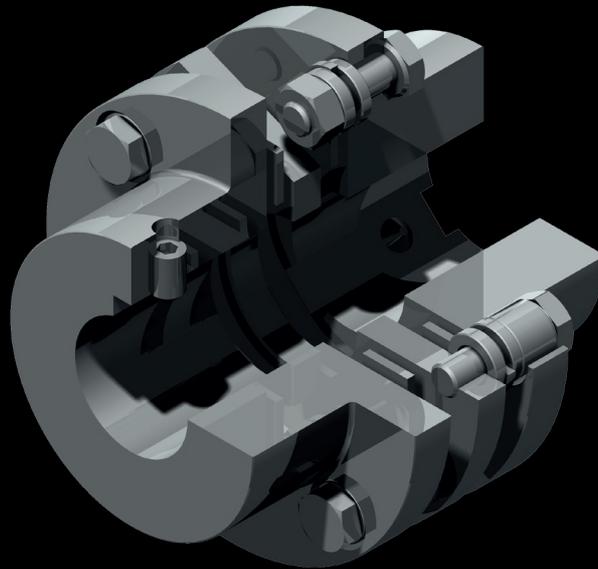


Mönninghoff

**ServoFlex - torsionally
stiff coupling
Type 318**



Driven by excellence

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- intensive dialog with our customers' engineers
- decades of experience and competence
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- enthusiasm for quality
- flexibility, inventiveness and communication skills of our employees
- commitment to Germany and Bochum as industrial location

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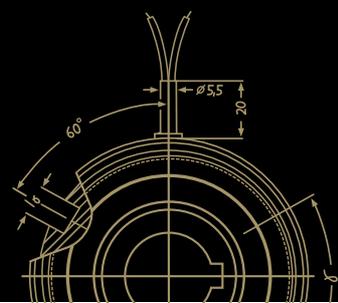
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Operating and Assembly Instructions

ServoFlex
Type 318.XX



Doc-ID: T24.0092_e
as off 12/2018

**Read these operating
instructions before starting
any kind of work!**

Content

1. General	4
1.1. Information on these instructions	4
1.2. Explanation of symbols	4
1.3. Limitation of liability	6
1.4. Copyright protection	6
1.5. Spare parts	6
1.6. Guarantee conditions	7
1.7. Customer service	7
1.8. Declaration of Incorporation	8
2. Safety	9
2.1. General	9
2.2. Staff requirements	9
2.2.1. Qualifications	9
2.2.2. Unauthorized persons	10
2.3. Intended use	11
2.4. Technical modifications	11
2.5. Personal protective equipment	11
2.6. Specific dangers	12
2.7. Signs	13
3. Technical Specifications	13
3.1. Dimensions	13
3.2. Technical Specifications	15
3.3. Connection dimensions, connection fixings	18
4. Setup and method of function	19
4.1. Structure and designs	19
4.2. Description	20
4.2.1. Features	20
4.3. Functional method	20
5. Transport, packaging and storage	21
5.1. Safety instructions for transport	21
5.2. Transport inspection	21
5.3. Packaging	22
5.4. Removing from the packaging	22
5.5. Storing the packaged items	22
6. Assembly	24
6.1. Safety	24
6.2. Preparations	25

6.2.1.	Instructions on assembly	25
6.2.2.	Assembling the clutch	26
6.2.3.	Assembling clutch with flanged hub (feather key connection)	28
6.2.4.	Assembling the clutch with the clamping hub	29
6.2.5.	Assembling the clutch with clamping hub sets	31
6.2.6.	Assemble the clutch and the connecting plate (design 4)	33
6.2.7.	Supporting the double flange	33
6.2.8.	Assembling the clutch vertically	34
7.	Startup	38
8.	Using in potentially explosive areas	39
8.1.	Construction of the clutch size	39
8.2.	Control events	39
8.3.	Startup	39
8.4.	Contact protection	40
8.5.	Construction of the clamping sets, clamping hub sets and clamping hubs	41
8.6.	Permissible temperatures	41
8.7.	EC Declaration of Conformity	42
9.	Operation	43
9.1.	General	43
9.2.	Recommendations for operation	43
10.	Faults	44
10.1.	Safety	44
10.2.	Malfunctions	46
11.	Maintenance	46
11.1.	Maintenance intervals	46
11.2.	Checking for wear	46
12.	Dismantling	48
12.1.	Safety	48
12.2.	Dismantling	48
12.3.	Disposal	48
13.	Applicable standards, guidelines and regulations	49

1. General

1.1. Information about these instructions

These instructions allow safe and efficient handling of the type 318.XX, ServoFlex clutches hereinafter referred to as clutch.

These instructions are part of the clutch system and must be kept in the immediate vicinity of the location, where the clutch is used and be accessible to staff at all times. Staff must read and understand these instructions carefully before beginning any work. Compliance with all safety instructions stated in these instructions constitute the basic requirement for safe working practices.

In addition, local accident prevention regulations and general safety rules apply to the range of application of the combination.

1.2. Explanation of symbols

Warnings

All warnings in these operating instructions will be indicated by a warning symbol.

The following warning symbols are used throughout these operating instructions:

Symbol	Meaning
	General warning
	Danger of crushing!
	Danger of environmental pollution
	Danger of explosion
	Special instructions when using the device in explosion-proof areas.
	General instructions and useful suggestions on handling

Safety precautions

The safety instructions are indicated in these instructions by symbols. The safety instructions are introduced by signal words that are intended to indicate the extent of the danger.

The warning symbol also indicates the type of danger.

The following warnings are used throughout these instructions:

	⚠WARNING
	<p>Risk of injury!</p> <p>Consequences upon non-observance of the instructions...</p> <p>▶ In order to avoid these...</p>

A warning of this category indicates a potentially dangerous situation.

If the dangerous situation is not avoided, it may lead to serious injury or even death.

Follow the instructions in this warning to avoid the danger of serious injury to persons or even death.

	⚠CAUTION
	<p>Injury to persons due to...!</p> <p>Consequences upon non-observance of the instructions...</p> <p>▶ In order to avoid these...</p>

A warning of this category indicates a potentially dangerous situation.

If the dangerous situation is not avoided, it may lead to light or minor injuries.

Follow the instructions in this warning to avoid the danger of serious injury to persons.

	ATTENTION
	<p>Damage to property due to...</p> <p>Consequences upon non-observance of the instructions...</p> <p>▶ In order to avoid these...</p>

A warning of this category indicates potential danger to property.

If the situation is not avoided, it may lead to damage to property.

Follow the instructions in this warning to avoid damage to property.

Tips and recommendations

	NOTE
	Descriptive text...

A descriptive text contains additional information that is important for further processing or for simplifying the procedure step explained.

1.3. Limitation of liability

All specifications and notes in these instructions were compiled according to all standards and regulations considering the current state of technology and many years of knowledge and experience.

The manufacturer assumes no liability for damages resulting from:

- upon non-observance of the instructions
- Use for the non-intended purpose
- Deployment of insufficiently qualified staff
- Unauthorized modifications
- Technical modifications
- Use of non-approved spare parts

The commitment as agreed in the delivery contract, the general terms and conditions, the delivery conditions specified by the manufacturer as well as the applicable statutory regulations apply.

We reserve the right to make technical modifications resulting from improvements and further development.

1.4. Copyright protection

This documentation is protected by copyright.

The contents and instructions are for internal use only and may not be transferred to a third party, reproduced in any form or manner, either in whole or in part, utilized or communicated without the written permission of the manufacturer.

Infringement obligates damage compensation. We reserve the right to impose further claims.

1.5. Spare parts

	▲WARNING
	<p>Danger of injury due to wrong or faulty spare parts!</p> <p>Incorrect or defective replacement parts can lead to injury, damage, malfunction or total breakdown.</p> <p>► Use original spare parts from the manufacturer only.</p>

NOTE	
i	<p>The use of spare parts other than original Mönninghoff spare parts or use of spare parts not purchased directly from Maschinenfabrik Mönninghoff GmbH & Co. KG invalidates all commitments of Maschinenfabrik Mönninghoff GmbH & Co. KG or its dealers such as guarantee, service contracts etc. without prior notice.</p> <p>► Obtain spare parts from authorized dealers or directly from the manufacturer. See page 7 for the address.</p>

1.6. Guarantee conditions

The guarantee conditions are included in the general terms and conditions of the manufacturer.

1.7. Customer service

Technical information is available from our customer service department

Maschinenfabrik Mönninghoff GmbH & Co. KG

Bessemerstraße 100 Postfach 101749
D – 44793 Bochum D – 44717 Bochum
Tel.: +49 (0) 234 3335-0
E-Mail: service@moenninghoff.de
Internet: www.moenninghoff.de

Moreover, our employees are always interested in new information and experiences, which result from the use of our products or can lead to the improvement of our products.

1.8. Declaration of Incorporation

Declaration of Incorporation

according to EC Machine Directive 2006/42/EC,

Annex II B

Name of the manufacturer: **Maschinenfabrik Mönninghoff GmbH & Co. KG**
 Address of the manufacturer: **Maschinenfabrik Mönninghoff GmbH & Co. KG**
Bessemerstrasse 100
D - 44793 Bochum

We hereby declare that the products

Model: ServoFlex

Type 318.XX

Project no.:

are intended for installing into a system/machine. Startup is not permitted until it is determined that the system/machine in which this ServoFlex clutch is installed, complies with the requirements of the EC directives.

The following harmonized standards were applied:

DIN EN ISO 12100 Safety of machinery - General principles for design - Risk assessment and risk reduction

The technical documentation is available in entirety and can be requested from:

Maschinenfabrik Mönninghoff GmbH & Co. KG

The corresponding operating instructions for the machine/machine part are available.

- in their original version and
- in the national language of the user in their original version and in the national language of the user

Bochum,
21.09.2018

Signature..... *Bodo Finger*
 Managing director: Dipl.-Kfm. Bodo Finger

2. Safety

2.1. General

This section provides an overview on all safety aspects for optimum protection of staff during assembly and startup as well as safe and trouble-free operation.

	⚠WARNING
	<p>Danger due to failure to observe the safety instructions!</p> <p>Failure to observe the safety and instructions listed in these assembly instructions can lead to considerable danger.</p> <p>▶ Always pay attention to all warnings and instructions specified here.</p>

2.2. Staff requirements

2.2.1. Qualifications

	⚠WARNING
	<p>Risk of injury due to insufficient qualification!</p> <p>Improper use can result in considerable damage to persons or property.</p> <p>All activities shall only be performed by qualified staff.</p>

The following qualifications are stated in the operating instructions for various different fields of activities.

- **Instructed person**
was given instruction by the operator on his/her assigned tasks and possible dangers resulting from improper conduct.
- **Specialist staff**
is able to carry out assigned work tasks as well as recognize and prevent possible dangers based on his/her technical training, knowledge and experience, including knowledge of applicable regulations.
- **Qualified electrician**
is able to carry out assigned work tasks on electrical systems as well as recognize and prevent possible dangers based on his/her technical training, knowledge and experience, including knowledge of applicable standards and regulations.

The qualified electrician has been trained for the specific work site to which he/she is deployed, and is familiar with the relevant standards and regulations.

Only permit members of staff if it can be expected that they will carry out their assigned tasks reliably. Those staff members whose responsiveness is affected by substances such as drugs, alcohol or medication shall not be permitted.

	NOTE
	Observe all age and occupational regulations at the location of the electromagnetic tooth clutch when selecting staff!

	⚠WARNING
	<p>Risk of injury</p> <p>Rotating components always constitute a risk of injury!</p> <ul style="list-style-type: none"> ▶ Remove jewellery. ▶ Protect long hair with a cap or hairnet!

2.2.2. Unauthorized persons

	⚠WARNING
	<p>Danger due to unauthorized persons!</p> <p>Unauthorized persons who do not fulfil the requirements described here, are not familiar with the dangers in the work area.</p> <ul style="list-style-type: none"> ▶ Do not permit unauthorized persons to be in the vicinity of the work area. ▶ In case of doubt, approach the persons and instruct them to leave the work area. ▶ Do not continue with work while the unauthorized person is in the vicinity of the work area.

2.3. Intended use

The clutch was conceived and constructed exclusively for connecting shafts.

The clutch may only be used according to the technical data and operating conditions defined by the manufacturer, see the section "**Technical Data**" as well as "**Setup and method of function**".

When using the clutch in potentially explosive areas, see section 8 "**Using in potentially explosive areas**".

	⚠WARNING
	<p>Danger due to use for other than the intended purpose!</p> <p>Any use other than for the intended purpose of the combination can lead to dangerous situations.</p> <ul style="list-style-type: none"> ▶ Only use the clutch for its intended purpose. ▶ All information contained in these operating instructions must be strictly complied with.

The operator is liable for all damage caused from use for other than the intended purpose.

2.4. Technical modifications

	NOTE
	<p>In order not to endanger the operational safety of the clutch, unauthorized modifications and alterations are prohibited!</p>

2.5. Personal protective equipment

To minimize health risks during work it is necessary to wear personal protective equipment.

- The protective equipment corresponding to the work, which is carried out, must be worn at all times.
- Pay attention to all advices on personal protective equipment within the work area.

Only wear

The following must be worn for all work:

	<p>Close-fitting protective clothing with a low tear strength and no protruding parts. They are principally designed to protect against being caught by moving machine parts.</p> <p>Do not wear rings, bracelets or other jewellery.</p>
	<p>Goggles to protect the eyes from flying parts and liquids</p>
	<p>Safety footwear with protective caps and oil-resistant soles</p>

2.6. Specific dangers

The following section specifies residual hazards identified during risk assessment.

Pay attention to the safety instructions and warning notes specified in following sections of these operating instructions in order to reduce the risk of damage to health and avoid dangerous situations.

Moving components

	<p style="text-align: center;">⚠CAUTION</p> <p>Risk of injury due to moving parts!</p> <p>Rotating and/or linearly moving parts can cause injury.</p> <ul style="list-style-type: none"> ▶ Do not reach into moving parts with your hands or tamper with these parts during operation. ▶ Do not open the covers during operation. ▶ Wear close-fitting protective clothing in the danger zone. ▶ Remove jewellery. ▶ Protect long hair with a cap or hairnet.
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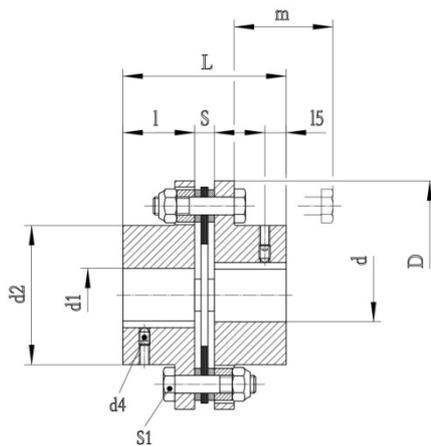
2.7. Signs

The following symbols and signs could be located in the working area. These apply to the area immediate surrounding where they are attached.

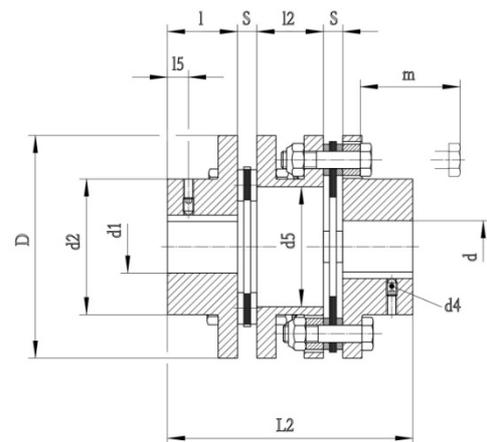
	⚠ WARNING
	<p>Risk of injury due to illegible symbols!</p> <p>Due to dirt or other causes, stickers and signs can become illegible.</p> <ul style="list-style-type: none"> ▶ All safety, warning and operating instructions must remain legible. ▶ Damaged signs or stickers must be replaced immediately.

3. Technical Specifications

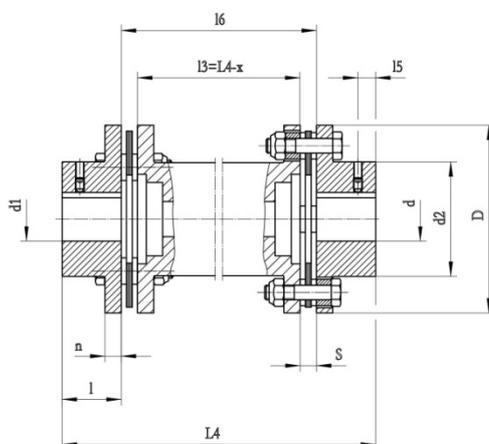
3.1. Dimensions



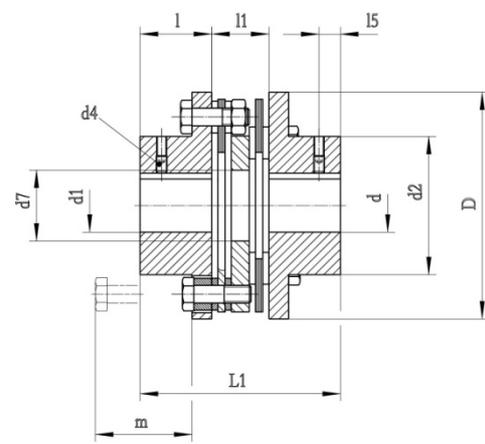
Design 1.1



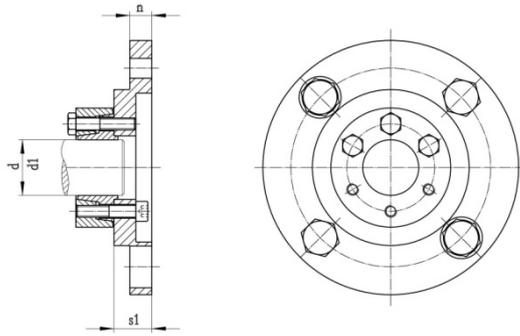
Design 2.1



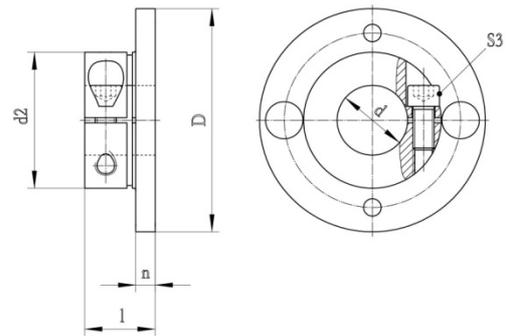
Design 3.1



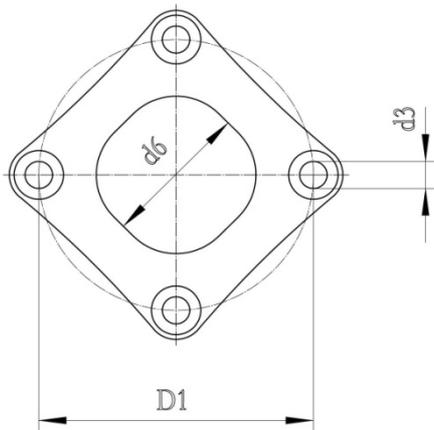
Design 4.1



Hub Design □.2



Hub Design □.4



Diaphragm Dissambly

3.2. Technical Specifications

Size			20	25	35	38	42	50
Preferred bores d, d1 H7 [mm]	Design Ø.1 keyway according to DIN 6885-1		12, 14, 16, 19, 20	14, 16, 18, 19, 20, 24, 25	19, 20, 24, 25, 28, 30, 35	22, 24, 25, 28, 30, 32, 35, 38	24, 25, 28, 30, 32, 35, 40, 42	28, 30, 32, 35, 40, 45
Bore d, d1 H7 [mm]	Design Ø.1 keyway according to DIN 6885-1	min	7	7	12	12	20	19
		max	20	25	35	38	42	55
	Design Ø.2	min	-	12	16	20	25	25
		max	-	16	25	30	36	45
	Design Ø.4	min	12	12	19	20	30	32
		max	17	22	32	32	35	40
Clutch torque at angular displacement per diaphragm assembly	T _{KN}	0,50° [Nm]	35	60	150	200	300	500
		0,75° [Nm]	25	40	100	120	160	200
		1,00° [Nm]	10	25	50	70	-	-
Design 4	T _K max [Nm]		25	45	55	120	135	250
Alternating torques	T _{KW} [Nm]		18	40	55	120	135	250
Max. rotating speed	Design 1.1, 2.1, 4.1 n [rpm]		20000	16000	13000	12000	10000	8000
	Design 3.1 n [rpm]		n max. (siehe Kennlinie "Betriebsdrehzahl")					
	Design 2, 4 n [rpm]		5000	5000	5000	5000	5000	5000
Moment of inertia	Design 1. I [10 ⁻³ Kg m ²]		0,11	0,30	0,87	1,60	2,60	6,50
	Design 2 I [10 ⁻³ Kg m ²]		0,20	0,55	1,50	2,90	4,60	11,80
	Design 3 I		0,41	1,06	3,123	5,543	8,26	16,41
	$I_3 = 1000 \text{ mm}$ pro 100 mm Rohr [10 ⁻³ Kg m ²]		0,0172	0,038	0,150	0,248	0,340	0,6
	Design 4. I [10 ⁻³ Kg m ²]		0,4	0,7	1,2	1,8	2,5	4,6
Weight	Design 1 m [Kg]		0,3	0,6	1,0	1,4	2,1	3,4
	Design 2 m [Kg]		0,5	1,1	1,7	2,4	3,3	5,8

Size		20	25	35	38	42	50	
Weight	Design 3 $l_3 = 1000 \text{ mm}$ pro 100 mm Rohr [Kg]	1,54	2,42	4,31	6,77	7,52	13,7	
		0,098	0,128	0,252	0,418	0,362	0,436	
	Design 4. m [Kg]	0,4	0,7	1,2	1,8	2,5	4,6	
Max. resilience	angled	Design 1. [°]	1	1	1	1	1	1
		Design 2. / 3. / 4. [°]	2	2	2	2	2	2
	axial	Design 1. [°]	0,6	0,8	1	1,2	1,4	1,6
		Design 2. / 3. / 4. [°]	1,2	1,6	2	2,4	2,8	3,2
	radial	Design 2. [°]	0,5	0,5	0,5	0,6	0,6	0,8
		Design 3. [°]	0,0175 ($l_3 + s$)					
		Design 4. [°]	0,1	0,2	0,2	0,3	0,3	0,4
Torsion spring stiffness	Design 1. C_T [10^6 Nm/rad]	0,016	0,029	0,083	0,170	0,250	0,430	
	Design 2, 4. C_K [10^6 Nm/rad]	0,008	0,014	0,041	0,085	0,125	0,215	
	Design 3. /Rohr C_R [10^6 Nm/rad]	$\frac{1,76}{l_3}$	$\frac{3,88}{l_3}$	$\frac{25,2}{l_3}$	$\frac{25,2}{l_3}$	$\frac{43,6}{l_3}$	$\frac{60,7}{l_3}$	
Axial spring stiffness	Design 1. C_a [N/mm]	43	45	60	122	160	197	
	Design 2. /3. /4. C_a [N/mm]	21	22	30	61	80	98	
Dimensions [mm]	D	56	68	82	94	104	128	
	D_1	44	53	67	75	85	100	
	d_2	32	40	54	58	68	78	
	d_3 H8	5	6	6	8	8	10	
	d_4	M 5	M 5	M 6	M 6	M 6	M 6	
	d_5	27	35	48	50	60	50	
	d_6	24	30	38	42	48	54	

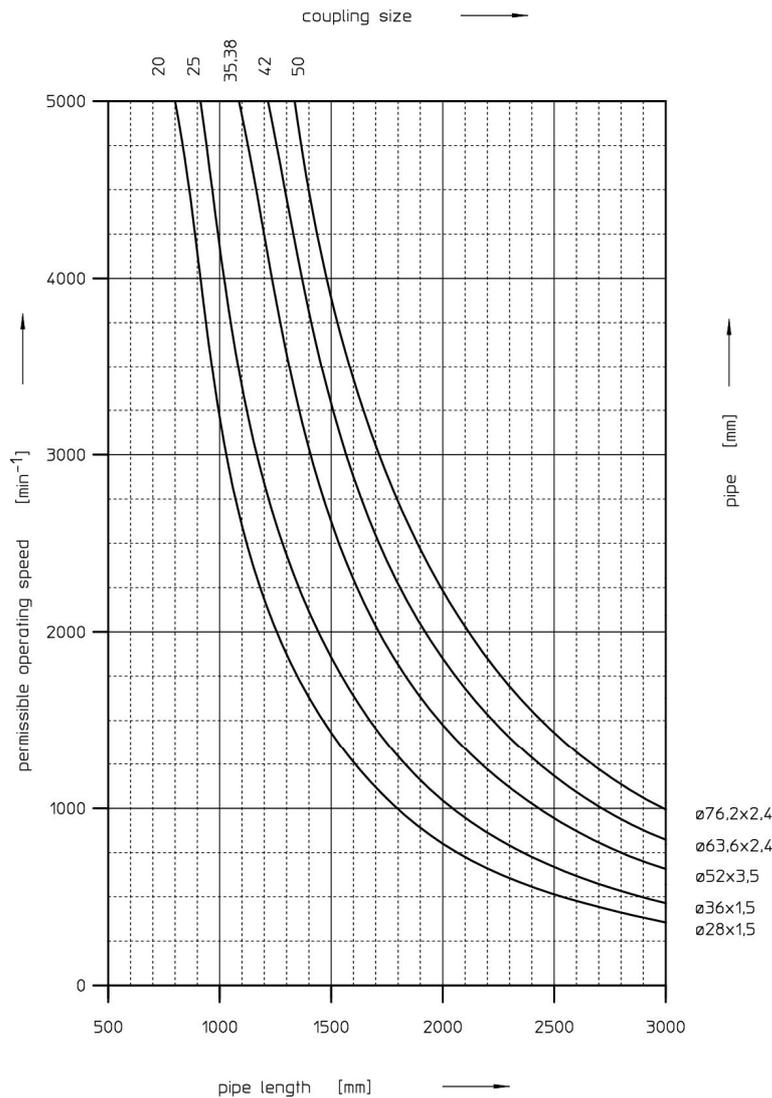
Size		20	25	35	38	42	50	
Dimensions [mm]	d ₇	20	24	28	32	34	40	
	L Design 1.1	45	56	66	68	80	91	
	L ₁ Design 4.1	55	68	78	86	98	112	
	L ₂ Design 2.1	74	88	98	106	118	140	
	l	20	25	30	30	35	40	
	l ₁ Design 4.	15	18	18	26	28	32	
	l ₂ Design 2.	24	26	26	30	28	38	
	l ₃ max. Bf. 3	1500	1500	2000	2000	3000	3000	
	l ₅	6	8	8	8	10	12	
	l ₆	Abstand zwischen den Wellenspiegeln						
	S	5	6	6	8	10	11	
	m min. Design 1. / 2. / 3.	27	31	35	44	44	57	
	m min. Design 4.	20	24	26	35	35	44	
	n	5	6	8	9	9	11	
	s ₁	-	16	16	16	18	19	
x	50	62	72	76	90	102		
Torque	S1		M 5	M 6	M 6	M 8	M 8	M 10
		[Nm]	5,5	13	13	33	33	65
	S2		-	M 6	M 6	M 6	M 6	M 6
		[Nm]	-	12	12	12	12/29	12/29
	S3		M 4	M 6	M 6	M 8	M 10	M 12
		[Nm]	5	10	17	33	75	95

**NOTE**

Obtain further technical data from the assembly drawing.

The assembly drawing can be requested from the manufacturer.

Permissible operating speed for intermediate shafts type 318.



i	NOTE
	The critical bending speed is 20% over the permissible operating speed.

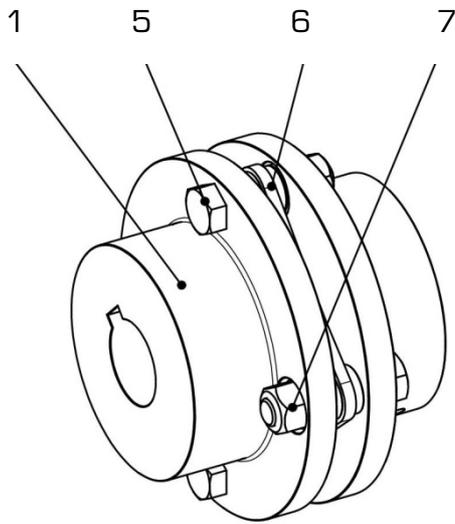
3.3. Connection dimensions, connection fixings

Refer to the assembly drawing for connection dimensions and information on connection fixings.

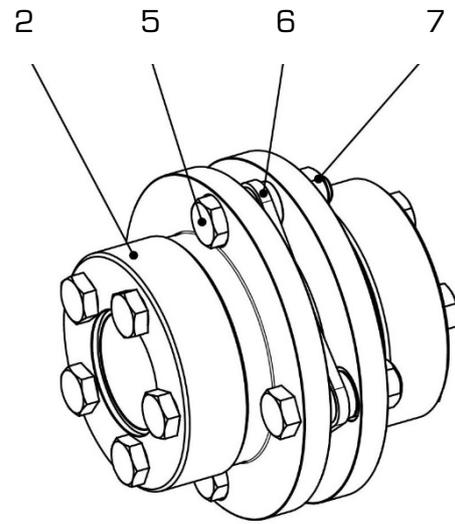
i	NOTE
	The assembly drawing can be requested from the manufacturer.

4. Setup and method of function

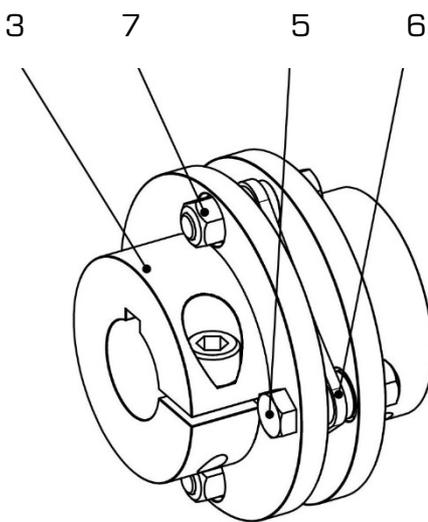
4.1. Structure and designs



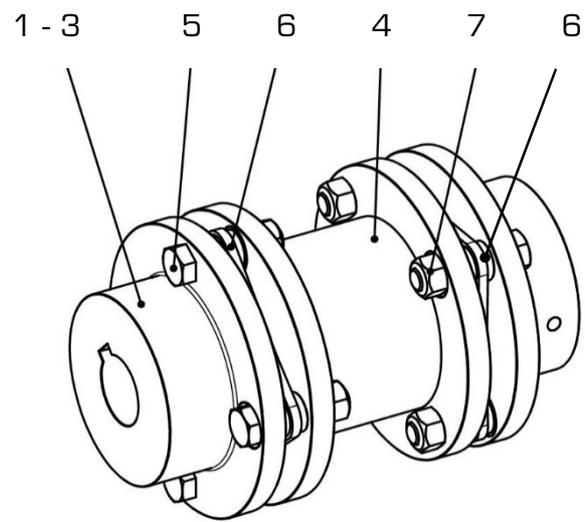
Design 1.1



Design 1.2



Design 1.4



Design 2 - 3 - 4

- | | | | |
|---|---------------|---|--------------------|
| 1 | Flanged hub | 5 | Adapter screw |
| 2 | Clamping set | 6 | Diaphragm assembly |
| 3 | Clamping hub | 7 | Stover nut |
| 4 | Double flange | | |

4.2. Description

4.2.1. Features

Mönninghoff ServoFlex clutches are connecting couplings. The ServoFlex clutches are distinguished by the following characteristics:

- Compensation of axial, radial and angular displacements
- Suitable for clockwise and counter-clockwise and alternating load operation
- High transmittable torques
- Low absorption of torque peaks, direct torque transmission

4.3. Functional method

The clutch connects drive and drive shaft like a cardan joint but with a maximum angle that must be maintained.

The flanged hubs attached to both shaft ends are fixed to the shaft by threaded pins.

The flanged hubs are screwed to the diaphragm assembly with high-strength screws. This connection is force locking and therefore wear free.

 	<p style="text-align: center;">▲WARNING</p> <p>Using a clamping hub</p> <p>When using a clamping hub, installation in potentially-explosive areas is restricted (category 3).</p> <p>Ex marking:  II 3 GD c IIC X</p>
--	--

5. Transport, packaging and storage

5.1. Safety instructions for transport

Improper transport

	ATTENTION
	<p>Damage due to improper transport!</p> <p>Improper transport can cause considerable damage.</p> <ul style="list-style-type: none"> ▶ When unloading the packaged items after delivery, as well as during in-house transport, proceed with care and pay attention to the symbols and instructions on the packaging. ▶ Protect the clutch against heavy knocks as well as all types of force during transport. ▶ Avoid strong ambient temperature fluctuations to prevent formation of condensation. ▶ Remove the packaging immediately prior to installation.

5.2. Transport inspection

Upon receipt, check consignment immediately for completeness and transport damage.

	NOTE
	<p>Failure to observe the following instructions will invalidate claims to the insurer for damage.</p>

In the event of obvious visible transport damage, proceed as follows:

- Even if damage is only suspected, sign receipt of delivery (e.g. on the shipping document) with corresponding information under reservation.
- Determine and adhere to deadlines for submission of claims.
- Report the insurance claim immediately to the insurer and provide him with complete documentation of the damage as soon as possible (however, at the latest before possible exclusion and/or limitation periods for compensation claims against third parties expire) to enable acceleration of the claim processing procedure.

	NOTE
	Register any claim as soon as a defect is detected. Claims for damage can only be accepted within the valid reclamation period.

5.3. Packaging

Regarding the packaging

The individual packages are packed according to the expected transport conditions. Environmentally compatible materials have been used exclusively for packing.

Packaging should protect the individual components from transport damage, corrosion and other damage up until installation. For this reason, do not destroy the packaging and remove it only just prior to installation.

Handling packing material

The packaging protects the device against damage during transit. The packing materials were selected according to environmental and waste disposal aspects and can therefore be recycled.

Recycling the packaging material for further use saves raw materials and reduces waste. When no longer required, dispose of the packaging materials according to local environmental regulations.

5.4. Removing from the packaging

Carefully remove the individual parts of the clutch from the packaging.

5.5. Storing the packaged items

Anticorrosion oil was applied to clutch parts, which are not protected against corrosion. In addition, the clutch must be stored in the original packaging.

Check the corrosion protection when the duration of storage exceeds six months. If the corrosion protection was removed during control of received goods, conservation should be renewed (e.g., with Tectyl 472 from Valvoline).

Packages must be stored under the following conditions:

- Do not store outdoors.
- Store at a dry and dust-free location.
- Do not expose to aggressive media.
- Protect against solar radiation.
- Avoid mechanical shocks and damage.
- Storage temperature: +5 to +45 °C.
- Relative humidity: max. 60 pc.
- When storing for longer than 3 months, check the general condition of all parts and the packaging regularly.

	NOTE
i	It is possible that instructions for storage are on the packaging that go beyond the stated requirements. Follow these instructions accordingly.

6. Assembly

6.1. Safety

Staff

Installation and initial startup may only be carried out by specially trained specialist staff.

Personal protective equipment

Wear the following protective equipment during all work on installation and initial startup:

	<p>Close-fitting protective clothing with a low tear strength and no protruding parts. They are principally designed to protect against being caught by moving machine parts.</p> <p>Do not wear rings, bracelets or other jewellery.</p>
	<p>Goggles to protect the eyes from flying parts and liquids</p>

Improper installation and initial startup

	<p style="text-align: center;">⚠CAUTION</p> <p>Risk of injury due to improper installation and initial startup!</p> <p>Improper installation and initial startup can lead to personal injury or material damage.</p> <ul style="list-style-type: none"> ▶ Before beginning work, make sure that sufficient installation workspace is available. ▶ Be careful when handling exposed, sharp-edged components. ▶ Pay attention to tidiness and cleanliness at the workplace! Parts and tools lying around or on top of each other can be sources of accidents. ▶ Parts must be properly installed. Adhere to the specified screw torques.
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6.2. Preparations

Before assembling, check the following points:

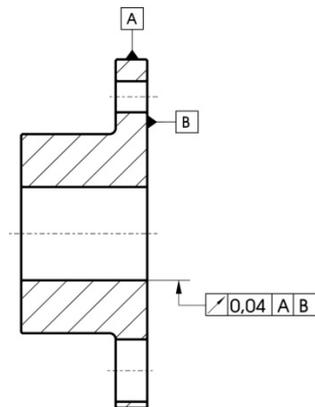
- The clutch should not show any deformation, scratches and other damage indicating that it was dropped.

6.2.1. Instructions on assembly

The clutch is supplied in individual parts with the shaft bore as requested by the customer.

The flanged hubs are not balanced.

In the event of finished bores from the customer, the following concentricity and axial run-out tolerances must be adhered to:



While considering the transmittable torque, it is not permitted to go below or exceed the specified bore diameters for each respective size!

In addition, the transmission limits of the feather key must be considered! Failure to observe these values can tear the flanged hub.

	▲WARNING
	<p>Danger of explosion!</p> <p>► Customer-created finished bores are not permitted for potentially explosive areas!</p>

i	NOTE
	<p>To avoid damage to the components of the clutch, only remove the transport packaging at the assembly location.</p>

Ensure that the current occupational safety regulations are observed. Check the parts for completeness, and damage. Check the bore of the flanged hubs for burrs and eliminate them if necessary. Clean the shaft ends and flanged hub bores thoroughly!

If connections are intended via press fitting, the hubs must be heated up **evenly to a maximum of 200 °C** before assembly.

Improper assembly and initial startup

	⚠CAUTION
	<p>Danger of burns due to improper handling of the heated hubs!</p> <p>▶ Wear gloves when handling hot hubs.</p>

 	⚠WARNING
	<p>Danger of explosion when heating a hub for press-fitting assembly in potentially explosive areas!</p> <p>▶ Heating the clutch in potentially explosive areas may only take place after considering the maximum permitted temperatures for the location.</p> <p>▶ The assembly area must be approved before assembly as "no explosion risk area".</p>

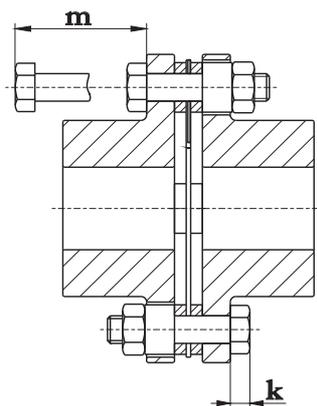
6.2.2. Assembling the clutch

Check the parts for completeness, dimensional stability and damage. Check the bore of the flanged hubs for burrs and eliminate them if necessary. Clean and degrease shaft ends and bores thoroughly.

	NOTE
	<p>The shaft fitting should be h7 to j6 The bore fitting is H7 as standard.</p>

ATTENTION	
	<p>Damage due to improper, forced assembly!</p> <p>Improper, forceful assembly can cause considerable damage to property.</p> <ul style="list-style-type: none"> ▶ Never forcefully strike or press the flanged hub onto the shaft! ▶ Installation of the diaphragm assembly may only take place according to the permitted angle values. ▶ The diaphragm assemblies must be installed without tension in an axial direction. ▶ Align the shaft ends exactly. ▶ When replacing or dismantling diaphragm assemblies, always use new fitting screws for installation. ▶ Do not grease or oil screws and nuts. ▶ Adhere to the fitting tightening torques T_A for the feather keys on the diaphragm assemblies.

NOTE	
	<p>If the "m" screw assembly dimension cannot be adhered to for installation reasons, the fixing screws for the diaphragm assemblies must be inserted into the flanged hubs before pushing them on the shafts.</p>



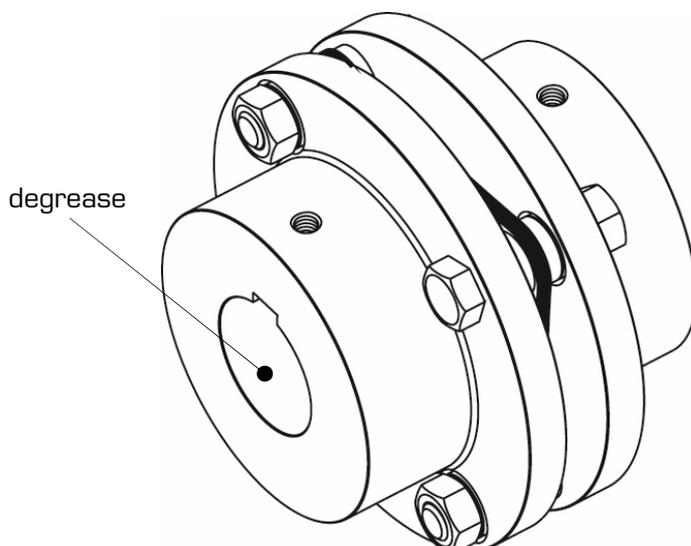
Size	20	25	35	38	42	50
m [mm]	27	31	35	44	44	57
Excess k [mm]	3.5	4	4	5.5	5.5	7
T _A [Nm]	5.5	13	13	33	33	65

6.2.3. Assembling clutch with flanged hub (feather key connection)

i	NOTE
	When screwing the diaphragm assemblies, the T _A tightening torques for the feather keys must be adhered to.

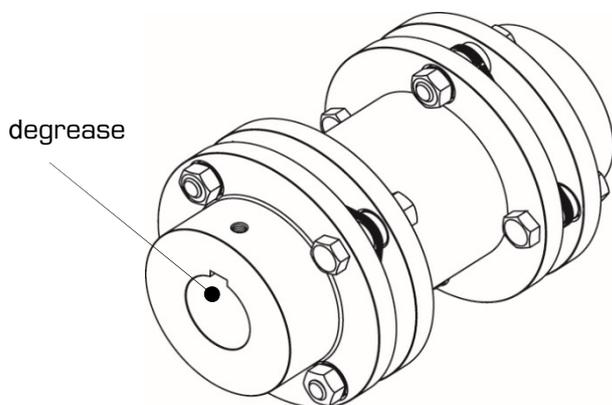
Single cardan (design 1)

- Hub bores and shafts must be clean and free of grease.
- Push the first flanged hub onto the first shaft. Pay attention to the seating of the feathered key!
- Fix the flanged hub to the shaft with the threaded pin.
- Screw the flanged hub to the diaphragm assembly. Adhere to tightening torque T_A!
- Push the second flanged hub onto the second shaft. Pay attention to the seating of the feathered key!
- Align the clutch and screw the second flanged hub to the diaphragm assembly. Adhere to tightening torque T_A!
- Fix the second flanged hub to the shaft with the threaded pin.
- Ensure tension-free installation of the diaphragm assembly in an axial direction!



Double cardan
(design 2, and 3)

- Hub bores and shafts must be clean and free of grease.
- Push the first flanged hub onto the first shaft. Pay attention to the seating of the feathered key!
- Fix the flanged hub to the shaft with the threaded pin.
- Screw the flanged hub, diaphragm assembly and double flange. Support the double flange to protect the diaphragm assembly.
- Push the second flanged hub onto the second shaft and screw to the diaphragm assembly. Adhere to tightening torque T_A !
- Align the clutch and screw the double flange to the second diaphragm assembly.
- Fix the second flanged hub to the shaft with the threaded pin.
- Ensure tension-free installation of the diaphragm assembly in an axial direction!



6.2.4. Assembling the clutch with the clamping hub

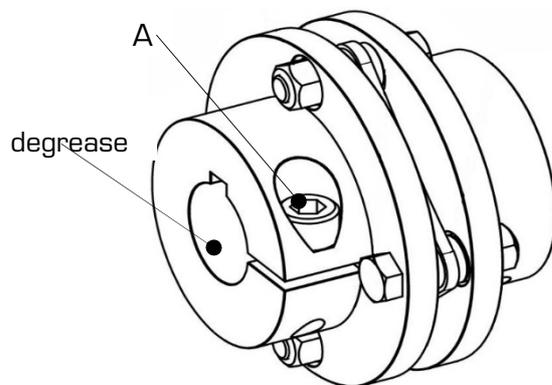
 	⚠ WARNING
	<p>Using a clamping hub</p> <p>When using a clamping hub, installation in potentially-explosive areas is restricted (category 3).</p> <p>Ex marking  II 3 GD c IIC X</p>

	NOTE
	<p>When screwing the diaphragm assemblies, the T_A tightening torques for the feather keys must be adhered to.</p>

Size	20	25	35	38	42	50
Tightening torque T_N [Nm]	5	10	17	33	75	95

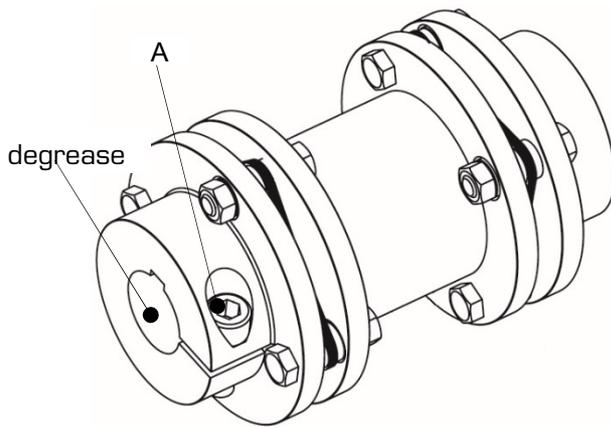
Single cardan
(design 1)

- Hub bores and shafts must be clean and free of grease.
- Push the first clamping hub onto the shaft.
- Fix the clamping hub on the shaft with cylinder screw "A". Adhere tightening torque T_N !
- Screw the clamping hub to the diaphragm assembly. Adhere to tightening torque T_A !
- Push the second clamping hub onto the second shaft.
- Align the clutch and screw the second clamping hub to the diaphragm assembly. Adhere to tightening torque T_A !
- Fix the second clamping hub on the shaft with cylinder screw "A". Adhere tightening torque T_N !
- Ensure tension-free installation of the diaphragm assembly in an axial direction!



Double cardan
(design 2, and 3)

- Hub bores and shafts must be clean and free of grease.
- Push the first flanged hub onto the first shaft.
- Fix the clamping hub on the shaft with cylinder screw "A". Adhere tightening torque T_N !
- Screw the flanged hub, diaphragm assembly and double flange. Support the double flange to protect the diaphragm assembly.
- Push the second flanged hub onto the second shaft and screw to the diaphragm assembly. Adhere to tightening torque T_A !
- Align the clutch and screw the double flange to the second diaphragm assembly.
- Fix the second clamping hub on the shaft with cylinder screw "A". Adhere tightening torque T_N !
- Ensure tension-free installation of the diaphragm assembly in an axial direction!

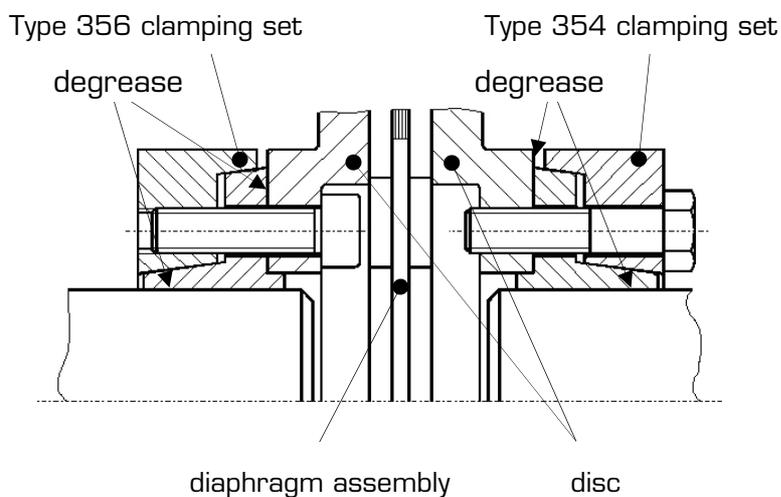


6.2.5. Assembling the clutch with clamping hub sets

i	NOTE
	When screwing the diaphragm assemblies, the T_A tightening torques for the feather keys must be adhered to.

Clamping sets

Type 354 and type 356 clamping sets	
Shafts \varnothing	Tightening torque T_s [Nm]
> 12 - 30	12
> 30 - 42	29



Single cardan (design 1)

- Clamping set and shafts must be clean and free of grease.
- Screw the first clamping set and disc loosely to the clamping hub set.
- Push the clamping hub set onto the shaft.
- Tighten the clamping screws one after the other during several rotations. Pay attention to tightening torque T_S !
- Screw the clamping hub set to the diaphragm assembly. Pay attention to tightening torque T_A !
- Screw the second clamping hub set (clamping set and disc) loosely together.
- Push the clamping hub set onto the second shaft.
- Align the clutch and screw the second clamping hub set to the diaphragm assembly. Pay attention to tightening torque T_A !
- Tighten the clamping screws of the second clamping hub set one after the other during several rotations. Pay attention to tightening torque T_S !
- Ensure tension-free installation of the diaphragm assembly in an axial direction!

Double cardan (design 2, and 3)

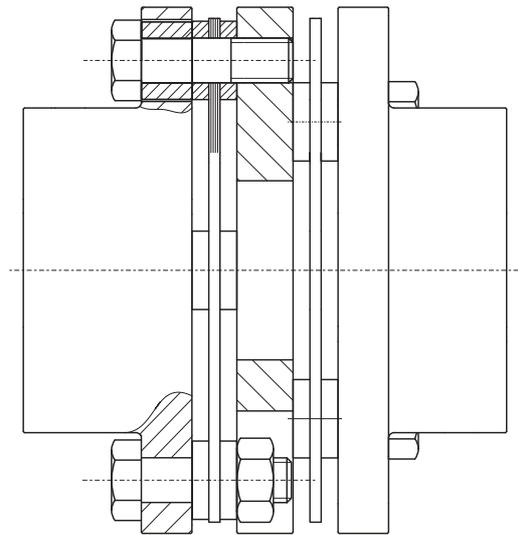
- Clamping set and shafts must be clean and free of grease.
- Screw the first clamping set and disc loosely to the clamping hub set.
- Push the clamping hub set onto the shaft.
- Tighten the clamping screws one after the other during several rotations. Pay attention to tightening torque T_S !
- Screw the clamping hub set, diaphragm assembly and double flange. Support the double flange to protect the diaphragm assembly.
- Screw the second clamping hub set (clamping set and disc) loosely together.
- Push the second clamping hub set onto the second shaft and screw to the second diaphragm assembly. Pay attention to tightening torque T_A !
- Align the clutch and screw the double flange to the second diaphragm assembly.
- Tighten the clamping screws of the second clamping hub set one after the other during several rotations. Pay attention to tightening torque T_S !
- Ensure tension-free installation of the diaphragm assembly in an axial direction!

6.2.6. Assemble the clutch and the connecting plate (design 4)

The designs with connecting plate can be assembled with both flange and clamping hubs.

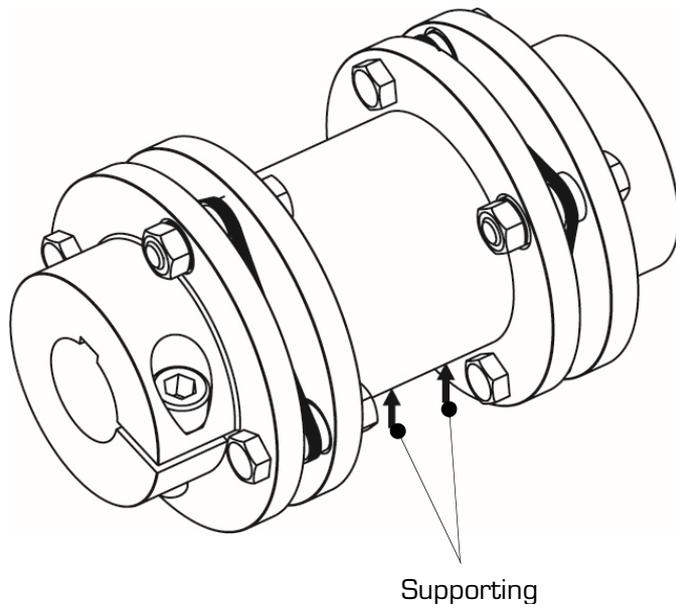
Assembling the clutch with a connecting plate:

- Screw the first hub to the diaphragm assembly.
- Attach the component to the first shaft end.
- Fix the component according to the version.
- Screw the second hub to the diaphragm assembly.
- Aligning the clutch.
- Screw the component with the prescribed torque.



6.2.7. Supporting the double flange

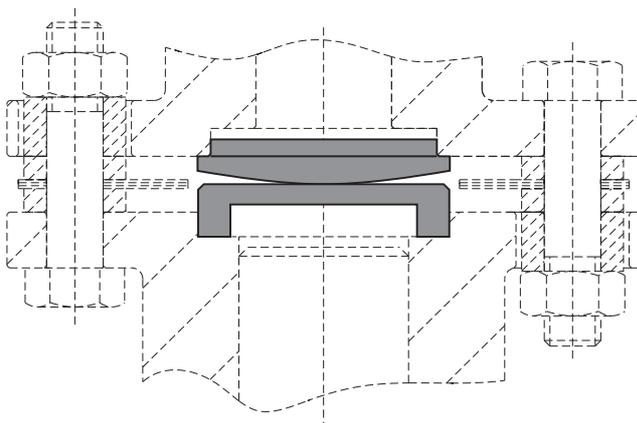
	ATTENTION
	<p>Damaged diaphragm assemblies due to force transmission over the hanging double flange</p> <p>The diaphragm assemblies are incorrectly loaded when assembling the double flange of the double cardan designs.</p> <p>► Support the double flange to avoid damaging the diaphragm assemblies.</p>



6.2.8. Assembling the clutch vertically

To assemble the clutch vertically, a pressure plate unit must be installed to absorb the forces.

 	<p style="text-align: center;">⚠ WARNING</p> <p>Using a connecting plate.</p> <p>When using a pressure plate unit for vertically-assembled clutches, installation in a potentially explosive area is forbidden.</p>
--	---



Use the pressure plate unit for supporting the weight of the lower clutch half.

For instructions on further assembly, refer to the instructions for the corresponding clutch design.

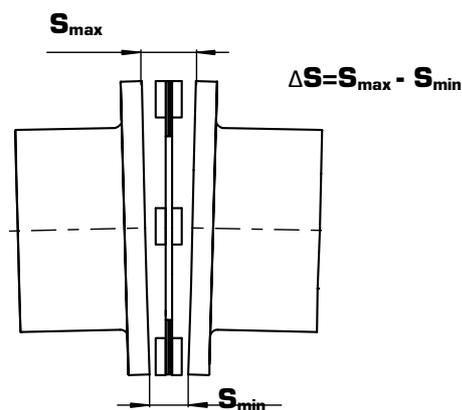
Aligning the clutch

Aligning the clutch is of decisive importance for the service life and smooth running of the shaft connection. The radial, axial and angular displacement should be as small as possible. Align the clutch with the axis levels perpendicular to each other with the help of a ruler, caliper and a feeler gauge. The measuring accuracy can be increased with a dial gauge.

If " Δs " (corresponds to an angle displacement of 0.2°) is exceeded, the load capacity of the diaphragm assembly is decreased. Refer to the catalogue to determine the transmission torque.

The following illustrates the options for measuring shaft displacements.

To consider production tolerances of the diaphragm assemblies when measuring " S_{max} " and " S_{min} ", measure the existing diaphragm assembly thickness " s " before assembling.



Align the clutch as follows:

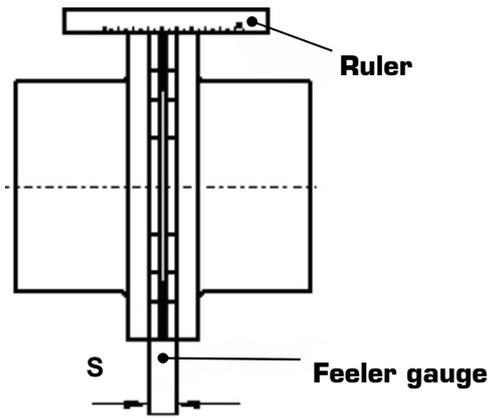
- Push the flanged hubs onto the shaft ends.
- Adhere exactly to dimension "S".

Calculate dimension "S" according to the following formula:

$$S_{min} \geq S - \frac{\Delta S}{2} \qquad S_{max} \leq S + \frac{\Delta S}{2}$$

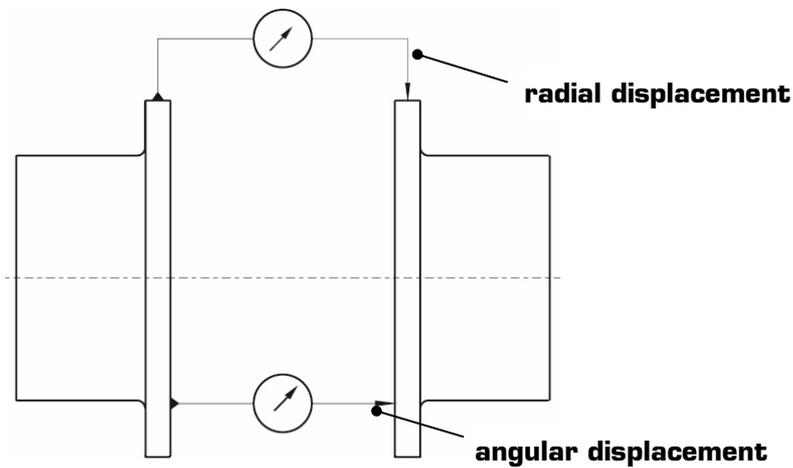
Type 318 - ServoFlex						
Size	20	25	35	38	42	50
ΔS	0.2	0.25	0.3	0.3	0.35	0.45
S	5 ± 0.2	6 ± 0.2	6 ± 0.2	8 ± 0.3	10 ± 0.4	11 ± 0.4

Aligning the clutch with a feeler gauge



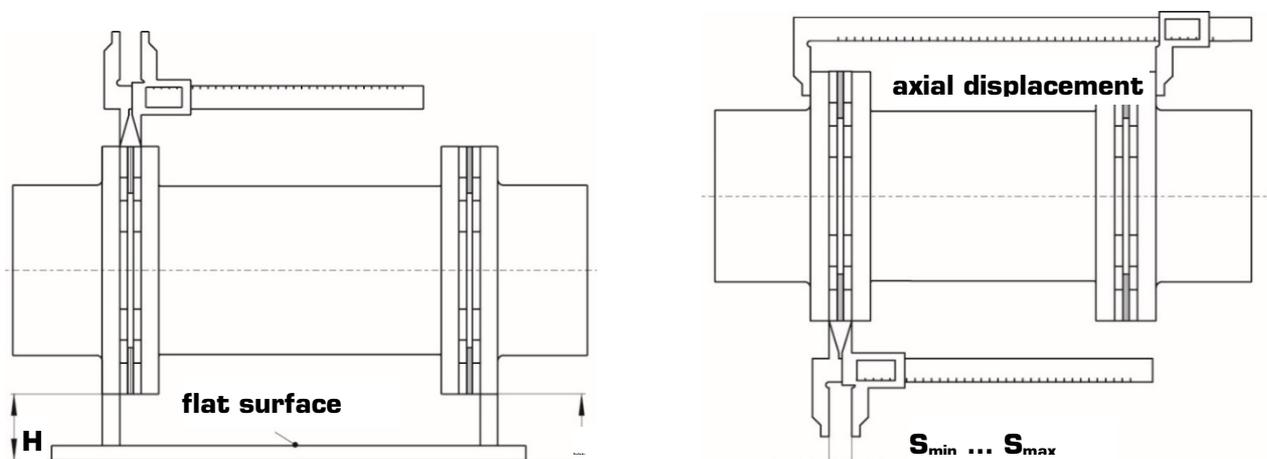
- Measure and check at several points of the circumference.

Aligning the clutch with dial gauge



- To align the clutch with the help of a dial gauge, a clutch side must be turned.

Aligning a double cardan clutch



To align a double cardan clutch, proceed as followed:

- Determine dimension "H" (radial displacement) of the input and output shafts and adjust if necessary.
- Determine dimension "S" (angular displacement), pay attention that the diaphragm assemblies are tension free axial and adjust if necessary.

	NOTE
i	<p>To optimize assembling the diaphragm assemblies, do not turn the screws (nuts) directly adjacent to the diaphragm assemblies.</p> <p>It is preferable to perform the turning movement on the hub side.</p>

Displacement and transmission torque diagram

In the "Technical Data" table, the permissible angular displacement $K_{w\ ges}$ for each diaphragm assembly is specified in conjunction with the permissible torque T_k .

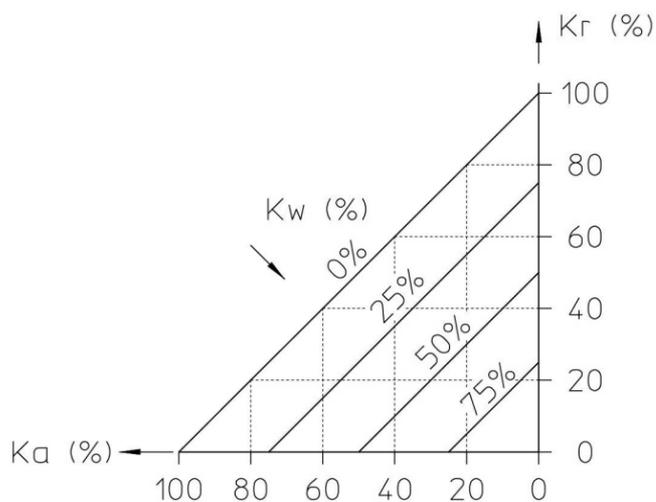
The permissible displacement values (angular K_w , axial K_a , radial K_r) also specified in the table may not occur simultaneously. Refer to the diagram for the percentage displacement.

The possible transmissible torque of the clutch is dependent on the size of the extent of the displacement.

The greater the shaft displacement $K_{w\ ge}$ of the input und output shaft, the less the transmissible torque.

(see "**Technical Data**" – section 3.2)

$$K_{w\ ges} = K_w + K_a + K_r = 100 \%$$



7. Startup

Danger due to rotating components

	⚠CAUTION
	<p>Damage to persons due to moving components!</p> <p>Rotating components can cause injury.</p> <ul style="list-style-type: none"> ▶ Never reach into the area of the rotating clutch and shafts! ▶ Protect the clutch against unintentional access during operation! ▶ Mount a suitable protective cover.

- Check for correct assembly of all components before startup of the clutch.
- Perform a trial run to test the function of the clutch.

	NOTE
	<p>A strong development of noise is an indication of inadequate alignment of the clutch or subsequent settling of the input or output.</p> <p>In this case, stop the trial run immediately and check the installation positions, installation dimension and alignment.</p>

- After 3 hours trial running under normal operating conditions, check the screw connections. Pay attention to the tightening torques (see section "**Technical Specifications**"). to the specified tightening torques
- The clutch can be put into continuous operation after checking for proper function.

	ATTENTION
	<ul style="list-style-type: none"> ▶ Before startup, all screw connections must be checked for mandatory tightening torque. The threaded pin for fixing the flanged hubs must be secured against loosening. e.g., with Loctite 243 or 262 (medium strength).

8. Using in potentially explosive areas

8.1. Construction of the clutch size

NOTE	
	<p>In explosion-protected areas, the safety when selecting the nominal torques must be at least a factor of 2. The permissible displacement values are reduced by a factor of 0.5.</p>

8.2. Control events

During visual checking, check the diaphragm assemblies for cracks, deformation and loosening feather keys. Loosened feather keys must be retightened according to the specified tightening torque T_A . Damaged feather keys and diaphragm assemblies must be replaced **immediately** (use original spare parts only!).

ATTENTION	
	<p>Damage to the clutch due to inaccurately aligned shaft ends!</p> <p>The function and service life of the clutch depends significantly on tension-free installation of the diaphragm assemblies.</p> <ul style="list-style-type: none"> ▶ To avoid hazards in Ex areas, align the shaft ends accurately.

8.3. Startup

Before startup, all screw connections must be checked for mandatory tightening torque. The threaded pin for fixing the flanged hubs must be secured against loosening. e.g., with Loctite 243 or 262 (medium strength).

8.4. Contact protection

The materials for contact protection must be selected according to EN 134631-1. This means in particular that light metals may not be used for the mining industry (device group I). The gap between the cover and rotating parts must be at least 5 mm. In the case of longer spacers, particularly clutch shafts, possible deflection of the shaft as a result of the rotation during measurement of the minimum gap must be considered.

When using clutches in mining operations (category **M2**) the clutch protection must be able to withstand higher mechanical loads than in other areas. Simple damage (such as dents) may not lead to slipping of the clutch, for which a gap greater than 5 mm to the rotating parts must be selected.

Furthermore, the cover must conduct electricity and also be included in the equipotential bonding. When using in areas with high risk of dust explosions, dust may not build up in order to avoid the risk of spontaneous combustion. The clutches may not run in dust accumulation. The operator must determine corresponding checking and cleaning intervals according to his own experience. The cover may not have any openings.

The dimensions for these openings can be obtained from the following table:

	Circular openings, Ø in mm	Rectangular openings, side length in mm
Top of the cover	4	4
Sides of the cover	8	8

Danger due to rotating components

	⚠CAUTION
	<p>Damage to persons due to moving components!</p> <p>Rotating components can cause injury.</p> <ul style="list-style-type: none"> ▶ Only remove the cover when the system is not running. Risk of injury! If anything is conspicuous (e.g., vibration and different running noises), the system must be shut down immediately. ▶ Eliminate causes. Other components in the system could be the cause. e.g., Displacement of the input or output side.

8.5. Construction of the clamping sets, clamping hub sets and clamping hubs

The nominal torque of the clamping sets or clamping hubs (without feather key only for cat. 3) must be constructed so that the system peak torque including all operating parameters has at least a safety of $s = 2$.

8.6. Permissible temperatures

Depending on the ambient and operating temperature and considering the safety factor of 20 K, the permissible temperatures for device group II, device category 2G are:

Temperature class	max. temperature (°C)
T3	130
T4	115
T5	80
T6	65

The requirements of explosion groups **IIC** and therefore also explosion groups **IIB** and **IIA** are fulfilled by the clutches.

No temperature increase >20 K relative to the ambient or operating temperature occurs in device group **II**, device category **2D**.

At an ambient or operating temperature of $T_a = 130$ °C, the maximum permitted surface temperature of 150 °C for **M2** is not exceeded for device class **I** category **M2**. The clutches are suitable for use under harsh and changing operating conditions in mining operations.

The Ex marking for the clutches is summarized as follows:

Hub with groove or clamping set:

 **II 2GD c IIC X / I M2 c**

Clamping hub:

 **II 3GD c IIC X**

8.7. EC Declaration of Conformity

EC Declaration of Conformity

according to EC directive 94/9/EC

Name of the manufacturer: **Maschinenfabrik Mönninghoff GmbH & Co. KG**

Address of the manufacturer: **Maschinenfabrik Mönninghoff GmbH & Co. KG
Bessemerstrasse 100
D - 44793 Bochum**

We hereby declare that the product ServoFlex clutch

Type **318.xx**

Fulfills the essential health and safety requirements for intended use in potentially explosive areas as specified in Annex II of RL 94/9/EC.

We hereby confirm that the documentation has been deposited according to the stipulations of RL 94/9/EC, article 8 (1) b) ii) at the NAMED LOCATION IBExU (EU-Ident. No. 0637) under the no. IB-03-4-574d.

EC type examination certificate: IBExU03ATEXBO27 X

IBExU

Institut für Sicherheitstechnik GmbH
Fuchsmühlenweg 7
09599 Freiberg

Bochum,
17.12.2018

Signature.....
Managing director: Dipl.-Staatswissenschaftler Kai Neubauer

9. Operation

9.1. General

The clutch is operated fully automatically after startup. Manual intervention is only required for cleaning and fault rectification.

9.2. Recommendations for operation

Pay attention to all relevant safety and accident prevention regulations for the place of operation during operation.

Only operate the clutch according to the protective requirements in DIN VDE 0580.

Danger due to rotating components

	⚠ CAUTION
	<p>Damage to persons due to moving components!</p> <p>Rotating components can cause injury.</p> <ul style="list-style-type: none">▶ Never reach into the area of the rotating clutch and shafts!▶ Protect the clutch against unintentional access during operation!▶ Remove jewellery.▶ Protect long hair with a cap or hairnet.

To protect against inadvertent contact and heavy contamination, the rotating clutch must be covered with a hood.

10. Faults

Possible causes of faults and their elimination are described in the following section.

If a fault cannot be eliminated after following the instructions provided, the manufacturer should be contacted, see service addresses on page 7.

10.1. Safety

Staff

- Faults may only be eliminated by specially trained, qualified staff.

Danger due to rotating components

	⚠CAUTION
	<p>Damage to persons due to rotating components!</p> <p>Rotating components can cause injury.</p> <ul style="list-style-type: none"> ▶ Never reach into the area of the rotating clutch! ▶ Remove jewellery. ▶ Protect long hair with a cap or hairnet.

Personal protective equipment

Wear the following protective equipment during work with the clutch:

	<p>Close-fitting protective clothing with a low tear strength and no protruding parts. These clothes are principally designed to protect against being caught by moving machine parts.</p>
	<p>Goggles to protect the eyes from flying parts and liquids</p>
	<p>Safety footwear with protective caps and oil-resistant soles</p>

Improperly performed work on elimination of faults

⚠WARNING	
	<p>Risk of injury due to improperly performed work on elimination of faults!</p> <p>Improperly performed work can cause severe damage to persons and property.</p> <ul style="list-style-type: none">▶ Before beginning work, make sure that sufficient installation workspace is available.▶ The following applies to the system in which the clutch will be operated: never disable the safety devices in the system.▶ Pay attention to tidiness and cleanliness at the workplace! Loosely stacked or scattered parts and tools are sources of accident.▶ If components are removed, pay attention to correct assembly; replace all fixing elements and adhere to all screw torques.▶ In the event of malfunctions or irregularities, stop the system and clutch and inform the person responsible. If faults cannot be rectified, contact the service department of the Maschinenfabrik Mönninghoff GmbH & Co. KG.▶ In the event of errors, switch off all electrical connections before determining the fault.

10.2. Malfunctions

The following table provides an overview of possible faults and their causes. If there are any uncertainties or questions, consult the manufacturer.

Error	Possible cause	Remedy
Strong noise emission	Incorrect assembly.	Check for correct assembly. If in doubt, contact the manufacturer.
Strong vibrations or knocks	Incorrect or inadmissible vibrations or knocks from connected machines or drives.	Check for correct assembly. Check perfect function of the connected machines or drives.

11. Maintenance

11.1. Maintenance intervals

Check the clutch for wear in the following intervals:

- after the first 10 hours of operation,
- in the case of single-shift operation: annually,
- in the case of two-shift operation: every six months,
- in the case of three-shift operation: every 4 months,

An increased load on the clutch leads to shorter intervals.

11.2. Checking for wear

	⚠ CAUTION
	<p>Damage to persons due to rotating components!</p> <p>Rotating components can cause injury.</p> <ul style="list-style-type: none"> ▶ Only check for wear when the machine is at a standstill! ▶ Never reach into the area of the rotating clutch! ▶ Remove jewellery. ▶ Protect long hair with a cap or hairnet.

- Check screw connections. See section 3.2 "**Technical Specifications**" for tightening torques.
- Check alignment of the clutch. For alignment, see section 6.2.9 "**Aligning the clutch**".
- Check diaphragm assemblies for mechanical damage.

	NOTE
i	Deformation or damage that deviates from the initial installation condition of the diaphragm assemblies are a result of overloading or inadmissible shaft displacement. Overloading also occurs at large angular displacement.

In the case of repairs, the diaphragm assemblies and the screw set must be exchanged and the clutch must be realigned.

	NOTE
i	Store spare parts such as diaphragm assemblies and screw sets to keep system downtimes as short as possible in the event of a breakdown.

12. Dismantling

When the end of the service life is reached, the clutch must be dismantled and disposed of according to environment regulations, see section "**Disposal**".

If premature dismantling is necessary and the components are to be stored for later use, they must be conserved and packed according to the specifications in section **5.5**. All other specifications on storage of the components must also be observed.

12.1. Safety

Staff

- Dismantling may only be performed by qualified staff.

12.2. Dismantling

Power supply

Before dismantling:

- Switch off the system, in which the clutch is installed and secure against being switched on again.
- Physically disconnect the entire power supply.

Subsequently clean modules and components properly and dismantle in accordance with local occupational safety and environmental protection regulations.

12.3. Disposal

If no agreement was made on product return and disposal, please submit dismantled components for recycling:

- Scrap metals
- Submit plastic elements for recycling.
- Sort and dispose of other components according to material characteristics.

ATTENTION	
	<p>Environmental damage due to improper disposal!</p> <ul style="list-style-type: none"> ▶ Electrical scrap, electronic components, lubricants and other accessories are subject to special waste handling and must be disposed of by authorized specialist companies only! ▶ The local authorities or special waste disposal companies can provide information on proper disposal according to environmental regulations.

13. Applicable standards, guidelines and regulations

Standard	Designation
DIN 740 - 1	Drive technology; flexible shaft couplings; Requirements; technical delivery conditions
DIN 740 - 2	Drive technology; flexible shaft couplings; Terms and calculation bases
DIN 31000	General principles for safety-conscious design of technical products
VDI 2230 sheet 1	Systematic calculation of heavily loaded screw connections; Cylindrical screw-in connections
DIN VDE 0580	Electromagnetic devices
DIN EN 13463-5	Ignition protection type only for non-electrical devices. The devices are constructed so that they do not have any ignition sources during normal operation. The risk of occurrence of mechanical faults that could lead to ignition sources was reduced to a minimum.
DIN ISO 1940	Requirements on the balancing quality of rigid rotors
ATEX Directive 94/9/EC	EG directive concerning equipment and protective systems intended for use in potentially explosive areas.