VULKAN COUPLINGS

SERVICE LIFE
# OF HIGHLY FLEXIBLE COUPLINGS

Contents

Theoretical expected lifetime

VULKAN couplings are produced and tested under the most stringent quality controls. In this way, apart from a high level of functional safety across several hours of operation, they even offer the user a long service life of several years. The expected service life of the flexible elements is depending on the individual operating or storage conditions.

Even under best conditions a significant excess of time periods (of service life or hours of operation) may lead to changes in the dynamic characteristics or functional performance of the coupling. Impermissible or excessively high element stresses caused by the connected machinery reduce the expected service life.

Hence, we recommend that you regularly inspect the elements at least twice a year. The inspection procedure should consider both the service life and the operating hours. The operating hour inspection can be done by checking the permanent set and the surface for cracks. This inspection can be completed on-site by referring to the data on the attached tables.

In the event of an increase in the stiffness it is recommended to replace the elements, since the dynamic characteristics of the drive line is changed by this rigidity. In case of impermissible cracks / lengths of cracks, it is also recommended to replace the elastic elements. Permissible lengths of cracks and permissible permanent set and the theoretical expected lifetimemay be taken from the tables enclosed. VULKAN Service is also pleased to provide support in the inspection and assessment of couplings that have been installed.

Dynamic characteristic

Static twist angle
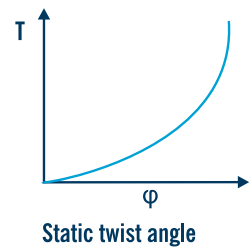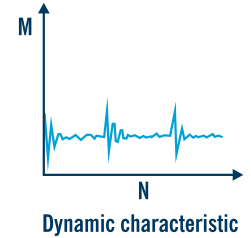
Tearing
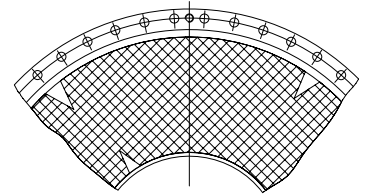
The theoretical expected lifetime for natural rubber products and silicon products is 10 years for normal operation hours.

Coupling	Natural Rubber		Silicon	
RATO S	50.000 h	10 years		
RATO S+	50.000 h	10 years		
RATO R	50.000 h	10 years		
RATO R+	50.000 h	10 years		
RATO DS	20.000 h	10 years		
RATO DG	20.000 h	10 years		
RATO DG+	20.000 h	10 years		
VULKARDAN E	20.000 h	10 years	20.000 h	10 years
VULKARDAN F	20.000 h	10 years	20.000 h	10 years
VULKARDAN G	30.000 h	10 years		
VULKARDAN L	20.000 h	10 years	20.000 h	10 years
VULASTIK L	20.000 h	10 years	20.000 h	10 years

PERMISSIBLE PERMANENT SET
OF RATO S / RATO S+ / RATO R / RATO R+ / VULKARDAN E / F / G / L

Permissible permanent set

RATO S / RATO S+ / RATO R / RATO R+ / VULKARDAN E / F / G / L
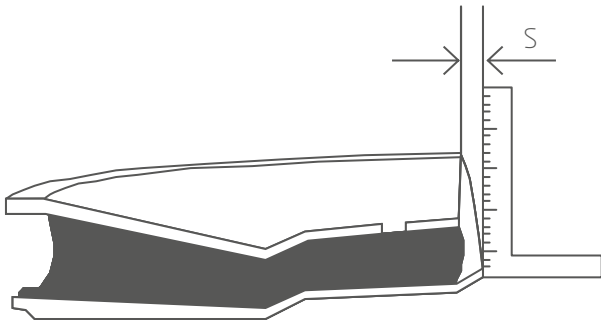
RATO S
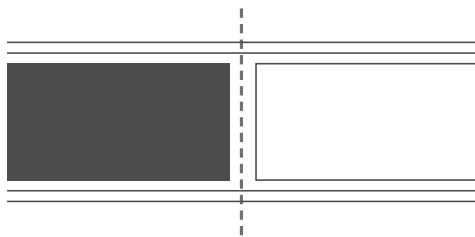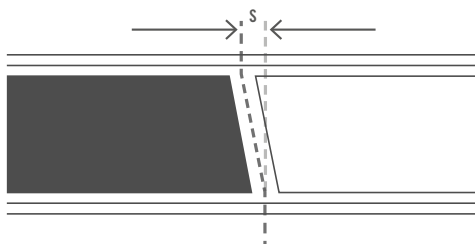
RATO S+

FIGURE 1

FIGURE 2

FIGURE 3

Checking the permissible permanent set of a RATO S / RATO S+ segment takes place by obtaining „S" at the outer diameter of the rubber element (Figure 1). In case of a RATO R / RATO R+ / VULKARDAN E / VULKARDAN F / VULKARDAN G / VULKARDAN L element, the dimension „S" may be obtained from the deformation of the rubber beading (Figure 3).

Size	S [mm]
G 0310	55.0
G 0510	65.0
G 0810	78.0
G 1210	20.0
G 1310	20.0
G 1410	22.0
G 1510	23.0
G 1610	25.0
G 1710	27.0
G 1910	29.0
G 2110	31.0
G 2310	33.0
G 2510	36.0
G 2710	36.0
G 2910	40.0
G 3010	45.0
G 3110	45.0
G 3210	48.0
G 3310	48.0
G 3410	51.0
G 3510	51.0
G 3610	58.0
G 3710	58.0
G 3810	92.0
G 3910	60.0
G 4010	60.0
G 4310	64.0
G 4410	64.0
G 4510	110.0
G 4610	38.0
G 4710	80.0
G 4810	80.0
G 4910	38.0
G 5010	85.0
G 5110	85.0
G 5310	130.0
G 5410	40.0
G 5510	90.0
G 5610	90.0
G 5720	97.0
G 5810	98.0
G 6010	44.0
G 6210	100.0
G 6310	100.0
G 6510	44.0
G 6810	118.0
G 7010	44.0
G 7310	125.0

Size	S [mm]
G 4J10	80.0
G 5B10	85.0
G 5G10	90.0
G 5H20	98.0

PERMISSIBLE PERMANENT SET
OF RATO S / RATO S+ / RATO R / RATO R+ / VULKARDAN E / F / G / L

RATO R

Size	S [mm]
G 1610R	26.0
G 1710R	28.0
G 1910R	29.0
G 2110R	33.0
G 2310R	35.0
G 2410R	19.0
G 2510R	39.0
G 2610R	42.0
G 2710R	42.0
G 2730R*	27.0
G 2910R	44.0
G 2930R*	29.0
G 3110R	50.0
G 3210R	58.0
G 3310R	58.0
G 3330R*	35.0
G 3430R*	37.0
G 3510R	37.0
G 3810R	44.0
G 3910R	75.0
G 4010R	75.0
G 4710R	75.0

* Values for 3-row elements

RATO R +

Size	S [mm]
G 2D10	35.0
G 2F10	39.0
G 2G10	42.0
G 3B10	50.0
G 3C10	58.0
G 3E30*	37.0
G 4A10	75.0

* Values for 3-row elements

VULKARDAN E

Size	S [mm]
E 1710	14.0
E 2310	22.0
E 2410	17.0
E 2810	20.0
E 3210	25.0
E 3410	33.0
E 4010	34.0
E 4910	39.0
E 5410	51.0
E 5710	48.0
E 6010	60.0

VULKARDAN G

Size	S [mm]
G 5410	16.0
G 5710	16.0
G 6010	20.0
G 6210	24.0
G 8410	17.0

VULKARDAN L
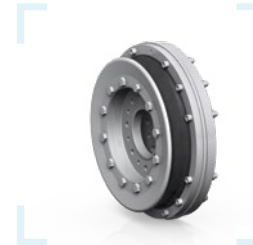
Size	S [mm]
L 1710	14.0
L 1910	15.0
L 2110	16.0
L 2510	18.0
L 2910	21.0
L 3410	32.0
L 4110	34.0
L 4510	35.0
L 4810	37.0
L 5010	39.0
L 5810	49.0

VULKARDAN F

Size	S [mm]
F 3510	25.0
F 4210	34.0
F 5010	39.0
F 5410	51.0
F 5710	48.0
F 6010	60.0
F 6210	60.0

PERMISSIBLE PERMANENT SET
OF RATO DS / RATO DS+ /RATO DG / RATO DG+

Permissible permanent set
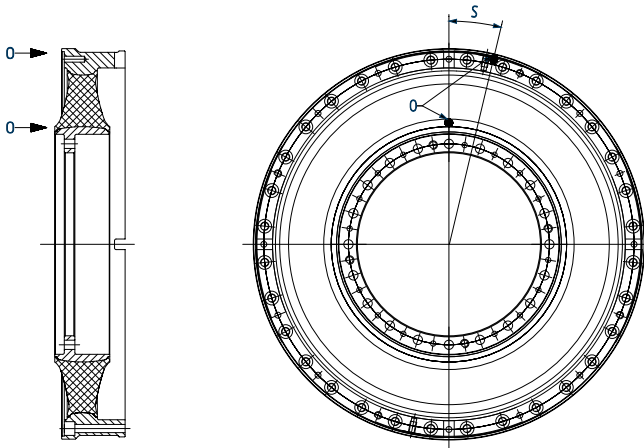**RATO DS / RATO DS+ / RATO DG / RATO DG+**
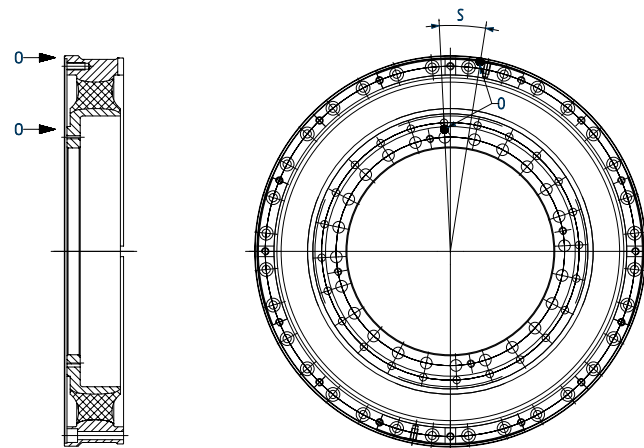

FIGURE 1 – RATO DS

FIGURE 2 – RATO DG / RATO DG+

Checking the permissible permanent set of a RATO DS / RATO DG element takes place by obtaining „S" at the outer diameter of the rubber element (Figures 1 & 2).

RATO DS

Size	S [mm]
2110	48
2310	52
2510	56
2710	61
2910	66
3110	70
3310	76
3410	82
3910	88

RATO DS+

Size	S [mm]
2K10	66
3D10	70

RATO DG

Size	S [mm]
2110	20
2310	24
2510	24
2710	27
2910	30
3110	31
3310	34
3410	36
3610	40
3910	42

RATO DG+

Size	S [mm]
2K10	30
3D10	34

PERMISSIBLE PERMANENT SET
OF VULASTIK L

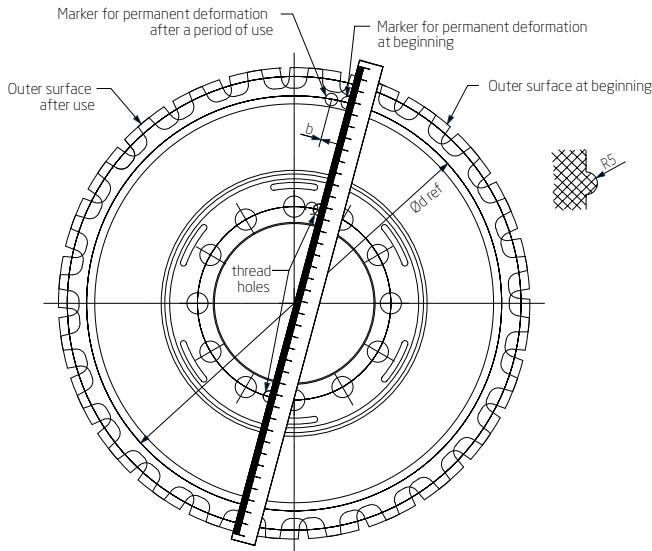### Permissible permanent set
VULASTIK L

FIGURE 3

Due to different inner design and multiple rubber stiffness of the Vulastik L the permanent set is depending on stiffness. The parameter for the permissible permanent set is the dimension „b". The permissible permanent set „b" is determined by the distance between the positions A and B. Position A lies on the extension of both the threaded boreholes of the angular ring. Position B is identified by the marking on the element. During operation, the element deforms itself and the marking shifts in the direction of rotation from the position A to the position B.

VULASTIK L

Size	Rubber quality								Reference diameter
	4	1	2	3	6	8	A	S	
	b in mm								
141X	24	18	16	16	16	16	16	22	Ø 203
161X	35	28	18	18	18	18	18	24	Ø 252
191X	36	29	19	19	19	19	19	24	Ø 288
221X	44	35	22	22	22	22	22	30	Ø 342
261X	48	38	25	25	25	25	25	32	Ø 390
301X	47	37	26	26	26	20	20	32	Ø 390
321X	47	37	26	26	26	26	26	32	Ø 390
331X	46	36	24	24	24	24	24	31	Ø 390
341X	39	30	21	21	21	21	21	30	Ø 450
371X	40	31	22	22	22	22	22	31	Ø 450
401X	46	35	24	24	24	24	24	44	Ø 531
431X	46	35	24	24	24	24	24	44	Ø 531

PERMISSIBLE DEPTHS OF CRACKS
OF RATO S

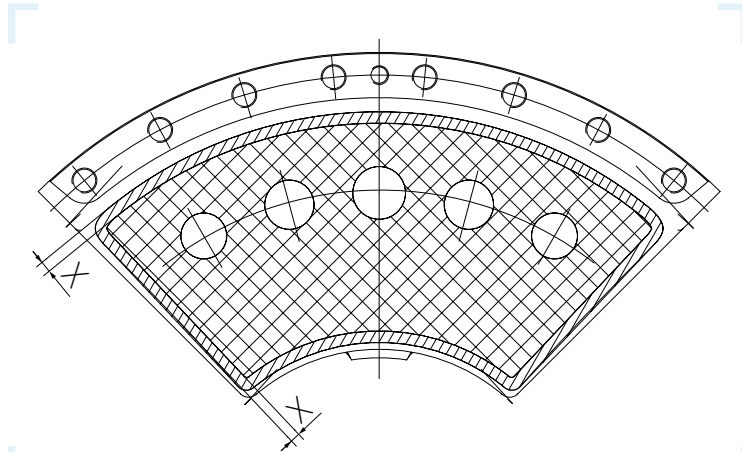**Permissible depths of cracks**
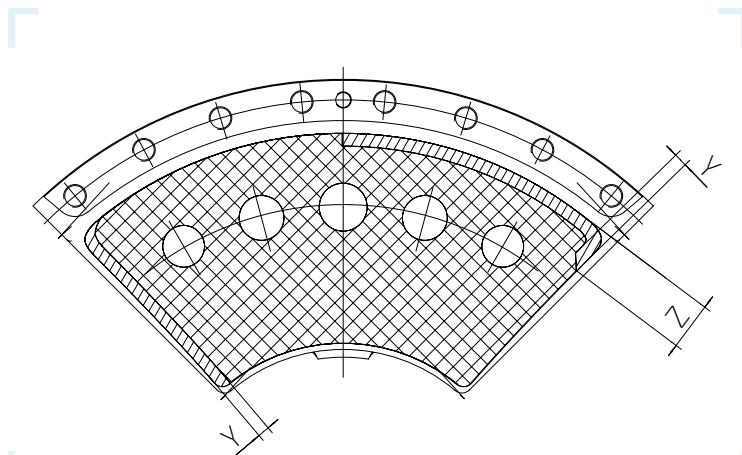**RATO S**

RATO S

FIGURE 1

FIGURE 2

As a result of the deformation of the elastic part during operation, cracks may get formed that are permissible up to a limited depth (Figures 1 & 2). Based on our experience, you may consider surface cracks in the elastic part of a RATO S / S+ / R coupling permissible, if these cracks occur on all sides of the entire surface up to a depth as mentioned (Figure 1, depth X). With cracks predominantly in the outer rubber corner surface, including the radius area, an equivalent depth of crack as mentioned (Figure 2, depth Y,Z). The following values are related to rubber as the material. If the permissible depth of a crack is exceeded, it is recommended to replace the element / segment concerned as soon as possible.

Size	Depth		
	X [mm]	Y [mm]	Z [mm]
G 0310	8.0	13.0	42.0
G 0510	10.0	14.0	49.0
G 0810	10.0	19.0	57.0
G 1210	4.3	7.0	19.0
G 1310	4.7	7.0	21.0
G 1410	5.0	8.0	22.0
G 1510	5.5	8.0	24.0
G 1610	6.0	9.0	26.0
G 1710	6.5	9.0	28.0
G 1910	7.0	10.0	30.0
G 2110	7.0	10.0	33.0
G 2310	8.0	13.5	36.0
G 2510	9.0	15.5	38.0
G 2710	9.5	16.0	42.0
G 2910	10.0	17.0	45.0
G 3010	11.0	19.0	49.0
G 3110	11.0	19.0	49.0
G 3210	12.0	20.5	52.0
G 3310	12.0	20.5	52.0
G 3410	13.0	22.0	57.0
G 3510	13.0	22.0	57.0
G 3610	13.0	24.0	61.0
G 3710	13.0	24.0	61.0
G 3810	15.0	25.5	66.0
G 3910	15.0	25.5	66.0
G 4010	15.0	25.5	66.0
G 4310	15.0	27.0	71.0
G 4410	15.0	27.0	71.0
G 4510	15.0	30.5	77.0
G 4610	15.0	30.5	77.0
G 4710	15.0	30.5	77.0
G 4810	15.0	30.5	77.0
G 4910	18.0	32.5	83.0
G 5010	18.0	32.5	83.0
G 5110	18.0	32.5	83.0
G 5310	20.0	34.0	90.0
G 5410	20.0	34.0	90.0
G 5510	20.0	34.0	90.0
G 5610	20.0	34.0	90.0
G 5720	21.0	36.0	94.0
G 5810	20.0	37.5	97.0
G 6010	20.0	37.5	97.0
G 6210	20.0	39.0	103.0
G 6310	20.0	39.0	103.0
G 6510	20.0	41.0	105.0
G 6810	20.0	42.5	111.0
G 7010	20.0	42.5	113.0
G 7310	20.0	47.5	125.0

Permissible depths of cracks
RATO S+

FIGURE 1

FIGURE 2

RATO S+

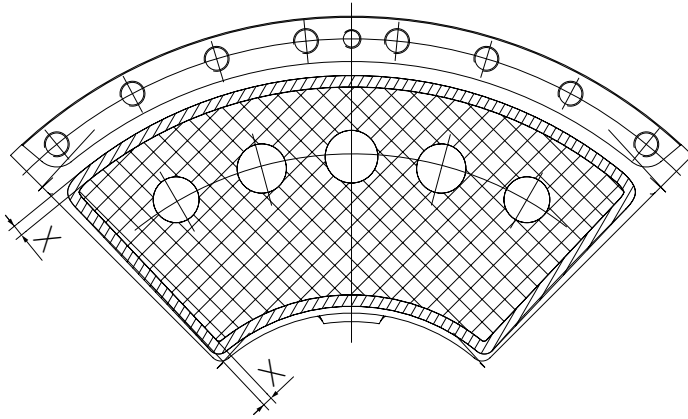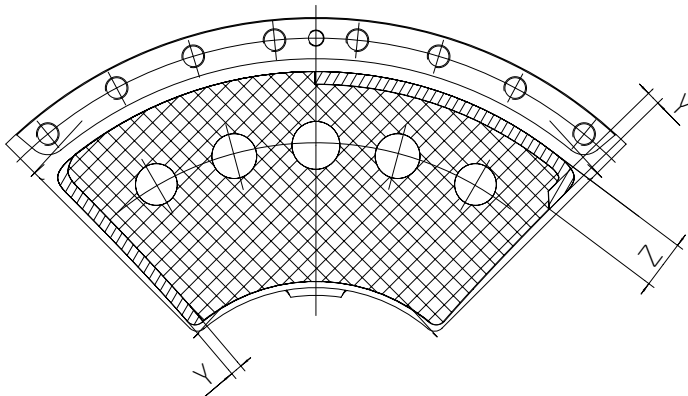| Size	Depth		
	X [mm]	Y [mm]	Z [mm]
G 4J10	15.0	30.5	77.0
G 5B10	18.0	32.5	83.0
G 5G10	18.0	34.0	90.0
G 5H20	18.0	36.0	94.0

As a result of the deformation of the elastic part during operation, cracks may get formed that are permissible up to a limited depth (Figures 1 & 2). Based on our experience, you may consider surface cracks in the elastic part of a RATO S / S+ / R coupling permissible, if these cracks occur on all sides of the entire surface up to a depth as mentioned (Figure 1, depth X). With cracks predominantly in the outer rubber corner surface, including the radius area, an equivalent depth of crack as mentioned (Figure 2, depth Y,Z). The following values are related to rubber as the material. If the permissible depth of a crack is exceeded, it is recommended to replace the element / segment concerned as soon as possible.

PERMISSIBLE DEPTHS OF CRACKS
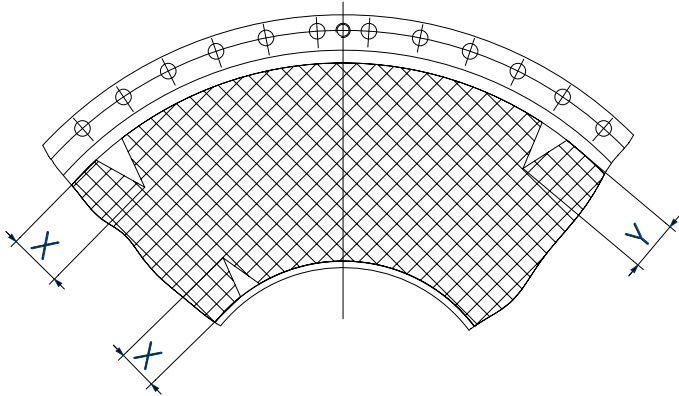## OF RATO R

Permissible depths of cracks
RATO R

As a result of the deformation of the elastic part during operation, cracks may get formed that are permissible up to a limited depth (Figures 1 & 2). Based on our experience, you may consider surface cracks in the elastic part of a RATO S / S+ / R coupling permissible, if these cracks occur on all sides of the entire surface up to a depth as mentioned (Figure 1, depth X). With cracks predominantly in the outer rubber corner surface, including the radius area, an equivalent depth of crack as mentioned (Figure 2, depth Y,Z). The following values are related to rubber as the material. If the permissible depth of a crack is exceeded, it is recommended to replace the element / segment concerned as soon as possible.

RATO R

	Depth	
Size	**X [mm]**	**Y* [mm]**
G 1610R	6.0	10.0
G 1710R	6.5	10.0
G 1910R	7.0	10.0
G 2110R	7.0	10.0
G 2310R	8.0	10.0
G 2410R	8.0	10.0
G 2510R	8.0	10.0
G 2610R	8.0	12.0
G 2710R	8.0	12.0
G 2730R	8.0	12.0
G 2910R	10.0	12.0
G 2930R	10.0	12.0
G 3110R	10.0	15.0
G 3210R	10.0	15.0
G 3310R	10.0	15.0
G 3330R	10.0	15.0
G 3430R	12.0	15.0
G 3510R	12.0	15.0
G 3810R	15.0	18.0
G 3910R	15.0	18.0
G 4010R	15.0	18.0
G 4710R	15.0	18.0

* Cracks in the outer diameter area /
  inner diameter is free of cracks

PERMISSIBLE DEPTHS OF CRACKS
OF RATO R+

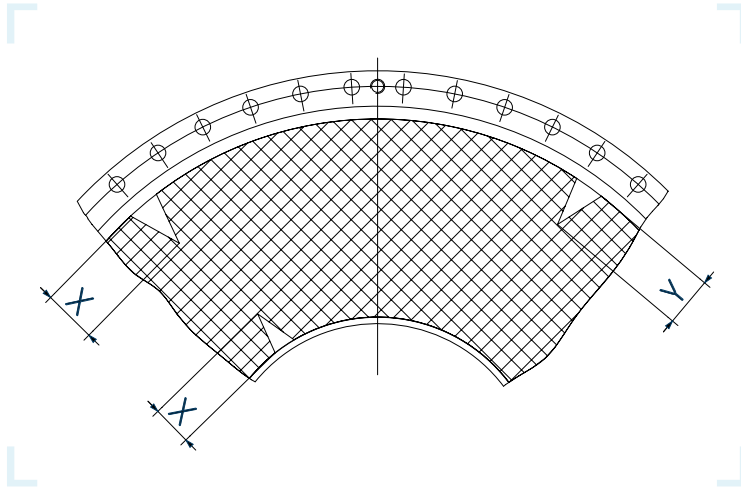**Permissible depths of cracks**
RATO R+

FIGURE 1

As a result of the deformation of the elastic part during operation, cracks may get formed that are permissible up to a limited depth (Figures 1 & 2). Based on our experience, you may consider surface cracks in the elastic part of a RATO S / S+ / R coupling permissible, if these cracks occur on all sides of the entire surface up to a depth as mentioned (Figure 1, depth X). With cracks predominantly in the outer rubber corner surface, including the radius area, an equivalent depth of crack as mentioned (Figure 2, depth Y,Z). The following values are related to rubber as the material. If the permissible depth of a crack is exceeded, it is recommended to replace the element / segment concerned as soon as possible.

RATO R+

Size	Depth	
	X [mm]	Y* [mm]
G 2D10R	8.0	13.6
G 2F10R	8.0	14.6
G 2G10R	8.0	15.8
G 3B10R	10.0	18.5
G 3C10R	10.0	20.1
G 3E30R	10.0	22.7
G 4A10R	15.0	25.6

* Cracks in the outer diameter area /
  inner diameter is free of cracks

PERMISSIBLE DEPTHS OF CRACKS
OF VULKARDAN E / VULKARDAN F / VULKARDAN G / VULKARDAN L

VULKARDAN E

Size	Depth X [mm]	Y [mm]
E 1710	0.8	1.3
E 2310	2.6	4.4
E 2410	2.8	4.8
E 2810	3.3	5.5
E 3210	3.2	5.5
E 3410	3.0	5.2
E 4010	3.1	5.2
E 4910	3.1	5.3
E 5410	2.6	4.5
E 5710	3.8	6.4
E 6010	4.7	8.0

VULKARDAN F

Size	Depth X [mm]	Y [mm]
F 3510	3.2	5.5
F 4210	3.1	5.2
F 5010	3.1	5.3
F 5410	2.6	4.5
F 5710	3.8	6.4
F 6010	4.7	8.0
F 6210	4.7	8.0

VULKARDAN G

Size	Depth X [mm]	Y [mm]
G 5410	3.4	5.8
G 5710	4.8	8.2
G 6010	4.7	8.0
G 6210	7.9	13.5
G 8410	4.5	7.7

VULKARDAN L

Size	Depth X [mm]	Y [mm]
L 1710	0.8	1.3
L 1910	0.9	1.5
L 2110	1.1	1.9
L 2510	1.4	2.3
L 2910	1.5	2.5
L 3410	1.7	2.9
L 4110	1.8	3.1
L 4510	1.9	3.2
L 4810	2.6	4.3
L 5010	2.3	3.8
L 5810	5.0	8.5

PERMISSIBLE DEPTHS OF CRACKS
OF RATO DS / RATO DS+

Permissible depths of cracks
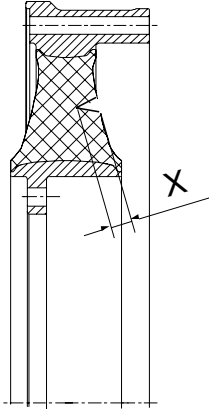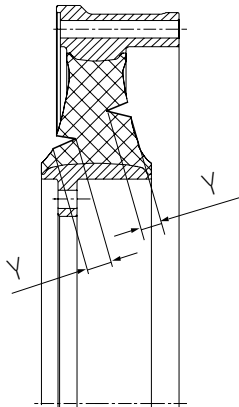**RATO DS / RATO DS+**

FIGURE 1

FIGURE 2

Based on our experience, you may consider surface cracks in an elastic part of a RATO DS / RATO DS+ coupling permissible if these cracks occur on all sides of the entire surface, up to a depth as given in the following table.

RATO DS

Size	Depth* Cracks on one surface [mm]	Depth* Cracks on two surfaces [mm]
21	12.0	6.0
23	13.5	6.7
25	15.5	7.7
27	16.0	8.0
29	15.0	8.0
31	15.0	9.0
33	20.0	10.0
34	20.0	10.0
39	20.0	12.0

* Table values: applicable, for cracks predominantly on **one** surface, with cracks uniformly on **both** surfaces, the value needs to be halved.

RATO DS+

Size	Depth* Cracks on one surface [mm]	Depth* Cracks on two surfaces [mm]
2K10	15.0	8.0
3D10	20.0	10.0

* Table values: applicable, for cracks predominantly on **one** surface, with cracks uniformly on **both** surfaces, the value needs to be halved.

PERMISSIBLE DEPTHS OF CRACKS
OF RATO DG / RATO DG+

Permissible depths of cracks
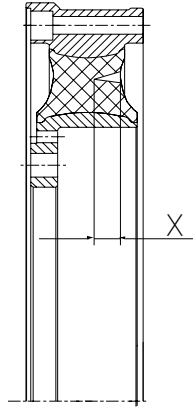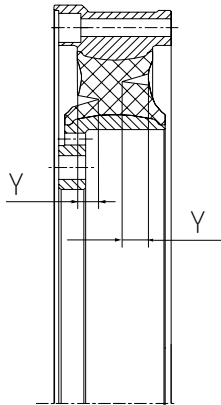**RATO DG / RATO DG+**

FIGURE 1

FIGURE 2

Based on our experience, you may consider surface cracks in an elastic part of a RATO DG / DG+ coupling permissible if these cracks occur on all sides of the entire surface, up to a depth as given in the following table.

RATO DG

Size	Depth* Cracks on one surface [mm]	Depth* Cracks on two surfaces [mm]
21	12.0	6.0
23	13.5	6.7
25	15.5	7.7
27	16.0	8.0
29	15.0	8.0
31	15.0	9.0
33	20.0	10.0
34	20.0	10.0
39	20.0	12.0

RATO DG+

Size	Depth* Cracks on one surface [mm]	Depth* Cracks on two surfaces [mm]
2K10	15.0	8.0
3D10	20.0	10.0

* Table values: applicable, for cracks predominantly on **one** surface, with cracks uniformly on **both** surfaces, the value needs to be halved.

VALIDITY CLAUSE

The present brochure shall replace all previous editions, any previous printings shall no longer be valid. Based on new developments, VULKAN reserves the right to amend and change any details contained in this brochure respectively. The new data shall only apply with respect to couplings that were ordered after said amendment or change. It shall be the responsibility of the user to ensure that only the latest brochure issue will be used. The respective latest issue can be seen on the website of VULKAN on www.vulkan.com.

The data contained in this brochure refer to the technical standard as presently used by VULKAN with defined conditions according to the explanations. It shall be the sole responsibility and decision of the system administrator for the drive line to draw conclusions about the system behaviour.

VULKAN torsional vibration analysis usually only consider the pure mechanical mass-elastic system. Being a component manufacturer exclusively, VULKAN assumes no system responsibility with the analysis of the torsional vibration system (stationary, transiently)! The accuracy of the analysis depends on the exactness of the used data and the data VULKAN is provided with, respectively.

Any changes due to the technological progress are reserved. For questions or queries please contact VULKAN.