Installation and Operational Instructions for ROBA®-ES Couplings Type 94_._ _ _._ Sizes 14 – 65 (B.9.6.EN)

Please read these Operational Instructions carefully and follow them accordingly!

Ignoring these Instructions may lead to malfunctions or to coupling failure, resulting in damage to other parts.
These Installation and Operational Instructions (I + O) are part of the coupling delivery.
Please keep them handy and near to the coupling at all times.

The product must be specially marked for use in areas where there is a danger of explosion.
The product will only be marked if it is ordered especially for an Ex-area.

Contents:

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Safety and Guideline Signs

DANGER

Immediate and impending danger, which can lead to severe physical injuries or to death.

CAUTION

Danger of injury to personnel and damage to machines.

Please Observe!
Guidelines on important points.

Guidelines on explosion protection

Safety Regulations

These Installation and Operational Instructions (I + O) are part of the coupling delivery.
Please keep them handy and near to the coupling at all times.

It is forbidden to start initial operation of the product until you have ensured that all applicable EU directives and directives for the machine or system, into which the product has been installed, have been fulfilled.
At the time these Installation and Operational Instructions go to print, the ROBA®-ES couplings accord with the known technical specifications and are operationally safe at the time of delivery.

DANGER

- ❒ If the ROBA®-ES couplings are modified.
- ❒ If the relevant standards for safety and / or installation conditions are ignored.

Some ROBA®-ES coupling series Types are permitted for use in areas where there is a danger of explosion (see page 21).
For application in Ex-areas, please observe the special safety-related guidelines and directives. The product must be especially marked for this area.
The product will only be marked if it is ordered especially for an Ex-area.

User-implemented Protective Measures

- ❒ Cover all moving parts to protect against seizure, dust impacts or foreign body impact.

To prevent injury or damage, only specialist personnel are allowed to work on the components. They must be familiar with the dimensioning, transport, installation, initial operation, maintenance and disposal according to the relevant standards and regulations.
Please read the Installation and Operational Instructions carefully prior to installation and initial operation of the device.

These Safety Regulations are user hints only and may not be complete!

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Summary of Constructional Designs

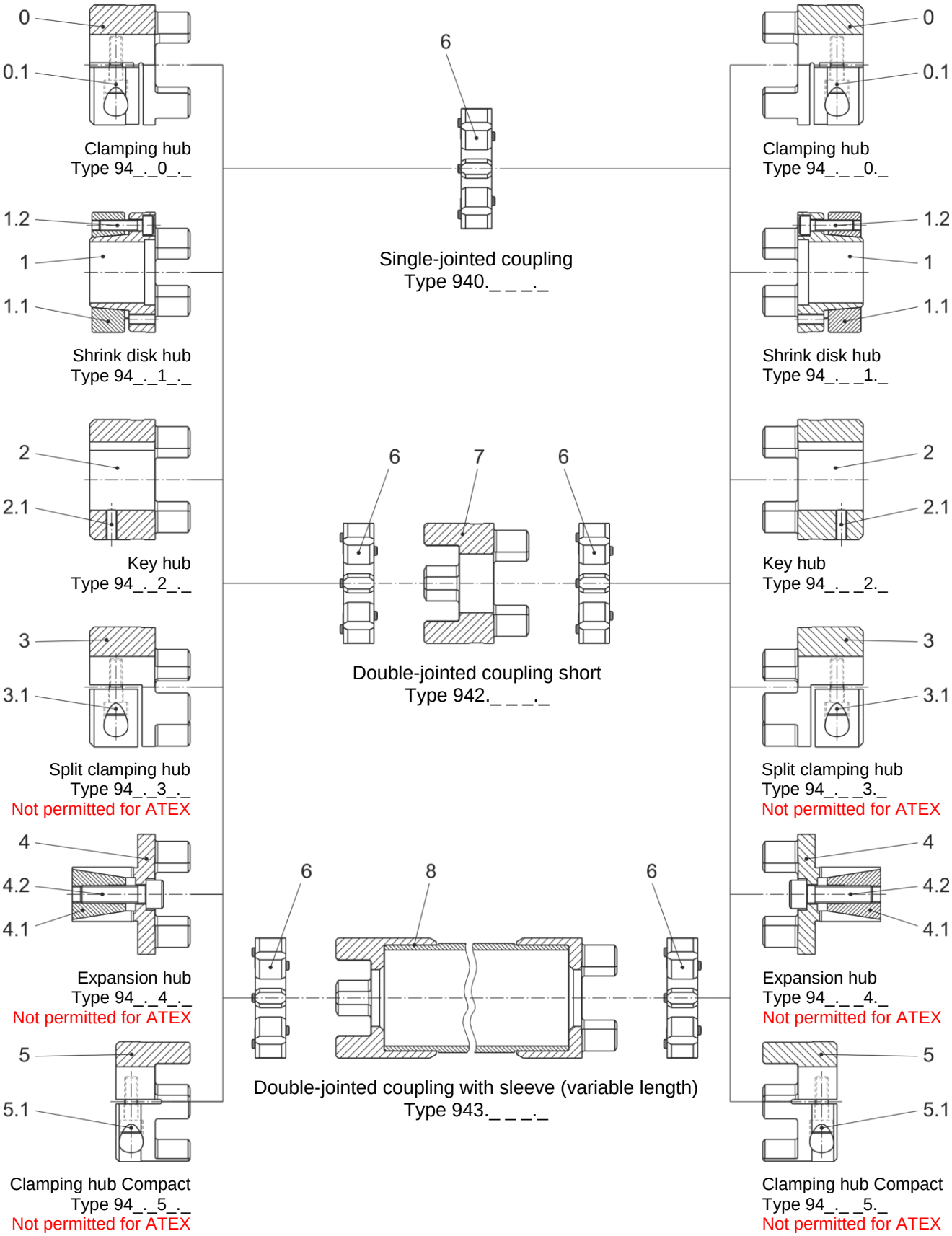

Fig. 1

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Parts List

Only use *mayr®* original parts

Item	Name	
0	Clamping hub Type 94_._00._	
0.1	Clamping screw Type 94_._00._	
1	Shrink disk hub assembly Type 94_._11._	
1.1	Shrink disk	
1.2	Tensioning screw Type 94_._11._	
2	Hub with keyway Type 94_._22._	
2.1	Set screw (adjusting screw)	
3	Split clamping hub Type 94_._33._	
3.1	Clamping screw Type 94_._33._	
4	Expansion hub assembly Type 94_._44._	
4.1	Tensioning cone	
4.2	Tensioning screw Type 94_._44._	
5	Clamping hub Compact Type 94_._55._	
5.1	Clamping screw Type 94_._55._	
6	Elastomeric element Elastomeric element Elastomeric element Elastomeric element Elastomeric element	98 Sh A (red) 92 Sh A (yellow) 80 Sh A (blue) 72 Sh D (grey) 64 Sh D (green)
7	Connection piece	
8	Sleeve	

Function - Application

ROBA®-ES stands for:
flexible (E), backlash-free (S) shaft coupling.

The coupling consists of (see Fig. 1)

- two coupling hubs and an elastomeric element (flexible, star-shaped intermediate ring) as a single-jointed coupling (Type 940._ _ _._)
- two coupling hubs, two elastomeric elements and a connection piece as a double-jointed coupling short (Type 942._ _ _._)
- two coupling hubs, two elastomeric elements and a sleeve with variable length as a double-jointed coupling (Type 943._ _ _._)

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.

ROBA®-ES couplings are shaft-shaft connections for flexible, backlash-free torque transmission in highly dynamic servo drives.

State of Delivery

ROBA®-ES couplings are delivered manufacturer-assembled ready for installation (Please check state of delivery).
Depending on size or Type, ROBA®-ES coupling hubs are made of aluminum or steel.
ROBA®-ES couplings with steel hubs and steel shrink disks have been zinc phosphated manufacturer-side to form a basic corrosion protection. All other components are untreated.
The hubs acc. DIN 69002 are blank and oiled.
The flexible, star-shaped intermediate ring (elastomeric element) is pressed into specially designed claws (Fig. 3) under light pre-tension.

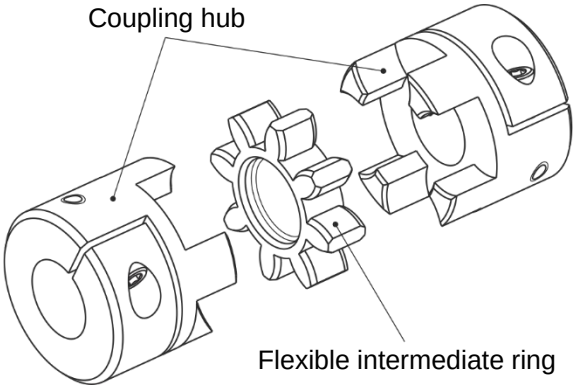

Fig. 2

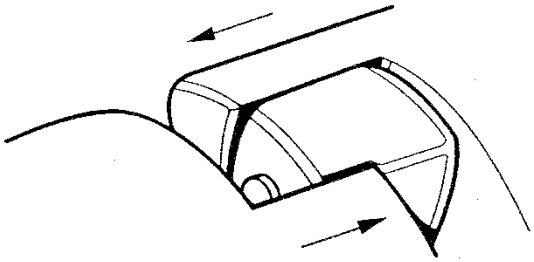

Fig. 3

Storage

The coupling hubs are delivered preserved and can be stored in dry rooms protected from the weather for 6 to 9 months .
If stored as stated below, the properties of the elastomeric elements (elastomers) are retained unchanged for up to 5 years.

Damp storage rooms are not suitable.
In order to exclude condensation, the relative air humidity should ideally total maximum 65 %.
There must be no ozone-generating equipment, for example fluorescent light sources, mercury vapor lamps or electrical high voltage devices in the storage rooms.

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Table 1: Technical Data for Design with Clamping Hub (Item 0 / Fig. 1)

Size	14	19	24	28	38	42	48	55	65
Minimum bore [mm]	6	10	15	19	20	28	35	40	45
Maximum bore [mm]	15	20	28	35	45	50	55	70	80
Maximum speed [rpm]	12600	9300	7000	5600	4700	4000	3700	3300	3000
Clamping screw thread	M3	M6	M6	M8	M8	M10	M12	M12	M14
Clamping screw tightening torques [Nm]	1.4	10	10	25	25	70	120	120	200

	Bores on clamping hubs and respective frictionally-locking transmittable torques T_R [Nm] **Suitable for F7 / k6** (with larger fit clearance, the transmittable torque is reduced)																	
Size	**Ø 6**	**Ø 7**	**Ø 8**	**Ø 9**	**Ø 10**	**Ø 11**	**Ø 12**	**Ø 14**	**Ø 15**	**Ø 16**	**Ø 19**	**Ø 20**	**Ø 22**	**Ø 24**	**Ø 25**	**Ø 28**	**Ø 30**	**Ø 32**	**Ø 35**
14	2.5	3.0	3.4	3.8	4.2	4.7	5.1	6.0	6.4	-	-	-	-	-	-	-	-	-	-
19	-	-	-	-	23	25	27	32	34	36	43	45	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	34	36	43	45	50	54	57	63	-	-	-
28	-	-	-	-	-	-	-	-	-	-	79	83	91	100	104	116	124	133	145
38	-	-	-	-	-	-	-	-	-	-	-	83	91	100	104	116	124	133	145
42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	208	228	248	280
48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	350
55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Size	**Ø 38**	**Ø 40**	**Ø 42**	**Ø 45**	**Ø 48**	**Ø 50**	**Ø 52**	**Ø 55**	**Ø 58**	**Ø 60**	**Ø 62**	**Ø 65**	**Ø 68**	**Ø 70**	**Ø 72**	**Ø 75**	**Ø 78**	**Ø 80**
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
38	158	166	174	187	-	-	-	-	-	-	-	-	-	-	-	-	-	-
42	315	340	365	404	442	470	-	-	-	-	-	-	-	-	-	-	-	-
48	390	420	455	505	560	600	640	705	-	-	-	-	-	-	-	-	-	-
55	-	340	365	405	435	465	490	525	570	600	625	665	700	740	-	-	-	-
65	-	-	-	545	590	630	662	710	764	800	840	900	954	990	1032	1095	1158	1200

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Table 2: Technical Data for Design with Shrink Disk Hub (Item 1 / Fig. 1)
Type 94_._ _ _.P (Steel Design)

Size		14-32	19-37.5	19	24-50	24	28	38
Minimum bore	[mm]	6	10	10	15	15	19	20
Maximum bore	[mm]	14	16	20	24	28	38	45
Bore acc. DIN 69002	[mm]	14	16	19	24	25	35	-
Maximum speed	[rpm]	28000	21000	21000	15500	15500	13200	10500
Tensioning screw thread		4 x M3	6 x M4	6 x M4	4 x M5	4 x M5	8 x M5	8 x M6
Tensioning screw tightening torques	[Nm]	1.3	3.0	3.0	6.0	6.0	6.0	10

Size	**Bores on steel shrink disk hubs and respective frictionally-locking transmittable torques T_R [Nm]** **Suitable for H6 / k6** (with larger fit clearance, the transmittable torque is reduced)											
	Ø 6	**Ø 7**	**Ø 8**	**Ø 9**	**Ø 10**	**Ø 11**	**Ø 12**	**Ø 14**	**Ø 15**	**Ø 16**	**Ø 17**	**Ø 18**
14-32	4	8	11.5	15	19.5	23.5	10.5	21.5	-	-	-	-
19-37.5	-	-	-	-	17	25	35	59	72	85	-	-
19	-	-	-	-	7	13	22	44	56	68	81	94
24-50	-	-	-	-	-	-		-	18	29	42	54
24	-	-	-	-	-	-		-	-	20	31	43
28	-	-	-	-	-	-		-	-	-	-	-
38	-	-	-	-	-	-		-	-	-	-	-

Size	**Ø 19**	**Ø 20**	**Ø 22**	**Ø 24**	**Ø 25**	**Ø 28**	**Ø 30**	**Ø 32**	**Ø 35**	**Ø 38**	**Ø 40**	**Ø 42**	**Ø 45**
14-32	-	-	-	-	-	-	-	-	-	-	-	-	-
19-37.5	-	-	-	-	-	-	-	-	-	-	-	-	-
19	106	120	-	-	-	-	-	-	-	-	-	-	-
24-50	66	79	109	139	-	-	-	-	-	-	-	-	-
24	54	67	95	124	139	186	-	-	-	-	-	-	-
28	71	91	134	179	203	277	329	375	460	548	-	-	-
38	-	-	111	165	193	282	346	395	500	608	685	761	879

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Table 3: Technical Data for Design with Shrink Disk Hub (Item 1 / Fig. 1)
Type 94_._ _ _.F (Steel Design)

Size		42	48	55	65
Minimum bore	[mm]	28	35	40	45
Maximum bore	[mm]	50	60	70	75
Maximum speed	[rpm]	9000	8000	6300	5600
Tensioning screw thread		4 x M8	4 x M10	4 x M10	4 x M12
Tensioning screw tightening torques	[Nm]	30	52	58	100

Size	Bores on steel shrink disk hubs and respective frictionally-locking transmittable torques T_R [Nm] **Suitable for H7 / k6** (with larger fit clearance, the transmittable torque is reduced)									
	Ø 28	**Ø 30**	**Ø 32**	**Ø 35**	**Ø 38**	**Ø 40**	**Ø 42**	**Ø 45**	**Ø 48**	**Ø 50**
42	215	285	330	450	570	655	745	875	1010	1105
48	-	-	-	475	620	720	820	980	1150	1265
55	-		-	-	-	555	655	825	1000	1120
65	-	-	-	-	-	-	-	1195	1425	1595

Size	**Ø 52**	**Ø 55**	**Ø 58**	**Ø 60**	**Ø 62**	**Ø 65**	**Ø 68**	**Ø 70**	**Ø 72**	**Ø 75**
42	-	-	-	-	-	-	-	-	-	-
48	1350	1530	1720	1840	-	-	-	-	-	-
55	1245	1430	1625	1755	1890	2090	2295	2435	-	-
65	1680	1945	2210	2395	2575	2855	3140	3330	3525	3825

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Table 4: Technical Data for Design with Shrink Disk Hub (Item 1 / Fig. 1)
Types 94_._ _ _.A (Aluminum Designs)

Size	14	19	24	28	38
Minimum bore [mm]	6	10	15	19	20
Maximum bore [mm]	14	20	28	38	45
Maximum speed [rpm]	28000	21000	15500	13200	10500
Tensioning screw thread	4 x M3	6 x M4	4 x M5	8 x M5	8 x M6
Tensioning screw tightening torques[Nm]	1.3	3.0	6.0	6.0	10

Size	**Bores on aluminum shrink disk hubs and respective frictionally-locking transmittable torques T_R [Nm]** **Suitable for H7 / k6** (with larger fit clearance, the transmittable torque is reduced)												
	Ø 6	**Ø 7**	**Ø 8**	**Ø 9**	**Ø 10**	**Ø 11**	**Ø 12**	**Ø 14**	**Ø 15**	**Ø 16**	**Ø 17**	**Ø 18**	**Ø 19**
14	13.5	16.5	19.0	22.5	19.0	22.5	26.5	34.5	-	-	-	-	-
19	-	-	-	-	41	48	58	77	87	88	107	117	126
24	-	-	-	-	-	-	-	-	67	78	89	100	109
28	-	-	-	-	-	-	-	-	-	-	-	-	194
38	-	-	-	-	-	-	-	-	-	-	-	-	-

Size	**Ø 20**	**Ø 22**	**Ø 24**	**Ø 25**	**Ø 28**	**Ø 30**	**Ø 32**	**Ø 35**	**Ø 38**	**Ø 40**	**Ø 42**	**Ø 45**
14	-	-	-	-	-	-	-	-	-	-	-	-
19	136	-	-	-	-	-	-	-	-	-	-	-
24	121	143	166	178	212	-	-	-	-	-	-	-
28	214	255	296	317	381	423	462	528	594	-	-	-
38	247	299	352	379	463	519	567	653	739	797	855	942

Table 5: Technical Data for Design with Key Hub (Item 2 / Fig. 1)

Size	14	19	24	28	38	42	48	55	65
Minimum bore [mm]	6	6	8	10	12	14	20	20	38
Maximum bore [mm]	15	24	28	38	45	55	60	70	80
Maximum speed [rpm]	19000	14000	10600	8500	7100	6000	5600	5000	4600
Adjusting screw thread (see Fig. 10)	M4	M5	M5	M6	M8	M8	M8	M10	M10
Adjusting screw tightening torques [Nm]	1.5	2	2	4.1	8.5	8.5	8.5	20	20

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Table 6: Technical Data for Design with Split Clamping Hub (Item 3 / Fig. 1)

Size	14	19	24	28	38	42	48	55	65
Minimum bore [mm]	8	8	10	14	18	22	22	40	45
Maximum bore [mm]	15	20	28	35	45	50	55	70	80
Maximum speed [rpm]	12600	9300	7000	5600	4700	4000	3700	3300	3000
Clamping screw thread	M3	M6	M6	M8	M8	M10	M12	M12	M12
Clamping screw tightening torques [Nm]	1.4	10	10	25	25	48	84	84	84

	Bores on split clamping hubs and respective frictionally-locking transmittable torques T_R [Nm] **Suitable for H7 / g6** (with larger fit clearance, the transmittable torque is reduced)																
Size	**Ø 8**	**Ø 9**	**Ø 10**	**Ø 11**	**Ø 12**	**Ø 14**	**Ø 15**	**Ø 16**	**Ø 18**	**Ø 19**	**Ø 20**	**Ø 22**	**Ø 24**	**Ø 25**	**Ø 28**	**Ø 30**	**Ø 32**	**Ø 35**
14	4	4.5	5	5.5	6	7	7.5	-	-	-	-	-	-	-	-	-	-	-
19	18	20	23	25	27	32	34	36	41	43	45	-	-	-	-	-	-	-
24	-	-	23	25	27	32	34	36	41	43	45	50	54	57	63	-	-	-
28	-	-	-	-	-	58	62	66	75	79	83	91	100	104	116	124	133	145
38	-	-	-	-	-	-	-	-	75	79	83	91	100	104	116	124	133	145
42	-	-	-	-	-	-	-	-	-	-	-	144	157	163	183	196	203	229
48	-	-	-	-	-	-	-	-	-	-	-	210	229	239	267	287	306	334
55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Size	**Ø 38**	**Ø 40**	**Ø 42**	**Ø 45**	**Ø 48**	**Ø 50**	**Ø 52**	**Ø 55**	**Ø 58**	**Ø 60**	**Ø 62**	**Ø 65**	**Ø 68**	**Ø 70**	**Ø 72**	**Ø 75**	**Ø 78**	**Ø 80**
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
38	158	166	174	187	-	-	-	-	-	-	-	-	-	-	-	-	-	-
42	248	261	274	294	314	327	-	-	-	-	-	-	-	-	-	-	-	-
48	363	382	401	430	458	478	497	525	-	-	-	-	-	-	-	-	-	-
55	-	382	401	430	458	478	497	525	554	573	592	621	649	669	-	-	-	-
65	-	-	-	430	458	478	497	525	554	573	592	621	649	669	688	716	745	764

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Table 7: Technical Data for Design with Expansion Hub (Item 4 / Fig. 1)

Size	14	19	24	28
Diameter, expansion hub [mm]	12	20	25	35
Maximum speed [rpm]	12600	9300	7000	5600
Tensioning screw thread	M5	M6	M8	M10
Tensioning screw tightening torques [Nm]	5.8	10.1	24	48

Size	Clamping diameter on expansion hubs and respective frictionally-locking transmittable torques T_R [Nm] Suitable for H7 / h7 (with larger fit clearance, the transmittable torque is reduced)			
	Ø 12	Ø 20	Ø 25	Ø 35
14	15	-	-	-
19	-	36	-	-
24	-	-	84	-
28	-	-	-	188

Table 8: Technical Data for Design with Clamping Hub Compact (Item 5 / Fig. 1)

Size	14	19	24	28	38
Minimum bore [mm]	5	8	10	14	15
Maximum bore [mm]	12	20	32	35	45
Maximum speed [rpm]	12600	9300	7000	5600	4700
Clamping screw thread	M4	M6	M6	M8	M10
Clamping screw tightening torques [Nm]	3	10	10	25	48

Size	Bores on clamping hubs Compact and respective frictionally-locking transmittable torques T_R [Nm] Suitable for F7 / k6 (with larger fit clearance, the transmittable torque is reduced)												
	Ø 5	Ø 6	Ø 7	Ø 8	Ø 9	Ø 10	Ø 11	Ø 12	Ø 14	Ø 15	Ø 16	Ø 18	Ø 19
14	5	6	7	8	9	10	11	12	-	-	-	-	-
19	-	-	-	18	20	23	25	27	32	34	36	41	43
24	-	-	-	-	-	23	25	27	32	34	36	41	43
28	-	-	-	-	-	-	-	-	58	62	66	75	79
38	-	-	-	-	-	-	-	-	-	98	105	118	124

Size	Ø 20	Ø 22	Ø 24	Ø 25	Ø 28	Ø 30	Ø 32	Ø 35	Ø 38	Ø 40	Ø 42	Ø 45
14	-	-	-	-	-	-	-	-	-	-	-	-
19	45	-	-	-	-	-	-	-	-	-	-	-
24	45	50	54	57	63	-	-	-	-	-	-	-
28	83	91	100	104	116	124	133	145	-	-	-	-
38	131	144	157	163	183	196	209	229	248	261	274	294

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Table 9: Torques

This concerns rated torques. For exact dimensioning, please observe the transmittable torques of the respective shaft-hub connections as well as the design calculation on pages 24 and 25.

Size	Torque Type 94_._ _ _._									
	Elastomeric element hardness 80 Sh A (blue)		Elastomeric element hardness 92 Sh A (yellow)		Elastomeric element hardness 98 Sh A (red)		Elastomeric element hardness 64 Sh D (green)		Elastomeric element hardness 72 Sh D (grey)	
	T_{KN} [Nm]	$T_{K\,max}$ [Nm]	T_{KN} [Nm]	$T_{K\,max}$ [Nm]	T_{KN} [Nm]	$T_{K\,max}$ [Nm]	T_{KN} [Nm]	$T_{K\,max}$ [Nm]	T_{KN} [Nm]	$T_{K\,max}$ [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	200	400	410	820	685	1370	825	1650		
65	450	900	900	1800	1040	2080	1250	2500		
	Only available as Type 940._11.P									
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		

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Table 10: Permitted Misalignment Values

Size	Permitted Shaft Misalignments										
	Axial	Radial					Angular				
	ΔK_a 80/92/98 Sh A 64/72 Sh D [mm]	ΔK_r 80 Sh A [mm]	ΔK_r 92 Sh A [mm]	ΔK_r 98 Sh A [mm]	ΔK_r 64 Sh D [mm]	ΔK_r 72 Sh D [mm]	ΔK_w 80 Sh A [°]	ΔK_w 92 Sh A [°]	ΔK_w 98 Sh A [°]	ΔK_w 64 Sh D [°]	ΔK_r 72 Sh D [mm]
	Misalignment values on Basic Type 940._ _ _._										
14	1.0	0.21	0.15	0.09	0.06		1.1	1.0	0.9	0.8	
19	1.2	0.15	0.10	0.06	0.04		1.1	1.0	0.9	0.8	
24	1.4	0.18	0.14	0.10	0.07		1.1	1.0	0.9	0.8	
28	1.5	0.20	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	0.10		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	0.28	0.24	0.17	0.12		1.3	1.0	0.9	0.8	
65	2.6	0.3	0.25	0.18	0.13		1.3	1.0	0.9	0.8	
	Only available as Type 940._11.P										
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	0.10	0.06	0.04		1.1	1.0	0.9	0.8	
24-50	1.4	0.18	0.14	0.10	0.07		1.1	1.0	0.9	0.8	
	Permitted shaft misalignments for double-jointed coupling short Type 942._ _ _._										
							per side				
14	2.0	0.42	0.30	0.18	0.12		1.1	1.0	0.9	0.8	
19	2.4	0.30	0.20	0.12	0.08		1.1	1.0	0.9	0.8	
24	2.8	0.36	0.28	0.20	0.14		1.1	1.0	0.9	0.8	
28	3.0	0.40	0.30	0.22	0.16		1.3	1.0	0.9	0.8	
38	3.6	0.44	0.34	0.24	0.18		1.3	1.0	0.9	0.8	
42	4.0	0.48	0.38	0.28	0.20		1.3	1.0	0.9	0.8	
48	4.2	0.52	0.42	0.32	0.22		1.3	1.0	0.9	0.8	
55	4.4	0.56	0.48	0.34	0.24		1.3	1.0	0.9	0.8	
65	5.2	0.60	0.50	0.36	0.26		1.3	1.0	0.9	0.8	
	Permitted shaft misalignments for double-jointed coupling with sleeve Type 943._ _ _._ [1)]										
		$(L_3 - 2 \times l_1 - E) \times A$ (calculation factor)					**per side**				
14	2.0	A = 0.0097	A = 0.0087	A = 0.0079	A = 0.0070	A = ———	1.1	1.0	0.9	0.8	
19	2.4						1.1	1.0	0.9	0.8	
24	2.8						1.1	1.0	0.9	0.8	
28	3.0	A = 0.0113					1.3	1.0	0.9	0.8	
38	3.6						1.3	1.0	0.9	0.8	
42	4.0						1.3	1.0	0.9	0.8	
48	4.2						1.3	1.0	0.9	0.8	
55	4.4						1.3	1.0	0.9	0.8	
65	5.2						1.3	1.0	0.9	0.8	

[1)] Dimensions L3 and l1 see Fig. 4 / page 13

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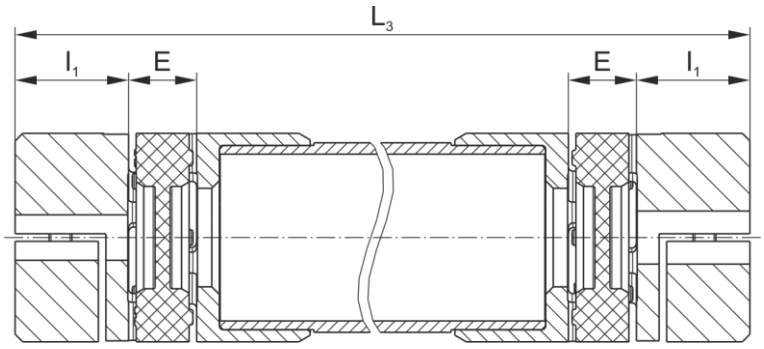

Fig. 4

Table 11: Spring Rigidities [1)]

Size	Static torsional spring rigidity				Dynamic torsional spring rigidity				Static radial 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.]	$C_{T\ dyn.}$ 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.]	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	5100	14200	20500	56300	8300	25800	48200	117400	4730	5680	8200	22500
65	6800	19100	32800	90200	11500	36200	67400	164000	6360	7640	13120	36000
Only available as Type 940._11.P												
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

Relative torsional spring rigidity $C_{T\ H\ rel.}$ of the sleeve [10^6 Nm mm/rad.] for Size								
14	**19**	**24**	**28**	**38**	**42**	**48**	**55**	**65**
0.65	2.18	6.26	11.15	18.11	109.66	254.50	421.75	555.18

[1)] The C_T-value of a double-jointed coupling can be roughly calculated as follows: $C_{T\ ges.} = \frac{1}{\frac{2}{C_r} + \frac{H_S[mm] - 2\ E\ [mm]}{C_{T\ H\ rel.}}}$

Table 12: Elastomeric Element Hardnesses and Permitted Temperature Ranges

Elastomeric element hardness [Shore]	Colour	Permitted temperature range	
		Permanent temperature	Max. temperature
80 Sh A	blue	-50 °C to +80 °C	-60 °C to +120 °C
92 Sh A	yellow	-40 °C to +90 °C	-50 °C to +120 °C
98 Sh A	red	-30 °C to +90 °C	-40 °C to +120 °C
64 Sh D	green	-30 °C to +100 °C	-40 °C to +140 °C
72 Sh D	grey	-20 °C to +110 °C	-60 °C to +150 °C

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Elastomeric Elements (6)

The elastomeric elements (6) are the central element of the ROBA®-ES-coupling. They define the application field as well as the shaft connection behavior 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 (6).

The elastomeric elements are available in different shore hardnesses (see Table 9).

The teeth of the elastomeric element (6) are chamfered at the sides. This makes blind assembly easier.

Agent Resistance – Elastomeric Elements (6)

The elastomeric elements (6) are very resistant against

- pure mineral oils (lubricating oils)
- 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
- aromatic fuels (super/four star petrol).

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

Temperature Resistance – Elastomeric Elements (6)

The ambient temperatures present during operation have a considerable effect on the torque, the rigidity or the damping behavior of the coupling. The permitted temperature ranges according to Table 12 must be maintained.
The temperature influence must be taken into account during coupling dimensioning (pages 24 and 25).

General Installation Guidelines

- The maximum bore diameter according to the Technical Data may not be exceeded.
- The hub bores are usually produced with tolerance H7, and with tolerance F7 for clamping hubs. The required shaft tolerance depends on the hub type used. We recommend the following shaft tolerances:
  - For clamping hubs, shrink disk hubs and key hubs: k6
  - For split clamping hubs: g6
- The recommended bore tolerances are to be produced using the position and tolerance width as references; at the same time, please keep to the shaft run-out tolerance of 0.05 mm to "A" (see Fig. 5).
- After producing the finish bore, please clean it using suitable cleaning agents.
- The shaft surfaces should be finely turned or ground (Ra = 0.8 µm).
- The required yield point for the shafts used is at least 350 N/mm² (St60, St70, C45, C60).

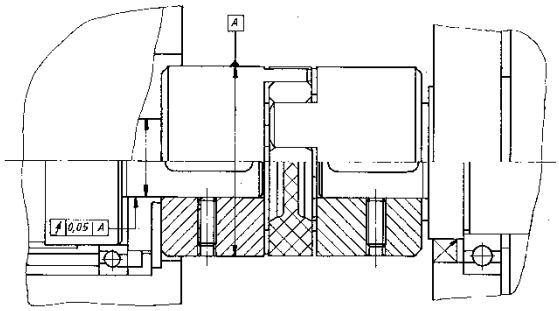

Fig. 5 ROBA®-ES with keyways

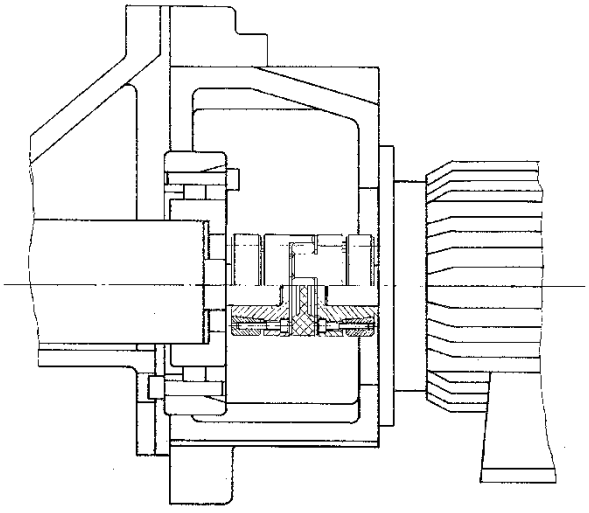

Fig. 6 ROBA®-ES with shrink disk hubs

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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 drive or driven shafts.
Any subsequent screwing together and special housings are not necessary
(see Installation Examples figures 5, 6 and 15).

Installation of the Coupling Halves (Hubs)

Installation of the Clamping Hubs (Item 0 / Fig. 7)

- ❑ The hub bores and the shaft ends must be completely grease-free during installation.
- ❑ Greasy or oily bores or shafts do not transmit the maximum coupling torque.
- ❑ Please make sure that the key sits securely for designs with keyway.
  Please see guideline under ATEX!
- ❑ The clamping hub must be completely relaxed; if necessary, loosen the screws by several thread turns.

1) Mount the coupling hubs (0) onto both shaft ends using a suitable device and bring them into the correct position.
2) Tighten the clamping screw (0.1) using a torque wrench evenly to the required torque acc. Table 1.

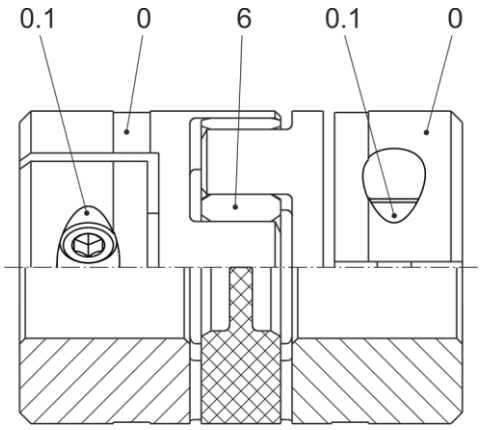

Fig. 7

Installation of the Clamping Hubs Compact (Item 5 / Figs. 8 and 9)

- ❑ The hub bores and the shaft ends must be completely grease-free during installation.
- ❑ Greasy or oily bores or shafts do not transmit the maximum coupling torque.
- ❑ Please make sure that the key sits securely for designs with keyway.
  Please see guideline under ATEX!
- ❑ The clamping hub must be completely relaxed; if necessary, loosen the screws by several thread turns.

On Sizes 14 and 19

1) Mount the coupling hubs (5) onto both shaft ends using a suitable device and bring them into the correct position.
2) Tighten the clamping screw (5.1) using a torque wrench evenly to the required torque acc. Table 8.

On Sizes 24 to 38

1) Mount the coupling hubs (5) onto both shaft ends using a suitable device and bring them into the correct position.
2) Tighten the clamping screws (5.1) alternately and in several tightening sequences to the tightening torque stated in Table 8. Please make sure that the gap "X" (Fig. 9b) has the same size on both hub sides. If necessary, re-adjust it.

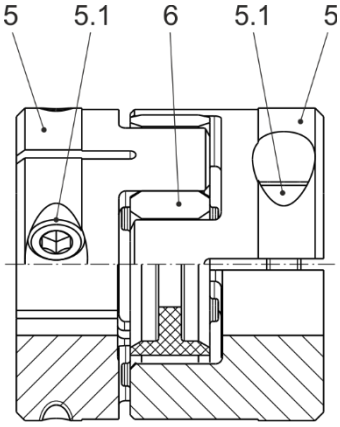

Fig. 8

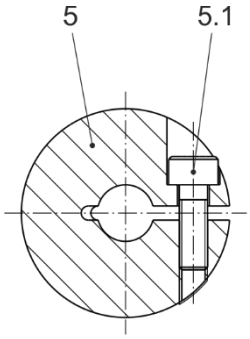

Fig. 9a
Sizes 14 and 19

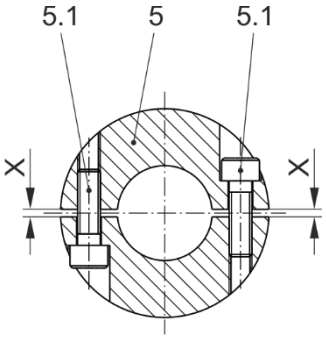

Fig. 9b
Sizes 24 to 38

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Installation of the Shrink Disk Hubs (Item 1 / Fig. 10)

- ❑ The shrink disk hub force is transmitted via frictional locking. The contact surfaces between the shrink disk and the hub are greased manufacturer-side.
- ❑ The hub bores and the shaft ends must be completely grease-free during installation.
- ❑ Greasy or oily bores or shafts do not transmit the maximum coupling torque.
- ❑ Please make sure that the key sits securely for designs with keyway.
  Please see guideline under ATEX!
- ❑ The hub and the shrink disk must be completely relaxed; if necessary, loosen the screws by several thread turns.

1) Mount the coupling hubs (1) onto both shaft ends using a suitable device and bring them into the correct position.
2) Tighten the tensioning screws (1.2) lightly up to contact.
3) Tighten the tensioning screws (1.2) stepwise (in 3 to max. 6 tightening sequences) and cross-wise evenly using a torque wrench to the required torque acc. Table 2, 3 or 4 (dependent on Type).

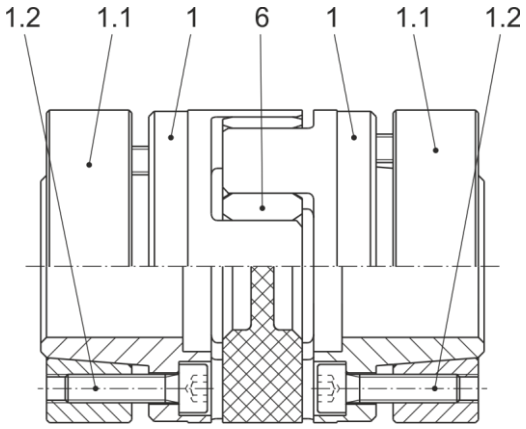

Fig. 10

De-installation of the Shrink Disk Hubs

1) Loosen all tensioning screws (1.2) by several thread turns.
2) Screw out the tensioning screws (1.2) located next to the tapped extracting holes and screw them into the tapped extracting holes up to their limits.
3) Tighten the tensioning screws (1.2) evenly and step-wise so that the shrink disk (1.1) is loosened from the shrink disk hub (1).

Installation of the Coupling Hubs with Keyway (Item 2 / Fig. 11)

- ❑ Please make sure that the key sits securely in the shaft.
  Please see guideline under ATEX!
- ❑ The key must lie over the entire length of the hub.
- ❑ For calculation, please take the yield point as R_p 0.2 for aluminum 200 N/mm^2 and for steel 350 N/mm^2.

1) Mount the coupling hubs (2) onto both shaft ends using a suitable device and bring them into the correct position.
2) Secure the hubs (2) axially. Axial securement takes place via a set screw (adjusting screw Item 2.1, see Fig. 11 and installation example Fig. 5 / page 14).

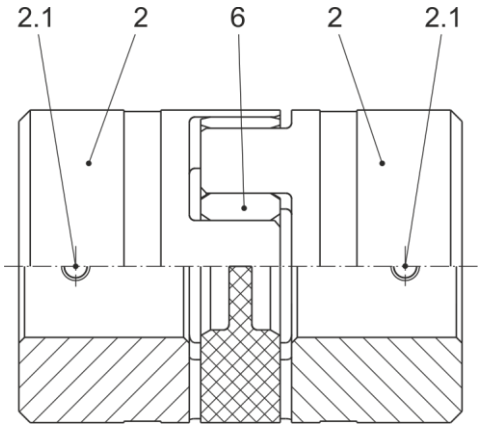

Fig. 11

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Installation of the Split Clamping Hubs (Item 3 / Figs 12 and 13)

- ❑ The hub bores and the shaft ends must be completely grease-free during installation.
- ❑ Greasy or oily bores or shafts do not transmit the maximum coupling torque.
- ❑ Please make sure that the key sits securely for designs with keyway.

1) Mount the coupling hubs (3) onto both shaft ends using a suitable device and bring them into the correct position.

The coupling design with two split clamping hubs (Type 94_._33._) allows a replacement of the elastomeric element / coupling without dismantling the input or output side due to the possibility of radial installation.

2) Tighten the clamping screws (3.1) alternately and in several tightening sequences to the tightening torque stated in Table 6. Please make sure that the gap "X" (Fig. 13) has the same size on both hub sides. If necessary, re-adjust it.

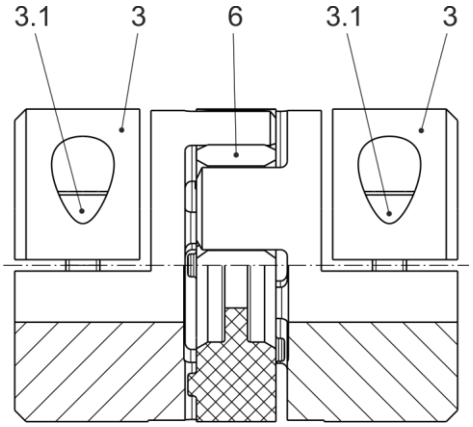

Fig. 12

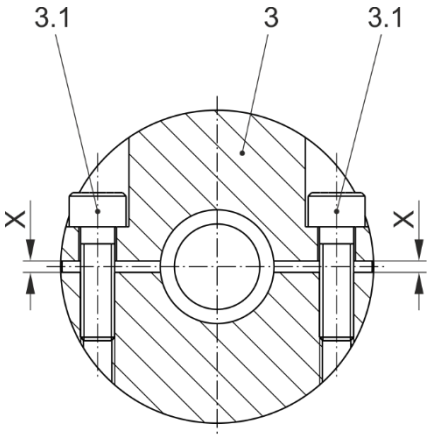

Fig. 13

Installation of the Expansion Hub (Item 4 / Fig. 14)

- ❑ The clamping surfaces and the bores of the hollow shafts must be completely grease-free during installation.
- ❑ Greasy or oily bores or shafts do not transmit the maximum coupling torque.

1) Loosen the tensioning screw (4.2) and the tensioning cone (4.1).
2) Insert the expansion hub (4) with the tensioning screw (4.2) and the tensioning cone (4.1) into the hollow shaft and bring it into the correct position.
3) Tighten the tensioning screw (4.2) using a torque wrench evenly to the required torque acc. Table 7.

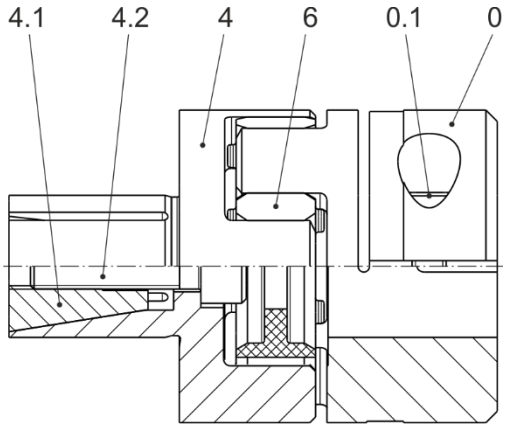

Fig. 14 (Exemplary illustration Type 940.040)

De-installation of the Expansion Hubs

Screw the tensioning screw (4.2) out of the tensioning cone a little way (4.1) so that the tensioning cone (4.1) is loosened.
Should the tensioning cone (4.1) not loosen itself, this can be achieved through a very gentle tap on the screw head.
The tensioning screw (4.2) must be completely removed for de-installation of the tensioning cone (4.1).

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Joining Both Coupling Hubs

Due to the pre-tension on the flexible elastomeric element (6), an axial installation force is required when joining the coupling hubs (Figs. 2 und 3 / page 4).
The force required can be reduced by lightly greasing the elastomeric element.

Use PU-compatible lubricants (e. g. Vaseline or a multi-purpose grease based on mineral oil, NLGI Class 2, with a basic oil viscosity of approx. 200 mm²/s).

After joining both coupling hubs, no axial pressure must be placed on the elastomeric element (6).
Keep to distance dimension “E” acc. Fig. 15 and Table 13!
Please see guideline under ATEX!

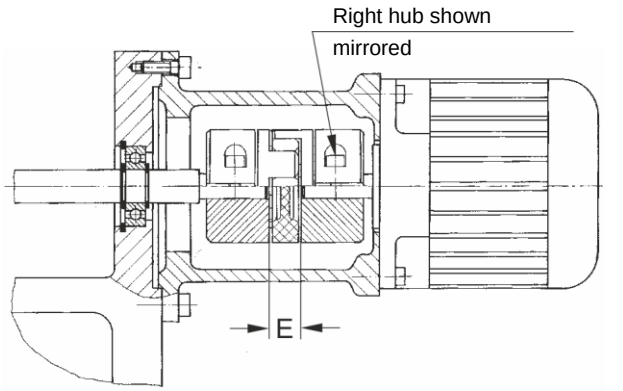


Fig. 15 ROBA®-ES with clamping hubs

Table 13: Distance Dimension "E"

Size	Distance dimension “E” (Fig. 15)
14	13 mm
19	16 mm
24	18 mm
28	20 mm
38	24 mm
42	26 mm
48	28 mm
55	30 mm
65	35 mm

Coupling Alignment

Exact alignment of the coupling increases the coupling service lifetime and reduces the load on the shaft bearings. In most of the applications, coupling alignment using a straight edge in two levels vertical to each other is sufficient.
However, we recommend alignment of the coupling (of the shaft ends) using a dial gauge or laser on drives operating at very high speeds.

Permitted Shaft Misalignments

ROBA®-ES couplings compensate for radial, axial and angular shaft misalignments (Fig. 17) without losing their backlash-free function. However, the permitted shaft misalignments indicated in Table 10 on page 12 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. 16.
The sum total of the actual misalignments in percent of the maximum value must not exceed 100 % (see example and Fig. 16).
The permitted misalignment values given in Table 10 refer to coupling operation at nominal torque, an ambient temperature of +30 °C and an operating speed of 1500 rpm. If the coupling is operated in other or more extreme operating conditions, please contact the manufacturers.

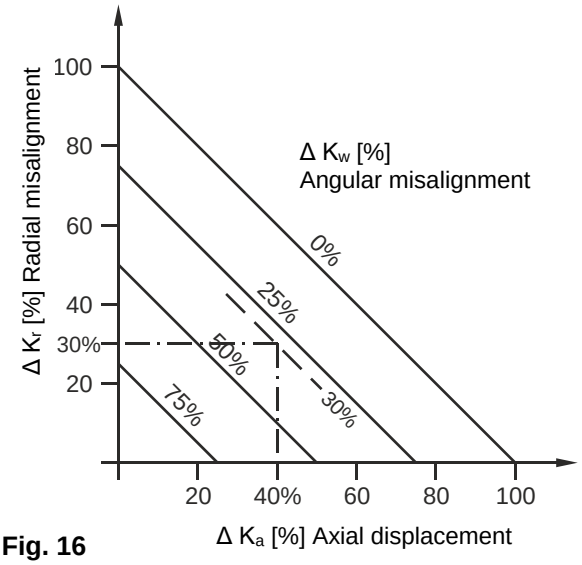
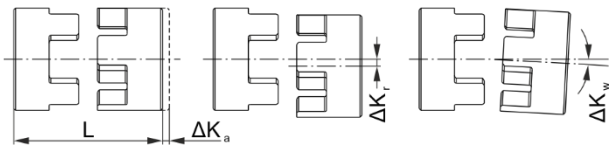


Fig. 16

Example:

ROBA®-ES, Size 24, Type 940.000.A
Axial displacement occurrence ΔK_a = 0.56 mm equals 40 % of the permitted maximum value ΔK_a = 1.4 mm.
Angular misalignment occurrence ΔK_w = 0.27° equals 30 % of the permitted maximum value ΔK_w = 0.9°.
=> permitted radial misalignment ΔK_r = 30 % of the maximum value ΔK_r = 1.0 mm
=> ΔK_r = 0.3 mm



Axial displacement | Radial misalignment | Angular misalignment

Fig. 17

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Permitted Speeds (Critical Bending Speed) for Designs with Sleeve (Type 943._ _ _._)

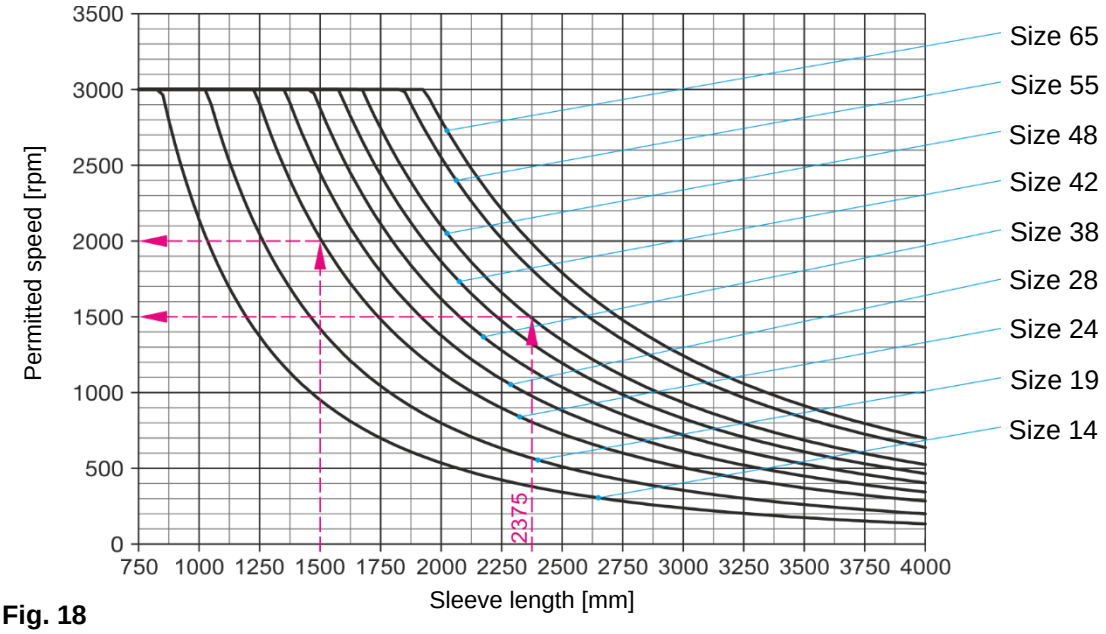

Fig. 18

Examples:

ROBA®-ES, Size 48 with sleeve length **H_S = 2375 mm** => Permitted speed: **1500 rpm**

ROBA®-ES, Size 24 with sleeve length **H_S = 1500 mm** => Permitted speed: **2000 rpm**

Using the coupling at high speeds

- Please keep to the maximum speeds defined in the catalogue. Higher speeds are only permitted after contacting the manufacturers.
- Please operate designs with sleeve (9) at subcritical levels.
- Both hub variants clamping hub (0/5) and split clamping hub (3) may only be used within a limited speed range.
  At very high speeds, shrink disk hubs (1) and key hubs (2) with press fit should be used.
- We recommend balancing the coupling in individual parts or complete.
- Shafts misalignments should be kept as low as possible for smoother system running.
- When using double cardanic shafts, axial animation of the middle coupling part is possible due to operating speed and misalignment. In order to avoid this animation, please minimise the shaft misalignment.

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Balancing the Coupling

- **Clamping hubs (0/5), key hubs (2), split clamping hubs (3) and expansion hubs (4)** rotate at maximum speed with a circumferential speed of 30 m/s.
  They are not balanced for standard delivery.
- **Shrink disk hubs (1) made of steel and aluminum** maintain balance quality G = 6.3 up to speed n_G (equals approx. 20 m/s) without needing to be balanced. Above this speed, we recommend balancing. The hubs are balanced individually. The diagram (Fig. 19) shows reference values. We recommend you use these values to balance the coupling components.

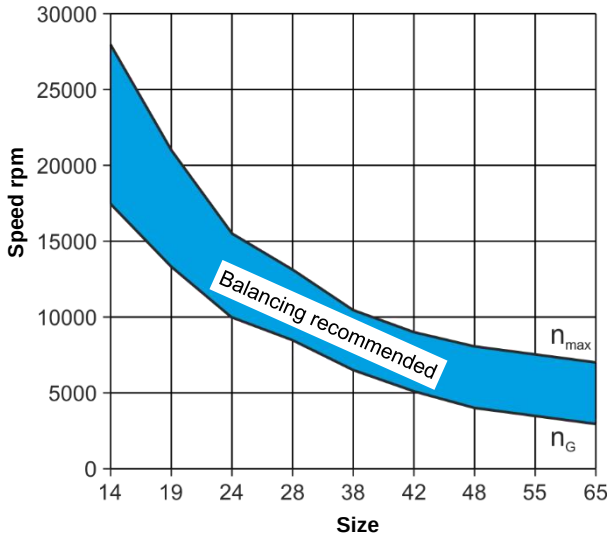

Fig. 19 (Balancing the shrink disk hubs)

Smooth running of the machine is not only ensured by the coupling balance quality, but is also influenced by parameters such as rigidity and distance to the adjacent bearings as well as by the sensitivity and mass of the entire construction.
Figure 19, therefore, only shows reference values as recommendations for balancing.

Maintenance

The following maintenance and inspection intervals are to be maintained:

1.) Visual inspection. Inspection of the installation parameters (misalignment and tightening torques) and the coupling running behavior **before initial operation.**

2.) Check the tightening torques produced **after 5 to 10 operating hours.**

3.) Visual inspection, torsional backlash and elastomer wear, inspection of the misalignment and the tightening torques, coupling running behavior **after 1000 h, at the latest after 3 months.**

4.) If no irregularities or wear are found during the maintenance and inspection interval defined in point 3.), further inspection intervals can, with unchanged operating parameters, take place **after 4000 operating hours or after maximum 12 months.**

5.) Replacement of the elastomeric element **after 5 years.**

In extreme coupling ambient or operating conditions, the maintenance and inspection intervals should be shortened.

Elastomer wear limit:

Elastomeric elements are parts subject to wear, which change their characteristics depending on the ambient conditions and loads.
The maximum operating time for the elastomer is 5 years.

No abraded particles are allowed on the elastomeric element (6), as the ROBA®-ES is a backlash-free coupling. The gap between two claws must be filled with the elastomer, with no room for backlash.
You should not be able to insert a feeler gauge with a thickness of 0.1 mm (Fig. 20).

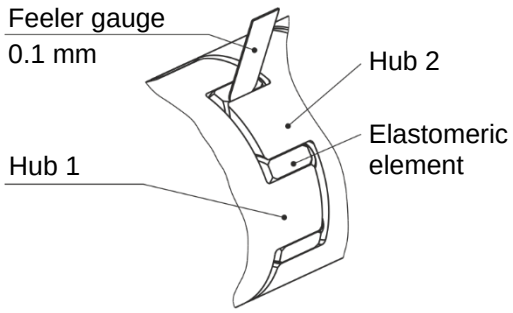

Fig. 20

If wear or damages are detected, the affected components must be replaced immediately and the cause of the malfunction must be determined.

Causes of malfunctions could be:

a) Excessive misalignment
b) Excessive load (load alternations, start-up impacts, overload)
c) Ambient influences

Wear or damage on the ROBA®-ES coupling manifest themselves as:

a) Noise development
b) Troubled running behavior, vibration occurrences
c) Formation of cracks on the components
d) Warming
e) Loosening of the components
f) Friction tracks

Should any irregularities occur, the system must be stopped independently of imminent maintenance and inspection intervals, and the cause of the malfunction must be determined using the Malfunctions / Breakdowns Table.

Disposal

All steel components:
Steel scrap (Code No. 160117)

All aluminum components:
Non-ferrous metals (Code No. 160118)

Elastomer:
Plastic (Code No. 160119)

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Guidelines and Directives for Operation in Ex Areas Where There is a Danger of Explosion

Classification of Ex Areas Where There is a Danger of Explosion and Permitted Types According to the Directive 2014/34/EU

For the implementation of the Directive, the ignition protection type “c” (constructional safety) has been applied in accordance with DIN EN ISO 80079-36/37/38 and the letter "h" has been recorded in the classification.

Key designs:

Dimensioning according to the requirements shaft diameter, transmittable torque and operating conditions must be carried out. To do this, the corresponding user data must be known or the user must carry out the dimensioning in accordance with the valid calculation basis (e.g. DIN 6892) for key connections and the permitted voltage values common in mechanical engineering.
For the calculation, please take the yield point $Rp_{0.2}$ = 200 N/mm² for aluminum and the yield strength R_e = 350 N/mm² for steel.
During initial operation, please make sure that the key is inserted correctly and that the coupling and the key are secured axially.
According to the described coupling combinations and if the measures and guidelines described in the Installation and Operational Instructions are observed, the ROBA®-ES is suitable for use in areas where there is a danger of explosion according to the category:

Ex II 2G Ex h IIC T4/T5/T6
-30°C ≤ Ta ≤ +80/60/45°C Gb

CE Ex II 2D Ex h IIIC T110°C
-30°C ≤ Ta ≤ +80/60/45°C Db

Ex I M2 Ex h I Mb

Permitted Types: 94_.022._ / 94_.122._ / 94_.522._ / 94_.622._
If the frictionally-locking hub types listed below are designed with additional key connections, they also accord with the category described here.

Couplings with a frictionally-locking shaft-hub connection:
These designs are in the standard design suitable for application in areas where there is a danger of explosion according to the category:

CE Ex II 3G Ex h IIC T4/T5/T6
-30°C ≤ Ta ≤ +80/60/45°C Gc

Ex II 3D Ex h IIIC T110°C
-30°C ≤ Ta ≤ +80/60/45°C Dc

Permitted Types: 94_.000._ / 94_.100._ / 94_.500._ / 94_.600._
94_.001._ / 94_.101._ / 94_.501._ / 94_.601._
94_.002._ / 94_.102._ / 94_.502._ / 94_.602._
94_.011._ / 94_.111._ / 94_.511._ / 94_.611._
94_.012._ / 94_.112._ / 94_.512._ / 94_.612._

The values specified in Tables 1 to 4 for transmittable torques for clamping hubs and shrink disk hubs must be observed.
For the bore diameters shown in Table 14, an additional keyway can be used in these designs for secure torque transmission. Furthermore, secure torque transmission is guaranteed if the respective customer-side application constellation is checked as to whether the torque transmission capability of the shaft-hub connection can be sufficiently guaranteed (at least 1.5 to the maximum torque on the system). This inspection must be repeated at regular intervals during maintenance work (see Maintenance).
In these conditions, coupling application is possible in the following areas:

CE Ex II 2G Ex h IIC T4/T5/T6
-30°C ≤ Ta ≤ +80/60/45°C Gb X

Ex II 2D Ex h IIIC T110°C
-30°C ≤ Ta ≤ +80/60/45°C Db X

The X at the end of the classification refers to the operating conditions for an inspection of the transmission reliability of the frictionally-locking shaft-hub connection.
Without this inspection, this classification is rendered invalid.

Table 14

Type	Bore [mm]	Size				
		14	**19**	**24**	**28**	**38**
94_._00._	d_{min}	6	10	15	19	20
	d_{max}	15	20	28	35	45
94_._11._	d_{min}	6	10	15	19	20
	d_{max}	12	18	22	32	36

Type	Bore [mm]	Size			
		42	**48**	**55**	**65**
94_._00._	d_{min}	28	35	40	45
	d_{max}	45	55	70	80
94_._11._	d_{min}	28	35	40	45
	d_{max}	42	52	58	63

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Guidelines and Directives for Operation in Ex Areas Where There is a Danger of Explosion

Conditions to Observe in Ex Areas Where There is a Danger of Explosion

For malfunction-free and wear-minimized coupling operation it is necessary to keep to the coupling characteristic values (Technical Data) stated on pages 5 to 13; furthermore, it is necessary that a suitable coupling dimensioning as described on pages 24 and 25 is carried out.
Large shaft misalignments, in particular with high speeds and an alternating overall load configuration with high frequency, strain and heat up the elastomer material.
Unpermittedly high overall load configuration, unpermittedly high speeds and unpermitted shaft misalignments can destroy the coupling.

Attention: Danger of ignition

For suitable coupling dimensioning (see ROBA®-ES Coupling Dimensioning, pages 24 and 25), please observe the following points:

a) Coupling nominal torque
b) Coupling peak torque
c) Max. speed
d) Max. shaft misalignments
e) Ambient temperatures
f) Service factors

CAUTION

Operation outside of the indicated characteristic data is not permitted. There is a danger of coupling destruction and of ignition.

The number and type of start-up impacts must be taken into account according to the calculation basis (pages 24 and 25) during coupling dimensioning. Furthermore, elastomer heating may occur due to speed resonance. This must also be taken into account during coupling dimensioning. Changed operating parameters in the system require a renewed inspection of the coupling dimensioning. The maximum given ambient temperatures are to be kept to. The maximum surface temperature of the coupling changes in dependence of the ambient temperature, see coupling marking. Exceeding the permitted ambient temperature means a danger of elastomer destruction, or the maximum permitted surface temperature of the coupling is exceeded. With destroyed or heavily worn elastomer there is the danger that the metallic claws of the hubs hit each other.

Attention: Danger of ignition

Electrical potential equalization on the coupling must be possible via the mounted shaft ends using the motor or gearbox.

All screws must be secured against loosening using a sealing lacquer, e.g. Loctite 243.

Hub combinations are only permitted in the same material combination, aluminum/aluminum or steel/steel.
Combinations steel/aluminum are not permitted.
The combination aluminum shrink disk hub and steel shrink disk does not represent any danger potential.

Despite technical coupling dimensioning, system-dependent vibration excitations may occur during operation, which might lead to resonances and therefore to destructions on the ROBA®-ES coupling. On critical applications, the total load profile of the system must be run through during initial operation in order to confirm the suitability of the coupling in the system.
Operation in an overcritical speed range and in the resonance range is not permitted.
Furthermore, coupling malfunctions must be expected if the Installation Guidelines are not observed. The data stated in these Installation and Operational Instructions must be observed.
All tightening torques must be observed.
After having reached the specified Maintenance and Inspection Intervals, the tightening torques must be inspected using a torque wrench. If the specified torques are not observed, component movements due to metal contact and therefore warming up and formation of sparks must be expected.
Constructional modifications of the coupling are not permitted.

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Guidelines and Directives for Operation in Ex Areas Where There is a Danger of Explosion

Initial Operation

Steel hubs and steel shrink disks have been zinc phosphated manufacturer-side to form a basic corrosion protection. All other components are untreated.
The hubs acc. DIN 69002 are blank and oiled.

The coupling must only be used in areas protected from the weather. Additional corrosion protection is required for use in the open air or if the device is subject to weather conditions. Severely corroded coupling components mean a danger of ignition.
The functional components of the coupling must not stick together as a result of paint or other sticky media, and electrostatic charges must not be caused (see DIN EN ISO 80079-36 6.7).
The ROBA®-ES coupling must be axially secured onto the drive and driven shaft. Correct securement must be checked before initial operation.
The shafts and keys must be positioned in the couplings so that the neighboring coupling parts do not contact each other (Fig. 21).

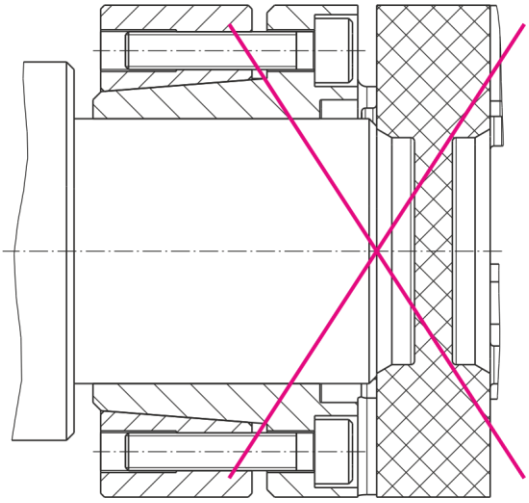

Fig. 21

In the key design, please secure the locking set screw with sealing lacquer, e.g. Loctite 243.
Layers of dust on the coupling or operation in piles of dust is not permitted.
It is essential that the distance dimension "E" acc. Fig. 15 and Table 13 is adhered to. If the two coupling parts touch, there is a risk of ignition caused through friction.

In particular for vertical applications with sleeves, compliance with dimension "E" must be monitored and checked as part of the regular maintenance work (for maintenance intervals, please see page 20).
It cannot be ruled out that the sleeve may lower during operation due to micro-movements, causing the sleeve and hub to come into contact.
Attention: Danger of ignition!

The rotating coupling components must be protected against contact and against foreign body impacts.
Please mount a suitable cover onto the coupling.
We recommend using a coupling cover made of rustproof steel.
The design must be arranged in such a way that no deformations occur by impacting parts which cause a rubbing of the cover at the coupling (danger of ignition).
The distance from the cover to the rotating components must be at least 5 mm.
The cover must be electrically conductible.
Covers made of aluminum are not permitted.

Maintenance and Inspection Intervals for Couplings in Ex Areas Where There is a Danger of Explosion

Please observe section Maintenance on page 20.

The maintenance and inspection intervals stated on page 20 must be maintained.

Should any irregularities occur, the system must be stopped independently of imminent maintenance and inspection intervals, and the cause of the malfunction must be determined using the Malfunctions / Breakdowns Table.

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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):**

Drive-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:

$$T_{KW} = 0.25 \times T_{KN} \text{ (for aluminum hubs)}$$
$$T_{KW} = 0.35 \times T_{KN} \text{ (for steel hubs)}$$
$$T_{KW} \geq T_W \times S_\delta \times S_f$$

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. 16 (page 18).

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 are on pages 5 to 10.

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 peak torque is the heaviest impact (S_A/S_L = 2.0). A flat sinus progression of the peak 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.

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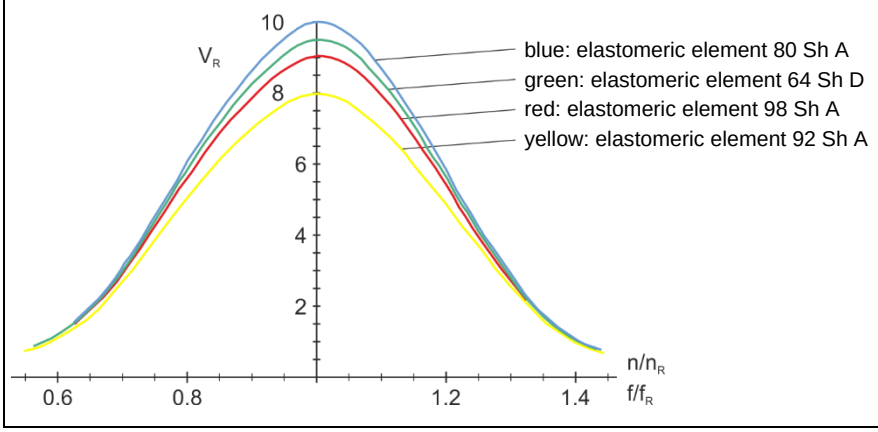
ROBA®-ES Coupling Dimensioning

Service Factors for Coupling Dimensioning

V_R = Resonance factor



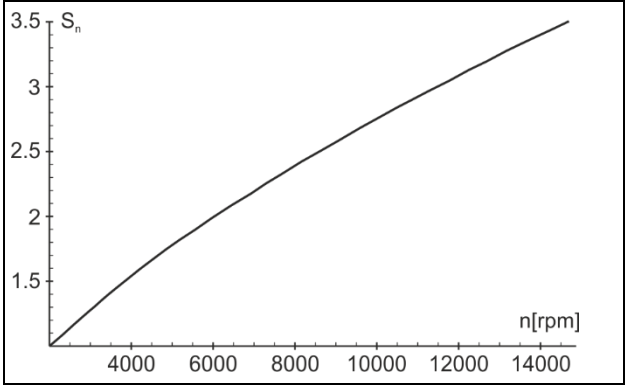
n_R = Resonance speed

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

f_R = Resonance frequency

$$f_R = \frac{1}{2\pi} \sqrt{C_{T\,dyn.} \frac{J_A + J_L}{J_A \times J_L}}\ [1/s]$$

S_n = Speed factor



S_f = Frequency factor

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

f shows the load alternation per second (Hz = 1/s)

S_z = Start-up factor/impact frequency

S/h	0 – 100	101 – 200	201 – 400	401 – 800	801 – 1000
S_z	1	1.2	1.4	1.6	1.8

S_δ = Safety factor for temperature

T	-30 °C / +30 °C	+60 °C	+90 °C
S_δ	1	1.5	2

S_A or S_L = 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]	Drive-side/load-side power
T_R	[Nm]	Transmittable torque (frictional locking, Tables 2 – 8 on pages 5 – 10)
$T_{AS/AW}$	[Nm]	Excitational torque, drive end
$T_{LS/LW}$	[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, drive end
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 misalignment
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, drive end/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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Malfunctions / Breakdowns

Malfunction	Possible Causes	Danger Guidelines for Ex Areas	Solutions
Changes in running noise and / or vibration occurrence	Incorrect alignment	Increased temperature on the elastomeric element surface; Danger of ignition due to hot surfaces	1) Set the system out of operation 2) Find / resolve the cause of incorrect alignment (e. g. loose foundation screws, motor securement breakage, heat expansion of system components, changes in the coupling installation dimension “E”) 3) Check the coupling for wear
	Wear on the elastomeric element, temporary torque transmission due to metal contact	Danger of ignition due to formation of sparks	1) Set the system out of operation 2) Dismantle the coupling and remove the remainders of the elastomeric element 3) Check the coupling parts and replace if damaged 4) Insert a new elastomeric element, install coupling components 5) Check the alignment and correct if necessary
	Tensioning and clamping screws or locking set screw for axial hub securement are loose	Danger of ignition due to hot surfaces and formation of sparks	1) Set the system out of operation 2) Check the coupling alignment 3) Tighten the tensioning and clamping screws for axial hub securement to the required torque or tighten the locking set screw and secure it against self-loosening using sealing lacquer 4) Check the coupling for wear
Cam breakage	Wear on the elastomeric element, torque transmission due to metal contact	Danger of ignition due to formation of sparks	1) Set the system out of operation 2) Replace the entire coupling 3) Check the alignment
	Cam breakage due to high impact energy / overload / excessively high shaft misalignments	Danger of ignition due to formation of sparks	1) Set the system out of operation 2) Replace the entire coupling 3) Check the alignment 4) Find the cause of overload
	Operating parameters are not appropriate for the coupling performance	Danger of ignition due to formation of sparks	1) Set the system out of operation 2) Check the operating parameters and select a suitable coupling (observe installation space) 3) Install a new coupling 4) Check the alignment
	Operational mistakes due to coupling characteristic data being exceeded	Danger of ignition due to formation of sparks	1) Set the system out of operation 2) Check coupling dimensioning 3) Replace the entire coupling 4) Check the alignment 5) Train and advise operating personnel
Premature wear on the elastomeric element	Incorrect alignment	Increased temperature on the elastomeric element surface; Danger of ignition due to hot surfaces	1) Set the system out of operation 2) Find / resolve the cause of incorrect alignment (e. g. loose foundation screws, motor securement breakage, heat expansion of system components, changes in the coupling installation dimension “E”) 3) Check the coupling for wear

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Malfunctions / Breakdowns

Malfunction	Possible Causes	Danger Guidelines for Ex Areas	Solutions
Premature wear on the elastomeric element	e.g. contact with aggressive liquids / oils, ozone influences, excessively high ambient temperature etc., which lead to physical changes in the elastomeric element	Danger of ignition due to formation of sparks on metallic contact of the cams	1) Set the system out of operation 2) Dismantle the coupling and remove the remainders of the elastomeric element 3) Check the coupling parts and replace if damaged 4) Insert a new elastomeric element, install coupling components 5) Check the alignment and correct if necessary 6) Make sure that further physical changes to the elastomeric element can be ruled out
	The ambient or contact temperatures permitted for the elastomeric element are exceeded see Table 9	Danger of ignition due to formation of sparks on metallic contact of the cams	1) Set the system out of operation 2) Dismantle the coupling and remove the remainders of the elastomeric element 3) Check the coupling parts and replace if damaged 4) Insert a new elastomeric element, install coupling components 5) Check the alignment and correct if necessary 6) Check the ambient or contact temperature and regulate them (if necessary, use other elastomeric element materials)
Premature wear on the elastomeric element (material liquidation inside the elastomeric element toothing)	Drive vibrations	Danger of ignition due to formation of sparks on metallic contact of the cams	1) Set the system out of operation 2) Dismantle the coupling and remove the remainders of the elastomeric element 3) Check the coupling parts and replace if damaged 4) Insert a new elastomeric element, install coupling components 5) Check the alignment and correct if necessary 6) Find the cause of vibration (if necessary, use an elastomeric element with a lower or higher shore hardness)

Please Observe!
mayr® will take no responsibility or guarantee for replacement parts and accessories which have not been delivered by *mayr*®, or for damage resulting from the use of these products.

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Declaration of Conformity

According to the EU Directive on the harmonisation of the laws of the Member States concerning devices and protective systems intended for use in areas where there is a danger of explosion (ATEX) 2014/34/EU, we:

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D-87665 Mauerstetten

hereby declare that the product described in these Installation and Operational Instructions

ROBA®-ES shaft coupling
Type 94_._ _ _._X (single-jointed coupling)
Sizes 14, 19, 24, 28, 38, 42, 48, 55, 65
with the permitted hub types:

- **clamping hub (Item 0)**
- **shrink disk hub (Item 1)**
- **key hub (Item 2)**

has been developed, constructed and produced by us in accordance with the EU Directive named above.

Deposit Receipt: EX9A 010376 0002

Notified Body number: 0123

Applied Standards, Regulations and Inspections (ASRI)

1 DIN EN 1127-1: 2011-10
Explosive atmospheres - Explosion prevention and protection - Part 1: Basic concepts and methodology

2 DIN EN 1127-2: 2014-09
Explosive atmospheres - Explosion prevention and protection - Part 2: Basic concepts and methodology for mining

3 DIN EN ISO 80079-36: 2016-12
Explosive atmospheres - Part 36: Non-electrical equipment for explosive atmospheres - Basic method and requirements

4 DIN EN ISO 80079-37: 2016-12
Explosive atmospheres - Part 37: Non-electrical equipment for explosive atmospheres
- Non-electrical type of protection constructional safety “c”, control of ignition sources “b”, liquid immersion “k”

5 DIN EN ISO 80079-38: 2017-10
Explosive atmospheres - Part 38: Equipment and components in explosive atmospheres in underground mines

Mauerstetten, October 22, 2020
Place / Date

Graduate Engineer (FH, University of Applied Science) Günther Klingler
(Managing Director ppa.)

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