



DOCUMENTATION

VULKAN

RATO-S Coupling

rigid membrane clamping

Customer: Caterpillar Motoren GmbH, 24159 Kiel

Series: 2200

VULKAN Kupplungs- und Getriebbau

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Technical data	RATO-S-082W
General drawing	1G08200001
Partslist	1G082W0001
Flexible part	EG0820A002
Partslist	EG082WA002
Flexible Element	EG08100003
Partslist	EG081W0003
Membrane dimension group	2G34R5014M
Partslist	2G34R5014M
Installation and Operating Instruction	E 12220
Alignment Instructions	„Alignment Instructions for highly-flexible VULKAN-RATO-S/R-Couplings “
Inspections Criteria	Criteria for the inspection of VULKAN-RATO-S/R-Couplings
Delivery condition	AG08200001



Technical data

RATO-S-082W

Nominal torque		T_{KN}	=	80,0	kNm
Max. torque 1		T_{kmax1}	=	96,0	kNm
Max. torque 2		T_{kmax2}	=	360,0	kNm
Max. torque range		ΔT_{max}	=	115,5	kNm
Permissible vibratory torque		T_{KW}	=	20,00	kNm
Permissible power loss		P_{KV50}	=	1,08	kW
Permissible revolutions/min.		n_{Kmax}	=	925	rpm
Permissible axial shaft displacement		ΔK_a	=	7,0	mm
Permissible radial shaft displacement		ΔK_r	=	18,0	mm
Axial reaction force		$F_{ax1,0}$	=	0,4	kN
Radial stiffness		C_{rdyn}	=	2,15	kN/mm
Dynamic torsional stiffness	nominal	C'_{Tdyn}	=	240	kNm/rad
Relative damping	nominal	ψ	=	1,13	

Please pay attention to the instructions in the enclosed sheet **RATO-ETD-1/1 - 7/1** for **RATO** couplings.



Technical data	RATO-S-082W
General drawing	1G08200014
Partslist	1G082W0014
Flexible part	EG0820A002
Partslist	EG082WA002
Flexible Element	EG08100003
Partslist	EG081W0003
Membrane dimension group	2G34R5014M
Partslist	2G34R5014M
Installation and Operating Instruction	E 12097
Alignment Instructions	„Alignment Instructions for highly-flexible VULKAN-RATO-S/R-Couplings “
Delivery condition	AG08200014



Technical data

RATO-S-082W

Nominal torque		T_{KN}	=	80,0	kNm
Max. torque 1		T_{kmax1}	=	120,0	kNm
Max. torque 2		T_{kmax2}	=	360,0	kNm
Permissible vibratory torque		T_{KW}	=	20,00	kNm
Permissible power loss		P_{KV50}	=	1,26	kW
Permissible revolutions/min.		n_{Kmax}	=	925	rpm
Permissible axial shaft displacement		ΔK_a	=	7,0	mm
Permissible radial shaft displacement		ΔK_r	=	9,0	mm
Axial reaction force		$F_{ax1,0}$	=	0,4	kN
Radial stiffness		C_{rdyn}	=	4,3	kN/mm
Dynamic torsional stiffness	nominal	C'_{Tdyn}	=	240,0	kNm/rad
	warm	C'_{Tdyn}	=	168,0	kNm/rad
Relative damping	nominal	ψ	=	1,13	
	warm	ψ	=	0,79	

Please pay attention to the instructions in the enclosed sheet **RATO-ETD-1/1 - 7/1** for **RATO** couplings.

Echtfirma

VULKAN: PRODUKTIONSSTÜCKLISTE OHNE SUFFIX

Datum : 05.02.02 08:18
Seite : 1
gedruckt von: sprung

Fert.-Art. 1G082W0001
RATO-S
Drawing 1G08200001

Info:

Author : troestee
Date : 31.05.2001

Pos	Quant.	Article	Description	Measurement	Material	Remark
1	1	EG082WA002	FLEX.ELEMENT		ST/GUMMI	
5	1	3G34B2000M	HUB	FM 600X 135 X310	42CRMO4V	VERG.17200
7	1	4G34B6002M	INN.CLAMP.RING	FM 600X 320 X350	GGG-40	
9	1	4G34630050	SLEEVE BEARING	FM 406X 381 X 84	LUYTEXC320	
10	1	2G34R5014M	MEMBRANE-DG.			
16	32	3G34S20000	DISC	FM 45X 24 X 5.50	42CRMO4V	VERG.17200
19	32	7000122100	HEXAGON BOLT	M 22 X100	10.9	931M
20	32	7000122070	HEXAGON BOLT	M 22 X 70	10.9	931M
22	24	7000130100	HEXAGON BOLT	M 30 X100	10.9	931M
28	32	7020122000	HEX NUT	M 22	10	934
35	24	7033630000	DISC	30	42CRMO4V	VERG.17200
39	32	7033622000	DISC	22	42CRMO4V	VERG.17200
39	32	7033622000	DISC	22	42CRMO4V	VERG.17200
41	32	3G34S50000	DISTANCE DISC.	FM 45X 24 X 0.25	CUSN6 F55	
50	32	7020122000	HEX NUT	M 22	10	934
51	8	4G08610001		FM 33x20,2x60	42CRMO4V	EN 10083-1
52	8	7010020090	SOCK HD SCREW	M 20 X 90	8.8	912M

Montage-Kontrollmaß
alignment-control

8573 10.8

262.2

194.5

24.2

28

41

39

19

1

20

39

50

16

35

7

22

310

51

52

9

M1

M2

M3

595.5

280

385

1085

3 x 46°

Ø 1025

Ø 1070^{+0.066}

32-Teilung/holes

M 22

41.5

1

2

3

1

2

3

1

2

3

1

SI-System	
J	m
1	27 175
2	56 399
3	58 700

Montagekontrollmaß. Das Montagekontrollmaß ist um anlagenbedingte Wärmedehnungen zu korrigieren. Alignment-control. The alignment-control dimension must be corrected by the thermal expansion specific for the respective system.

Anzugsmoment
Tightening torque

- POS. 20 = 500.0 Nm
- POS. 22 = 1300.0 + 150.0 Nm
- POS. 28 = 510.0 + 60.0 Nm
- POS. 52 = 350.0 + 40.0 Nm

Schrauben bzw. Muttern mit Motorenöl eingesetzt
Bolts and nuts installed with lubricating oil.

Lagerbuchse, Pos.9, bei der Montage auf Beweglichkeit kontrollieren ggf. anpassen, anschließend allseitig gefettet einsetzen.
Attention: Nur Fette ohne Festschmierstoffe verwenden.

During assembly ensure that the bearing bush, item 9, is free to glide. If applicable adjust and install greased all-round.
Attention: The grease to be used is to be free of solid matter.

Auslieferungszustand nach Zeichnung:
Delivery condition according to drawing:
AG0820001

Stückliste Nr.:
partlist no.:
1G08210001
1G082T0001
1G082W0001

Baureihe/series: 2200

SCHUTZMERK NACH DIN 24-BEACHTEN	
ÜBERFÜHRUNG	MAßSTAB 1:2.5 (DIN A1)
VERZEICHNIS	WERKSTOFF
ALUMINIUM	ROHTEIL-NR.
WELTHERM	BENENNUNG
DATUM	NAME
BRÄUN 21.01.1993	GRH
NOTIZ	10.11.1991
MIHOF	
VULKAN	
44635 HERNE	
Hochelast-RATO-S	
Kupplung Baugr. G0820	
ZEICHNUNGSNUMMER	
1G08200001	
BLATT	
BL.	

PROJ. NR.	PROJ. BEZ.	PROJ. DATUM	PROJ. NAME
4	Proj. 21.01.1993	20.11.2001	Werk
3	Einb. Teil-Abnahme und SDA-Maß-NRW	31.05.2001	1.6.007
2	Proj. 20.01.1993	10.10.2003	Werk
1	Einb. Teil-Abnahme	04.05.1993	GRH

Achtung !
Membran-Baugruppe Pos. 10 darf nicht demontiert werden.
Attention !
Membran package item 10 must not be disassembled.

Bei Abnahme durch eine Klassifikationsgesellschaft sind die Anschlussverbindungen den Vorschriften entsprechend auszuführen.
When required to classification societies the connections must be designed to meet the respective classification rules.

Echtfirma

VULKAN: PRODUKTIONSTÜCKLISTE OHNE SUFFIX

Datum : 05.02.02 08:21
Seite : 1
gedruckt von: sprung

Fert.-Art. EG082WA002
ELAST.TEIL
Drawing EG0820A002

Info:

Author : troestee
Date : 31.05.2001

Pos	Quant.	Article	Description	Measurement	Material	Remark
1	2	EG081W0003	FLEX.ELEMENT		ST/GUMMI	
2	1	4G34380010	MEMBRANE	FM1070X 439 X 1.6	50CRV4V	
3	1	4G34780010	CENTERING RING	FM 535X 406 X106	C45N	
4	1	4G34970010	COVER	FM 535X 439 X 18	C45N	
5	16	7000122090	HEXAGON BOLT	M 22 X 90	10.9	931M
6	16	4G3472006M	HEX FITTEDBOLT	M 22X 25js6X 82	42CRMO4V	
7	16	7000020065	HEXAGON BOLT	M 20 X 65	8.8	931M
8	16	7020122000	HEX NUT	M 22	10	934
9	16	7020122000	HEX NUT	M 22	10	934
10	16	7020020000	HEX NUT	M 20	8	DIN934
11	32	7033622000	DISC	22	42CRMO4V	VERG.17200
12	16	7033724000	DISC	24	42CRMO4V	VERG.17200
13	16	7033622000	DISC	22	42CRMO4V	VERG.17200

Echtfirma

VULKAN: PRODUKTIONSSTÜCKLISTE OHNE SUFFIX

Datum : 05.02.02 08:26
Seite : 1
gedruckt von: sprung

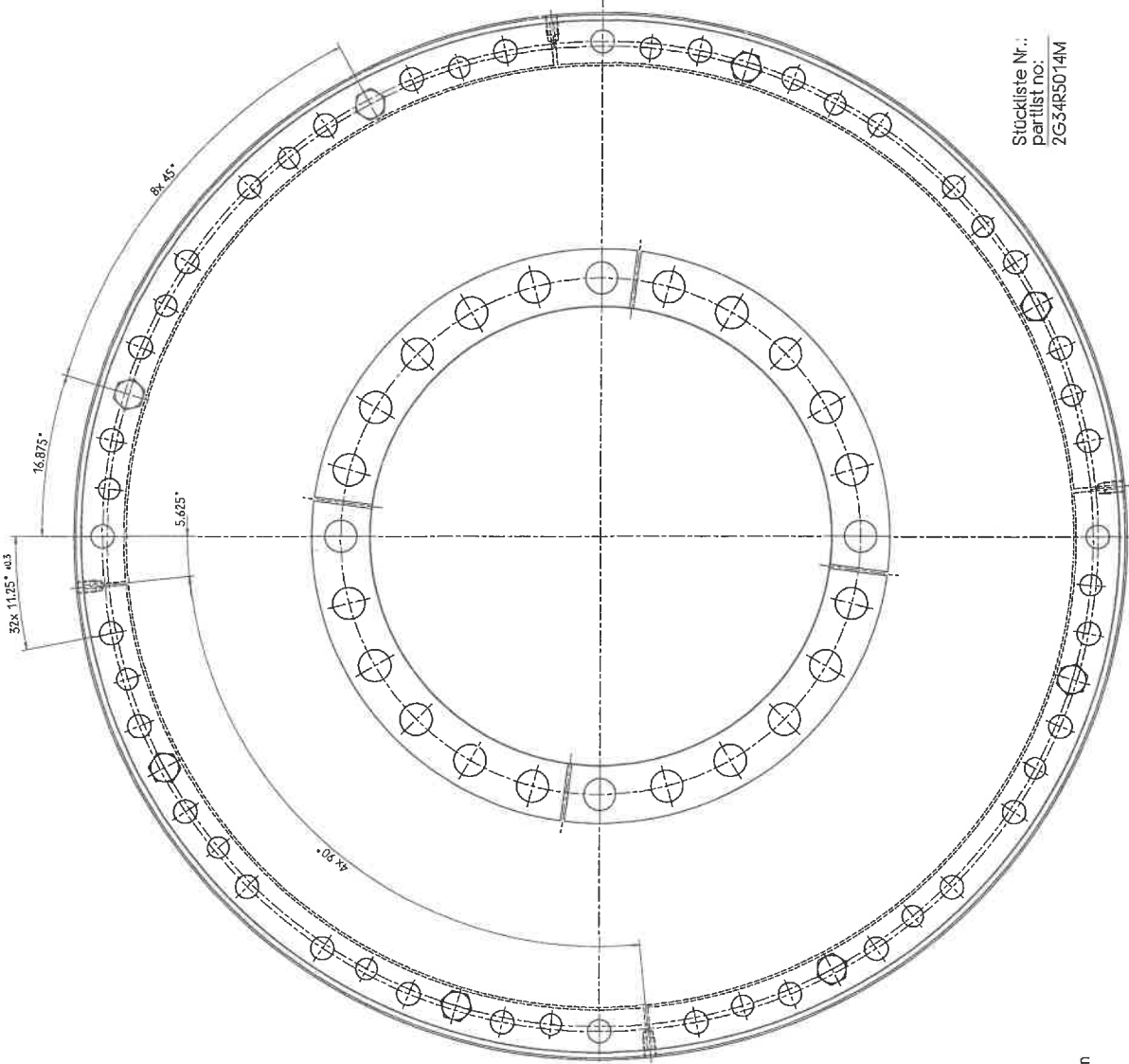
Fert.-Art. 2G34R5014M
MEMBRANE-BG.
Drawing 2G34R5014M

Author : GRIHN
Date : 09.11.1998

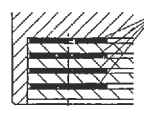
Info:

Pos	Quant.	Article	Description	Measurement	Material	Remark
1	4	3G34R5010M	MEMBRANE	FM1070X 475 X 0.85	50CRV4	
2	16	3G34R80000	SPACER SHEET	FM 753.1X186,6X 0,25	CUSN6 F55	
3	20	3G34R70000	SPACER SHEET	FM 418X 127.80X 0.25	CUSN6 F55	
4	1	3G34S6011M	CLAMPING RING	FM1085X 975 X 36	42CRMO4V	EN 10083-1
5	8	7033620000	DISC	20	42CRMO4V	VERG.17200
6	8	7001020025	HEXAGON BOLT	M 20 X 25	8.8	933M

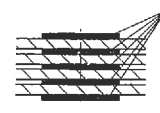
Winkeltoleranz in mm
bezogen auf den Teilkreis



Stückliste Nr.:
partlist no:
2G34RS014M



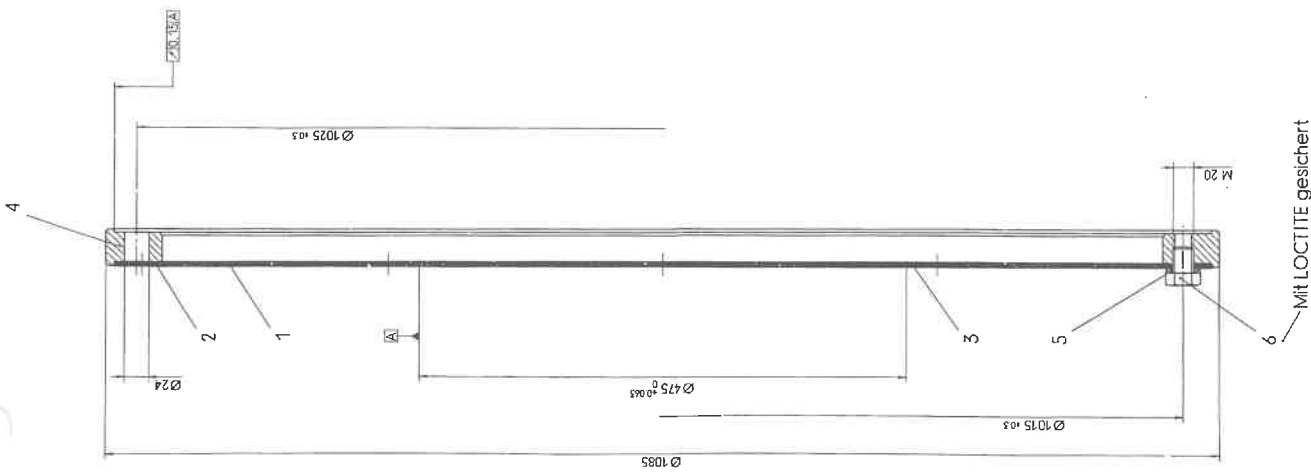
DIE DISTANZBLECHE POS.2
AN DEN MEMBRANEN MIT
TECTYL FIXIERT.



DIE DISTANZBLECHE POS.5
AN DEN MEMBRANEN MIT
TECTYL FIXIERT.

Anzugsmoment
Tightening torque
POS. 6 = 370.0 ± 40.0 Nm

Membran-Baugruppe in der
Montagevorrichtung montiert



Mit LOCTITE gesichert

Normalausführung

FORMULIERUNG FUNKTIONSBESCHREIBUNG DIN EN 10204		MASSESTAB 1:2.5 (DIN A1)		GEWICHT	
ALTERNATIV FUNKTIONSBESCHREIBUNG DIN EN 10204		WERKSTOFF		SCHÜTZVERBODEN	
BEZUG 11.11.1993		NAME BREMENING		MEMBRAN-Baugruppe 2-Reihig	
ZEICHENSTÄMMEL		ZEICHENSTÄMMEL		ZEICHENSTÄMMEL	
VULKAN		446531-HEBE		2G34RS014M	
FILM		ZUST.		BLATT	
ANLEITUNG		DATUM		BL.	
11		12		15	

Echtfirma

VULKAN: PRODUKTIONSSTÜCKLISTE OHNE SUFFIX

Datum : 05.02.02 08:24
Seite : 1
gedruckt von: sprung

Fert.-Art. EG081W0003

ELAST.ELEMENT
Drawing EG08100003

Info:

Author : troesteo
Date : 31.05.2001

Pos	Quant.	Article	Description	Measurement	Material	Remark
1	1	EG081WA002	FLEX.ELEMENT		ST/GUMMI	

Echtfirma

VULKAN: PRODUKTIONSSTÜCKLISTE OHNE SUFFIX

Datum : 16.01.02 07:48
Seite : 1
gedruckt von: sprung

Fert.-Art. IG082W0010
RATO-S
Drawing IG08200010

Author : grihn
Date : 08.11.2001

Info:

Pos	Quant.	Article	Discription	Measurement	Material	Remark
1	1	EG082WA002	FLEX.ELEMENT		ST/GUMMI	
5	1	4G08B2002M	HUB	FM 600X 206,47X310	42CRMO4V	EN 10083-1
7	1	3G34B6000M	INN.CLAMP.RING	FM 600X 475 X 37	C45N	
9	1	4G34630050	SLEEVE BEARING	FM 406X 381 X 84	LUYTEXC320	
10	1	2G34R5014M	MEMBRANE-DG.			
16	32	3G34S20000	DISC	FM 45X 24 X 5.50	42CRMO4V	VERG.17200
19	32	7000122100	HEXAGON BOLT	M 22 X100	10.9	931M
20	32	7000122070	HEXAGON BOLT	M 22 X 70	10.9	931M
22	24	7000130100	HEXAGON BOLT	M 30 X100	10.9	931M
28	32	7020122000	HEX NUT	M 22	10	934
35	24	7033630000	DISC	30	42CRMO4V	VERG.17200
39	32	7033622000	DISC	22	42CRMO4V	VERG.17200
39	32	7033622000	DISC	22	42CRMO4V	VERG.17200
41	32	3G34S50000	DISTANCE DISC.	FM 45X 24 X 0.25	CUSN6 F55	
47	8	7010020180	SOCK HD SCREW	M 20 X180	8.8	912M
48	1	4G08620030	GUIDE RING	FM 385X 276 X375	C45N	
50	32	7020122000	HEX NUT	M 22	10	934

Echtfirma

VULKAN: PRODUKTIONSSTÜCKLISTE OHNE SUFFIX

Datum : 13.06.02 14:52
Seite : 1
gedruckt von: sprung

Fert.-Art. EG082WA002
ELAST.TEIL
Drawing EG0820A002

Author : troestee
Date : 31.05.2001

Info:

Pos	Quant.	Article	Description	Measurement	Material	Remark
1	2	EG081W0003	FLEX.ELEMENT		ST/GUMMI	
2	1	4G34380010	MEMBRANE	FM1070X 439 X 1.6	50CRV4V	
3	1	4G34780010	CENTERING RING	FM 535X 406 X106	C45N	
4	1	4G34970010	COVER	FM 535X 439 X 18	C45N	
5	16	7000122090	HEXAGON BOLT	M 22 X 90	10.9	931M
6	16	4G3472006M	HEX FITTEDBOLT	M 22X 25js6X 82	42CRMO4V	
7	16	7000020065	HEXAGON BOLT	M 20 X 65	8.8	931M
8	16	7020122000	HEX NUT	M 22	10	934
9	16	7020122000	HEX NUT	M 22	10	934
10	16	7020020000	HEX NUT	M 20	8	DIN934
11	32	7033622000	DISC	22	42CRMO4V	VERG.17200
12	16	7033724000	DISC	24	42CRMO4V	VERG.17200
13	16	7033622000	DISC	22	42CRMO4V	VERG.17200

Echtfirma

VULKAN: PRODUKTIONSSTÜCKLISTE OHNE SUFFIX

Datum : 13.06.02 14:48
Seite : 1
gedruckt von: sprung

Fert.-Art. 1G082W0014

RATO-S

Drawing 1G082W0014

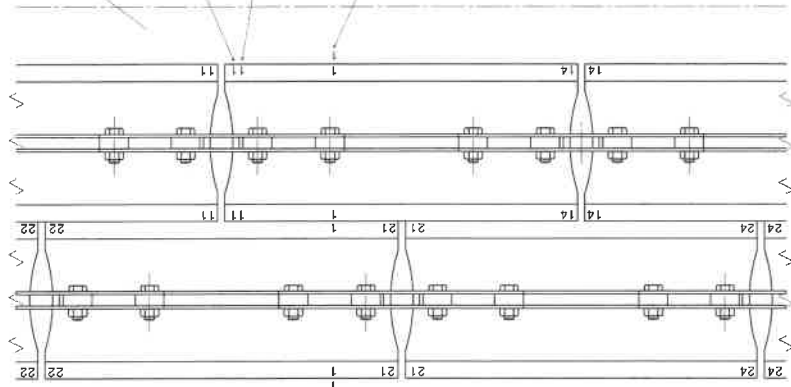
Info:

Author : mirhoff
Date : 10.06.2002

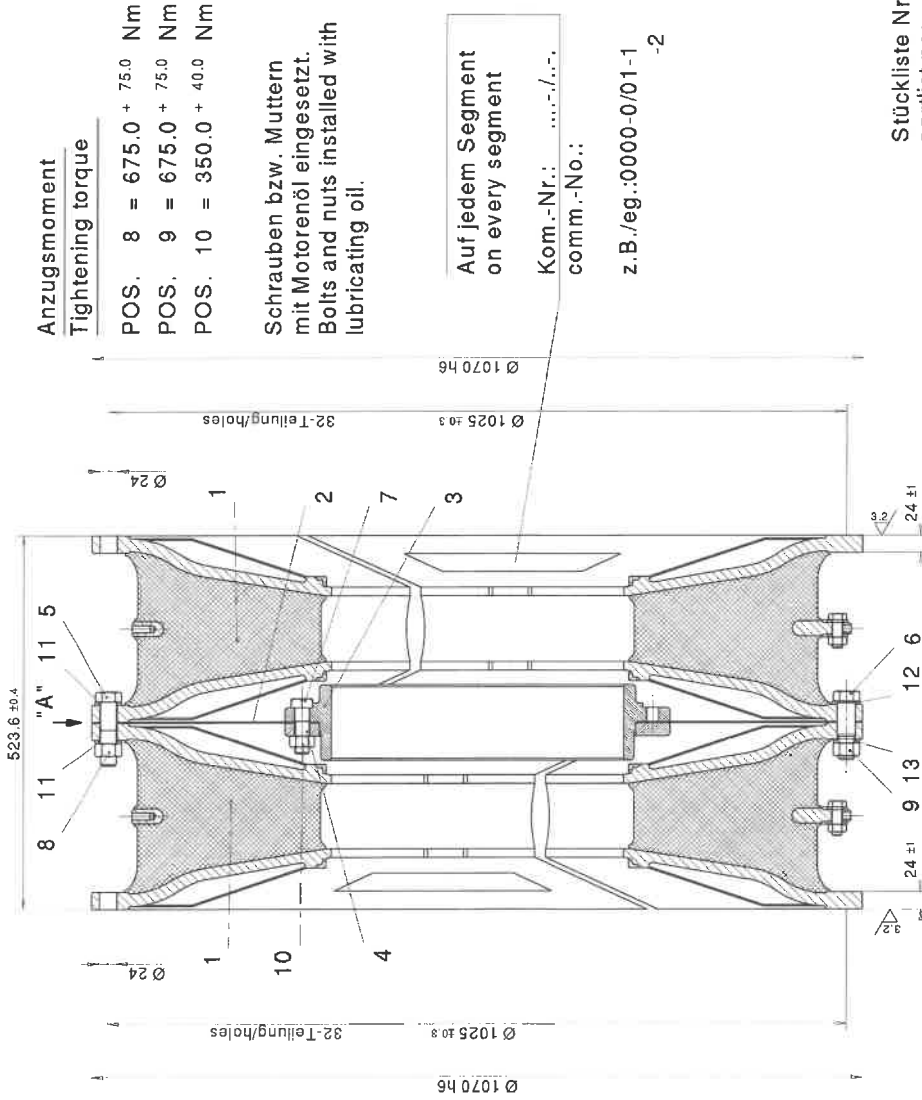
Pos	Quant.	Article	Discription	Measurement	Material	Remark
1	1	EG082WA002	FLEX.ELEMENT		ST/GUMMI	
5	1	4G34B2014M	HUB	FM 600X 135	42CRMO4V	EN 10083-1
7	1	4G34B6002M	INN.CLAMP.RING	FM 600X 320	GGG-40	
9	1	4G34630050	SLEEVE BEARING	FM 406X 381	LJYTEXC320	
10	1	2G34R5014M	MEMBRANE-DG.			
16	32	3G34S20000	DISC	FM 45X 24	42CRMO4V	VERG.17200
19	32	7000122100	HEXAGON BOLT	M 22	10.9	931M
20	32	7000122070	HEXAGON BOLT	M 22	10.9	931M
22	24	7000130160	HEXAGON BOLT	M 30	10.9	931M
28	32	7020122000	HEX NUT	M 22	10	934
35	24	7033630000	DISC	30	42CRMO4V	VERG.17200
39	32	7033622000	DISC	22	42CRMO4V	VERG.17200
39	32	7033622000	DISC	22	42CRMO4V	VERG.17200
41	32	3G34S50000	DISTANCE DISC.	FM 45X 24	CUSN6 F55	
50	32	7020122000	HEX NUT	M 22	10	934
51	8	4G08610001		FM 33x20,2x60	42CRMO4V	EN 10083-1
52	8	7010020090	SOCK HD SCREW	M 20	8.8	912M
72	1	4G3471014M	FLYWHEEL MASS	FM 1085x 475 x 70	C45N	

Ansicht/view "A"

Ansatzstelle mit Kennzeichnung (siehe "ZZ") versehen!
connection parts to be marked! (see "ZZ")



zu YY: mit der Kennzeichnung "1" rechts beginnen! start with mark "1" right side!



Anzugsmoment
Tightening torque

- POS. 8 = 675.0 + 75.0 Nm
- POS. 9 = 675.0 + 75.0 Nm
- POS. 10 = 350.0 + 40.0 Nm

Schrauben bzw. Muttern
mit Motorenöl eingesetzt.
Bolts and nuts installed with
lubricating oil.

Auf jedem Segment
on every segment

Kom.-Nr.: ...-...-...
comm.-No.:

z.B./eg.: 0000-0/01-1
-2

Stückliste Nr.:
partlist no.:
EG082WA002
EG082TA002

XX: Schnittstellen-Kennzeichnung der Segmente/sectional segment marking

YY: Kennzeichnung der Elemente (z.B. 1=1.Reihe,2=2.Reihe,...)/Marking of elements (eg. 1=single row,2=double-row,...)

ZZ: Kennzeichnung der Grundstellung mit fortlaufender Numerierung der Kupplung pro. Kom.

- z.B.: 1 = 1.Kupplung der Kom.-Nr. 0000-0/01-1
- 2 = 2.Kupplung der Kom.-Nr. 0000-0/01-2

Marking of basic position with consecutive numbering of coupling per comm.-No.

- eg.: 1 = 1.coupling of comm.-no. 0000-0/01-1
- 2 = 2.coupling of comm.-no. 0000-0/01-2

Normalausführung
standard design

FORM UND AUSEE DES WERKSTÜCKES DRAWING OF THE PART		SCHUTZVERMERK NACH DIN 34. BEACHTEN!	
WERTSTOFF MATERIAL	MARKSTAB SCALE	% (D/N A2)	GEWICHT WEIGHT
WERTSTOFF-NR. MATERIAL NO.	ROHTEIL NR. PART NO.	BENENNUNG DESCRIPTION	
DATUM DATE	NMME NAME	Elast. Teil Elastic part	
BEFARB COLOR	TROSBIBR. FINISH	zweireihig double row	
SEPR. SEPARATION	LEBZEIT LIFE	ZEICHNUNGSNUMMER DRAWING NO.	
NORM. STANDARD		EG0820A002	
VULKAN 44833 HEINE		ERL. NR. DRAWING NO.	EG0820A002
ÄNDERUNG REVISION		ERL. NR. DRAWING NO.	EG0820A002
DATUM DATE	NMME NAME	ERL. NR. DRAWING NO.	EG0820A002

Echtfirma

VULKAN: PRODUKTIONSSTÜCKLISTE OHNE SUFFIX

Datum : 13.06.02 14:54
Seite : 1
gedruckt von: sprung

Fert.-Art. EG081W0003
ELAST.ELEMENT
Drawing EG08100003

Author : troestee
Date : 31.05.2001

Info:

Pos	Quant.	Article	Description	Measurement	Material	Remark
1	1	EG081WA002	FLEX.ELEMENT		ST/GUMMI	

Echtfirma

VULKAN: PRODUKTIONSSTÜCKLISTE OHNE SUFFIX

Datum : 13.06.02 14:47
Seite : 1
gedruckt von: sprung

Fert.-Art. 2G34R5014M
MEMBRANE-BG.
Drawing 2G34R5014M

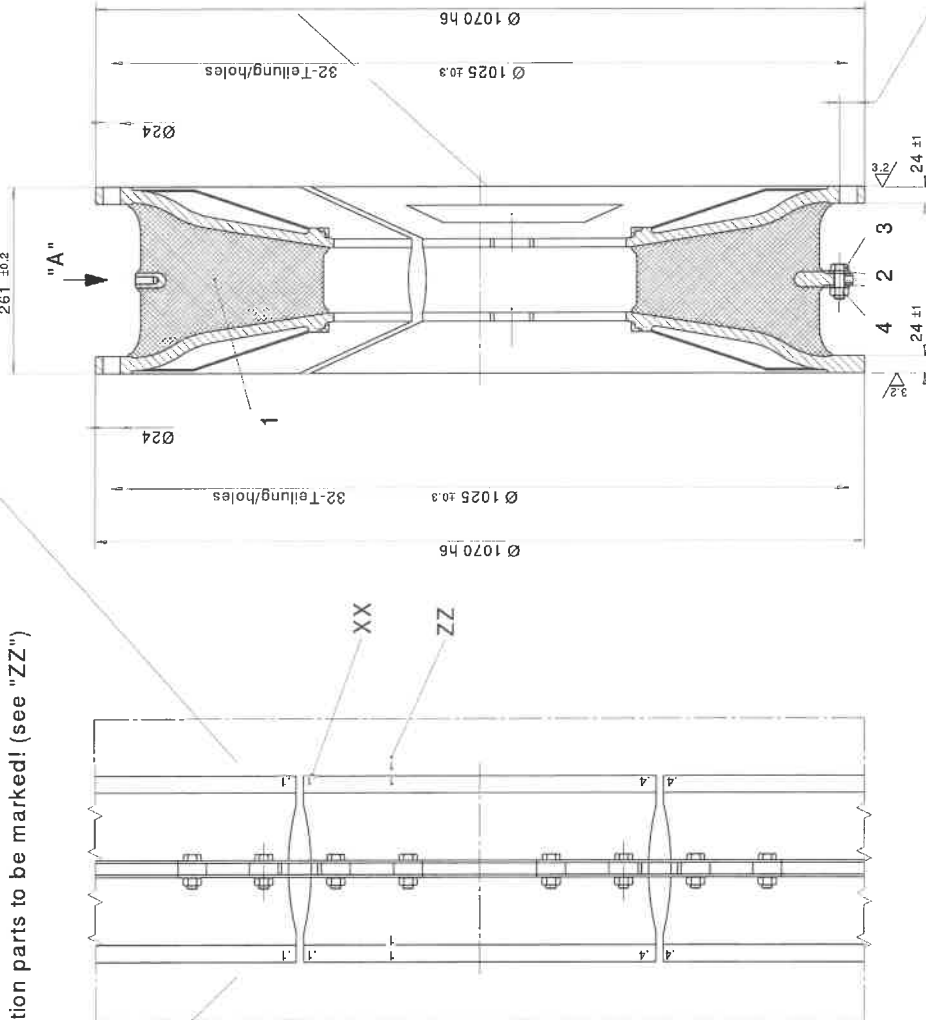
Author : GRIHN
Date : 09.11.1998

Info:

Pos	Quant.	Article	Description	Measurement	Material	Remark
1	4	3G34R5010M	MEMBRANE	FM1070X 475 X 0.85	50CRV4	
2	16	3G34R80000	SPACER SHEET	FM 753.1X186,6X 0,25	CUSN6 F55	
3	20	3G34R70000	SPACER SHEET	FM 418X 127.80X 0.25	CUSN6 F55	
4	1	3G34S6011M	CLAMPING RING	FM1085X 975 X 36	42CRMO4V	EN 10083-1
5	8	7033620000	DISC	20	42CRMO4V	VERG.17200
6	8	7001020025	HEXAGON BOLT	M 20 X 25	8.8	933M

Ansicht/view "A"

Anschlußteile mit Kennzeichnung (siehe "ZZ") versehen!
connection parts to be marked! (see "ZZ")



XX: Schnittstellen-Kennzeichnung der Segmente/sectional segment marking

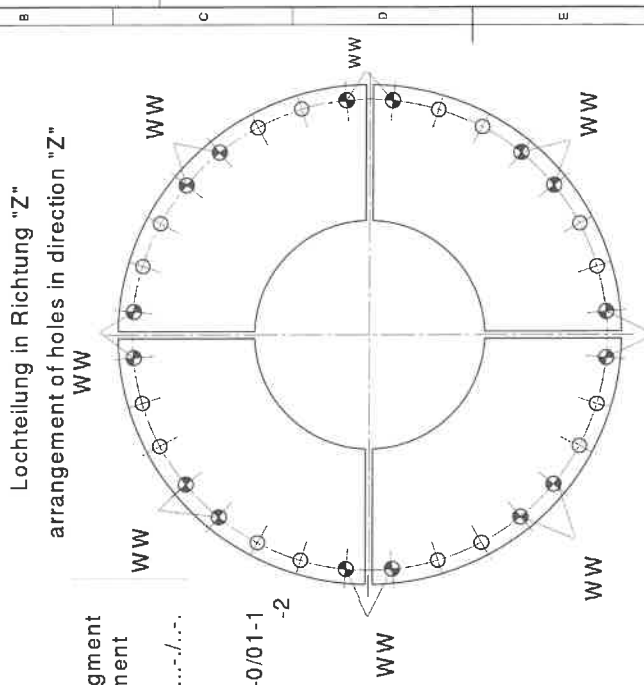
ZZ: Kennzeichnung der Grundstellung mit fortlaufender Numerierung der Kupplung pro. Kom.

z.B.: 1 = 1.Kupplung der Kom.-Nr. 0000-0/01-1
2 = 2.Kupplung der Kom.-Nr. 0000-0/01-2

Marking of basic position with consecutive numbering of coupling per comm.-No.

eg.: 1 = 1.coupling of comm.-no. 0000-0/01-1
2 = 2.coupling of comm.-no. 0000-0/01-2

Geh.zu: EG0820A002.



Auf jedem Segment
on every segment
Kom.-Nr.: ...-...-1-1
z.B./eg.:0000-0/01-1-1-2

Anzugsmoment
Tightening torque
POS. 4 = 165.0 ± 20.0 Nm

WW Nach dem Vulkanisieren
auf Ø 25 H7 aufgerieben
after vulcanisation
reamed to Ø 25 H7

SI-System		
J	m	
kgm ²	kg	
1	27	175
2	27	175

Stückliste Nr.:
partlist no.:
EG081W0003
EG081T0003

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**Installation
and
Operating Instruction**

E12220E

VULKAN-RATO-S Couplings

Size: G0520, G0820

with link connection

Series : 2100, 2200

rigid membrane clamping

VULKAN Kupplungs- und Getriebebau

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1. General safety instructions

1.1 Symbol for industrial safety



This symbol is added to all passages in this documentation concerning industrial safety and including a risk to people's life and limb. Please follow these instructions and handle with the utmost caution in these situations. Hand over all industrial safety instructions to other users as well.

1.2 Attention remark

Attention!

This "Attention!" remark is added to passages in this documentation which should be specially noted in order to stick to the guidelines, regulations, instructions and correct flow of work and to prevent any damages or destruction of the coupling.

1.3 Safety regulations

A coupling shield has to be provided, according to the accident prevention regulations. According to **EN 292, part 1 „Safety of Machines“**, a shield against mechanical movements of machine parts (protection against accidental contact) is permissible, if a **„usage according to the regulations“** is guaranteed during all working conditions.

At the same time a good ventilation of the coupling has to be ensured (use of perforated plates).

If the possibility of exceeding the permissible speed of the coupling, n_{kmax} , cannot be excluded completely, e. g. in case of an incident or because of a failure of the over-speed-trip in the system, the coupling shield has to be so designed that **possible coupling fragments cannot escape to the surrounding environment**.

For coupling applications in fast ships (Dynamically Supported Craft), the safety regulations of publication **A373** of **IMO** (International Maritime Organisation) are valid.

Dependant on the construction, these machine arrangements contain components with a high rotating energy.

When the coupling runs **outside of a casing**, an external protecting device has to be provided to **keep off possible coupling fragments in any case**.



2. Generalities

The highly-flexible **VULKAN-RATO-S** coupling is a rubber coupling, flexible in all directions. Its essential parts are the flexible part, the membrane dimension group and the connecting parts.

All connecting elements of the coupling are arranged without clearance.

The coupling must be protected against permanent influence of oil and against the radiation of heat. Oil mist and oil splashes are not detrimental.

The flexible part is fit for use at ambient temperatures comprised between -50° (C) to $+70^{\circ}$ (C). Due to the segmental construction of the flexible part, a good heat dissipation in the coupling is guaranteed. The free-of-play torque transmission in the coupling and the large sectional rubber area of the flexible element guarantee good noise attenuation.

Basically, the connection surfaces and the fitted as well as the finish bores of the couplings are protected by Tectyl. Prior to installation of the coupling, these surfaces have to be cleaned with conventional solvents.



Pay attention to wear protective clothes (gloves, safety glasses etc.) while working with solvents.

When the cleaned surfaces are completely dry, they have to be greased slightly.

On behalf of the classification societies we herewith give the following instruction:

The torsional vibration behaviour of the driving system has been checked and approved by the classification society. The expected and satisfactory behaviour is guaranteed only, provided that all components comply to the values, the torsional vibration calculation is based upon. With respect to the coupling, this means to exactly keep to the dynamic stiffness and damping.

In case of a replacement of the elements, only original VULKAN elements with coordinated technical data, approved by the classification societies, must be used!

The highly-flexible VULKAN RATO-S coupling is delivered in the partially assembled condition, so that no extensive disassembly procedure at the coupling is required for installation.

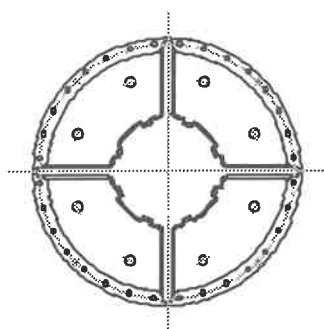
To guarantee faultless function and optimum use of the highly-flexible **RATO-S** coupling, certain installation instructions have to be observed. Basically, each screwed connection participating in the transmission of the torque must be tightened by means of a torque spanner. The individual tightening torques are given in the respective execution drawing of the coupling.

In case of a flexible mounted system, the alignment has to be coordinated with the manufacturers of engine, coupling and gearbox.

When using 10.9 screws, hardened washers have to be provided.

3. Design of the flexible part

The flexible part consists of two flexible elements. Each flexible element is divided into 4 flexible segments (please refer to the following sketch).



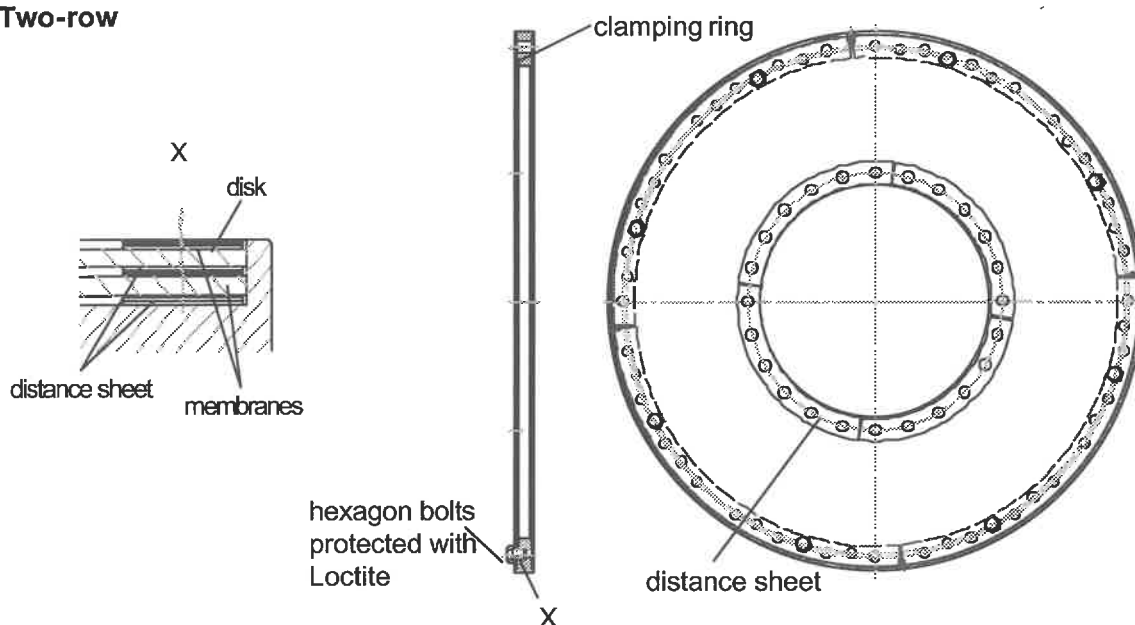
The position of the flexible segments as well as the position of both flexible elements to each other is marked.

Further information with respect to the marking can be taken from drawing No. EG....

4. Design of the membrane dimension group

The membrane part consists of a number of ring-shaped membranes which are externally rigidly clamped. The membrane dimension group is connected to the flexible part and allows a displacement in the axial direction.

Two-row



5. Installation of the coupling

As the coupling is delivered in the partially assembled condition, no extensive disassembly procedure is required for installation.
Only the connecting elements inserted to connect both flexible elements have to be removed.

5.1 Assembly procedure for series 2100, 2200



During transportation please pay attention to a sufficient carrying force of the lifting devices.
Only use approved transportation elements.
Thoroughly fix the transportation elements to the attaching device.

Attention! While lifting the flexible elements, take care not to damage the flexible elements and the add-on pieces.

The hub (5) with the connected parts has to be attached to the connecting part of the corresponding machine. Should the connection be made with a free shaft end which would require a heating of the hub at the membrane part, a temperature of $+150^{\circ}\text{C}$ is not allowed to be exceeded.

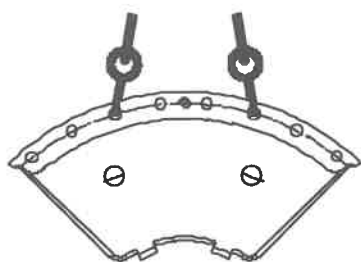
After having established the connection with the corresponding machines, both machines have to be erected according to the installation dimension of the coupling. Possible thermal expansions specific to the system are to be considered (please refer to the alignment instructions sheet S / R-A- 1/1 - 5/1).

After the alignment of the drive system, the assembly of the flexible part can be started.

Attention! The whole center bar is not allowed to be used as attaching device for transportation of the elements or segments resp.

First of all the membrane support has to be checked with respect to its movability (fit in, if necessary), subsequently the bearing bush should be inserted allround greased.

Attention! Only use grease without solid lubricants.

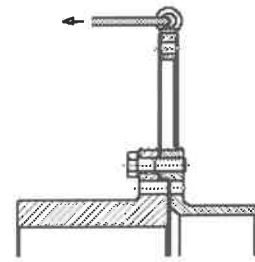


For assembly, the individual segments have to be hung into a lifting device using suitable aids. First install the segments arranged opposite to the membrane part one after the other and connect them with the connecting part on the driving side by means of the corresponding fixing elements.
The prescribed tightening torque is to be kept. When using 10.9 screws, hardened washers have to be provided.



In order to insert the driven side segments, it is required to deflect the membranes. This deflection can be carried out by means of a suitable traction device. For this purpose two ring bolts have to be screwed into the tapped holes radially arranged in the clamping ring one beside the other.

After having applied a suitable traction device, which is to be connected with both ring bolts, the membrane package can be deflected as far as to allow to insert one segment on the membrane side of the coupling.



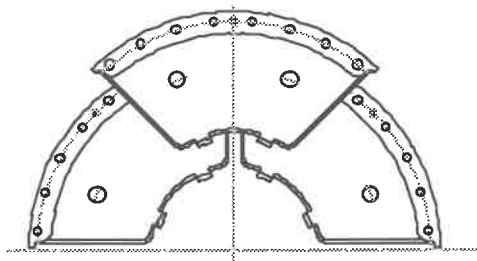
After having inserted the segment by means of suitable aids and having positioned it correctly, the connection with the clamping ring has to be established.

The nuts have to be tightened with the prescribed tightening torque.

Attention

During the tightening process please check whether the respective segment is at its outer circumference in metallic contact with the centering of the connecting part!

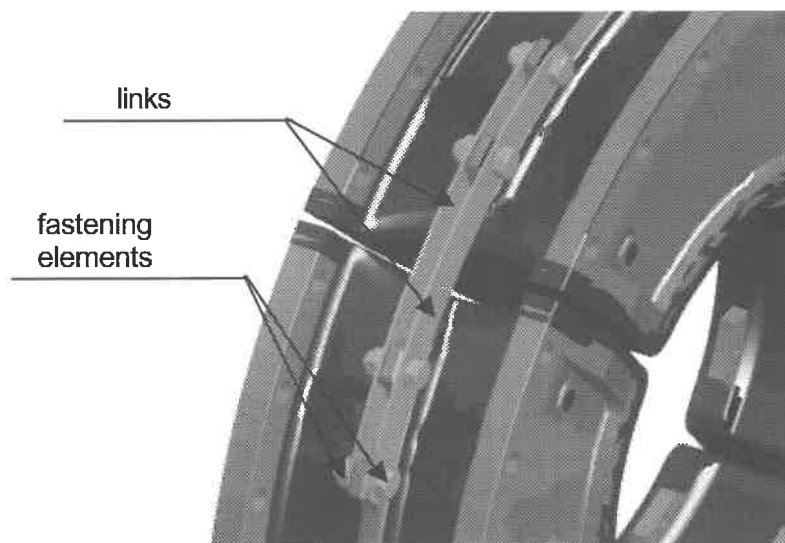
The same sequence of operations is required for the remaining segments.



During the assembly, please pay attention that the segments to be installed at this side are displaced regularly to the segments already assembled at the other side, so that a closed ring formation will arise. The figure at the left shows the arrangement with a 4-part element and should serve as a reference.

Subsequently the connection of both segment-rows is to be established.

Then the connection of the individual center bars is to be established with the links and the fastening elements provided for this purpose (please refer to the following figure).





The fastening elements have to be tightened with the given tightening torque.
When using 10.9 bolts, hardened washers are to be provided.

6. Commissioning



Press „EMERGENCY SHUTDOWN“ in case of danger.
Do not touch any rotating parts.
Equip the coupling with a sufficient protection device against contact.

Attention!

Make sure that the coupling is protected against contact with oil, solvents and other chemicals.

We would like to point out that before commissioning you have to make sure that all assembling auxiliaries have been removed from the coupling.
A coupling shield has to be provided, according to the accident prevention regulations. If there are no other objections having priority, these shields have to be made of perforated plates or expanded metal to ensure a good ventilation of the coupling as well.

7. Maintenance



Stop the system for maintenance work.
Safely protect the system against unintentional starting resp. rotation.

Under normal circumstances the highly-flexible **RATO-S** coupling does not require maintenance. In many cases, however, the **RATO-S** coupling is an indicator for malfunctioning in the system. We recommend a check of the flexible part in case of exceptional incidents, e. g. propeller contact, misfiring operation, short circuit, disturbance of synchronization or emergency cut-off.
In addition, an annual alignment control and a check of the flexible part should be carried out. The flexible elements can be judged according to leaflet S/R-CRIT-1/1 - 7/1 and reworked, if necessary.

8. Replacement of the flexible part

Should, however, due to an inadmissible load a damage occur to the flexible part installed, the individual segments can be removed or installed without the driving or driven machine having to be displaced.

We would like to explain the replacement of the flexible part in detail as follows:



8.1 Disassembly of the flexible part

The individual segments have to be disassembled using a lifting device. First of all the segments mounted on the membrane side are to be disassembled.

For this purpose the membrane package has to be deflected sufficiently. After removal of the fasteners arranged on both sides for each segment, all segments can be dismantled one after the other.

Please note: In case that a damage occurs to one of the segments, it is a basic requirement to replace all remaining segments of the flexible element concerned as well! If the fitting bolts of the plate connection have to be installed or removed several times (max. 5 times) for some reason specific to the system (e. g. engine test bed), these bolts and nuts have to be replaced. When ordering spares for the flexible part or flexible elements resp., please give us the following information with respect to the coupling:

1. order no.
2. drawing no.
3. partslist no.

8.2 Assembly of the flexible part

Before starting the assembly, a new alignment control should be carried out at the drive system.

The assembly of the segments has already been described in paragraph 5.1.

After completion of the assembly, the drive system is ready for operation, as far as the coupling is concerned.

9. Service and spare parts

Contact address:

VULKAN Service dept.

Heerstraße 66

D-44653 HERNE

Phone: +49 (0)2325 922 224

FAX: +49 (0)2325 71110

Mobile: +49 (0)1782922179



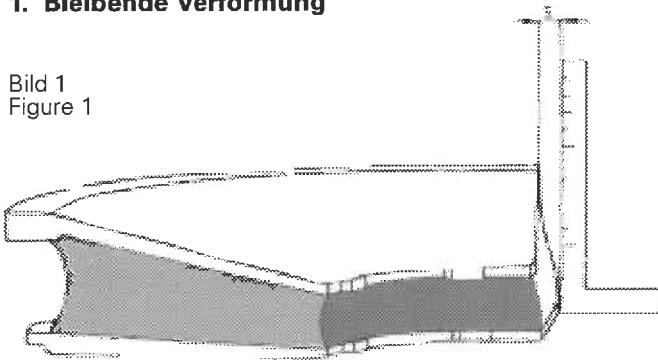
Die außenliegenden Oberflächen einer rotierenden Kupplung sind im ständigen Kontakt mit der sie umgebenden Luft. Dies gewährleistet eine gute Belüftung der Kupplung, bringt sie aber gleichzeitig auch in Kontakt mit Sauerstoff, Ozon und besonders aggressiven Abgasen. In Kombination mit Temperaturschwankungen, Feuchtigkeit und UV-Strahlung kann dies zu irreversiblen Veränderungen der Materialstruktur an der Oberfläche des Gummis führen. Diesen nicht vermeidbaren Prozeß nennt man "ALTERN".

Da das "ALTERN" durch die Kombination der unterschiedlichsten Einflüsse hervorgerufen wird, ist es nicht möglich, den Vorgang unter Laborbedingungen zu simulieren. Um trotzdem eine Aussage über den Einfluß der "ALTERUNG" auf die Betriebssicherheit der Kupplung machen zu können, wurden RATO-Kupplungen mit einer langen Betriebszeit von VULKAN untersucht. Die Ergebnisse dieser Untersuchungen sind in den folgenden Abschnitten zusammengefaßt.

Bedingt durch den konstruktiven Aufbau der Elemente und die verschiedenen Beanspruchungsarten und -größen zeigen sich nach einer mehr oder weniger langen Betriebszeit an den Elementen Gebrauchsspuren. Die häufigsten Erscheinungsformen sind:

1. Bleibende Verformung

Bild 1
Figure 1



Die Kontrolle der bleibenden Verformung eines RATO-S-Segmentes erfolgt durch die Ermittlung von "s" am äußeren Durchmesser des Gummielementes (Bild 1). Bei einem RATO-R-Element kann das Maß "s" über die Verformung der Gummiwulst ermittelt werden (Bild 2).

Überschreitet die vorhandene Verformung "s" die Werte in der folgenden Tabelle, müssen die elastischen Teile ausgetauscht werden; andernfalls sind die elastischen Teile für den weiteren Betrieb geeignet, sofern keine anderen Anzeichen für eine Schädigung der elastischen Teile vorhanden sind.

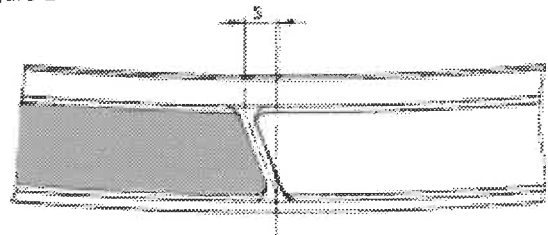
The outer surface of a rotating coupling is continuously in contact with the surrounding air. This ensures a good ventilation of the coupling but also gives rise to permanent contact with oxygen, ozone and especially aggressive exhaust gases. This, in combination with temperature, humidity and UV-radiation, causes irreversible changes in the material structure at the external surface of the RATO segment. This unavoidable process is generally known as AGEING.

Due to the fact that AGEING is a combination of various influences it is impossible to simulate under laboratory conditions. VULKAN has therefore examined RATO elements, with a long operational life, to investigate the influence of AGEING on the operational-safety of the coupling. The results of these investigations can be summarized as follows.

Due to the constructional design of the element, and the different types and values of stresses, the element will, after a certain period of service, show indications of having undergone operational service. The most frequent symptoms are:

1. Permanent set

Bild 2
Figure 2



To determine the permanent set of a RATO-S segment the dimension "s", measured at the outer diameter of the coupling segment, is determined (figure 1). The permanent set "s" of a RATO-R element can be measured through the deformation of the rubber roll (figure 2).

If the permanent set "s" exceeds the criteria in the following table, the elements must be replaced; otherwise the elements are suitable for further service provided there are no other indications of elements damage.

Zulässige bleibende Verformung für ein RATO-S-Segment
Permissible permanent set for a RATO-S segment

Baugröße Size	X = 1 mm	X = 2 mm	X = 7 mm	X = W mm	X = T mm	Baugröße Size	X = 1 mm	X = 2 mm	X = 7 mm	X = W mm	X = T mm
141 X	19,0	12,0	20,0	–	–	391 X	67,0	38,0	67,0	–	67,0
151 X	23,0	16,0	23,0	–	–	431 X	73,0	42,0	76,0	–	73,0
161 X	24,0	17,0	26,0	–	–	451 X	–	–	–	105,0	105,0
171 X	26,0	18,0	30,0	–	–	461 X	34,0	20,0	41,0	–	34,0
191 X	28,0	19,0	27,0	–	–	481 X	67,0	40,0	82,0	–	67,0
211 X	30,0	20,0	36,0	–	30,0	491 X	36,0	22,0	44,0	–	36,0
231 X	32,0	22,0	34,0	–	32,0	511 X	72,0	43,0	78,0	–	72,0
251 X	36,0	22,0	38,0	–	36,0	531 X	–	–	–	120,0	120,0
271 X	37,0	24,0	38,0	–	37,0	541 X	39,0	23,0	48,0	–	39,0
031 X	–	–	–	55,0	55,0	561 X	88,0	47,0	95,0	–	88,0
291 X	41,0	26,0	44,0	–	41,0	581 X	94,0	56,0	103,0	–	94,0
311 X	49,0	28,0	51,0	–	49,0	601 X	47,0	28,0	52,0	–	47,0
051 X	–	–	–	65,0	65,0	631 X	–	–	–	85,0	85,0
331 X	53,0	31,0	51,0	–	53,0	651 X	51,0	30,0	56,0	–	51,0
341 X	58,0	33,0	59,0	–	58,0	681 X	–	–	–	103,0	103,0
081 X	–	–	–	75,0	75,0	701 X	55,0	33,0	60,0	–	55,0
361 X	62,0	36,0	64,0	–	62,0	731 X	–	–	–	110,0	110,0
381 X	–	–	–	90,0	90,0						

Zulässige bleibende Verformung für eine RATO-R-Reihe
Permissible permanent set for one RATO-R row

Baugröße Size	X = 1 mm	X = 2 mm	X = 7 mm	X = 5 mm
161 X	23,0	14,0	25,0	21,0
171 X	25,0	15,0	27,0	22,0
191 X	27,0	16,0	29,0	27,0
211 X	29,0	18,0	32,0	24,0
231 X	31,0	19,0	35,0	28,0
251 X	35,0	21,0	39,0	30,0
271 X	38,0	23,0	42,0	34,0
271 X ²	23,0	14,0	26,0	32,0
291 X	40,0	24,0	45,0	26,0
291 X ²	25,0	15,0	27,0	26,0
311 X	45,0	27,0	50,0	41,0
331 X ²	30,0	18,0	33,0	27,0
341 X ²	39,0	23,0	42,0	35,0

² 3reihige Elemente
3 row elements

Werden die zulässigen Werte durch die vorhandene Verformung überschritten, sollten, bevor die neuen Elemente eingebaut werden, die Ursachen für die zu große bleibende Verformung beseitigt werden.

It is advisable to determine and eliminate the reasons for the permanent set, that is in excess of the permissible values given in the table, before installing replacement elements.

2. Oberflächenrisse

Der "ALTERUNGSPROZESS" führt zu einer Oberflächenverhärtung des Gummis und dadurch zu einer verringerten Elastizität der Oberfläche. Durch die Verformung des elastischen Teiles im Betrieb kann es deshalb zu Rissen kommen, die bis zu einer begrenzten Tiefe zulässig sind (Bild 3).

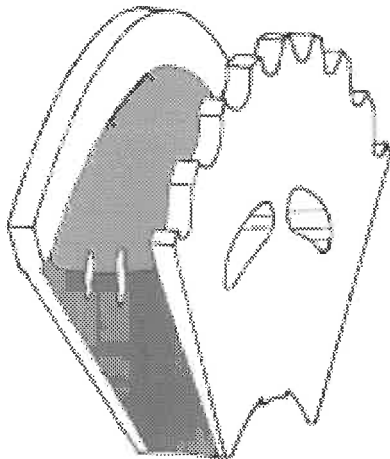


Bild 3
Figure 3

2. Cracks

AGEING gives rise to a hardening of the surface rubber. Due to the reduced elasticity at the outer surface cracks can be formed when the elements are deformed during service. Cracks with a depth LESS than the permissible value are acceptable (figure 3).

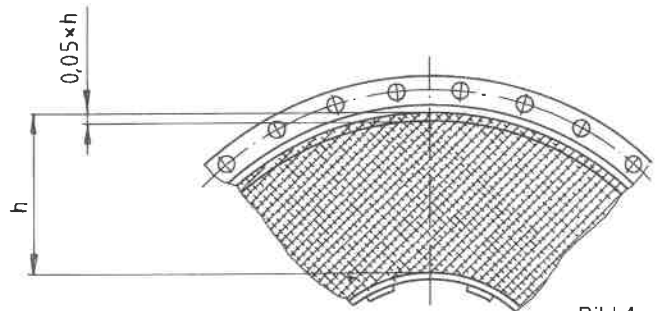


Bild 4
Figure 4

Nach unseren heutigen Erfahrungen kann man einen Riß im elastischen Teil einer RATO-S-/R-Kupplung bis zu einer Tiefe von ca. 5 % der radialen Gummihöhe auf dem kompletten Umfang als zulässig betrachten (Bild 4).

According to our present experience, for a RATO-S/R flexible element a crack with a depth of about 5 % of the segment's radial thickness of the total circumference is to be considered acceptable (figure 4).

Risse sollten so bald wie möglich ausgeschliffen (ausgemuldet) werden. Diese von Stahl- und Gußteilen bekannte Methode kann auch bei Gummikörpern angewendet werden.

The cracks should be ground out as soon as possible. This procedure, usually used for steel and cast components, can also be used for rubber elements.

Zulässige Rißtiefe einer RATO-S-/R-Kupplung Permissible crack depth of a RATO-S/R coupling

Baugruppe Dimension group	Tiefe / Depth [mm]		Baugruppe Dimension group	Tiefe / Depth [mm]	
	RATO-S	RATO-R		RATO-S	RATO-R
1410	5,0		3610	14,0	
1510	6,0		3910	15,0	
1610	6,0	6,0	4310	16,0	
1710	6,0	6,0	4610	18,0	
1910	7,0	7,0	4810	18,0	
2110	7,0	7,0	4910	19,0	
2310	8,0	8,0	5110	19,0	
2510	9,0	9,0	5410	20,0	
2710	9,0	9,0	5610	20,0	
2910	10,0	10,0	5810	22,0	
3110	11,0	11,0	6010	22,0	
3310	12,0	12,0	6510	24,0	
3410	13,0	13,0	7010	25,0	

Richtlinien für VULKAN-RATO-S-/R-Kupplungen sind:

- Risse sollten so bald wie möglich ausgeschliffen (ausgemuldet) werden. Das Ausmulden kann durch unsere Monteure durchgeführt werden oder mit Hilfe der Arbeitsanweisung „Schleifen“ durch den Kunden.
- Wenn ein Riß entdeckt wird, sollte seine Tiefe und Länge markiert werden.
- Zur Überwachung des Risses sollte seine Länge markiert werden.
- Es ist wichtig festzustellen ob die Anlage abnormal arbeitet oder gearbeitet hat.
- In vielen Fällen ist die Kupplung ein Indikator für eine Fehlfunktion der Anlage. Wenn trotzdem keine Fehlfunktion festgestellt werden konnte, sollte die Kupplung in kürzeren Intervallen überprüft werden.
- Sind Risse durch Überlastung der Kupplung entstanden und die Ursachen werden nicht beseitigt, wird der Riß weiter wachsen.
- Ist die Kupplung durch eine „einmalige Fehlfunktion“ der Anlage beschädigt worden, kann sich das Schadbild auch unter normalen Betriebsbedingungen verschlechtern.
- Wird die zulässige Tiefe eines Risses überschritten, wird empfohlen, das betreffende Element baldmöglichst auszutauschen.

Inspektionsintervall für RATO-Kupplungen

- Wenn nach einer Inspektion Oberflächenrisse gefunden wurden, die die zulässigen Werte in den Tabellen nicht überschreiten, dann sollte das Wachstum des Risses innerhalb von 3 Monaten noch einmal überprüft werden.
- Wenn die Kupplungsbelastung zulässig ist und der Riß sich zwischen zwei Inspektionen nicht wesentlich verändert hat, ist der Riß auf Grund von „ALTERUNG“ entstanden. Weitere Inspektionen können dann alle 6 Monate durchgeführt werden.
- Wenn die Kupplungsbelastung zulässig ist und der Riß durch eine „einmalige Fehlfunktion“ der Anlage entstanden ist, muß diese gefunden und behoben werden. Eine Überprüfung sollte dann nach 3 Monaten durchgeführt werden oder sobald es zu einer weiteren Fehlfunktion der Anlage kommt.
- Wird die zulässige Tiefe eines Risses überschritten, wird empfohlen, das betreffende Element baldmöglichst auszutauschen.

A guidance for VULKAN-RATO-S/R couplings is as follows:

- The cracks should be ground out as soon as possible.
This can be done by a VULKAN service engineer, or the operator can, by using the instructions for „grinding“, do the job.
- When a crack is noticed, the depth and length must be measured.
- To aid surveillance of the crack, the length should be marked.
- It is important to check if the installation is operating / or has operated abnormally.
- In many cases the coupling acts as an indicator of installation malfunction.
When no system malfunction can be determined, then the coupling has to be checked at shorter intervals.
- When the cracks formed are due to an overloading of the coupling and this is not corrected, the crack will continue to grow.
- An “unique event” can damage the coupling. This, however, does not infer, that when the installation operates “normally” that the damage situation will not get worse.
- If the crack depth exceeds the permissible, we recommend to replace the relevant row as soon as possible.

Interval for checking RATO couplings

- When, after checking a RATO coupling, surface cracks have been found which have a depth LESS than the maximum value given in the table, a “2nd measurement” of the crack dimensions should be made at an interval of about 3 months in order to check crack growth.
- Assuming that the coupling itself is subjected to permissible load levels, the crack can be defined as being the result of AGEING, when the crack dimensions do not significantly change in the interval between the tests. Subsequent checks every 6 months can be made.
- After a system “unique-occurrence”, cracks can appear in couplings that normally operate within their permissible limits. The reason for the malfunction must be investigated and repaired. A check on the crack is necessary after 3 months. In case of new system malfunction, the coupling has to be re-checked.
- If the crack depth exceeds the permissible, we recommend to replace the relevant segment row as soon as possible.

Arbeitsanweisung Schleifen

Die Arbeitsanweisung Schleifen ist ein Bestandteil der Kriterien für die Beurteilung von RATO-S-/R-Kupplungen. Die Nacharbeit der Risse in dem Gummi der Segmente/Elemente kann mit einem geeigneten Bandschleifer durchgeführt werden.

Diese Bandschleifer sind als Elektrobandschleifer und Pneumatikbandschleifer im Fachhandel erhältlich. Die Schleifbänder dafür gibt es in drei verschiedenen Körnungen (fein, mittel, grob).

Beim Schleifen ist darauf zu achten, daß die Temperatur bei der Abschlußbehandlung am Ende des Schleifvorganges nicht zu hoch wird und das Material Gummi aushärtet.

Die Ausmuldung der Risse soll nach Möglichkeit **sehr sauber gerundet sein und keine scharfen Kanten aufweisen.**

Die bearbeitete Fläche sowie die Oberfläche der elastischen Elemente muß abschließend mit VULKANOX behandelt werden.

Anbei die Bilder über Werkzeuge und nachgearbeitete Segmente.

Working instruction „grinding“

The working instruction „grinding“ is one component of the criteria for the inspection RATO-S/R couplings. The rework of the cracks in the rubber of the segments/elements can be done with a suitable belt grinder.

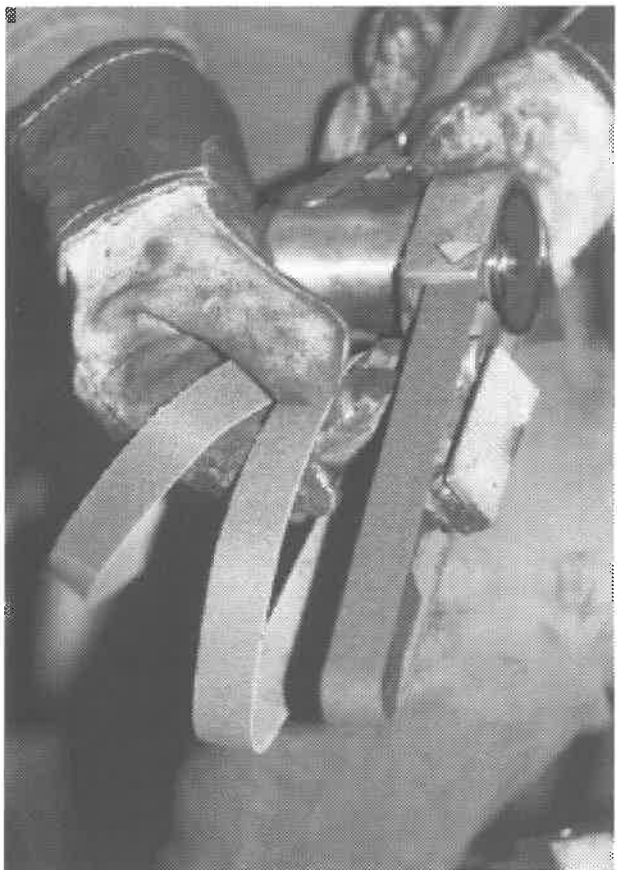
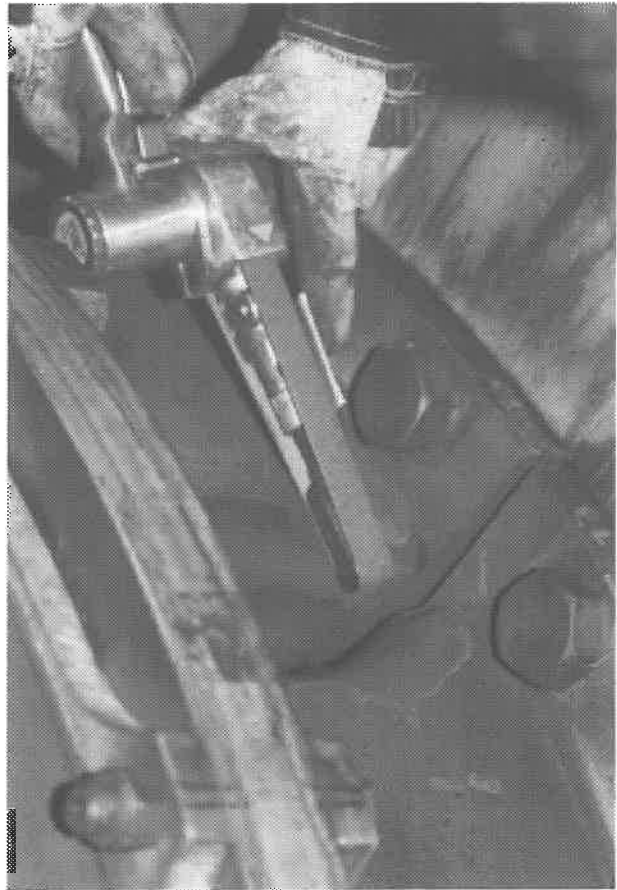
These belt grinders are available in specialist shops as electric and pneumatic belt grinders. The abrasive belts are available in three different coarseness (fine, medium, rough).

When grinding you should take care that the temperature is not too high at the final end of the grinding procedure and the material rubber not hardened.

The moulding of the cracks should be, if possible, **very accurately rounded and should not show sharp corners.**

The reworked area as well as the surface of the flexible elements must be coated finally with VULKANOX.

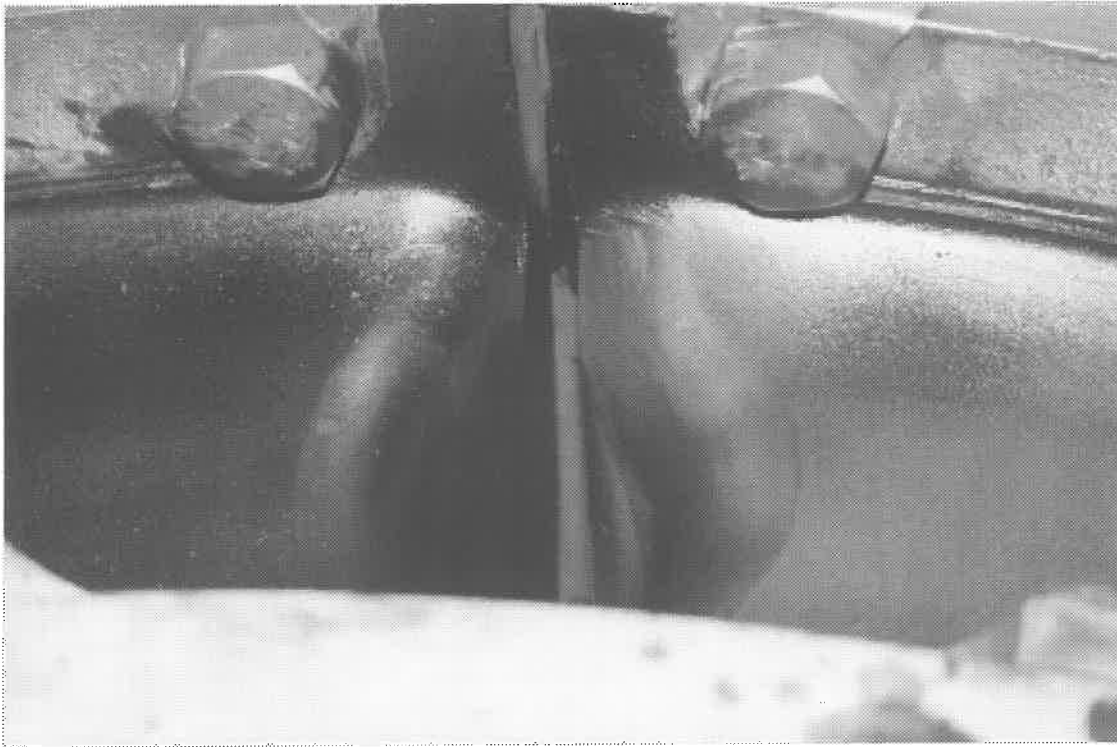
Enclosed you will find photos about tools and reworked segments.



Die Nacharbeit der Risse kann mit einem geeigneten Bandschleifer durchgeführt werden.

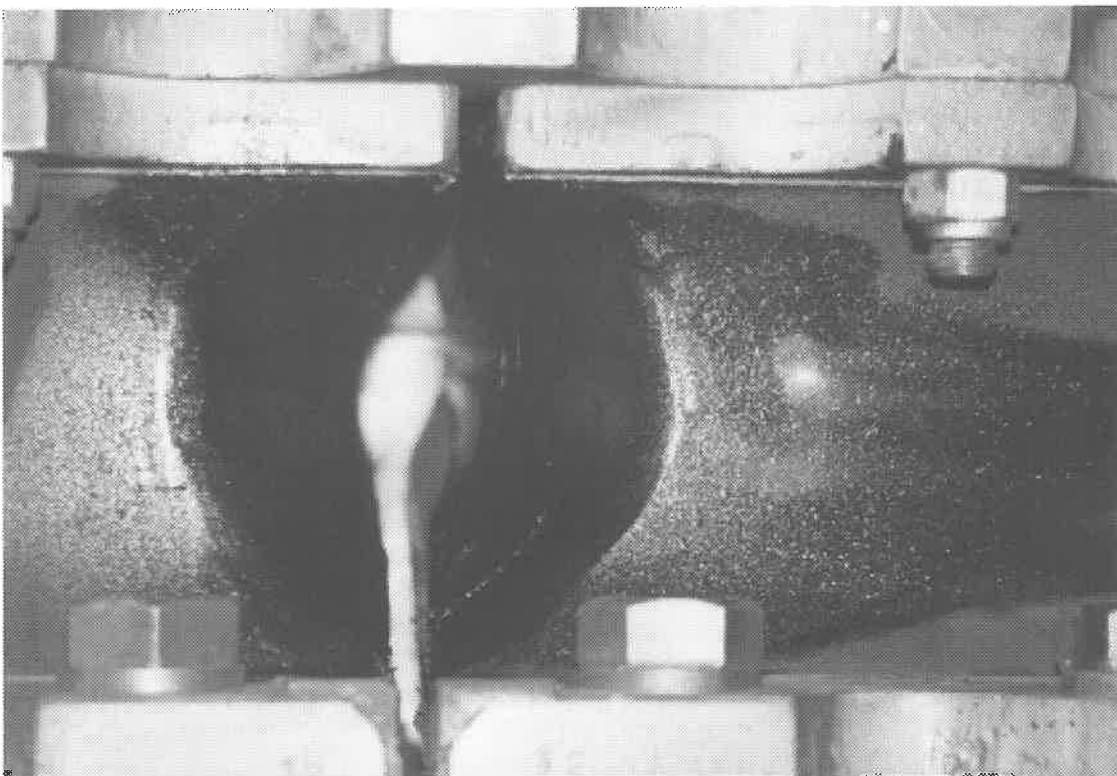
Die Schleifbänder dafür gibt es in drei verschiedenen Körnungen (fein, mittel, grob).

The rework of the cracks can be done with a suitable belt grinder. The abrasive belts are available in three different coarseness (fine, medium, rough).



Bearbeitete Segmentkanten.

Segment corners reworked.





Es wird vorausgesetzt, daß die Kupplung gemäß der auftragsbezogenen mitgelieferten Einbau- und Betriebsanweisung ohne das elastische Teil in die Anlage eingebaut ist. Nur die Anschlußflächen sind von dem vor dem Versand zur Konservierung aufgebrauchten Tectyl gereinigt.

It is assumed that the coupling metal parts have been installed without the flexible element assembly as set in VULKAN "Installation and Operating Instructions". The connection faces need to be cleaned to remove Tectyl preserving agent.

Vor dem Einbau des elastischen Teils ist eine Ausrichtkontrolle durchzuführen. Hierbei ist die radiale, axiale und winklige Ausrichtung mit geeigneten Meßgeräten zu überprüfen.

Prior to installing the flexible part, an alignment check must be carried out. The radial, axial and angular alignment must be checked, using appropriate measuring instruments.

Wir empfehlen, bei der Ermittlung der einzelnen Meßwerte beide Wellen jeweils um 90 Grad weiterzudrehen, da bei dieser Meßmethode Rundlauf- und Planlauffehler nicht mitgemessen werden. Je genauer die Anlage ausgerichtet wird, desto größer sind die Reserven der Kupplung für die Aufnahme von Verlagerungen während des Betriebes.

We recommend that both shafts are rotated by 90 deg before each measurement in order to eliminate any inbuilt errors due to eccentricity and non-parallelism. The accuracy of the alignment determines the reserves the coupling will have to accommodate misalignments during operation.

RATO-Kupplungen sind in der Lage, große Verlagerungen der angeschlossenen Maschinen auszugleichen, ohne größere Reaktionskräfte zu erzeugen und an Lebensdauer einzubüßen. **Wir empfehlen im Normalfall eine praxiserreichte Ausrichtgüte anzustreben. Unter praxiserreicht soll hier eine Ausrichtung verstanden werden, die ohne erhöhten Arbeits- und Meßgeräteaufwand erreicht werden kann. Die entsprechenden Ausrichtwerte sind der folgenden Tabelle zu entnehmen: Bei Anlagen mit zu erwartenden großen Verlagerungen empfehlen wir, die zulässigen Ausrichttoleranzen mit dem Motor- oder Getriebebauer abzustimmen.**

RATO couplings are able to accommodate high misalignments of connecting machines, without generating high reaction forces or reducing service life. **We recommend to work out an alignment-quality for the normal case oriented on practicability. Usually the required alignments may be achieved with normal alignment measuring equipment without having to use sophisticated or time consuming procedures. The recommended alignment tolerances can be taken from the following table: In installations with high misalignments to be expect we recommend to check tolerances with engine or gearbox manufacturer.**

Alle Werte gelten für den betriebswarmen Zustand¹⁾ / All data are valid for service-warm condition¹⁾

Baugruppe Dimension group	empfohlene Ausrichttoleranz / recommended alignment tolerance [mm]		
	radial	axial ²⁾	winklig / angular ³⁾
	elastisch aufgestellt elastic mounted		
K 4010 - K 5710 G 1210 - G 1340	+0,5 ± 0,5	±0,25	±0,35
G 1410 - G 2340	+1,0 ± 1,0	±0,5	±0,35
G 2510 - G 3140 G 0310 - G 0520	+1,0 ± 1,0	±0,6	±0,5
G 3310 - G 3440 G 0810 - G 0820	+1,0 ± 1,5	±0,8	±0,6
G 3610 - G 7340	+1,0 ± 1,5	±0,8	±0,6

¹⁾ Für Neuausrichtungen im kalten Zustand gelten anlagenspezifische Werte, die vom Ersteller der Anlagen zu ermitteln und zu berücksichtigen sind.

²⁾ Bezogen auf Montagekontrollmaß

³⁾ Bezugsdurchmesser = Schwungradrezeß bzw. Kupplungsaußendurchmesser

¹⁾ installation depending values are valid for service-cold conditions. These values must be determined by the plant-constructor and have to take into account.

²⁾ to relate on alignment-control

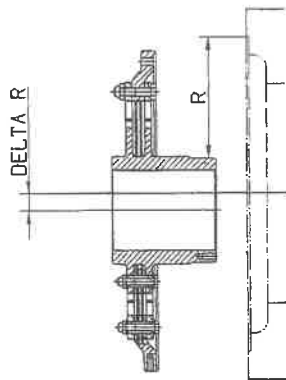
³⁾ relating diameter = flywheel recess respectively outer Diameter of the coupling

Beispiel:

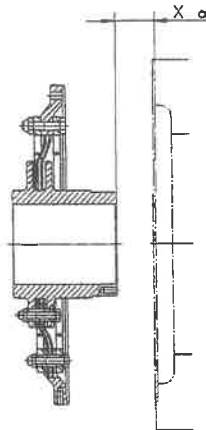
Example:

Ohne Durchdrehsicherung

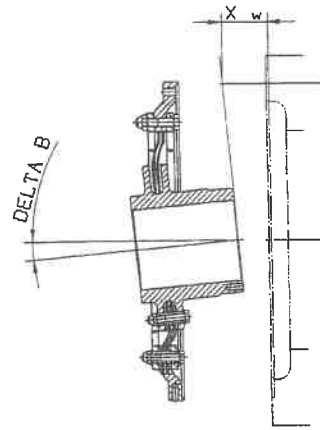
Without torsional limit device



radial



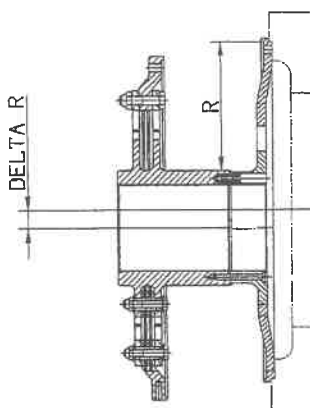
axial



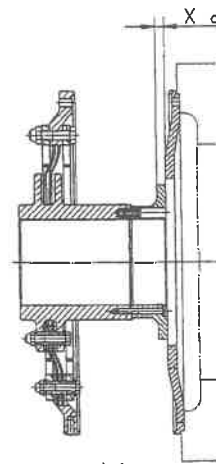
winklig/angular

Mit Durchdrehsicherung

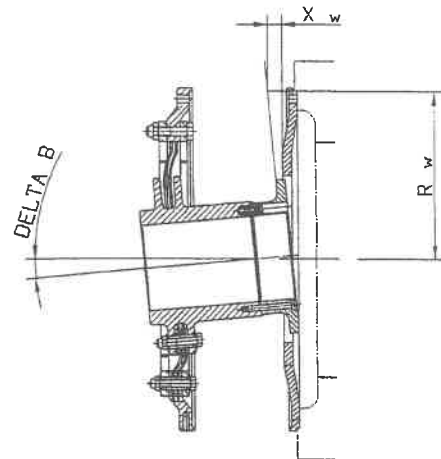
With torsional limit device



radial



axial



winklig/angular

Ziel jeder Ausrichtung muß sein, für den betriebswarmen Zustand eine möglichst ideale Fluchtung zu erreichen. Für die im kalten Zustand auszurichtenden Maschinen kann sich u.a. aus Gründen der Wärme-dehnung ein Fluchtversatz ergeben (siehe hierzu Fußnote 1 in der Tabelle), dem die angegebenen Toleranzen zu überlagern sind.

Final cold alignment conditions should take into account an ideal alignment in the warm service condition (see note 1). Any adjustments required should be included in the cold alignment condition after considering any information supplied by Engine/Gearbox supplier.

Einen Sonderfall stellen Anlagen mit elastisch gelagerten Motoren dar. Hier werden die Motoren gegenüber dem Getriebe auch betriebswarm um einige Millimeter höher gestellt, um die zeitabhängige Setzung der Gummielemente zu berücksichtigen. Die Kupplung läuft also zumindestens anfänglich mit einem gewissen Radialversatz. Wegen dieses relativ großen Versatzes, aber auch wegen der Schwierigkeit, den gewünschten Versatz gezielt einstellen zu können, werden bei derartigen Anlagen die Ausrichtertoleranzen entsprechend erhöht.

Installations with elastic mounted engines should be given special consideration since these engines may settle relative to the gearbox (or driven machine) due to the creep characteristics of the chosen mounting. For these installations it is normal to set the engine some millimetres high to offset settlement. The mounting supplier should advise the expected settlement figure to enable the installation to be adjusted. This adjustment will mean that the coupling will have a higher radial displacement initially and this has been considered as set out in the table.

Beispiel für starr aufgestellte Anlage:

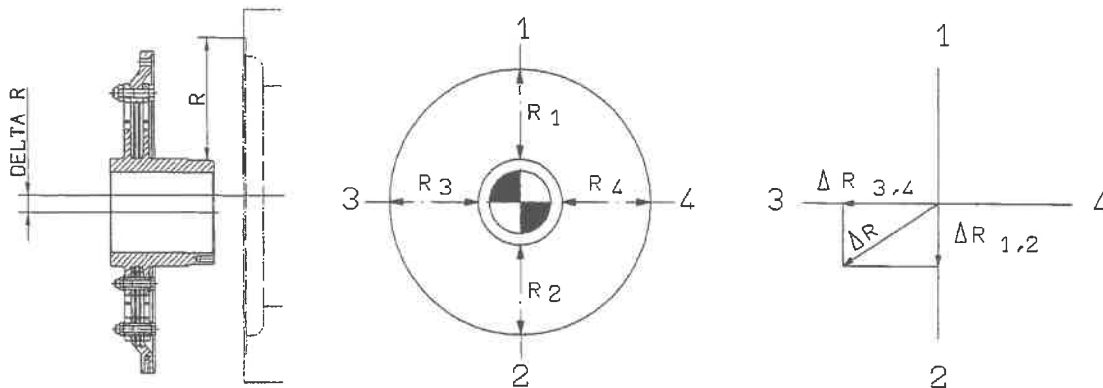
Hochelastische VULKAN-Kupplung Größe RATO-S 2521

Example for rigid mounted engine plant:

Highly flexible VULKAN coupling size RATO-S 2521

Radiale Ausrichtung – ohne eingebautes elastisches Teil.

Radial alignment – without installed flexible part.



$$\Delta R_{12} = \frac{R_2 - R_1}{2} = \frac{236,1 - 237,6}{2} = -0,75 \text{ mm}$$

$$\Delta R_{34} = \frac{R_3 - R_4}{2} = \frac{236,0 - 237,5}{2} = -0,75 \text{ mm}$$

$$\Delta R = \sqrt{R_{12}^2 + R_{34}^2}$$

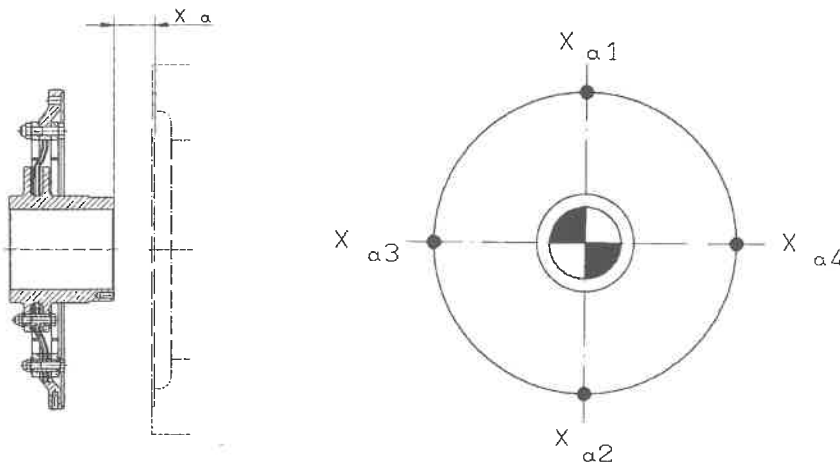
$$\Delta R = \sqrt{0,75^2 + 0,75^2} = 1,06 \text{ mm}$$

Dieser Wert ist größer als die empfohlene Ausrichttoleranz in der Tabelle. Die Ausrichtung sollte deshalb korrigiert werden.

This value exceeds the recommended tolerance in table. The alignment should be corrected.

Axiale Ausrichtung – ohne eingebautes elastisches Teil.

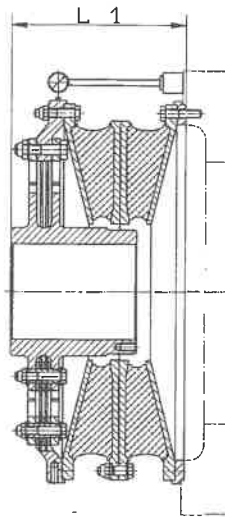
Radial alignment – without installed flexible part.



$$\Delta X_a = \frac{(X_{a1} + X_{a2} + X_{a3} + X_{a4})}{4} - X_a = \frac{91,2 + 91,4 + 91,6 + 91,0}{4} - 90 = 1,3 \text{ mm}$$

Dieser Wert ist größer als die empfohlene Ausrichttoleranz in der Tabelle. Die Ausrichtung sollte deshalb korrigiert werden. VULKAN empfiehlt, die axiale und radiale Ausrichtkontrolle ohne eingebautes elastisches Teil durchzuführen.

This value exceed the recommended tolerance in table. The alignment should be corrected. VULKAN recommend that the axial alignment control is made prior to the installing of the flexible part.



Sollte dies in Ausnahmefällen nicht möglich sein, so kann bei der komplett eingebauten Kupplung die axiale Ausrichtung über die Gesamteinbaulänge "L₁" – NICHT am Membranpaket – kontrolliert werden.

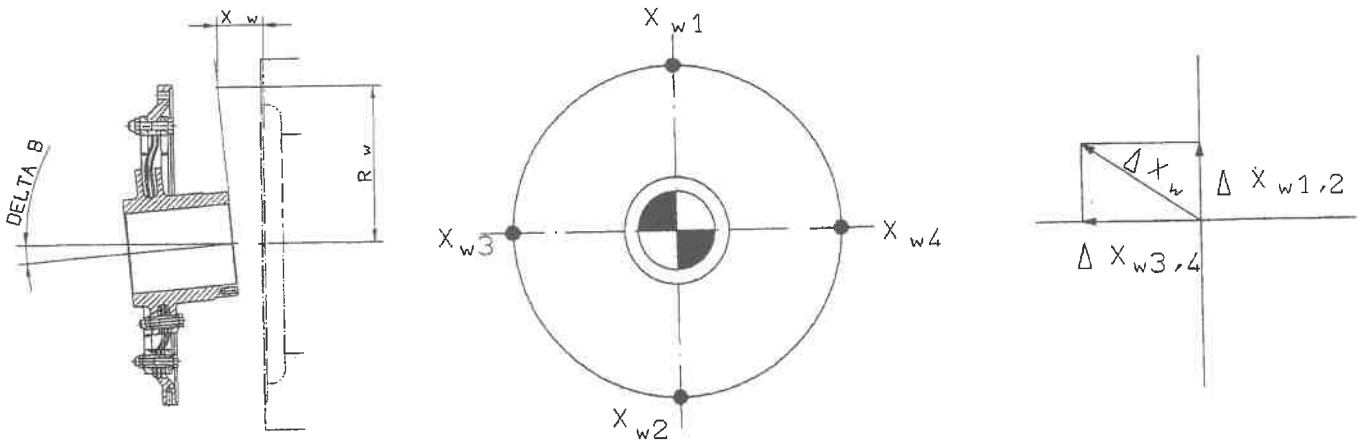
Should this, in exceptional cases, not be possible, the axial alignment will be checked over the complete installation length of the coupling "L₁" and NOT to the membrane package.

Die radiale Ausrichtung kann mittels Meßuhr am Außendurchmesser des Spannrings kontrolliert werden.

The radial alignment can be checked by means of a measurement gauge at the outer diameter of the clamping ring.

Winklige Ausrichtung – ohne eingebautes Teil

Angular Alignment – without installed flexible part



$$\Delta X_{w1,2} = \frac{X_{w2} - X_{w1}}{2} = \frac{90,4 - 90,2}{2} = 0,10 \text{ mm}$$

$$\Delta X_{w3,4} = \frac{X_{w3} - X_{w4}}{2} = \frac{90,0 - 90,6}{2} = -0,30 \text{ mm}$$

$$\Delta X_w = \sqrt{X_{w1,2}^2 + X_{w3,4}^2}$$

$$\Delta X_w = \sqrt{0,10^2 + 0,30^2} = 0,32 \text{ mm}$$

Der Winkelversatz ist in Ordnung, da er unter dem gemäß Tabelle 1 zulässigen Wert liegt.

The angular displacement is correct as it is below the permissible value of table 1.

Surface Protection COATING 113 for VULKAN RATO- S/R Couplings

To supplement the chemical ageing protection included in the Elastomer material, the outer surfaces of the highly-flexible VULKAN coupling elements are equipped with a protecting coat consisting of liquid Elastomer. This Elastomer offers a better protection against environmental influences, especially against the influence of atmospheric oxygen which causes an „ageing“ of the near-surface zones on the couplings' elements.

Basically, the system COATING 113 consists of two components:

PRECOATING 113-1
COATING 113-2

Both protecting coatings consist of the same elastomer material. PRECOATING 113-1, which is a bit more liquid, is used for the priming coat of a pretreated surface according to regulation S/R-CRIT-1/1-7/1,.

For both main coats COATING 113-2 is used.

RATO-S couplings are coated on the outer surface including the radius passings to the front surfaces per segment. It is not required to disassemble the segments.

With RATO-R couplings, the complete outer rubber surface is coated.

Processing instructions for the application of COATING 113

Surfaces of highly-flexible elements which have been grinded crack-free within the scope of inspections according to the „criteria for inspection“.

- 1.) The surfaces of highly-flexible elements should be grinded with a belt grinder on the complete surface in order to optimally prepare them for the priming coat with PRECOATING 113-1.

This special surface treatment guarantees an optimum cleaning and removes possibly existing microcracks at the same time.

In case that the surfaces are in good condition, a sufficient cleaning can be reached by careful brushing (brass brush).

- 2.) The surfaces are properly cleaned from grinding dust by blowing-off with compressed air. In order to keep the surfaces dry and free from grease, it has to be ensured that the compressed air is almost free from oil and condensates.

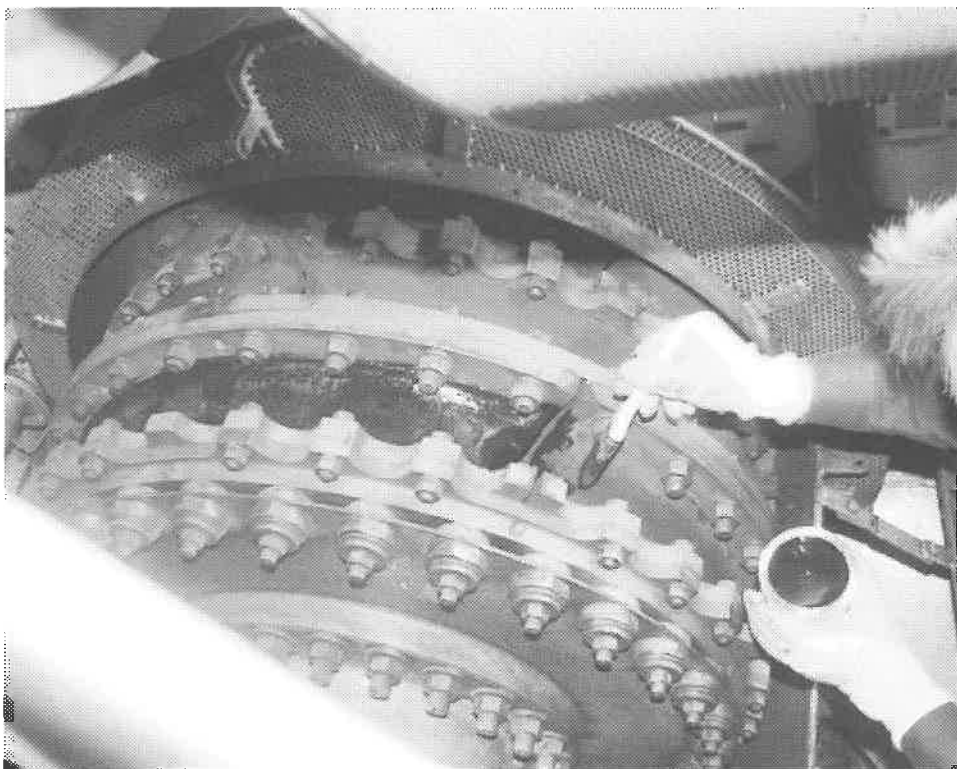
- 3.) The priming coat is made with PRECOATING 113-1. The drying time is approx. 30 minutes. The coat is dried if it is not ropy when toughing it by hand.
- 4.) The first main coat is made with COATING 113-2. The drying time is approx. 30 minutes. The coat is dried if it is not ropy when toughing it by hand.
- 5.) The second main coat is made with COATING 113-2 as well. The procedure is the same as described under 4.).

All coatings are to be applied thinly, but covering.

The waiting time until recommissioning of the coupling should be at least one hour after having applied the last coating.

COATING 113 can be used approx. 8 weeks supposed that it has been stored in a closed tin.

The safety regulations according to safety data sheet /93/112/EG are to be observed.



valid from: 19.11.1999
subst. version from: NEU
current date: 27.09.2001

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND COMPANY
COMPOSITION / INFORMATION ON INGREDIENTS
PRECOATING 113
VORSTRICHLIUNG FR COATING 113
COMPANY
PHOENIX AG
HANNOVERSCHE STRASSE 88
D-21079 HAMBURG

+49/40/76 67 01
2. COMPOSITION / INFORMATION ON INGREDIENTS
90%
Toluene CAS no. 108-88-3
RINCS no. 203-625-9
TLV: 300 mg/m³
Hazard symbol: F, Xn R-phrases: 11, 20
3. HAZARDS IDENTIFICATION
R11 : Highly flammable
R20 : Harmful by inhalation
R36/37 : Irritating to eyes and respiratory system
4. FIRST AID MEASURES
Remove soiled or soaked clothing immediately.
AFTER INHALATION
Remove the casualty into fresh air and keep him calm.
In case of breathing difficulties or no breathing give oxygen. Summon a doctor.
AFTER INGESTION
Induce the patient to vomit only if fully conscious.
Summon a doctor.
AFTER SKIN CONTACT
Wash thoroughly with water and soap. The solvent of the product has a strong degreasing effect, therefore use a skin protection cream afterwards.
AFTER EYE CONTACT
Rinse with plenty of water for several minutes, keeping the eyelid open. Call or go to a doctor.
ALIVE TO DOCTOR
5. FIRE-FIGHTING MEASURES

valid from: 19.11.1999
subst. version from: NEU
current date: 27.09.2001

SUITABLE EXTINGUISHING MEDIA

Water, foam, extinguishing powder, carbon dioxide

UNSUITABLE EXTINGUISHING MEDIA

Full water jet

HAZARDS ARISING FROM COMBUSTION PRODUCTS

Danger of formation of toxic pyrolysis products

Use self contained breathing apparatus

6. ACCIDENTAL RELEASE MEASURES

Keep people away and stay on the upwind side. Do not discharge into the drains, surface waters or groundwater. Take up with absorbant material (e.g. sand, general-purpose binder). Do not use sawdust or other combustible materials.

7. HANDLING AND STORAGE

Use only in well-ventilated areas
Keep away from ignition sources - do not smoke.
Take precautionary measures against static discharges.
Wear shoes with conductive soles. Vapours can form an explosive mixture with air.
Provide solvent-resistant and impermeable floor.
Keep container tightly closed. Keep in a cool place.
Protect from frost.

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

INGREDIENTS WITH EXPOSURE LIMITS TO BE MONITORED

Toluene	CAS no. 108-88-3
	EINECS no. 203-625-9
	TLV: 380 mg/m ³
Hazard symbol: F,Xn	R-phrases: 11,30

Do not eat, drink, smoke during work. Wash hands thoroughly with water and soap before breaks and after work. Use barrier skin cream.

RESPIRATORY PROTECTION

Insufficient ventilation, short term mask with filter: solvents

HAND PROTECTION

Solvent-resistant gloves

EYE PROTECTION

Framed protective goggles

BODY PROTECTION

valid from: 19.11.1999
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9. **PHYSICAL AND CHEMICAL PROPERTIES**
FORM
liquid
COLOUR
black
ODOUR
aromatic
BOILING POINT (DEG. C)
111,000
FIRE POINT (DEG. C)
5,000
FLASH POINT (DEG. C)
535,000
SELF IGNITIONABILITY
EXPLOSIVE LIMITS
1,0 / 7,0
VAPOR PRESSURE (hPa AT 50 DEG. C)
12,360
DENSITY (kg/l AT 20 DEG. C)
1,000
SOLUBILITY (AT 20 DEG. C)
VISCOSITY (AT 50 DEG. C)
1600 cP
CONTENT OF SOLVENTS (%)
CA. 80
CONTENT OF SOLIDS (%)
CA. 20
10. **STABILITY AND REACTIVITY**
None, if used correctly
Hydrogen halides are formed in contact with flames, and,
under unfavourable conditions, toxic pyrolysis products.
11. **TOXICOLOGICAL INFORMATION**
The values of the preparation are not determined
CLASSIFICATION RELEVANT VALUES
Values of the single components
Toluene, LD 50 (oral, rat) 5000 mg/kg
Frequent persistent contact with the skin can cause
skin irritation.
12. **ECOLOGICAL INFORMATION**
Danger to drinking water is possible if large quantities
penetrate into the subsoil and natural waters.
13. **ADVICE ON DISPOSAL**

valid from: 19.11.1999
subst. version from: NEU
current date: 27.09.2001

PRODUCT

Can be disposed of together with household refuse after compaction in accordance with the regulations and after consultation with the disposal agency and the relevant authorities.

EAK No.

080402

PACKAGING

Recommendations:

The packing units should be completely emptied (drop-free, cleaned with a trowel). The packing material should preferably be recycled or reused, in accordance with the relevant, applicable local/national regulations.

14. TRANSPORT INFORMATION / ANGABEN ZUM TRANSPORT

STRASSENTRANSPORT (ADR)

Gefahrgut Klasse 3 Ziffer 5e ADR
UN 1133 Klebstoffe, laemittelhaltig mit einem
Flammpunkt unter 23 Grad C
Verpackungsgruppe III
ADR-Label 3
Schriftliche Weisung K1

SEEVERSAND (IMDG-CODE)

Dangerous good class 3.2
UN 1133 Adhesives, containing a flammable liquid
Packing group III
IMDG-Label K3
EMG: 3-05
MPAG: 330

LUFTVERSAND (IACO/IATA - CODE)

Dangerous good class 3
UN 1133 Adhesives, containing a flammable liquid
PkgGr III
PkgInst 309
IATA-Label: Flamm.liquid

15. REGULATORY INFORMATION

HAZARD

Toluene

CLASSIFICATION ACCORDING TO EEC DIRECTIVES

F: Highly inflammable

Xn: Harmful

CONTAINS

R-PHRASES

R11 : Highly flammable

R23 : Harmful by inhalation

R35/37 : Irritating to eyes and respiratory system

valid from: 19.11.1999
subst. version from: NEU
current date: 27.09.2001

8 PHRASES

- S9 : Keep container in a well-ventilated place
- S16 : Keep away from sources of ignition -
: No smoking
- S23 : Do not breath vapor/spray
- S33 : Take precautionary measures against static
: discharges
- S51 : Use only in well-ventilated areas

SPECIAL LABELLING FOR CERTAIN PREPARATIONS
Only for industrial users

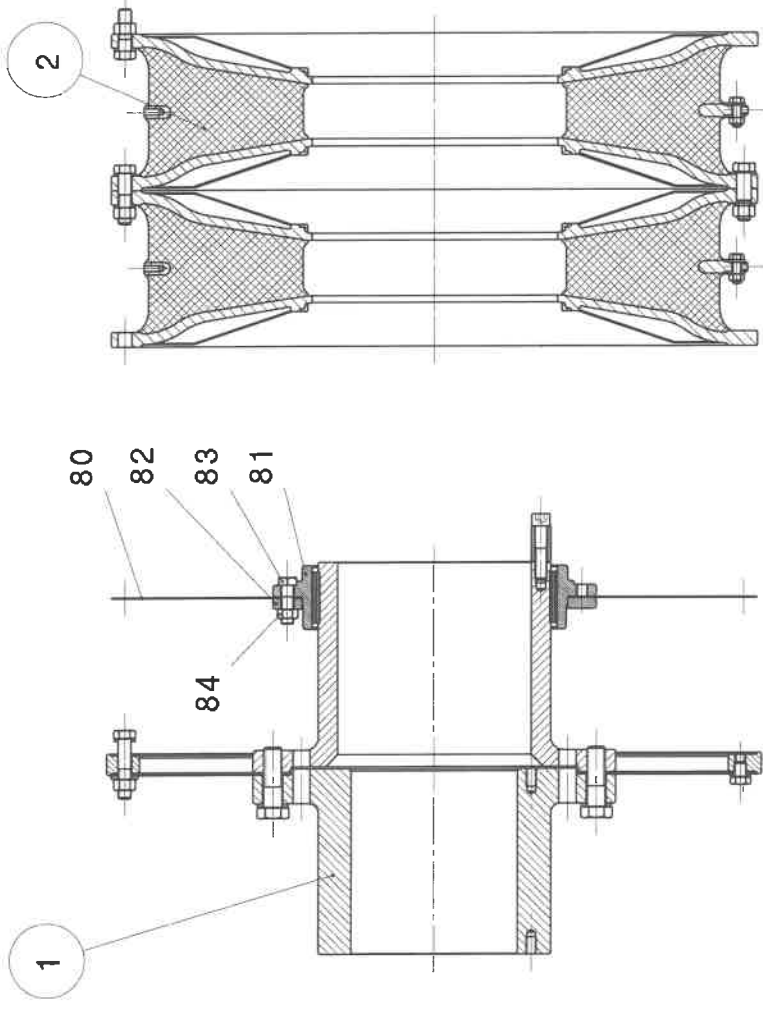
* Refer also to point 8

* A1

16. OTHER INFORMATION

The information given here does not represent any
guarantee or properties. Please refer to our technical
leaflets.

Auslieferungszustand der hochelastischen RATO Kupplung
 Delivery condition of the highly flexible RATO coupling
 Condition de livraison d'accouplement du haut elasticate RATO



numero de
 nomenclature:
 Stückliste Nr.:
 partlist no:
 AG08210001
 AG082T0001
 AG082W0001

Baureihe/series/serie: 2200

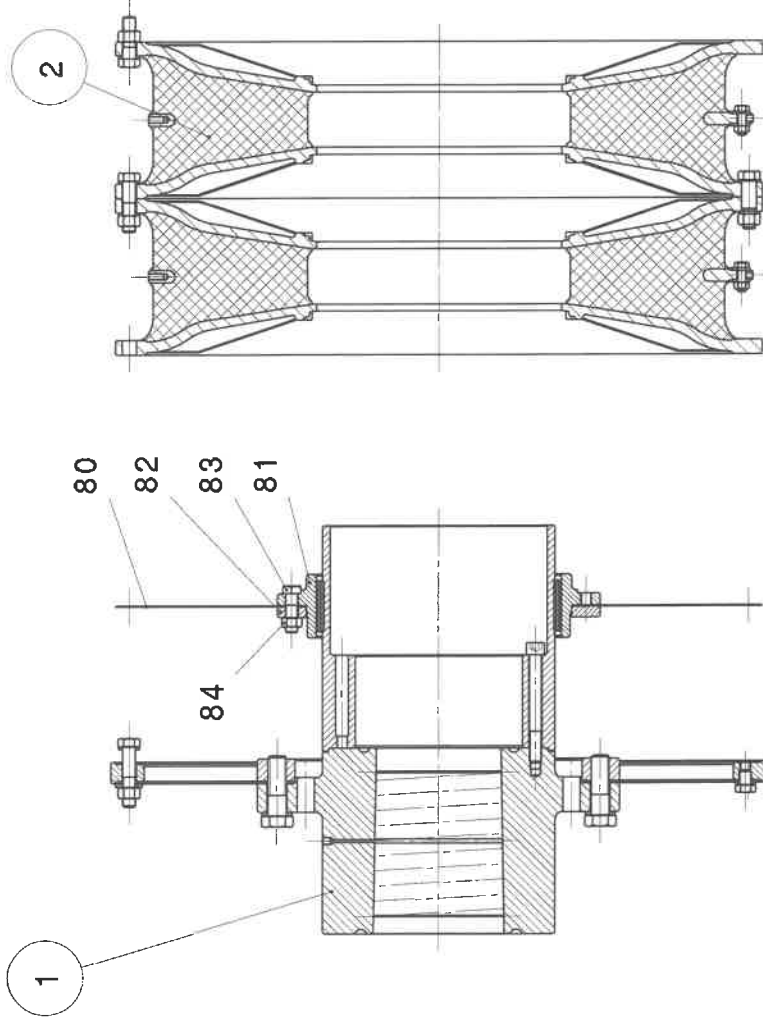
Komplett an Getriebehersteller
 Komplett an MaK
 Komplett an die Wert
 Pos.1 an Getriebehersteller
 Pos.2 an MaK

Die Naben- und Zapfenabmessungen sind grundsätzlich durch den Kupplungslieferanten mit dem Getriebehersteller bzw. mit der Wert zu klären.

FORM- UND LAGE-TOLERANZEN NACH DIN 7184		MABSTAB % (DIN A3)		GEWICHT	
ALLGEMEIN-TOLERANZEN NACH ISO 2768-mK		WERKSTOFF		ROHTEIL-NR.	
DATUM		NAME		BENENNUNG	
BEARB. 10.10.2000 Werner		Werner		Auslieferungszustand	
GEPR. 20.11.2001 Mirhoff		Mirhoff		RATO-S G0820	
NORM					
VULKAN		44653 HERNE		ZEICHNUNGSNUMMER	
				AG08200001	
				Auslieferungszustand	
				RATO-S G0820	
				BLATT	
				AG08200001	
				Ers. durch	
				7	
				8	

FILM	ZUST.	AENDERUNG	DATUM	NAME
2		Pos. 1 überarbeitet.	20.11.2001	Werner
1		Elast. Elemente aktualisiert und Stückliste hinzu	01.06.2001	Tröster

Auslieferungszustand der hochelastischen RATO Kupplung
Delivery condition of the highly flexible RATO coupling
Condition de livraison d'accouplement du haut elasticate RATO



numero de
nomenclature:
Stückliste Nr.:
partlist no.:
AG082W0010
AG082T0010

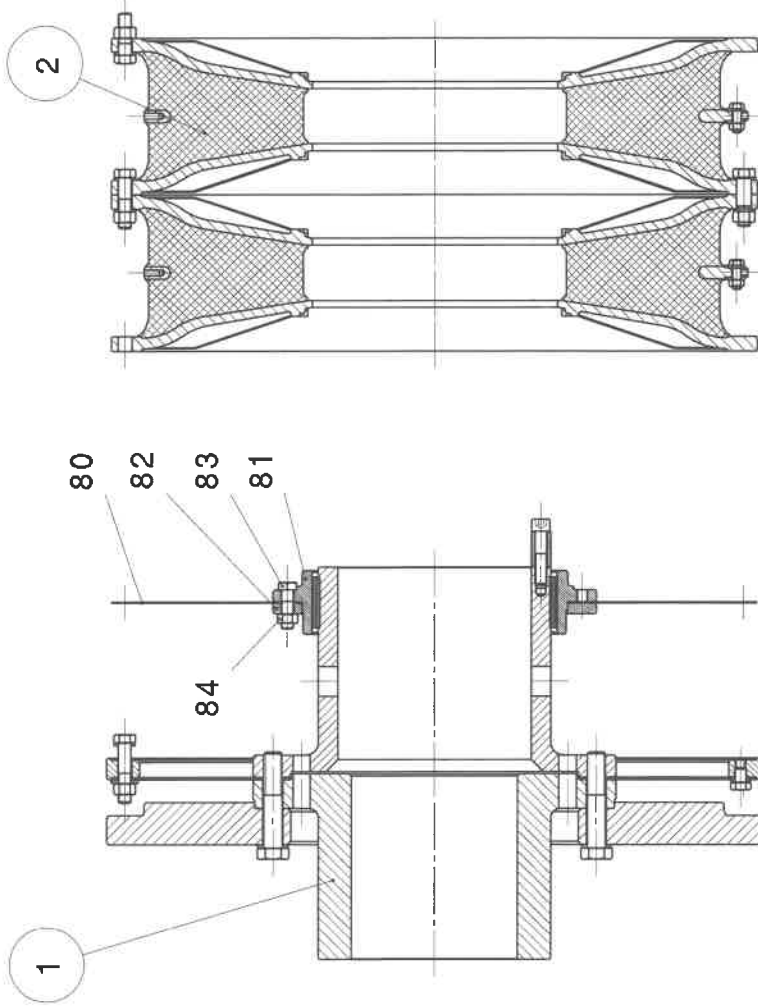
Baureihe/series/serie: 2200

Komplett an Getriebehersteller
 Komplett an MaK
 Pos.1 an Getriebehersteller
 Komplett an die Werft
 Pos.2 an MaK

Die Naben- und Zapfenabmessungen sind grundsätzlich durch den Kupplungslieferanten mit dem Getriebehersteller bzw. mit der Werft zu klären.

FORM- UND LAGE-TOLERANZEN NACH DIN 7184		*SCHUTZVERMERM NACH DIN 34 BEACHTEN*	
ALLGEMEIN-TOLERANZEN NACH ISO 2768-mS		MARSTAB	% (DIN A3)
DATUM		WERKSTOFF	GEWICHT
BEARB. 07.11.2001 G/ihn		ROHTEIL-NR.	
GEPR. 08.11.2001 Mitho/H		BENENNUNG	
NORM		Auslieferungszustand	
		RATO-S G0820	
VULKAN		ZEICHNUNGSNUMMER	
44653 HERNE		AG08200010	
FILM ZUST.		Ers. für	
AENDERUNG		Ers. durch	
DATUM		BLATT	
NAME		BL.	

Auslieferungszustand der hochelastischen RATO Kupplung
 Delivery condition of the highly flexible RATO coupling
 Condition de livraison d'accouplement du haut elasticate RATO



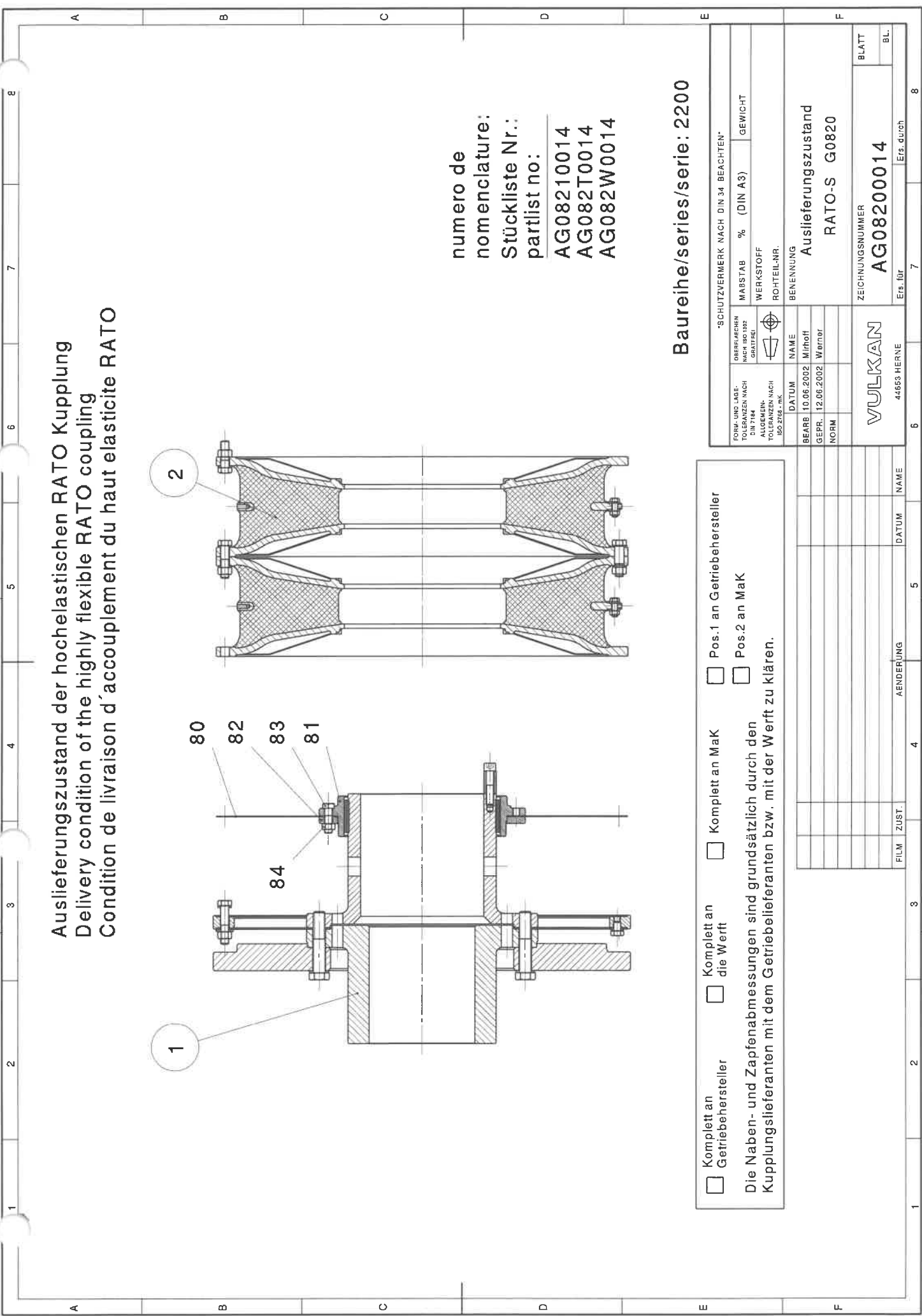
numero de
 nomenclature:
 Stückliste Nr.:
 partlist no:
 AG08210014
 AG082T0014
 AG082W0014

Baureihe/series/serie: 2200

Komplett an Getriebehersteller
 Komplett an die Wert
 Pos.1 an Getriebehersteller
 Pos.2 an MaK
 Die Naben- und Zapfenabmessungen sind grundsätzlich durch den Kupplungslieferanten mit dem Getriebehersteller bzw. mit der Wert zu klären.

FORM- UND LAGE-TOLERANZEN NACH DIN 7184		*SCHUTZVERMERK NACH DIN 34 BEACHTEN*	
OBERRÄCHEN NACH ISO 1382 (GRATFREI)	MARSTAB % (DIN A3)	WERKSTOFF	GEWICHT
ALLGEMEIN-TOLERANZEN NACH ISO 2768-MS	ROHTEIL-NR.		
DATUM	NAME	BENENNUNG	
BEARB. 10.06.2002	Mirhoff	Auslieferungszustand	
GEPR. 12.06.2002	Wörndt	RATO-S G0820	
NORM			
VULKAN		ZEICHNUNGSNUMMER	
44663 HERNE		AG08200014	
		Ers. für	
		Ers. durch	

FILM	ZUST.	ÄNDERUNG	DATUM	NAME



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Coupling RATO