROBA®-ES Contents

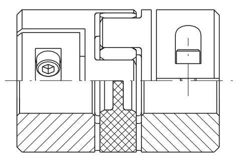
Nominal torques	**4 to 1250 Nm**
Max. axial displacement	**2,6 mm**
Max. radial misalignment	**0,26 mm**
Max. angular misalignment	**1,3°**



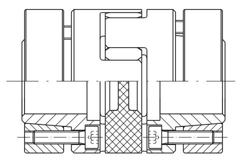
Nominal torques	**4 to 1250 Nm**
Bores	**6 to 80 mm**
Max. axial displacement	**2,6 mm**
Max. radial misalignment	**0,26 mm**
Max. angular misalignment	**1,3°**



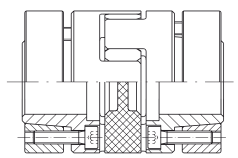
Nominal torques	**4 to 1250 Nm**
Bores	**6 to 80 mm**
Max. axial displacement	**2,6 mm**
Max. radial misalignment	**0,26 mm**
Max. angular misalignment	**1,3°**



Nominal torques	**4 to 405 Nm**
Bores	**6 to 45 mm**
Max. axial displacement	**1,8 mm**
Max. radial misalignment	**0,2 mm**
Max. angular misalignment	**1,3°**



Nominal torques	**4 to 1250 Nm**
Bores	**6 to 75 mm**
Max. axial displacement	**2,6 mm**
Max. radial misalignment	**0,26 mm**
Max. angular misalignment	**1,3°**



ROBA®-ES Elastomeric Elements

The elastomeric elements are the central element of the ROBA®-ES coupling. They define the application range as well as the shaft connection behaviour via the permitted torque, the rigidity, the damping and the misalignment values.

By using a unique polyurethane material and a special injection procedure, it is possible to achieve a high dimensional accuracy and evenness in the teeth of the elastomeric element.

The elastomeric elements are available in different shore hardnesses.

The teeth of the elastomeric element are chamfered at the sides. This makes blind assembly easier.

Elastomeric element hardness [Shore]	Colour	Permitted temperature range	
		Permanent temperature	Temporary max. temperature
80 Sh A	Blue	-50 to +80 °C	-60 to +120 °C
92 Sh A	Yellow	-40 to +90 °C	-50 to +120 °C
98 Sh A	Red	-30 to +90 °C	-40 to +120 °C
64 Sh D	Green	-30 to +100 °C	-40 to +140 °C

Temperature Influence

The ambient temperatures present during operation have a considerable effect on the dimensioning of a ROBA®-ES coupling (see Dimensioning page 14).

Dimensioning

The characteristics of ROBA®-ES couplings can be greatly varied by using different elastomeric elements. Due to different damping characteristics and the non-linear rigidity of the elastomer, this element also offers more parameters than the steel shaft connection, which should be taken into account on selection.

We therefore recommend careful, thorough coupling dimensioning (see Dimensioning page 14).

Agent Resistance

The elastomeric elements are very resistant against:
- pure mineral oils (lubricating oils)
- and anhydrous greases.

They have a similar resistance against fuels such as
- regular-grade petroleum
- diesel oil
- kerosene.

Damage may occur after longer exposure to
- alcohols or
- aromatic fuels (super/four star petrol).

The elastomeric element material used is resistant to hydrolysis. In contrast to other polyurethane materials, water (including seawater) causes, even after years of exposure, no particular changes to the mechanical characteristics. Hot water, however, reduces the mechanical strength.

For information on contact with special agents or radiation, please contact the manufacturers.

According to German notation, decimal points in this catalogue are represented with a comma (e.g. 0,5 instead of 0.5).

ROBA®-ES Elastomeric Elements

Torques

Size	Torque Type 940._ _ _._ [1) Elast. element hardness 80 Sh A (blue) T_{KN} [2)] [Nm]	80 Sh A (blue) $T_{K\,max}$ [Nm]	Elast. element hardness 92 Sh A (yellow) T_{KN} [2)] [Nm]	92 Sh A (yellow) $T_{K\,max}$ [Nm]	Elast. element hardness 98 Sh A (red) T_{KN} [2)] [Nm]	98 Sh A (red) $T_{K\,max}$ [Nm]	Elast. element hardness 64 Sh D (green) T_{KN} [2)] [Nm]	64 Sh D (green) $T_{K\,max}$ [Nm]
14	4	8	8	16	13	26	16	32
19	5	10	10	20	17	34	21	42
24	17	34	35	70	60	120	75	150
28	46	92	95	190	160	320	200	400
38	95	190	190	380	325	650	405	810
42	125	250	265	530	450	900	560	1120
48	150	300	310	620	525	1050	655	1310
55	-	-	410	820	685	1370	825	1650
65	-	-	900	1800	1040	2080	1250	2500
Only available on P-design (page 9)								
14-32	4	8	8	16	13	26	16	32
19-37,5	4	8	8	16	14	28	17	34
24-50	12	24	25	50	43	86	54	108

1) The permitted max. torque for Types 940._00._ and 940._11._ is dependent on bore diameter d_3/d_4, see Tables 1 to 4, pages 10 and 11.
2) For permitted alternating torques, see Coupling Dimensioning page 14.

Permitted Misalignment Values

Size	Shaft misalignments: Axial ΔK_a 80/92/98 Sh A 64 Sh D [mm]	Radial ΔK_r 80 Sh A [mm]	Radial ΔK_r 92 Sh A [mm]	Radial ΔK_r 98 Sh A [mm]	Radial ΔK_r 64 Sh D [mm]	Angular ΔK_w 80 Sh A [°]	Angular ΔK_w 92 Sh A [°]	Angular ΔK_w 98 Sh A [°]	Angular ΔK_w 64 Sh D [°]
14	1,0	0,21	0,15	0,09	0,06	1,1	1,0	0,9	0,8
19	1,2	0,15	0,1	0,06	0,04	1,1	1,0	0,9	0,8
24	1,4	0,18	0,14	0,1	0,07	1,1	1,0	0,9	0,8
28	1,5	0,2	0,15	0,11	0,08	1,3	1,0	0,9	0,8
38	1,8	0,22	0,17	0,12	0,09	1,3	1,0	0,9	0,8
42	2,0	0,24	0,19	0,14	0,1	1,3	1,0	0,9	0,8
48	2,1	0,26	0,21	0,16	0,11	1,3	1,0	0,9	0,8
55	2,2	-	0,24	0,17	0,12	-	1,0	0,9	0,8
65	2,6	-	0,25	0,18	0,13	-	1,0	0,9	0,8
Only available on P-design (page 9)									
14-32	1,0	0,21	0,15	0,09	0,06	1,1	1,0	0,9	0,8
19-37,5	1,2	0,15	0,1	0,06	0,04	1,1	1,0	0,9	0,8
24-50	1,4	0,18	0,14	0,1	0,07	1,1	1,0	0,9	0,8

Spring Rigidity

Size	Static torsional spring rigidity $C_{T\,stat.}$ 80 Sh A [Nm/rad.]	$C_{T\,stat.}$ 92 Sh A [Nm/rad.]	$C_{T\,stat.}$ 98 Sh A [Nm/rad.]	$C_{T\,stat.}$ 64 Sh D [Nm/rad.]	Dynamic torsional spring rigidity $C_{T\,dyn.}$ 80 Sh A [Nm/rad.]	$C_{T\,dyn.}$ 92 Sh A [Nm/rad.]	$C_{T\,dyn.}$ 98 Sh A [Nm/rad.]	$C_{T\,dyn.}$ 64 Sh D [Nm/rad.]	Static radial spring rigidity C_r 80 Sh A [N/mm]	C_r 92 Sh A [N/mm]	C_r 98 Sh A [N/mm]	C_r 64 Sh D [N/mm]
14	50	80	120	230	120	240	300	730	180	300	470	960
19	350	820	900	1400	1050	1800	2200	4200	700	1200	2100	2700
24	820	2300	3700	4500	1300	4800	7600	10800	800	1900	2800	4200
28	1300	3800	4200	7000	2200	6800	10100	17200	950	2100	3500	4900
38	2000	5600	7400	9000	3400	11900	19900	30500	1300	2900	4800	5600
42	3500	9800	13800	15000	5950	20500	31100	64900	3400	4100	5400	6900
48	4300	12000	15100	28500	7300	22800	44900	102800	3750	4500	6200	8200
55	-	14200	20500	56300	-	25800	48200	117400	-	5680	8200	22500
65	-	19100	32800	90200	-	36200	67400	164000	-	7640	13120	36000
Only available on P-design (page 9)												
14-32	50	80	120	230	120	240	300	730	180	300	470	960
19-37,5	280	660	720	1120	840	1440	1760	3360	560	960	1680	2160
24-50	600	1700	2700	3300	1000	3600	5700	8100	600	1500	2100	3200

ROBA®-ES with keyways Type 940._22._

Sizes 14 to 65

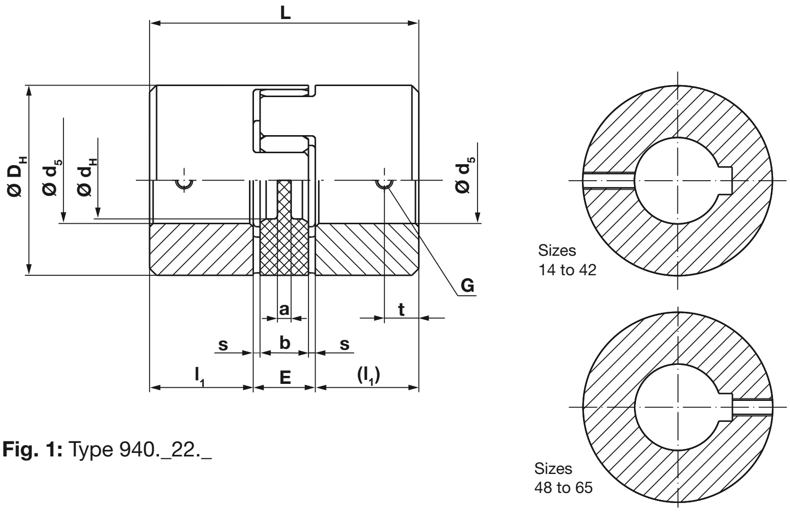


Fig. 1: Type 940._22._

ROBA®-ES couplings are delivered as un-bored hub design (further processing to be carried out customer-side) or with a finish bore and keyway JS9 (DIN 6885/1). An adjusting screw is located in the hub for axial securement, which is offset by 180° to the keyway (for Sizes 14 to 42, see Fig. right).

Up to Size 38, the hubs are made of aluminium. From Size 42, they are made of steel.

Conventional bores can be delivered from stock.

Technical Data and Bores				Size 1)								
				14	19	24	28	38	42	48	55	65
Minimum hub bore 2)		$d_{5\,min}$	[mm]	6	6	8	10	12	14	20	20	38
Maximum hub bore 2)		$d_{5\,max}$	[mm]	15	24	28	38	45	55	60	70	80
Maximum speed		n_{max}	[rpm]	19000	14000	10600	8500	7100	6000	5600	5000	4600
Mass moments of inertia	per hub and max. bore	J	[10^{-6} kgm²]	2,8	20,4	50,8	200,3	400,6	2246	3786	8546	16043
Weight			[kg]	0,020	0,066	0,132	0,253	0,455	1,85	2,52	4,14	5,96

Dimensions	Size 2)								
	14	19	24	28	38	42	48	55	65
a	2	4	4	5	5	5	5	9	8
b	10	12	14	15	18	20	21	22	26
D_H	30	40	55	65	80	95	105	120	135
d_H	10,5	18	27	30	38	46	51	60	68
E	13	16	18	20	24	26	28	30	35
G	M4	M5	M5	M6	M8	M8	M8	M10	M10
L	35	66	78	90	114	126	140	160	185
l_1	11	25	30	35	45	50	56	65	75
s	1,5	2,0	2,0	2,5	3,0	3,0	3,5	4,0	4,5
t	5	10	10	15	15	20	25	20	20

1) Further Sizes and Types available on request.
2) Recommended fit connection H7/k6.

We reserve the right to make dimensional and constructional alterations.

Order Number

__ / 9 4 0 . __ 2 2 . __ / __ / __

Sizes	Elastomeric element		Design		Bore ø	Bore ø
Sizes 14 to 65	Elast. element hardness 98 Sh A (red)	0	Aluminium design up to Size 38	A	**Bore ø** **d_5^{H7}** (see Table)	**Bore ø** **d_5^{H7}** (see Table)
	Elast. element hardness 92 Sh A (yellow)	1	Steel design from Size 42	F		
	Elast. element hardness 80 Sh A (blue) 3)	5				
	Elast. element hardness 64 Sh D (green)	6				

Example: 42 / 940.022.F / Ød$_5$ 30 / Ød$_5$ 30

3) Elastomeric element 80 Sh A (blue) only available up to Size 48

ROBA®-ES with clamping hubs Type 940._00._

Sizes 14 to 65

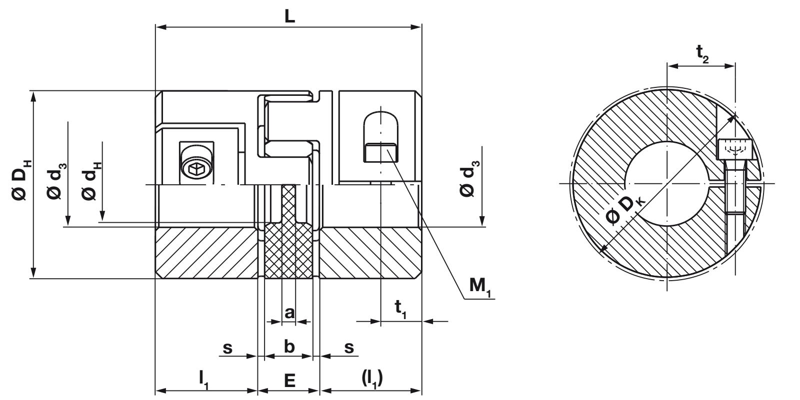


Fig. 2: Type 940._00._

ROBA®-ES couplings with clamping hubs are conceived for fast and safe installation or de-installation. They have no keyway. The tightening torque (T_A) on the clamping screws must be maintained in order to ensure reliable, frictionally-locking torque transmission.

Please observe the maximum permitted torques (Table 4, page 11).

Up to Size 38, the hubs are made of aluminium. From Size 42, they are made of steel.

The clamping hub can be designed with an additional keyway on request.

Technical Data and Bores				Size [1]								
				14	19	24	28	38	42	48	55	65
Minimum hub bore [2]		$d_{3\,min}$	[mm]	6	10	15	19	20	28	35	40	45
Maximum hub bore [2]		$d_{3\,max}$	[mm]	15	20	28	35	45	50	55	70	80
Maximum speed		n_{max}	[rpm]	19000	14000	10600	8500	7100	6000	5600	5000	4600
Mass moments of inertia	per hub and max. bore	J	[10^{-6} kgm²]	2,8	20,4	50,8	200,3	400,6	2246	3786	9676	17872
Weight			[kg]	0,020	0,066	0,132	0,253	0,455	1,85	2,52	3,89	5,62
Tightening torques	Clamping screws	T_A	[Nm]	1,4	10	10	25	25	70	120	120	200

Dimensions	Size [1]								
	14	19	24	28	38	42	48	55	65
a	2	4	4	5	5	5	5	9	8
b	10	12	14	15	18	20	21	22	26
D_H	30	40	55	65	80	95	105	120	135
D_K	32,2	47	56,4	72,6	83,3	78,8	108	122	139
d_H	10,5	18	27	30	38	46	51	60	68
E	13	16	18	20	24	26	28	30	35
L	35	66	78	90	114	126	140	160	185
l_1	11	25	30	35	45	50	56	65	75
M_1	M3	M6	M6	M8	M8	M10	M12	M12	M14
s	1,5	2,0	2,0	2,5	3,0	3,0	3,5	4,0	4,5
t_1	5,5	12	12	13,5	20	20	21	26	27,5
t_2	11	14	20	24	30	34	36	45	52

1) Further Sizes and Types available on request.
2) For transmittable torques dependent on bore, see Table 4, page 11.

We reserve the right to make dimensional and constructional alterations.

Order Number

__ / 9 4 0 . __ 0 0 . __ / __ / __

Sizes	Elastomeric element		Design		Bore ø	Bore ø
14 to 65	Elast. element hardness 98 Sh A (red)	0	Aluminium design up to Size 38	A	d_3^{F7}	d_3^{F7}
	Elast. element hardness 92 Sh A (yellow)	1	Steel design from Size 42	F	(see Table) In the slotted area, the bore tolerances can deviate	
	Elast. element hardness 80 Sh A (blue) [3]	5				
	Elast. element hardness 64 Sh D (green)	6				

Example: 42 / 940.000.F / Ød_3 30 / Ød_3 30

3) Elastomeric element 80 Sh A (blue) only available up to Size 48

ROBA®-with aluminium shrink disk hubs Type 940._11.A

Sizes 14 to 38

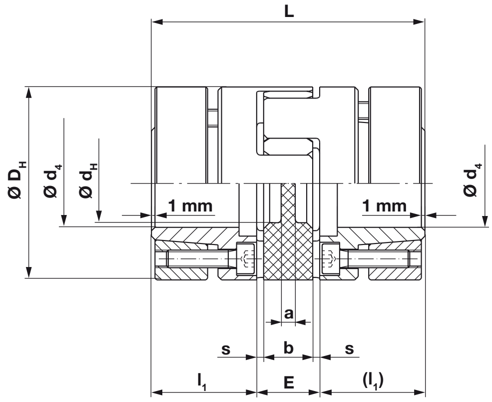


Fig. 3: Type 940._11.A

On this design, the hub body is made of aluminium and the ring of phosphated, annealed steel. The design is constructionally identical to the P-design (page 9). The symmetry, the absence of keyways and radial bores produces an optimum shaft run-out. Therefore, much higher speeds are possible compared to the other hub designs (please observe the Balancing Diagram, page 12).

The torque is transmitted via frictional locking onto the shaft. Therefore, please observe the maximum torques on this shaft-hub connection (Table 1, page 10).

Technical Data and Bores				Size				
				14	19	24	28	38
Minimum hub bore [1)]		$d_{4\ min}$	[mm]	6	10	15	19	20
Maximum hub bore [1)]		$d_{4\ max}$	[mm]	14	20	28	38	45
Maximum speed		n_{max}	[rpm]	28000	21000	15500	13200	10500
Mass moments of inertia	per hub and max. bore	J	[10^{-6} kgm^2]	7	31	135	313	960
Weight			[kg]	0,049	0,12	0,28	0,45	0,95
Tightening torques	Tensioning screws	T_A	[Nm]	1,3	3,0	6,0	6,0	10,0

Dimensions	Size				
	14	19	24	28	38
a	2	4	4	5	5
b	10	12	14	15	18
D_H	30	40	55	65	80
d_H	10,5	18	27	30	38
E	13	16	18	20	24
L	50	66	78	90	114
l_1	18,5	25	30	35	45
M_2	4 x M3	6 x M4	4 x M5	8 x M5	8 x M6
s	1,5	2,0	2,0	2,5	3,0

1) For transmittable torques dependent on bore, see Table 1, page 10.

We reserve the right to make dimensional and constructional alterations.

Order Number

__ / 9 4 0 . __ 1 1 . A / __ / __

Sizes				Bore ø	Bore ø
14 to 38	Elast. element hardness 98 Sh A (red)	0	Aluminium design A	d_4^{H7} (see Table)	d_4^{H7} (see Table)
	Elast. element hardness 92 Sh A (yellow)	1			
	Elast. element hardness 80 Sh A (blue)	5			
	Ealst. element hardness 64 Sh D (green)	6			

Example: 38 / 940.011.A / Ød_4 30 / Ød_4 30

ROBA®-ES with steel shrink disk hubs Type 940._11._ — Sizes 14-32 to 65

On this design, the hub body is made of steel (oiled) and the ring of phosphated, annealed steel. This design is available in a standard variant and a variant according to DIN 69002. The DIN variant has an elastomeric element with a central, standardised bore and standardised bore diameters in the hubs. The DIN variants are conceived for use in short bore spindles and multi-spindle heads. Because of the steel hubs, this DIN design combines robustness with precision. This design should be selected in preference to others, in particular on applications with heavily pulsating or alternating load.

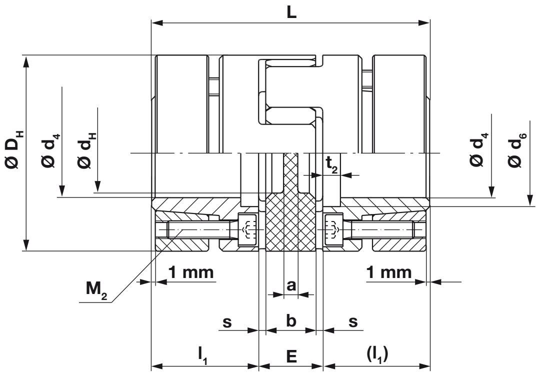


Fig. 4: Type 940._11.P – Sizes 14 to 38
Type 940._11.F – Sizes 42 to 65

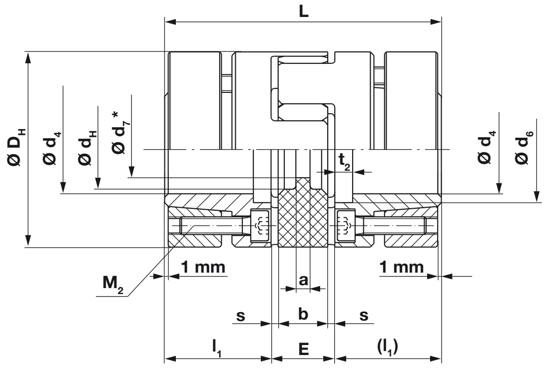


Fig. 5: Type 940.011.P
Sizes 14-32 to 28 acc. DIN 69002

Technical Data and Bores				Size										
				14-32	19-37,5	19	24-50	24	28	38	42	48	55	65
Minimum hub bore 1)		$d_{4\ min}$	[mm]	6	10	10	15	15	19	20	28	35	40	45
Maximum hub bore 1)		$d_{4\ max}$	[mm]	14	16	20	24	28	38	45	50	60	70	75
DIN-bore *		d_4	[mm]	14	16	19	24	25	35	-	-	-	-	-
Maximum speed		n_{max}	[rpm]	28000	21000	21000	15500	15500	13200	10500	9000	8000	6300	5600
Mass moments of inertia	per hub and max. bore	J	[10^{-6} kgm²]	11	37	46	136	201	438	1320	3170	5200	9069	17209
Weight			[kg]	0,1	0,16	0,19	0,33	0,44	0,64	1,3	2,3	3,1	3,61	5,52
Tightening torques	Tensioning screws	T_A	[Nm]	1,3	3,0	3,0	6,0	6,0	6,0	10	25	30	52	90

Dimensions	Size										
	14-32	19-37,5	19	24-50	24	28	38	42	48	55	65
a	2	4	4	4	4	5	5	5	5	9	8
b	10	12	12	14	14	15	18	20	21	22	26
D_H	32	37,5	40	50	55	65	80	95	105	120	135
d_H	10,5	18	18	27	27	30	38	46	51	60	68
d_6	17	19	22	29	30	40	46	55	60	72	77
d_7 *	8,5	9,5	9,5	12,5	12,5	14,5	-	-	-	-	-
E	13	16	16	18	18	20	24	26	28	30	35
L	50	66	66	78	78	90	114	126	140	160	185
l_1	18,5	25	25	30	30	35	45	50	56	65	75
M_2	4 x M3	6 x M4	6 x M4	4 x M5	4 x M5	8 x M5	8 x M6	4 x M8	4 x M8	4 x M10	4 x M12
s	1,5	2,0	2,0	2,0	2,0	2,5	3,0	3,0	3,5	4,0	4,5
t_2	3	4	4	5	5	5	5	5	6	7	7

1) For transmittable torques dependent on bore, see Tables 2 and 3, pages 10 and 11.
* Elastomeric elements with DIN bore only available with 98 Sh A (red), Type 940.011.P

We reserve the right to make dimensional and constructional alterations.

Order Number

__ / 9 4 0 . __ 1 1 . __ / __ / __ / __

Sizes	Elastomeric element		Design		Bore ø	Bore ø	Design
14-32 to 65	Elast. element hardness 98 Sh A (red)	0	Steel design up to Size 38	P	d_4^{H6} up to Size 38	d_4^{H6} up to Size 38	- DIN
	Elast. element hardness 92 Sh A (yellow)	1	Steel design from Size 42	F	d_4^{H7} from Size 42	d_4^{H7} from Size 42	- No values for standard
	Elast. element hardness 80 Sh A (blue) 2)	5			(see Table)	(see Table)	
	Elast. element hardness 64 Sh D (green)	6					

Example: 42 / 940.011.F / Ød_4 30 / Ød_4 30

2) Elastomeric element 80 Sh A (blue) only available up to Size 48

Frictionally-locking transmittable torques

Shrink disk hubs made of aluminium Type 940._11.A			Bore	Size 14	19	24	28	38
Frictionally-locking transmittable torques **Shrink disk hubs made of aluminium** Valid for H7 / k6 With larger fit clearance, the transmittable torque is reduced.	T_R	[Nm]	Ø6	7	-	-	-	-
			Ø7	9	-	-	-	-
			Ø8	11	-	-	-	-
			Ø9	13	-	-	-	-
			Ø10	15	33	-	-	-
			Ø11	17	38	-	-	-
			Ø14	24	55	-	-	-
			Ø15	-	61	56	-	-
			Ø16	-	67	62	-	-
			Ø17	-	73	68	-	-
			Ø18	-	78	74	-	-
			Ø19	-	84	81	141	-
			Ø20	-	88	87	153	197
			Ø22	-	-	100	177	228
			Ø24	-	-	120	203	261
			Ø25	-	-	125	216	279
			Ø28	-	-	135	256	332
			Ø30	-	-	-	282	368
			Ø32	-	-	-	308	405
			Ø35	-	-	-	343	460
			Ø38	-	-	-	373	513
			Ø40	-	-	-	-	547
			Ø42	-	-	-	-	577
			Ø45	-	-	-	-	617

Table 1

Shrink disk hubs made of steel Type 940._11.P			Bore	Size 14-32	19-37,5	19	24-50	24	28	38
Frictionally-locking transmittable torques **Shrink disk hubs made of steel** Valid for H6 / k6 With larger fit clearance, the transmittable torque is reduced.	T_R	[Nm]	Ø6	7	-	-	-	-	-	-
			Ø7	9	-	-	-	-	-	-
			Ø8	11	-	-	-	-	-	-
			Ø9	13	-	-	-	-	-	-
			Ø10	15	26	33	-	-	-	-
			Ø11	17	30	38	-	-	-	-
			Ø14	25	45	55	-	-	-	-
			Ø15	-	50	61	45	56	-	-
			Ø16	-	60	67	50	62	-	-
			Ø17	-	-	73	54	68	-	-
			Ø18	-	-	78	60	74	-	-
			Ø19	-	-	84	65	81	141	-
			Ø20	-	-	88	70	87	153	197
			Ø22	-	-	-	85	100	177	228
			Ø24	-	-	-	112	120	203	261
			Ø25	-	-	-	-	125	216	279
			Ø28	-	-	-	-	135	256	332
			Ø30	-	-	-	-	-	282	368
			Ø32	-	-	-	-	-	308	405
			Ø35	-	-	-	-	-	343	460
			Ø38	-	-	-	-	-	373	513
			Ø40	-	-	-	-	-	-	547
			Ø42	-	-	-	-	-	-	577
			Ø45	-	-	-	-	-	-	617

Table 2

Frictionally-locking transmittable torques

Shrink disk hubs made of steel
Type 940._11.F

Frictionally-locking transmittable torques **Shrink disk hubs made of steel**

Valid for H7 / k6

With larger fit clearance, the transmittable torque is reduced.

T_R [Nm]

Bore	Size 42	Size 48	Size 55	Size 65
Ø28	300	-	-	-
Ø30	350	-	-	-
Ø32	400	-	-	-
Ø35	500	450	-	-
Ø38	600	500	-	-
Ø40	680	600	723	-
Ø42	730	720	814	-
Ø45	790	850	946	1402
Ø48	850	1000	1085	1596
Ø50	880	1180	1187	1731
Ø52	-	1270	1284	1873
Ø55	-	1353	1436	2095
Ø58	-	1428	1585	2308
Ø60	-	1471	1682	2420
Ø62	-	-	1795	2570
Ø65	-	-	1943	2750
Ø68	-	-	2100	2989
Ø70	-	-	2207	3157
Ø72	-	-	-	3306
Ø75	-	-	-	3550

Table 3

Clamping hubs
Type 940._00._

Frictionally-locking transmittable torques **Clamping hubs**

Valid for F7 / k6

With larger fit clearance, the transmittable torque is reduced.

T_R [Nm]

Bore	Size 14	19	24	28	38	42	48	55	65
Ø6	2,5	-	-	-	-	-	-	-	-
Ø7	3,0	-	-	-	-	-	-	-	-
Ø8	3,4	-	-	-	-	-	-	-	-
Ø9	3,8	-	-	-	-	-	-	-	-
Ø10	4,2	23	-	-	-	-	-	-	-
Ø11	4,7	25	-	-	-	-	-	-	-
Ø12	5,1	27	-	-	-	-	-	-	-
Ø14	6,0	32	-	-	-	-	-	-	-
Ø15	6,4	34	34	-	-	-	-	-	-
Ø16	-	36	36	-	-	-	-	-	-
Ø19	-	43	43	79	-	-	-	-	-
Ø20	-	45	45	83	83	-	-	-	-
Ø22	-	-	50	91	91	-	-	-	-
Ø24	-	-	54	100	100	-	-	-	-
Ø25	-	-	57	104	104	-	-	-	-
Ø28	-	-	63	116	116	208	-	-	-
Ø30	-	-	-	124	124	228	-	-	-
Ø32	-	-	-	133	133	248	-	-	-
Ø35	-	-	-	145	145	280	350	-	-
Ø38	-	-	-	-	158	315	390	-	-
Ø40	-	-	-	-	166	340	420	340	-
Ø42	-	-	-	-	174	365	455	365	-
Ø45	-	-	-	-	187	404	505	405	545
Ø48	-	-	-	-	-	442	560	435	590
Ø50	-	-	-	-	-	470	600	465	630
Ø52	-	-	-	-	-	-	640	490	662
Ø55	-	-	-	-	-	-	705	525	710
Ø58	-	-	-	-	-	-	-	570	764
Ø60	-	-	-	-	-	-	-	600	800
Ø62	-	-	-	-	-	-	-	625	840
Ø65	-	-	-	-	-	-	-	665	900
Ø68	-	-	-	-	-	-	-	700	954
Ø70	-	-	-	-	-	-	-	740	990
Ø72	-	-	-	-	-	-	-	-	1032
Ø75	-	-	-	-	-	-	-	-	1095
Ø78	-	-	-	-	-	-	-	-	1158
Ø80	-	-	-	-	-	-	-	-	1200

Table 4

ROBA®-ES Technical Explanations

ROBA®-ES stands for flexible (E), backlash-free (S) shaft coupling. The device consists of two coupling hubs and a flexible, star-shaped intermediate ring (Fig. 6).

ROBA®-ES couplings are conceived specially for backlash-free operation at comparatively high speeds.

ROBA®-ES couplings are mainly used in measurement and regulatory technology as well as in control and procedure technology.

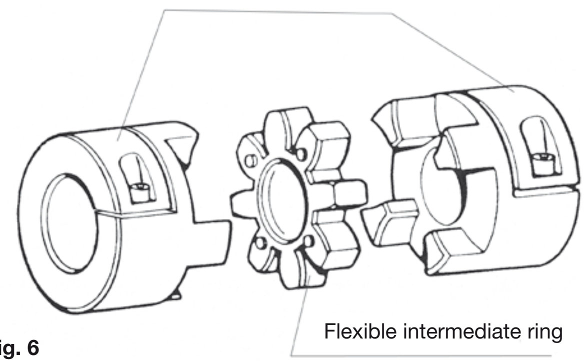


Fig. 6

Shaft Misalignments

The ROBA®-ES coupling compensates for radial, axial and angular shaft misalignments (Fig. 9), without losing its backlash-free function. However, the permitted misalignments indicated on page 5 must not simultaneously reach their maximum value. If more than one kind of misalignment takes place simultaneously, they influence each other. This means that the permitted misalignment values are dependent on one another, see Fig. 8.
The sum total of the actual misalignments – in percent of the maximum value – must not exceed 100 %.
The permitted misalignment values given on page 5 refer to coupling operation at nominal torque, an ambient temperature of +30 °C and an operating speed of 1500 rpm.

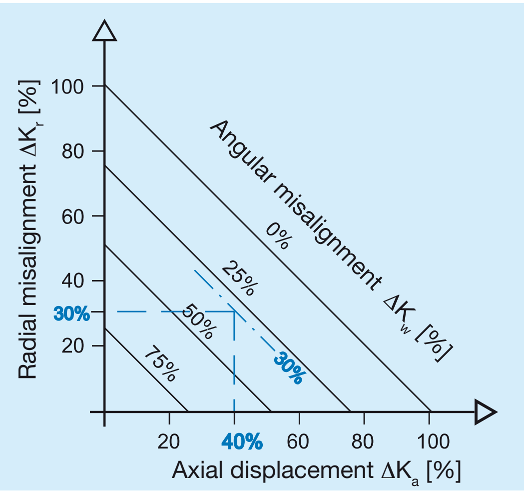
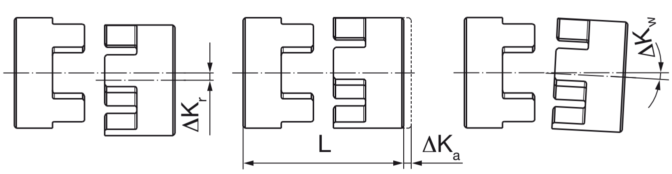


Fig. 8



Radial misalignment Axial displacement Angular misalignment

Fig. 9

State of Delivery

ROBA®-ES couplings are delivered manufacturer-assembled ready for installation. The star-shaped intermediate ring is pressed into the specially designed claws (Fig. 7) under light pretension.

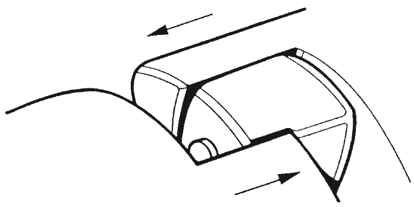


Fig. 7

The principle of backlash-free torque transmission is possible due to this pre-tension.

ROBA®-ES couplings are delivered in four torque variations; that is with four different flexible intermediate rings varying in shore hardness and colour (see Type key page 5).

Due to the small construction dimensions and therefore the low mass moments of inertia, the device allows itself to be installed even into small installation spaces.

Balancing

Key hubs and clamping hubs:

Key hubs and clamping hubs rotate at maximum speed with a circumferential speed of 30 m/s. They are not balanced for standard delivery.

Shrink disk hubs:

Shrink disk hubs maintain balance quality G = 6,3 up to speed n_G (equals approx. 30 m/s) without needing to be balanced. Above his speed, we recommend balancing. The hubs are balanced individually. Diagram 1 shows reference values. We recommend you use these values to balance the coupling components.

Smooth running of a machine or system is not only dependent on the balance quality of the coupling, but also on many parameters such as rigidity or distance to the adjacent bearing. Therefore there are no fixed rules in which conditions you have to balance.

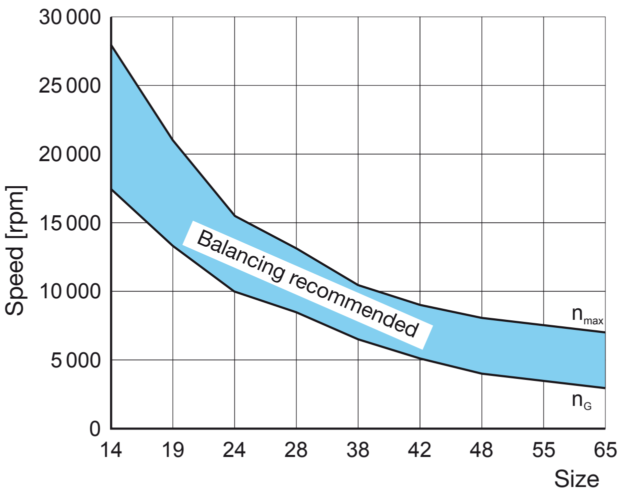


Diagram 1: Balancing the shrink disk hubs

ROBA®-ES Installation Guidelines and Examples

Installation Guidelines – Installation

Due to its optimum construction the ROBA®-ES coupling offers the possibility to connect the coupling axially after the hubs have been assembled onto the input or output shafts. Any subsequent screwing together and special housings are not necessary (see Installation Example page 13).

The installation or installation dimensions must be kept to so that there is no facing-side pressure on the elastomeric element after clutch installation has been completed, meaning that the elastomeric element must not be distorted axially.

By keeping to the installation dimensions (in particular dimension “E“, see Dimension Figs. and Dimension Tables, pages 6 – 9), the elastomeric element’s axial flexibility remains guaranteed.

On elastomeric elements with differing numbers of nubs, the side with the larger number of nubs must be installed first (for easier installation).

Due to the pre-tension on the flexible elastomeric element, an axial installation force is required when joining the coupling hubs.

The axial installation force required can be reduced by lightly greasing the elastomeric element.

Only use grease based on mineral oil without additives. Vaseline is also suitable.

Installation of the shrink disk hubs (ROBA®-ES Type 940._11._)

The conical surfaces of the shrink disk hubs are greased manufacturer-side with a special grease (should the device be cleaned, the device must be re-greased with special grease).

- Mount the shrink disk hubs into both shaft ends using a suitable device, align them and tighten the tensioning screws lightly up to their limits.
- Tighten the tensioning screws evenly stepwise and cross-wise to the specified tightening torque (see pages 8 and 9) using a torque wrench.
- **For de-installation,** loosen all tensioning screws by several thread turns.
- Screw out the tensioning screws located next to the tapped extracting holes and screw them into the tapped extracting holes up to their limits.
- Tighten the tensioning screws evenly stepwise and cross-wise so that the shrink disk is loosened from the conical shrink disk hub.

Safety Regulations

The coupling rotates during operation. It must be secured customer-side against inadvertent contact.
Installation and maintenance must be carried out by personnel who have been trained accordingly.

Installation Examples

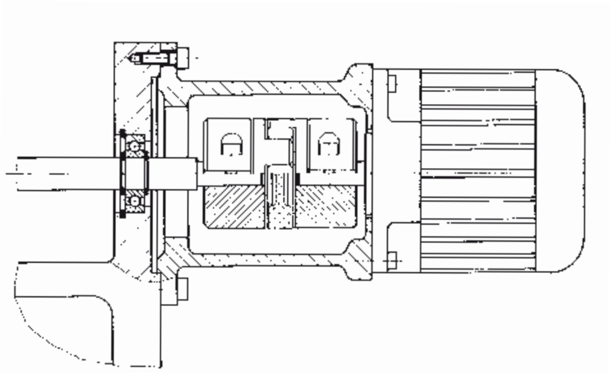


Fig. 10: ROBA®-ES with clamping hubs

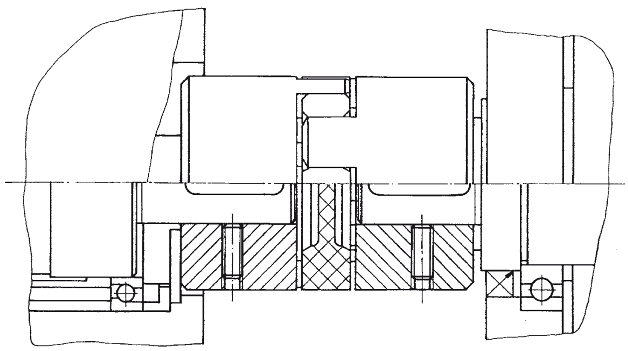


Fig. 11: ROBA®-ES with keyways

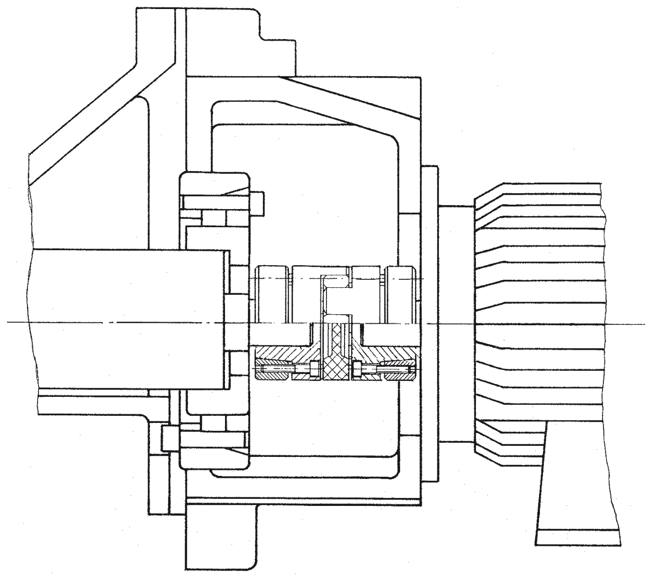


Fig. 12: ROBA®-ES with shrink disks

ROBA®-ES Coupling Dimensioning

1. Approximate calculation of the coupling torque:

1.1. **T_N from the nominal power**

$$T_N = \frac{9550 \times P_{AN/LN}}{n}$$

1.2. **Dynamic torques T_S and T_W (5.1 and 5.2):**

Input-side excitation:

Peak torque: $$T_S = T_{AS} \times \frac{J_L}{J_A + J_L} \times S_A$$

Alternating torque: $$T_W = T_{AW} \times \frac{J_L}{J_A + J_L} \times V_R$$

Load-side excitation:

Peak torque: $$T_S = T_{LS} \times \frac{J_A}{J_A + J_L} \times S_L$$

Alternating torque: $$T_W = T_{LW} \times \frac{J_A}{J_A + J_L} \times V_R$$

2. Comparison of torques occurring in the coupling with the permitted torques

The coupling must be dimensioned so that the loads occurring do not exceed the permitted values in any operating condition.

2.1. **Load due to nominal torque**

$$T_{KN} \geq T_N \times S_\delta$$

2.2. **Load due to torque impacts (5.3)**

$$T_{K\,max} \geq T_S \times S_Z \times S_\delta + T_N \times S_\delta$$

2.3. **Load due to resonance passing through (5.4)**

$$T_{K\,max} \geq T_S \times S_Z \times S_\delta \times V_R + T_N \times S_\delta$$

2.4. **Load due to constantly alternating torque – cycle operation (5.5 and 5.6)**

Permitted alternating torque on coupling:

$T_{KW} = 0{,}25 \times T_{KN}$ (for aluminium hubs)

$T_{KW} = 0{,}35 \times T_{KN}$ (for steel hubs)

$$T_{KW} \geq T_W \times S_\delta \times S_f$$

3. Inspection of permitted misalignments

$$\Delta K_a \geq \Delta W_a \times S_\delta$$

$$\Delta K_r \geq \Delta W_r \times S_\delta \times S_n$$

$$\Delta K_w \geq \Delta W_w \times S_\delta \times S_n$$

If more than one kind of misalignment occurs at the same time, please observe Fig. 8 (page 12).

4. Frictional locking inspection on hub connection

$T_R > T_{max}$: T_{max} is the maximum torque occurring in the coupling.

Values for T_R can be found on pages 10 and 11.

5. Explanations

5.1. The torque determination on the coupling is applicable if the shaft coupling in the system is the torsionally softest element, and therefore the system can be considered as a double-mass oscillator. If this is not the case, the calculation of the torque on the coupling requires a more detailed calculation procedure.

5.2. The impact factors S_A / S_L describe the impact progression. A rectangular progression of the impact torque is the heaviest impact (S_A/S_L=2,0). A flat sinus progression of the impact torque is a light impact (S_A/S_L=1,2).

5.3. T_S, the peak torque in the coupling, is the maximum torque on the coupling during the impact minus the system torque having an effect on the coupling during normal operation.

$T_S = T_{max,\,impact} - T_N$

5.4. If a drive is operated supercritically, meaning that the operating speed n lies above the resonance speed n_R, then resonance passing through causes particular loads.
If the resonance passes through quickly below the operating speed, only a few resonance peaks occur. The alternating torque in resonance can therefore be compared to the maximum torque on the coupling (see also 5.6)

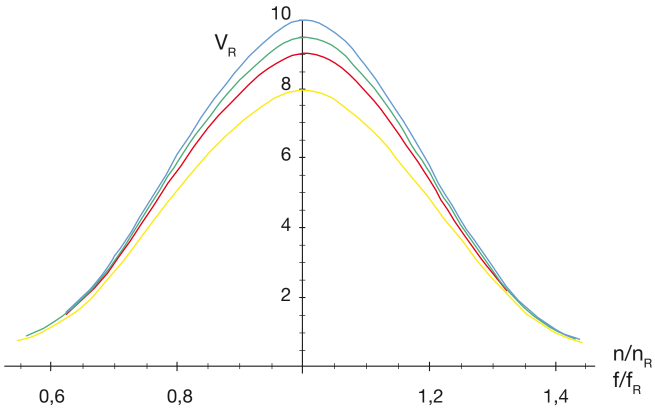
5.5. S_f takes the frequency dependency of lifetime into account. The frequency dependency is first taken into account above 5 Hz.

5.6. On appreciable vibration excitation, the resonance must be moved out of the operating range by selecting a suitable torsional spring rigidity of the coupling.

ROBA®-ES Coupling Dimensioning

Service Factors for Coupling Dimensioning

V_R = Resonance factor



Blue: elast. element 80 Sh A

Yellow: elast. element 92 Sh A

Red: elast. element 98 Sh A

Green: elast. element 64 Sh D

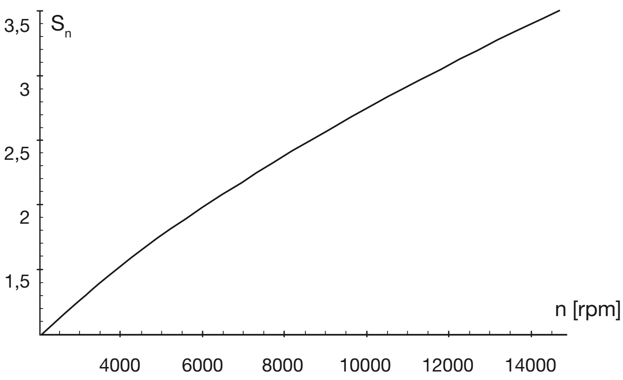
n_R = Resonance speed

$$n_R = \frac{30}{\pi} \sqrt{C_{T\,dyn.} \frac{J_A + J_L}{J_A x J_L}} \text{ [rpm]}$$

f_R = Resonance frequency

$$f_R = \frac{1}{2\pi} \sqrt{C_{T\,dyn.} \frac{J_A + J_L}{J_A x J_L}} \text{ [Hz]}$$

S_n = Speed factor



S_f = Frequency factor

f in H_z	≤ 5	> 5
S_f	1	$\sqrt{\frac{f}{5}}$

f shows the load alternation per second (Hz = s^{-1})

S_z = Start-up factor/impact frequency

S/h	0 – 100	101 – 200	201 – 400	401 – 800	801 – 1600
S_z	1	1,2	1,4	1,6	1,8

S_δ = Safety factor for temperature

T [°C]	-30 °C / +30 °C	+60 °C	+90 °C
S_δ	1	1,5	2

S_L or S_A = Impact factor

Impacts	S_A or S_L
Light impacts	1,2
Medium impacts	1,6
Heavy impacts	2,0

Terms

$P_{AN/LN}$	[kW]	Input-side/load-side power
T_R	[Nm]	Transmittable torque (frictional locking, Tables pages 10,11)
$T_{AS/AW}$	[Nm]	Excitational torque input-side
$T_{LS/LW}$	[Nm]	Excitational torque load-side
T_N	[Nm]	System torque
T_W	[Nm]	System alternating torque
T_S	[Nm]	Peak torque
T_{max}	[Nm]	Maximum torque in the coupling
T_{KN}	[Nm]	Permitted nominal torque
T_{Kmax}	[Nm]	Permitted maximum torque
T_{KW}	[Nm]	Permitted permanent alternating torque
J_A	[kgm²]	Mass moment of inertia, input-side
J_L	[kgm²]	Mass moment of inertia, load-side
ΔK_a	[mm]	Permitted axial displacement
ΔK_r	[mm]	Permitted radial misalignment
ΔK_w	[°]	Permitted angular misalignment
ΔW_a	[mm]	Axial shaft displacement
ΔW_r	[mm]	Radial shaft misalignment
ΔW_w	[°]	Angular shaft misalignment
c_T	[Nm/rad]	Torsional spring rigidity
n	[rpm]	Nominal speed
n_R	[rpm]	Resonance speed
$S_{A/L}$	[-]	Impact factor input-side/load-side
S_n	[-]	Speed factor
S_Z	[-]	Start-up factor/impact frequency
S_δ	[-]	Temperature factor
S_f	[-]	Frequency factor
V_R	[-]	Resonance factor
f	[1/s]=[Hz]	Load factor
f_R	[Hz]	Resonance frequency

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08/08/2013 SC