R.F.E.S.

VULKAN

Installation and Operating Instructions for the Highly Flexible VULKAN-RATO-S Couplings

Series 2200, Dimension Group 1920-5520, double-row execution

1. Generalities

The highly flexible VULKAN-RATO-S coupling is a rubber coupling, flexible in all directions. Its essential parts are the torsionally flexible part, the membrane part and the connecting parts. All connecting elements of the coupling are arranged without clearance, so no wear will occur during operation. For this reason the RATO-S coupling is free of maintenance.

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 RATO-S element - i.e. the torsionally flexible coupling part - is fit for use with ambient temperatures comprised between -50 degrees(C) to +80 degress(C). The segmental construction form of the RATO-S coupling guarantees good heat dissipation properties. The free-of-play torque transmission in the coupling and the large sectional rubber area of the RATO-S element provide good noise attenuation.

Basically, the connection surfaces and the fitted as well as the finish bores of the coupling are protected by Tectyl. Prior to installation, these surfaces must be cleaned by conventional solvants. After the cleaned surfaces are completely dry, they must be greased lightly.

The highly flexible VULKAN RATO-S coupling is supplied in the partially assembled condition, so that no disassembly work is required for the installation into the system.

To guarantee faultless function and optimum usage of the highly flexible RATO-S coupling, certain installation instructions must

be observed. Basically, each bolt connection participating in the transmission of the torque must be tightend by means of a torque spanner. The individual tightening torques are given in the respective execution drawing of the coupling.

2. Installation of the Coupling

As the coupling is supplied in the partially assembled condition, it will not be necessary any more to disassemble any coupling parts in order to carry out the installation.
The hub (24) with the parts connected to it must be mounted to the free shaft butt end, using a method which meets the requirement of modern engineering practice. Both machines must be positioned to the installation dimension of the coupling and must be aligned. Possible thermal expansions specific to the system involved must be taken into account. After the connecting ring (38) has been installed into the flywheel centering, the installation of the RATO-segments (1) can be carried out.

2.1 Assembly of the RATO Segments

Before beginning to describe the assembly procedure, we would like to point out that the RATO segments have been marked on the outer circumference of the steel parts. Please ensure that the RATO segments of one coupling are always marked by the same letter. The position of the RATO segments towards each other is marked by numbers. Therefore each RATO segment is marked by a letter and a number, i.e. 1A. Further information with respect to this marking is given in the enclosed sheet E 10197.

For installation, the RATO segments (1) must be placed into a lifting device, using suitable aids. First install, one after the other, the RATO segments at the engine side, and connect

them to the connecting ring (38) and flywheel by the fixation elements provided for this purpose. The prescribed tightening torque must be observed. During the tightening process please check whether the outer circumference of the respective segment is in metallic contact with the centering of the connecting ring.

Now the RATO segments arranged at the membrane part must be installed. In order to do this, the membrane package must be deflected. For this purpose, 2 ring bolts must be screwed into the radial threaded bores in the tension ring (3), one beside the other. Then turn this side, until the two ring bolts are in a symmetrical position to the axis of the coupling, on the up side. After having connected an appropriate traction device to these ring bolts, the membrane package can be deflected as far as to permit 1 RATO segment (1) to be placed in this location. Attention must be paid that the segments on this side are installed displaced by 45 degrees to the segments already installed on the other side, to obtain a closed-ring formation (figs. 1 and 2).

After the RATO segment so installed has been connected to the two opposite segments, this procedure must be repeated for the remaining segments, using the threaded holes directly adjacent to those used for installing the first segment on this side.

After all four RATO segments on this side have been installed and connected to the opposite segments, the hexagon bolts (4) must be knocked in and the locking nuts (6) must be screwed on. The locking nuts (6) must be tightened until the prescribed tightening torque has been reached. During the tightening process please check whether the outer circumference of the

respective segment is in metallic contact with the centering of the tension ring (3).

After this has been done, the highly flexible VULKAN RATO-S coupling is tightly connected to the system and the system alignment can be checked at the coupling.

3. Alignment of the Coupling

The alignment instructions for this coupling are given in the enclosed leaflet.

The alignment tolerances for the RATO-S couplings are given in the table at the end of these installation and operating instructions.

4. Putting in Operation and Safety Measures

After the alignment has been carried out, the drive system is ready for operation, as far as the coupling is concerned. We would like to point out that prior to the first operation you must make sure that all installation aid devices have been removed from the coupling.

The coupling must be shielded according to the safety regulations. These shields should be made from perforated sheet or wire mesh, if it is not in contradiction with other and prevailing requirements, in order to guarantee adequate ventilation of the coupling.

5. Maintenance

The highly flexible VULKAN RATO-S coupling does not require maintenance. We recommend however an annual alignment control and a visual inspection of the RATO segments.

6. Replacement of the RATO Segments

VULKAN RATO-S couplings are not subject to wear. Should however, due to an inadmissible load, a damage occur on the RATO segments installed, they can be replaced without the driving or the driven machine having to be displaced.

We would like to explain you the replacement of the segments in detail as follows:

6.1 Disassembly of the RATO Segments

First release the locking nuts (6) and remove them together with the hexagon bolts (4). Then take out the fixation elements (8 and 9). Now the first 4 segments can be disassembled, using an appropriate lifting device. The membrane package must be deflected as required. After the hexagon bolts installed at the other side of the individual segment have been taken out, the remaining 4 segments can be disassembled one after the other.

Please note: When one segment is damaged, it is a basic requirement that all other segments of the RATO element concerned are be replaced, too.

6.2 Assembly of the RATO-Segments

The procedure for assembling the RATO segments has been described already under point 2.
After installation and a new alignment have been carried out, the system can be operated again, as far as the coupling is concerned.

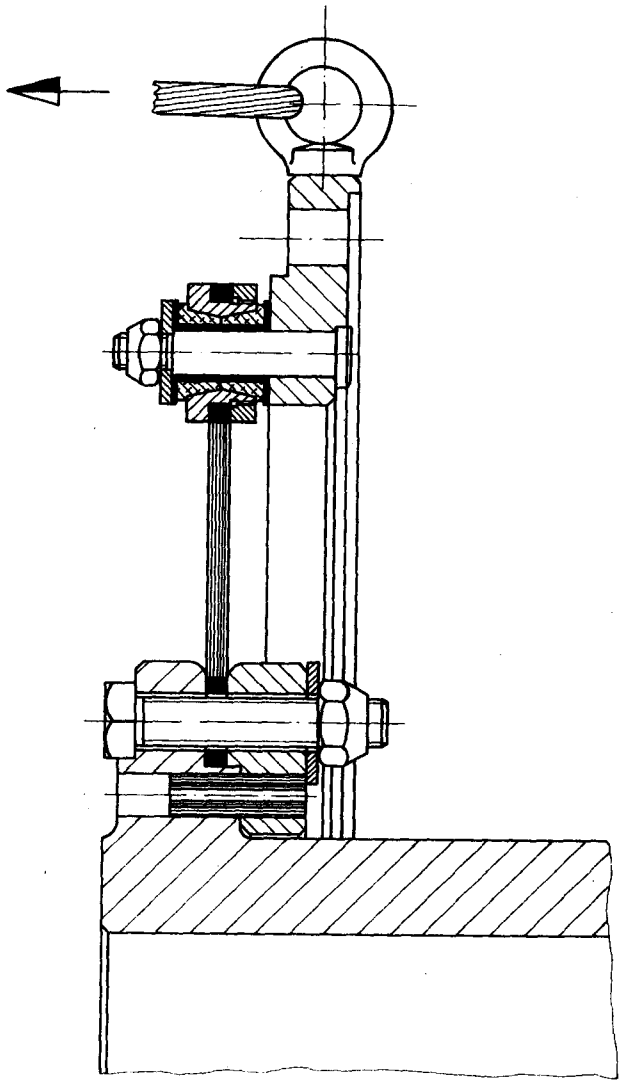

Figure 1

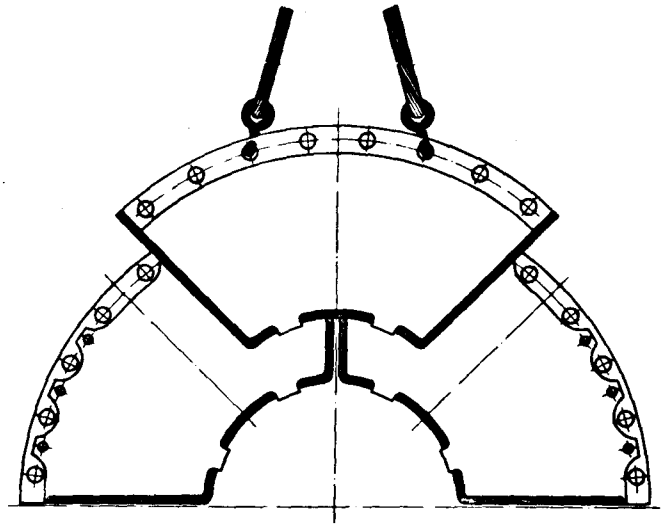

Figure 2

Baugruppe Dimension Group	Radiale Ausrichttoleranz radial alignment tolerance	Axiale Ausrichttoleranz axial alignment tolerance	Winklige Ausrichttoleranz angular alignment tolerance
1510 - 2210	± 0,35 mm	± 0,50 mm	± 0,35 mm
2310 - 3020	± 0,50 mm	± 0,60 mm	± 0,50 mm
3210 - 5520	± 0,60 mm	± 0,70 mm	± 0,60 mm
Die angegebenen Werte beziehen sich auf den Außendurchmesser der RATO - S - Kupplung The stated values refer to the outer diameter of the RATO - S - Coupling			

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Achtung.....

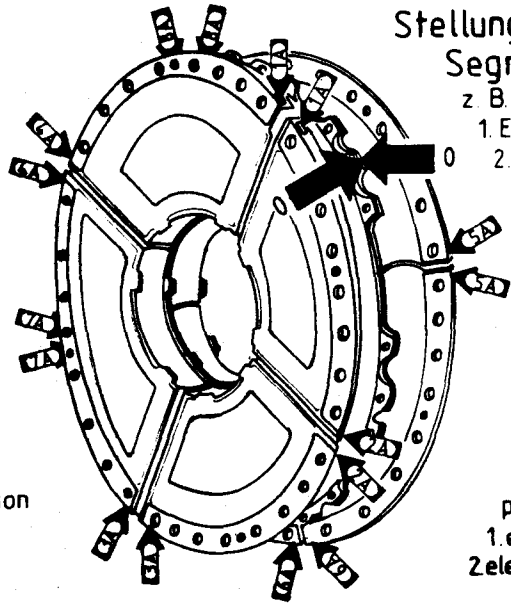
Montage innerhalb einer Kupplung nur mit gleichen Kennbuchstaben möglich

Please note.....

Installation within one coupling possible only when the identification letters are the same

Attention.....

Montage dans un accouplement seulement siles lettres d' identification sont les mêmes.



Stellungs-Kennzeichnung der Segmente zueinander :

z. B.:
1. Element der Kupplung 1A,2A, 3A,4A
2. Element der Kupplung 5A,6A, 7A,8A

Marking of the position of the segments towards each other :

e.g.:
1. element of the coupling 1A,2A,3A,4A
2.element of the coupling 5A,6A,7A,8A

Marquage de la position des segments les uns envers les autres :

par ex :
1.element de la accouplement 1A,2A,3A,4A
2element de la accouplement 5A,6A,7A,8A

Stellungs-Kennzeichnung der Elemente (0-0) zueinander, wenn vorhanden beachten.
Marking of the position of the elements towards each other (0-0), please pay attention, if these marks exist.
Marquage de la position des garnitures (0-0), à noter, si cettes marques existent

VULKAN HERNE 2	Einbau-und Betriebsanweisung Installation and Operating Instructions Prescription de Montage et de Surveillance	**Blatt-Nr.** Sheet-No. Page-No. E 10197 **Herne 2. den** 08.06.1984

„Safir-Normdruck" 12 6287 79

Ausrichthinweise für Hochelastische VULKAN-EZS Kupplungen

Um eine einwandfreie Funktion der **VULKAN-EZS** Kupplung und der verbundenen Maschinen zu gewährleisten, empfehlen wir die nachstehenden Ausrichthinweise zu beachten.

Nachdem die **VULKAN-EZS** Kupplung in die Antriebsanlage eingebaut ist, kann die Ausrichtung der Anlage an der Kupplung kontrolliert werden.

Bei der Ausrichtkontrolle müssen folgende Maße überprüft werden:

1. Radiale Ausrichtung
2. Axiale Ausrichtung
3. Winklige Ausrichtung

Alignment Instructions for Highly flexible VULKAN-EZS Couplings

In order to ensure a precise functioning of the **VULKAN-EZS** coupling and its connected machines it is recommended that the alignment instructions given below are observed.

After having installed the **VULKAN-EZS** coupling the proper alignment of the system can be checked at the coupling.

The system should be checked for:

1. radial alignment
2. axial alignment
3. angular alignment

Bild 31
Diagram 31

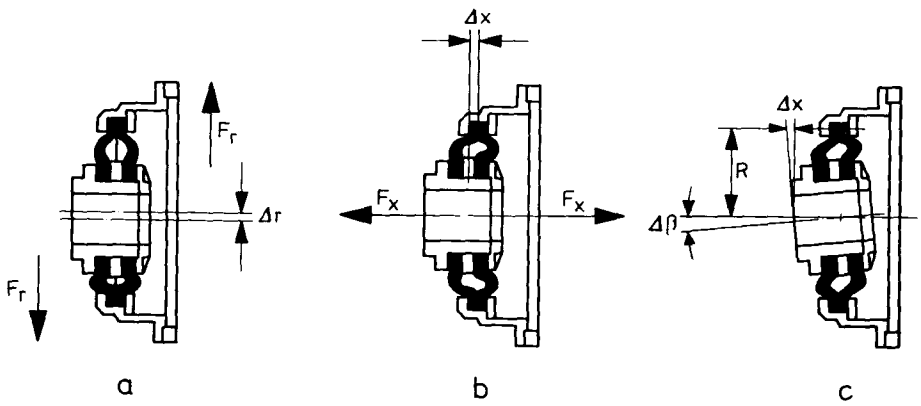


Bild 31 zeigt die verschiedenen Verlagerungsmöglichkeiten:
a) radiale Verlagerung Δr
b) axiale Verlagerung Δx
c) winklige Verlagerung $\Delta\beta$
In der Praxis wird die winklige Verlagerung zweckmäßig am Radius R als Axialmaß $\Delta x'$ gemessen.

Diagram 31 shows the different misalignments possible.
a) radial displacement Δr
b) axial displacement Δx
c) angular displacement $\Delta\beta$
In practice the angular shaft displacement will be measured as an axial dimension $\Delta x'$ at radius R.

Bei allen **EZS** Kupplungen wird mit geeigneten Instrumenten (Lineal, Schieblehre, Tiefenmaß, Meßuhr etc.) an vier um 90° versetzten Punkten das Maß x und r gemessen (siehe Bild 32).

The dimension x and r on all **EZS** couplings can be measured at four points displaced by 90° utilizing suitable instruments i. e. ruler slide gauge, depth gauge, dial gauge etc. (see diagram 32).

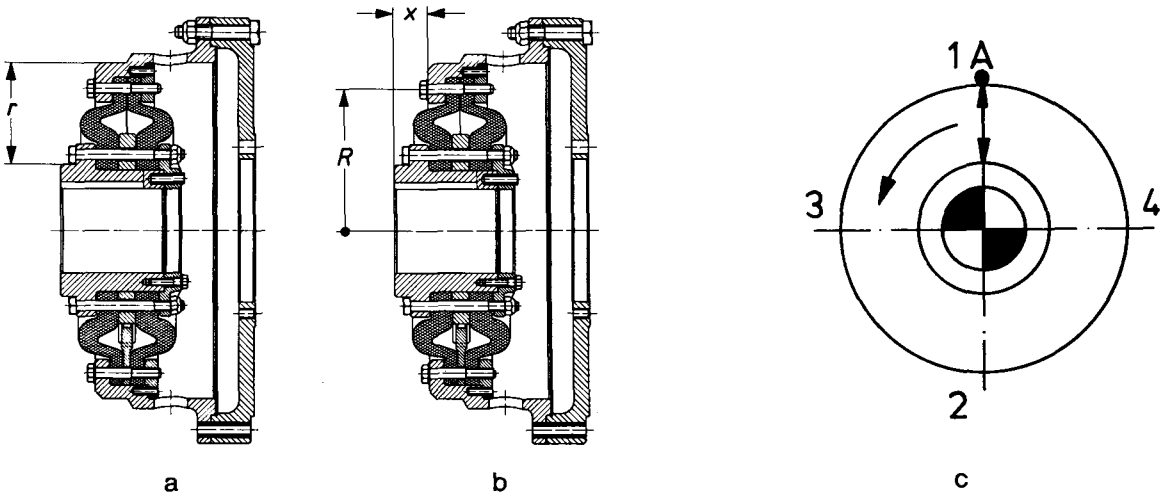


Bild 32

a) Messung der Maße r zur Ermittlung des radialen Wellenversatzes

b) Messung der Maße x zur Ermittlung des axialen und winkligen Wellenversatzes.

c) Meßpunkt A in 4 verschiedenen Lagen, um jeweils 90° gedreht, gemessen.

Diagram 32

a) Measurement of dimensions r for obtaining the radial shaft displacement.

b) Measurement of dimension x for obtaining the axial and angular shaft displacement.

c) Measuring points displaced by 90°.

Sollte die Kupplung schlecht zugänglich sein, so genügen drei um 90° versetzte Meßwerte. Der vierte Wert kann durch Berechnung ermittelt werden.

Es wird empfohlen, vor Ermittlung eines jeden einzelnen der 4 (3) Einzelwerte beide Wellen jeweils um 90° zu drehen, so daß in den verschiedenen Lagen immer am gleichen Punkt der beiden Kupplungsteile gemessen wird. Bei dieser Meßmethode ist der Einfluß von Rundlauffehlern bzw. Planlauffehlern ausgeschlossen.

Kann die Anlage nicht gedreht werden, so ist eine Messung an vier verschiedenen Meßpunkten um jeweils 90° versetzt – mit ausreichender Genauigkeit – möglich. Hierbei werden Rundlauf- bzw. Planlauffehler jedoch mitgemessen.

Je genauer die Antriebsanlage ausgerichtet wird, um so mehr Reserven sind für die Aufnahme von radialen, axialen und winkligen Verlagerungen für die Kupplungen während des Betriebes vorhanden.

If the coupling is not easily accessible it will be sufficient to take three readings displaced by 90°. The fourth value can be found by calculation.

In measuring each of the 4 (3) indicated single dimensions it is recommended that both shafts be turned by 90° so that measurements in the different positions will always be carried out at the same point of both coupling parts. Thus the influence of run-out and parallel misalignment is avoided.

If the system cannot be turned, measurements taken at four different points, each displaced by 90° and with sufficient accuracy, are acceptable. However with this method, eccentric and parallel misalignment errors are included in the measurements.

The more accurately the drive system is aligned, the less the coupling capacity to absorb, during operation, radial, axial and angular displacements is reduced.

Für Anlagen mit extrem großen Verlagerungen während des Betriebes kann mit Rücksicht auf eine günstige Beeinflussung der Federkräfte F_r und F_x die hochelastische **EZS** Kupplung in kaltem, unbelastetem Zustand mit dem entsprechenden Versatz in entgegengesetzter Richtung eingebaut werden. Voraussetzung für diesen Fall ist, daß die Größe und Richtung der Verlagerung genau bekannt ist. Wir empfehlen eine nachträgliche Kontrolle in betriebswarmem, halbbeladenem Zustand.

Bei der heutigen optimalen Auslegung von Antrieben mit Dieselmotoren ist es erforderlich, die zulässigen Ausrichttoleranzen mit dem Motoren-, Getriebe- oder Gerätebauer abzustimmen.

Das Beispiel auf Seite 4 zeigt die Überprüfung der Ausrichtung an der eingebauten Kupplung. Es wird hierbei nicht nur die Größe, sondern auch die Richtung der Verlagerung exakt bestimmt.

For systems where extremely large misalignments are known to occur in operation, the highly flexible **EZS** coupling can be installed in cold, unloaded condition, displaced in the opposite direction, in order to reduce, the axial and radial spring forces (reaction forces) F_x and F_r, which add to the bearing loads of the connected machinery. Of course, the exact magnitude and direction of the displacements should be known. We recommend a later check under warm operating conditions at about half load.

With todays optimum selection of diesel engine drives it is necessary to corelate the alignment tolerances with the engine, gear or unit manufacturer.

The example on page 4 shows the alignment control at the installed coupling.
Not only the magnitude but also the direction of misalignment will be exactly determined by this method.

Die empfohlenen Ausrichttoleranzen für die radiale, axiale und winklige Verlagerung im kalten Betriebszustand sind in den nachfolgenden Tabellen angegeben.

The recommended alignment tolerances for the radial, axial and angular shaft displacements in cold operation condition are given in the following tables.

Tabelle 3 / Table 3

EZS-S / EZS **Größe / Size**	**Radiale** Ausrichttoleranz **radial** alignment tolerance
35– 65	0–0,10 mm
71–115	0–0,20 mm
121–195	0–0,35 mm
201–285	0–0,50 mm
310–560	0–0,60 mm

Tabelle 4 / Table 4

EZS-S / EZS **Größe / Size**	**Axiale** Ausrichttoleranz **axial** alignment tolerance
35– 65	± 0,30 mm
71–115	± 0,40 mm
121–195	± 0,50 mm
201–285	± 0,60 mm
310–560	± 0,70 mm

Tabelle 5 / Table 5

EZS-S / EZS **Größe / Size**	**Winklige** Ausrichttoleranz **angular** alignment tolerance
35– 65	0–0,10 mm
71–115	0–0,20 mm
121–195	0–0,35 mm
201–285	0–0,50 mm
310–560	0–0,60 mm

Beispiel

Hochelastische **VULKAN-EZS** Kupplung 121 S Baureihe 1200

Example

Highly flexible **VULKAN-EZS** coupling 121 S Series 1200

A: Radiale Ausrichtung

A: Radial Alignment

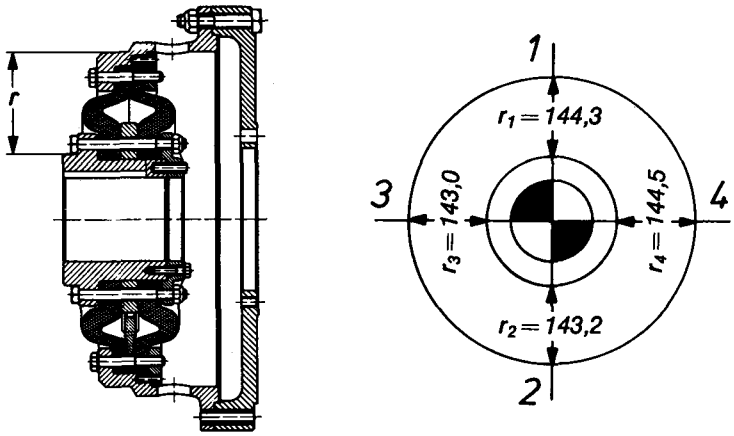


Bild 33 Radialversatz Δr

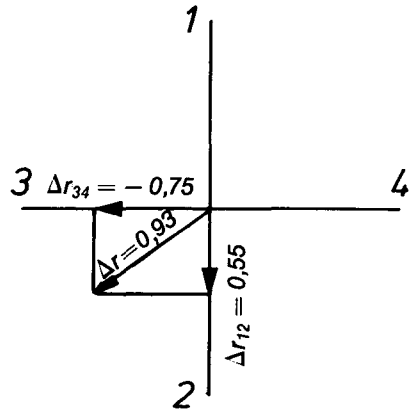


Diagram 33 radial displacement Δr

$$\Delta r_{12} = \frac{r_2 - r_1}{2} = \frac{143,2 - 144,3}{2} = -0,55 \text{ mm}$$

$$\Delta r_{34} = \frac{r_3 - r_4}{2} = \frac{143,0 - 144,5}{2} = -0,75 \text{ mm}$$

$$\Delta r = \sqrt{\Delta r_{12}^2 + \Delta r_{34}^2}$$

$$= \sqrt{0,55^2 + 0,75^2} = 0,93 \text{ mm}$$

Der Kupplungseinbau muß korrigiert werden bis $\Delta r \leqq 0,35$ mm ist. Siehe Tabelle 3 Seite 3.

The coupling installation must be corrected until $\Delta r \leqq 0,35$ mm is. See Table 3 page 3.

B: Axiale Ausrichtung

B: Axial Alignment

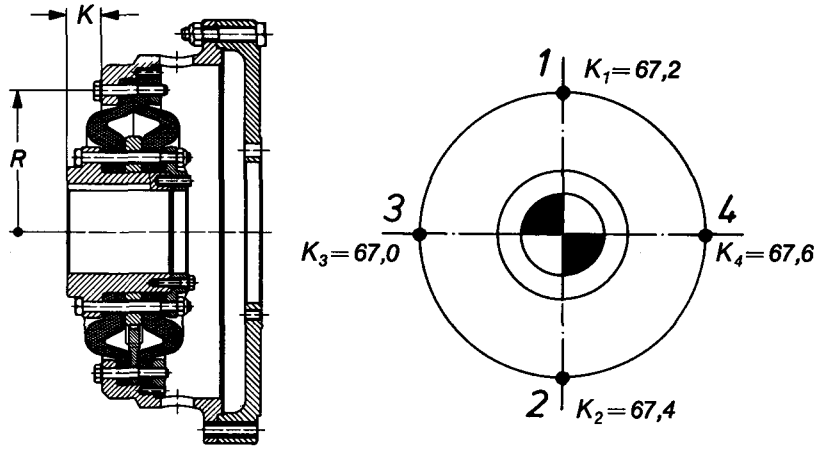


Bild 34 Axialversatz Δx

Diagram 34 axial shaft displacement Δx

k = Montage-Kontrollmaß
Das Sollmaß k ist aus der Zeichnung oder dem Maßblatt zu entnehmen. Für dieses Beispiel EZS 121 S ist das Maß k = 66 mm.

k = alignment control dimension
The nominal dimension k is to be taken from the drawing or the data sheet. For this example EZS 121 S the value k is = 66 mm.

$$\Delta x = \left(\frac{K_1 + K_2 + K_3 + K_4}{4}\right) - k = \left(\frac{67{,}2 + 67{,}4 + 67{,}0 + 67{,}6}{4}\right) - 66 = 67{,}3 - 66 = \underline{\underline{1{,}3 \text{ mm}}}$$

Der Kupplungseinbau muß korrigiert werden, bis $\Delta x \leqq 0{,}50$ mm ist. Siehe Tabelle 4, Seite 3.

The coupling installation must be corrected until $\Delta x \leqq 0{,}50$ mm. See Table 4, page 3.

C: Winklige Ausrichtung

C: Angular Alignment

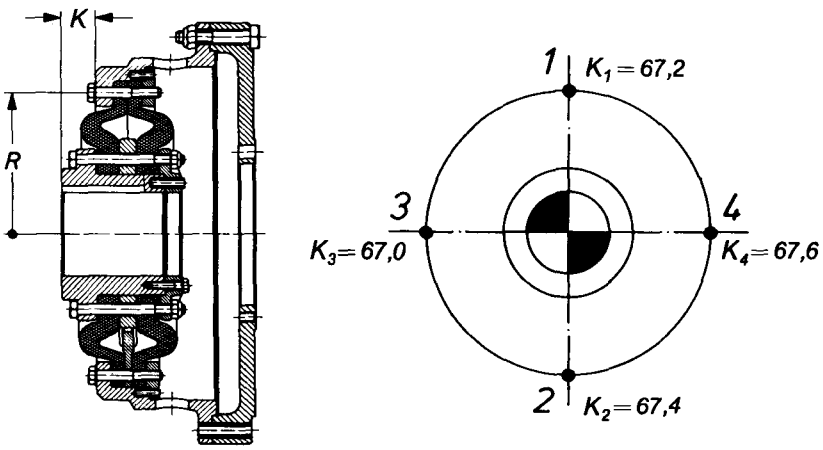


Bild 35
Winkelversatz $\Delta x'$ am Radius R gemessen

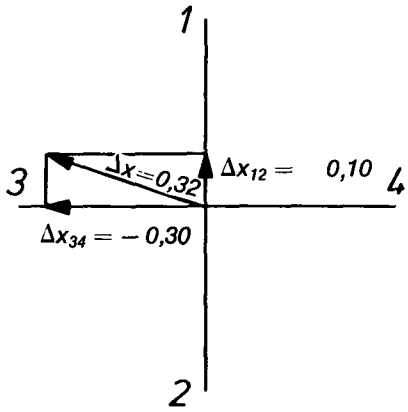


Diagram 35
Angular shaft displacement $\Delta x'$ measured at radius R

$$\Delta x'_{12} = \frac{K_2 - K_1}{2} = \frac{67{,}4 - 67{,}2}{2} = 0{,}10 \text{ mm}$$

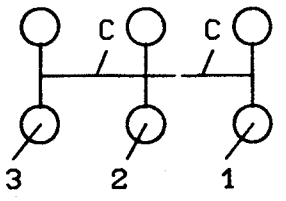
$$\Delta x'_{34} = \frac{K_3 - K_4}{2} = \frac{67{,}0 - 67{,}6}{2} = -0{,}30 \text{ mm}$$

$$\Delta x' = \sqrt{\Delta x_{12}^2 + \Delta x_{34}^2}$$

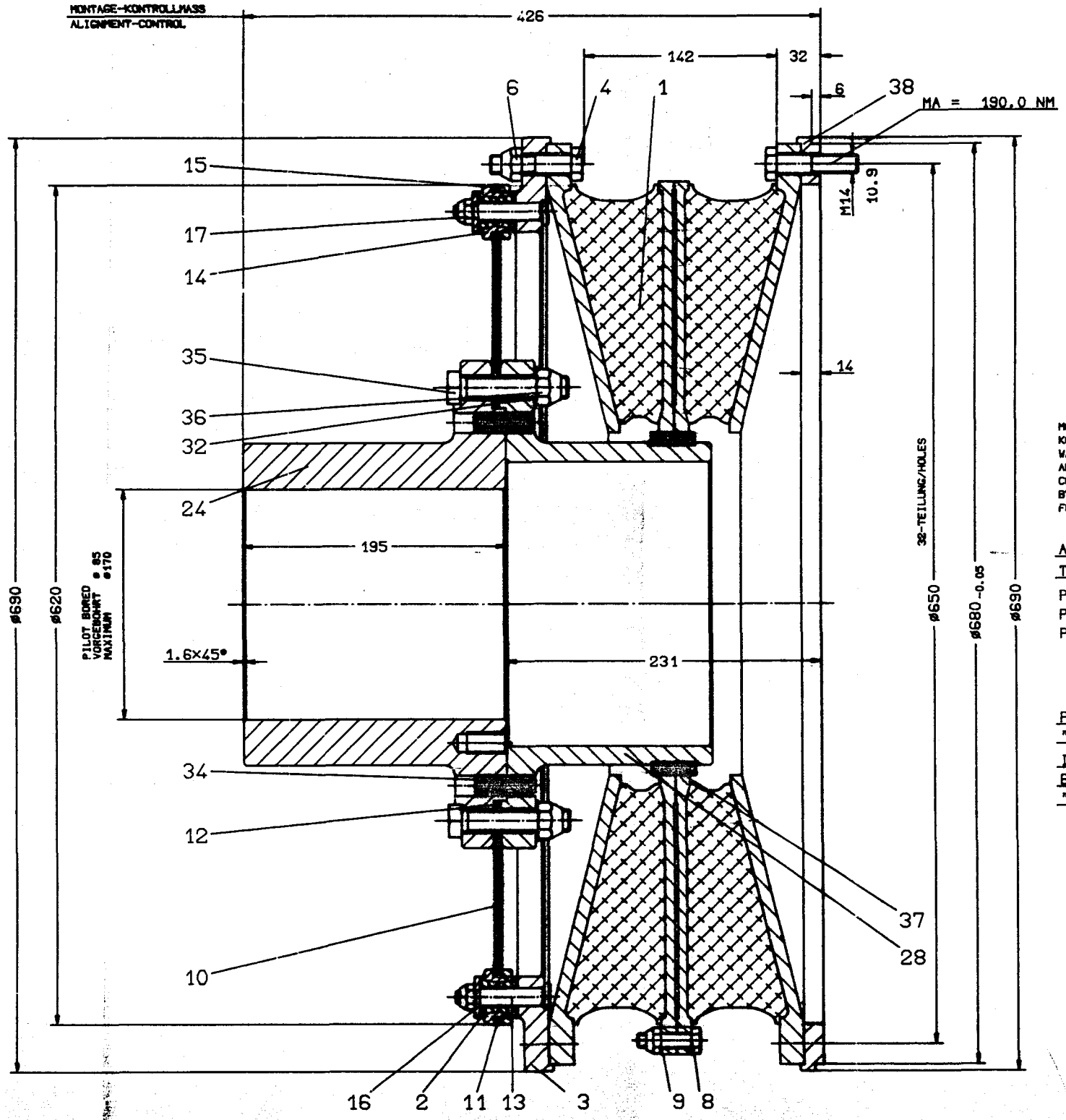
$$= \sqrt{0{,}10^2 + 0{,}30^2} = 0{,}32 \text{ mm}$$

Der Winkelversatz ist in Ordnung, da $\Delta x' \leqq 0{,}35$ mm. Siehe Tabelle 5, Seite 3.

The shaft displacement is in order as $\Delta x' \leqq 0{,}35$ mm. See Table 5, page 3.



	SI-SYSTEM	
	J	M
	KGM2	KG
1	3.200	41.0
2	3.000	49.2
3	6.700	169.6



MONTAGE-KONTROLLMASS. DAS MONTAGE-KONTROLLMASS IST UM ANLAGENBEDINGTE WAERMEDEHNUNGEN ZU KORRIGIEREN.
ALIGNMENT-CONTROL. THE ALIGNMENT-CONTROL DIMENSION MUST BE CORRECTED BY THE THERMAL EXPANSION SPECIFIC FOR THE RESPECTIVE SYSTEM.

ANZUGSMOMENT
TIGHTENING TORQUE

POS. 4 = 190.0 NM
POS. 8 = 49.0 NM
POS. 35 = 220.0 NM

POS.15+17 MIT LOCTITE 245 "MITTELFEST" GESICHERT.

ITEM 15+17 SECURED BY LOCTITE 245 "MEDIUM TIGHT".

STUECKLISTE NR.:
PARTLIST NO.:
1G232102A2
1G232202A2

FILM	ZUST.	AENDERUNG	DATUM	NAME

FREIMASS-TOLERANZ MITTEL DIN 7168	OBERFLAE. REIHE 3 DIN 3141 GRATFREI	MASSSTAB 1:2	GEWICHT	
		WERKSTOFF		
		RONTEIL-NR.		
		MODELL-NR.		
DATUM	NAME	BENENNUNG		
GEZ. 08.01.84	GRIMM	HOCHELAST. RATO-S KUPPLUNG BAUGR. 2320		
GEPR.				
NORM		ZEICHNUNG-NR.		
VULKAN REIHE 2		(1) 1G232002A2		
		ERS. FUER	ERS. DURCH	

NORMAUSFUEHRUNG
STANDARD DESIGN

Stückz. QUANT.	Benennung DESCRIPTION	Teil PART	Zeichng.-Nr. DRAWING-NO.		Werkstoff MATERIAL	Modell-Nr./Fertigmaße MODEL-NO./DIMENSIONS	Bemerkung REMARK
8	RATO - SEGMENT	1	2G2301A002		ST/RUBBER		
64	CONE BUSH	2	2G1839A002		ST/RUBBER		
1	TENSION RING	3	1/3G2235020M		CK45N	5G2235020M	
32	HEXAGON BOLT	4	7000114065	DIN 931 -M	10.9	M14X 65	
32	LOCKING NUT	6	7022114000	DIN 980	10	V M14	
24	HEXAGON FITTING BOLT	8	3/3G2372020M		8.8	M10X40	
24	LOCKING NUT	9	7022000000	DIN 980	8	V M 8	
5	MEMBRANE	10	2/3G2238020M		50CRV4 2)	3/5G2238020M	
120	DISTANCE-PLATE	11	4/3G1843O200		ST1203	D40/30X0.24	
4	DISTANCE-PLATE	12	2/3G2244O200		ST1203	D350/290X0.24	
32	BOLT	13	4/3G1842020M		10.9	D20X70	
32	COLLAR BUSH	14	3/3G1840O200		42CRMO4V 1)	D40/21X21	
32	GROOVED NUT	15	3/3G1841O200		8	D40/28.7X7.5	
32	DISC	16	4/3G1877O200		42CRMO4V 1)	D30/10X4	
32	LOCKING NUT	17	7022210000	DIN 980	8	V M10X1.25	
1	HUB	24	2/3G2216020M		CK45V/42CRMO4V 1)	3/5G2312020M	
1	INNER CLAMPING RING	28	2/3G2346020M		CK45N/GGG-40	5G2346020M	
24	CONICAL SPRING WASHER	32	7032516000	DIN 6796		16	

VULKAN
HERNE

1903	Datum DATE	Name NAME
Geschrieben WRITTEN	07.12.	GRIHN
Geprüft CHECKED		

Ausführung/Kunde
DESIGN/CUSTOMERS
STANDARD DESIGN

Zu Zeichng.-Nr.
TO DRAWING-NO.
(1) 1G232002A2

Stückliste Nr. PARTLIST-NO.
1G232102A2

Liste besteht aus LIST COMPRISES 2 Blatt SHEETS

Blatt SHEET 1

Stückz. QUANT.	Benennung DESCRIPTION	Teil PART	Zeichng.-Nr. DRAWING-NO.		Werkstoff MATERIAL	Modell-Nr./Fertigmaße MODEL-NO./DIMENSIONS	Bemerkung REMARK
12	DOUBLE SPRING DOWEL	34	ZR00800016				
12	SPRING DOWEL		7040115045	E9404		15X45X3.25	
12	SPRING DOWEL		7040300045	E9404		8.5X45X2.00	
24	HEXAGON BOLT	35	7002816080	DIN 961 -M	10.9	M16X1.50X 80	
36	LOCKING NUT	36	7022416000	DIN 980	10	V M16X1.50	
1	BEARING BUSH	37	2/3G23630200		VU556	D253/234X32	
1	CONNECTING RING	38	1/3G2205020M		CK45N	5G2205020M	

VULKAN HERNE	1983	Datum DATE	Name NAME	Ausführung/Kunde DESIGN/CUSTOMERS	Zu Zeichng.-Nr. TO DRAWING-NO.	Stückliste Nr. PARTLIST-NO. 1G232102A2
	Geschrieben WRITTEN	07.12.	GRIHN	STANDARD DESIGN	(1) 1G232002A2	Liste besteht aus LIST COMPRISES 2 Blatt SHEETS / Blatt SHEET 2
	Geprüft CHECKED					