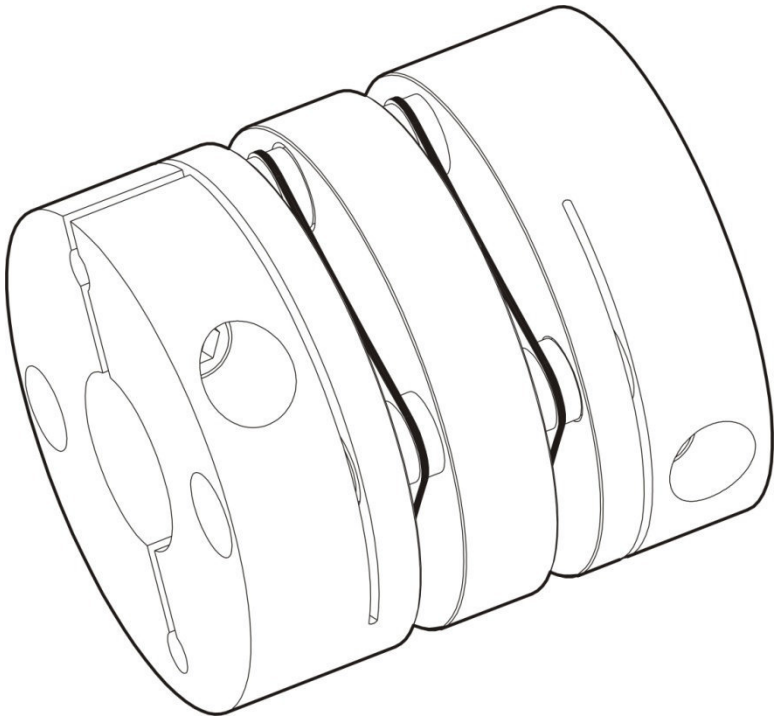
Operating and Assembly Instructions

ServoFlex
Type 328.XX



Mönninghoff

Doc-ID: T24.0140 as of: 08/2013 Read these operating instructions before starting any kind of work !

Maschinenfabrik Mönninghoff GmbH & Co. KG

Bessemerstrasse 100 Postfach 101749

D – 44793 Bochum D – 44717 Bochum

Telephone: +49 (0) 234 3335-186

Fax: +49 (0) 234 3335-215

Email: service@moenninghoff.de

Internet: www.moenninghoff.de

1 General

1.1 Information on these instructions

These instructions allow safe and efficient handling of the type 328.XX, ServoFlex clutches hereinafter referred to as clutche.

These instructions are a part of the clutch system and must be kept in the immediate vicinity of the location of use of the clutch 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 application area of the combination.

In addition to these instructions, the instructions for the installed components in the appendix also apply.

1.2 Explanation of symbols

Warnings

All warnings in these operating instructions are also 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
	**Risk of injury** Consequences of failure to observe... ► Instructions for avoiding

A warning of this category indicates a potentially dangerous situation.

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

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

⚠CAUTION!

Injury to persons by...

Consequences of failure to observe...

► Instructions for avoiding

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 possible danger of serious personal injuries.

ATTENTION

Damage to property by...

Consequences of failure to observe...

► Instructions for avoiding

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 Limitationof liability

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

The manufacturer assumes no liability for damages resulting from:

- Failure to observe the operating and assembly instructions
- Use other for the intended purpose
- Deployment of insufficiently qualified staff
- Unauthorised modifications
- Technical modifications
- Use of non-approved spare parts
- Faulty assembly

The responsibilities 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

1.5 Spare parts

⚠WARNING

Danger of injury due to wrong or faulty spare parts!

Incorrect or defective replacement parts can lead to injury, damage, malfunction or total breakdown.

► Use original spare parts from the manufacturer only.

NOTE

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 such as guarantee, service contracts etc. without prior notice.

► Obtain spare parts from authorised dealers or directly from the manufacturer. See page 2 for the address.

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.

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Telephone: +49 (0) 234 3335-186

Fax: +49 (0) 234 3335-215

Email: 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 product

Model:	ServoFlex clutch
Type	328.XX
Project no.:	

is 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 harmonised 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 it 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, 12.09.2013 Signature.....

Managing director: Dipl.-Staatswissenschaftler Kai Neubauer

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

Danger from failure to observe the safety instructions!

Failure to observe the safety and instructions listed in these assembly instructions can lead to considerable danger.

► Always pay attention to all warnings and instructions specified here.

2.2 Staff requirements

2.2.1 Qualifications

⚠WARNING

Risk of injury due to insufficient qualification!

Improper use can result in considerable damage to persons or property.

► All activities shall only be performed by **qualified** staff.

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 recognise and prevent possible dangers based on his/her technical training, knowledge and experience, including knowledge of applicable regulations.

Only those persons may serve as staff, of whom it can be expected that they will dependably carry out their assigned work tasks. Those staff members whose responsiveness is affected by substances such as drugs, alcohol or medication shall not be permitted.

	NOTE
	Observe age and occupational-specific regulations at the location of the clutch when selecting staff.

	**⚠WARNING**
	Risk of injury! Rotating components always constitute a risk of injury! ► Remove jewellery. ► Protect long hair with a cap or hairnet!

2.2.2 Unauthorised persons

	**⚠WARNING**
	Danger from unauthorised persons! Unauthorised persons who do not fulfil the requirements described here, are not familiar with the dangers in the work area. ► Do not permit unauthorised 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. ► Interrupt all work as long as the unauthorised person is in 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 in potentially explosive areas, see section 8 "**Using in potentially explosive areas**"

⚠WARNING

Danger from use for other than the intended purpose!

Any use other than for the intended purpose of the clutch can lead to dangerous situations.

- ► 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
i	In order not to endanger the operational safety of the clutch, unauthorised modifications and alterations **are prohibited**!

2.5 Personal protective equipment

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

- The protective equipment corresponding to the work being carried out must be worn at all times.
- Pay attention to all notices on personal protective equipment within the work area.

Only wear

The following must be worn for all work:

	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.
	Goggles to protect the eyes from flying parts and liquids.
	Safety footwear with protective caps and oil-resistant soles.

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

⚠CAUTION!

Risk of injury from moving parts!

Rotating and/or linearly moving parts can cause injury.

- ► 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.

2.7 Signs

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

⚠WARNING

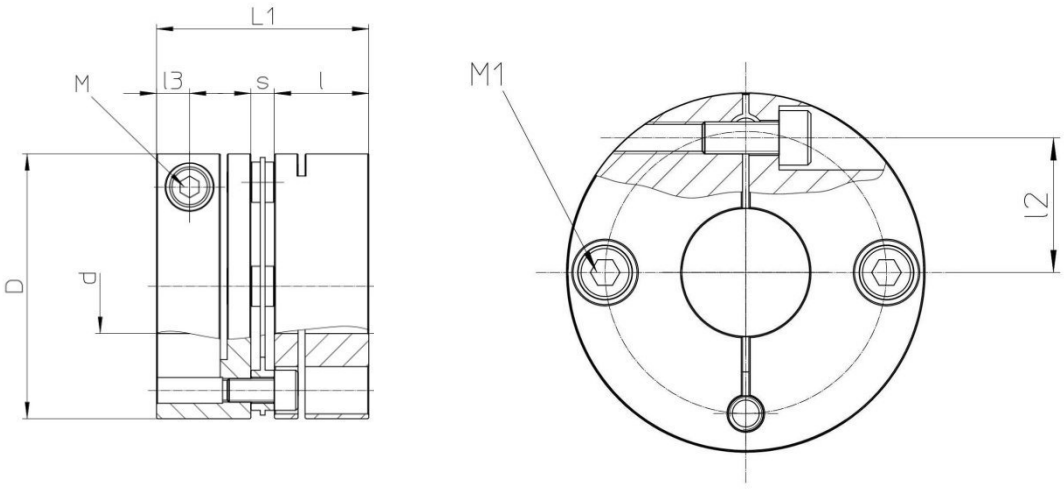
Risk of injury due to illegible symbols!

Due to dirt or other causes, stickers and signs can become illegible.

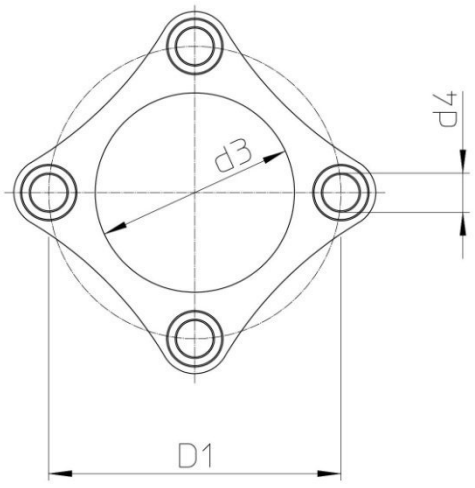
- ► All safety, warning and operating instructions must remain legible.
- ► Damaged signs or stickers must be replaced immediately.

3 Technical data

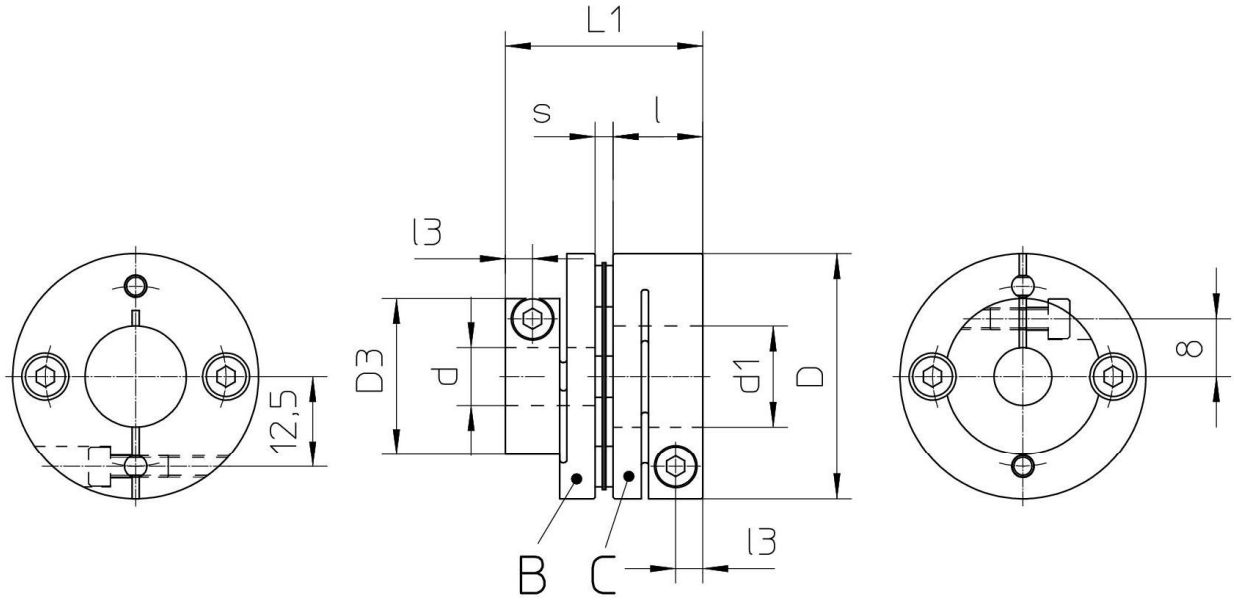
3.1 Dimensions



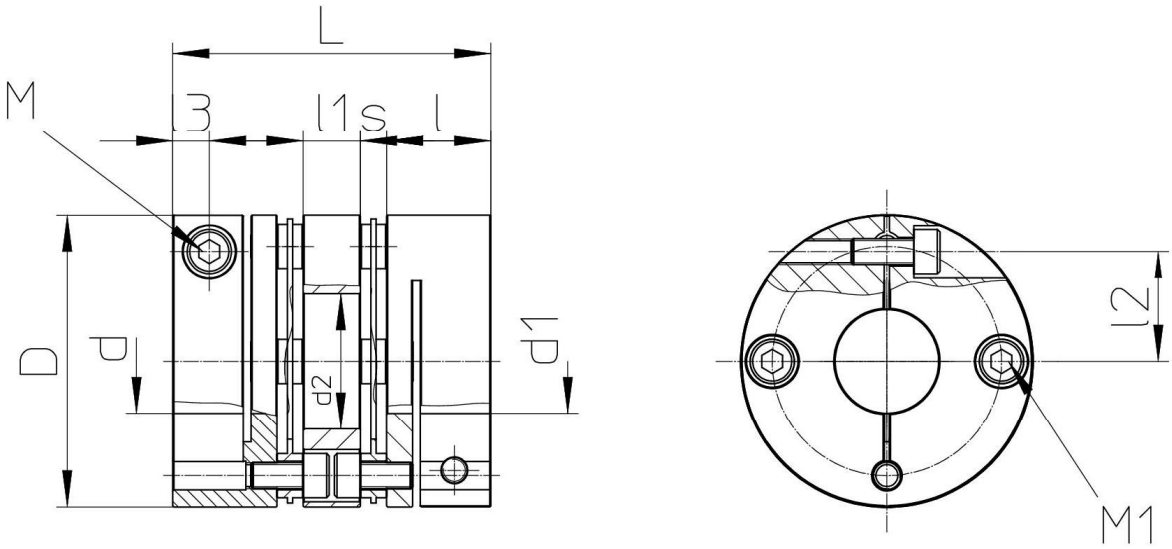
Design 1.4 type C-C



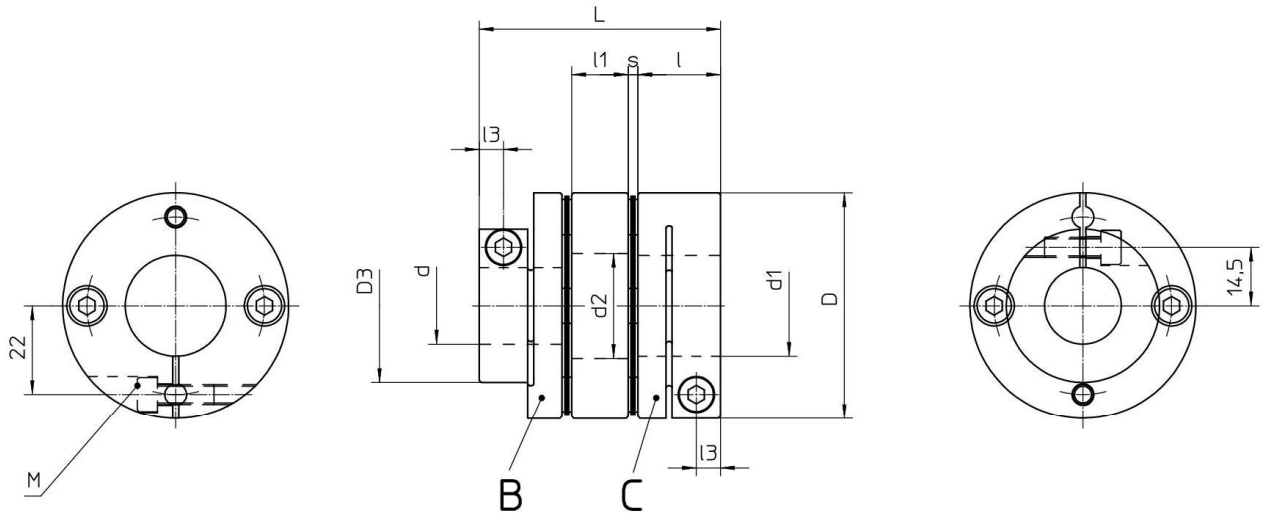
Diaphragm assembly



Design 1.4 type B-C



Design 4.4 type C-C



Design 4.4 type B-C

3.2 Technical data

Size			05	08	10	14	16	19	25
Nominal torque	Design 1.4 [Nm]		0.5	0.8	1.5	4	6	10	25
	Design 4.4 [Nm]		0.5	0.8	1.5	4	6	10	25
Max. rotating speed	Design 1.4 n [rpm]		10000						
	Design 4.4 n [rpm]		10000						
Torsion spring stiffness	Design 1.4 C_T [10^6 Nm/rad]		500	1400	3700	8000	18000	20000	32000
	Design 4.4. C_K [10^6 Nm/rad]		250	700	1850	4000	9000	10000	16000
Axial spring stiffness	Design 1.4 C_a [Nm / mm]		140	140	64	64	112	80	48
	Design 4.4 C_a [Nm / mm]		70	70	32	32	56	40	24
Moment of inertia	Design 1.4 I [kgm² x 10^{-6}] C-C		0.25	0.58	2.36	8.12	29.53	99.33	268.5
	B-B					4.00		16.42	54.88
	B-C					6.06		22.98	77.01
	Design 4.4 I [kgm² x 10^{-6}] C-C		0.36	0.79	3.40	11.45	26.78	42.61	141.4
	B-B					7.33		29.49	96.94
	B-C					9.39		36.05	119.2
Weight	Design 1.4 m [g] C-C		7	11	25	49	84	105	214
	B-B					33		76	156
	B-C					41		90	185
	Design 4.4 m [g] C-C		10	15	35	69	123	151	304
	B-B					53		122	246
	B-C					61		136	275
Max. resilience	angled [Kw]	Design 1.4 [°]	0.5	1					
		Design 4.4 [°]	1	2					
	axial [Ka]	Design 1.4 [mm]	±0.05	±0.1	±0.15	±0.2	±0.25	±0.3	±0.4
		Design 4.4 [mm]	±0.1	±0.2	±0.33	±0.4	±0.5	±0.6	±0.8
	radial [Kr]	Design 1.4 [mm]	not permitted						
		Design 4.4 [mm]	0.05	0.11	0.15	0.18	0.24	0.24	0.28
Bore d H7	Design 1.4 [mm] C-C	min.	4	4	5	>10	8	>15	>19
		max	6	8	10	14	16	19	25
	B-B	min.				5		8	10
		max				10		15	19

Technical data

Mönninghoff

Size			05	08	10	14	16	19	25
	B-C	min.				10		8	10
		max				14		19	25
	Design 4.4 [mm] C-C	min.	4	4	5	>10	8	>15	>19
		max	6	8	10	14	16	19	25
	B-B	min.				5		8	10
		max				10		15	19
	B-C	min.				5		8	10
		max				10		15	19
Preferred bore	Design 1.4 [mm]		4; 5;6	4; 5; 6; 7; 8	5; 6; 7; 8; 9; 10	6; 7; 8; 9; 10; 11; 12; 13; 14	8; 9; 10; 11; 12; 13; 14; 15; 16	8; 9; 10; 11; 12; 13; 14; 15; 16; 17; 18; 19	10;11;12; 13;14;15; 16;17;18; 19;20; 21; 22; 23; 24
	Design 4.4 [mm]		4; 5; 6	4; 5; 6; 7; 8	5; 6; 7; 8; 9;10	6; 7; 8; 9; 10; 11; 12; 13; 14	8, 9; 10; 11; 12; 13; 14; 15; 16	9; 9; 10; 11; 12; 13; 14; 15; 16; 17; 18; 19	10; 11;12; 13; 14;15; 16; 17;18; 19; 20;21
Dimensions	D		16	19	26	34	39	44	56
	D1			14	19	25	29	34	44
	D3					21.6		29.6	38
	d_2		6.5	8.5	10.6	15	17	20	26
	d_3		6.5	8.5	10.6	14.5	17	19.5	26
	d_4			1.6	2.5	3	4	4	5
	L1		16.7	19.35	23.15	27.3	34	34	43.4
	L		23.2	25.9	32.3	37.8	48	48	59.8
	l		7.85	9.15	10.75	12.4	15.5	15.5	20.5
	l1		5.5	5.5	7.5	8	11	11	14
	l2		4.8	5.8	9.5	12.5	14	17	22
	l3		2.5	3.15	3.3	3.75	4.5	4.5	6
	s		1	1.05	1.65	2.5	3	3	2.4
Screws	M		M 2	M 2.5	M 2.5	M 3	M 4	M 4	M 5
		[Nm]	0.4	1	1	1.5	3.4	3.4	7
	M1			M 1.6	M 2.5	M 3	M 4	M 4	M 5
		[Nm]		0.2	1	1.5	3.4	3.4	7

	NOTE
i	Obtain further technical data from the assembly drawing. The assembly drawing can be requested from the manufacturer.

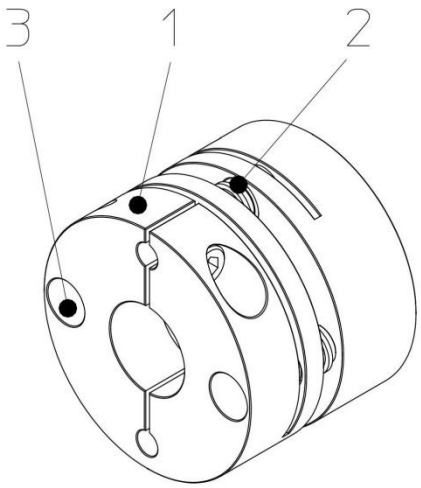
3.3 Connection dimensions, connection fixings

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

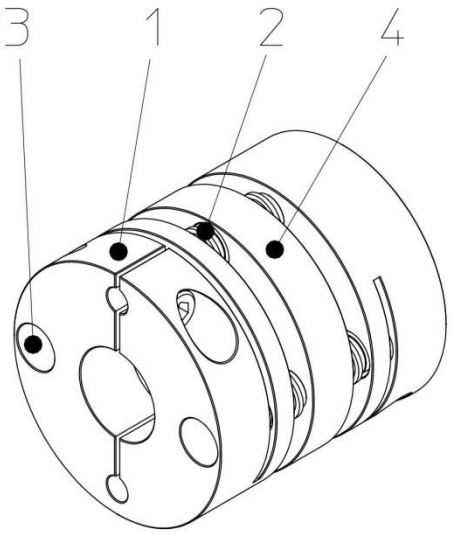
	NOTE
i	The assembly drawing can be requested from the manufacturer.

4 Setup and method offunction

4.1 Structure and designs



Design 1.4



Design 4.4

1 Clamping hub
2 Diaphragm assembly
3 Adapter screw
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 clamping hubs attached to both shaft ends are fixed to the shaft by clamping pins.

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

⚠WARNING

Using a clamping hub

When using a clamping hub, installation in potentially-explosive areas is restricted (category 3).

Ex marking: II 3 GD c IIC X

5 Transport, packaging and storage

5.1 Safety instructions for transport

Improper transport

ATTENTION

Damage due to improper transport!

Improper transport can cause considerable damage.

- ► 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

The delivery should be checked immediately for completeness and for transport damage.

NOTE

Failure to observe the following instructions will invalidate claims to the insurer for damage.

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
i	Register any claim as soon as a defect is detected. Claims for damages can be made only within the applicable reporting periods.

5.3 Packaging

On 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 materials

The packaging protects the device against damage during transit. The packaging 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 Unpacking

Carefully remove the clutch from the packaging.

5.5 Storing the packaged items

Storing the packaged items

Anticorrosion oil was applied to clutch parts not protected against corrosion, which 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 goods received, renew conservation (e.g., with Tectyl 472 from Valvoline).

Store packaged items under the following conditions:

- Do not leave outdoors.
- Store at a dry and dust-free location.
- Do not subject to aggressive media.
- Protect against solar radiation.
- Avoid mechanical shocks and damage.
- Storage temperature: +5 to +45 °C.
- Relative humidity: max. 60 %.
- For storage longer than 3 months, regularly check the general condition of all components and packaging.

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

6 Setup

6.1 Safety

Staff

Assembly and initial startup may only be carried out by specifically-trained specialist staff.

Personal protective equipment

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

	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.
	Goggles to protect the eyes from flying parts and liquids.
	Safety footwear with protective caps and oil-resistant soles.

Improper assembly and initial startup

⚠CAUTION!

Risk of injury due to improper assembly and initial startup!

Improper assembly and initial startup can lead to personal injury or material damage.

- ► Before beginning work, make sure that sufficient assembly workspace is available.
- ► Be careful when handling exposed, sharp-edged components.
- ► Pay attention to tidiness and cleanliness at the workplace! Components and tools lying around or on top of each other can be sources of accidents.
- ► Assembly components must be properly installed. Adhere to the specified screw torques.
- ► Do not grease or oil screws and nuts.

6.2 Preparation

Before assembling, check the following points:

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

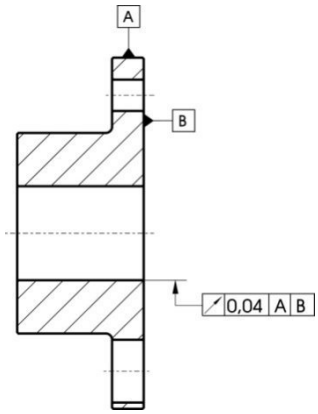
6.3 Setup

6.3.1 Instructions on assembly

The clutch is supplied assembled with the shaft bore as requested by the customer. If possible, the clutch should be left in an assembled condition unless the installation situation makes it necessary to take it apart.

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

Danger of explosion!

► Customer-created finished bores are not permitted for potentially explosive areas!

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

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!
	**Danger of burns from improper handling of the heated hubs!** ► Wear gloves when handling hot hubs.

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

6.3.2 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

The shaft fitting should be h7 to j6.
The bore fitting is H7 as standard.

ATTENTION

Damage from improper, forced assembly!

Improper, forceful assembly can cause considerable damage to property.

- ► 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 cylinder-head screws for installation.
- ► Do not grease or oil screws and nuts.
- ► Adhere to the TA tightening torques for the cylinder-head screws on the diaphragm assemblies.

Tightening torque for clamping hubs

Clutch size:						
	08	10	14	16	19	25
Tightening torque T_N for clamping screws [Nm]	0.4	1	1.5	3.4	3.4	7.0
Tightening torque T_A for cylinder-head screws [Nm]	0.2	1	1.5	3.4	3.4	7.0

6.3.3 Assembling the clutch with the clamping hub

⚠WARNING

Using a clamping hub

When using a clamping hub, installation in potentially-explosive areas is restricted (category 3).

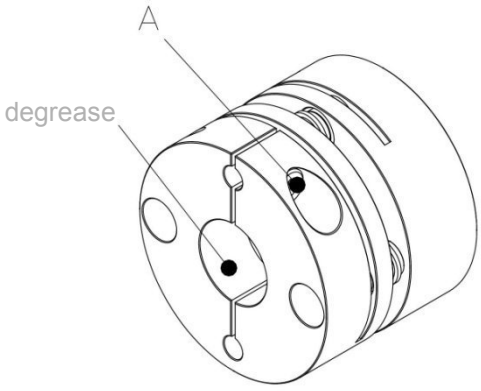
Ex marking: II 3 GD c II CX

NOTE

When screwing the diaphragm assemblies, the TA tightening torques for the cylinder-head screws must be adhered to.

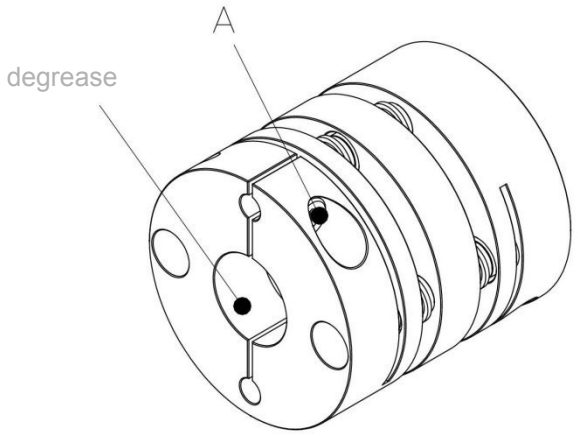
Single cardan (design 1)

- Hub bores and shafts must be clean and free of grease.
- The diaphragm set must remain screwed to a clamping hub.
- Push the first clamping hub onto the first shaft.
- Fix the clamping hub to the shaft with clamping screw "A". Adhere to the TN tightening torque.
- Push the second clamping hub onto the shaft.
- To avoid imbalance caused by the clamping screws, the clamping hubs must be mounted 180° opposite to each other.
- Align the clutch and screw the second clamping hub to the diaphragm assembly. Adhere to tightening torque TA!
- Fix the second clamping hub to the shaft with clamping screw "A". Adhere to tightening torque TN!
- Ensure tension-free installation of the diaphragm assembly in an axial direction! If necessary, spacers must be used to make sure that gap dimension "s" is not changed during assembly.



Double cardan (design 4)

- Hub bores and shafts must be clean and free of grease.
- The diaphragm assembly must remain screwed to the clamping hubs.
- Push the first clamping hub onto the shaft.
- Fix the clamping hub to the shaft with clamping screw "A". Adhere to the TN tightening torque.
- Screw the spacer to the diaphragm assembly. Adhere to tightening torque TA!
- Push the second clamping hub onto the second shaft.
- To avoid imbalance caused by the clamping screws, the clamping hubs must be mounted 180° opposite to each other.
- Align the clutch and screw the spacer to the diaphragm assembly. Adhere to tightening torque TA!
- Fix the second clamping hub to the shaft with clamping screw "A". Adhere to tightening torque TN!
- Ensure tension-free installation of the diaphragm assembly in an axial direction! If necessary, spacers must be used to make sure that gap dimension "s" is not changed during assembly.

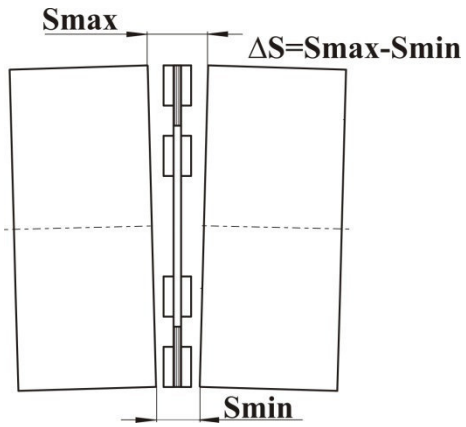


6.3.4 Assembling the clutch vertically

⚠WARNING

Clutches intended for use in potentially explosive areas are only suitable when mounted horizontally.

6.3.5 Aligning the clutch



Align the clutch as follows:

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

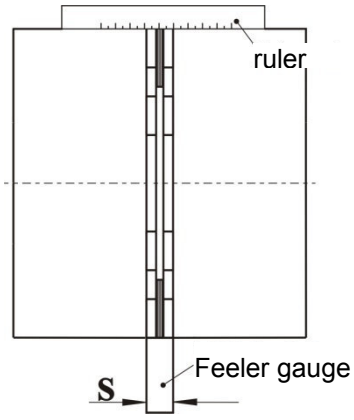
Calculate dimension "S" according to the following formula:

$$S_{min} \geq S - \frac{\Delta S}{2}$$

$$S_{max} \leq S + \frac{\Delta S}{2}$$

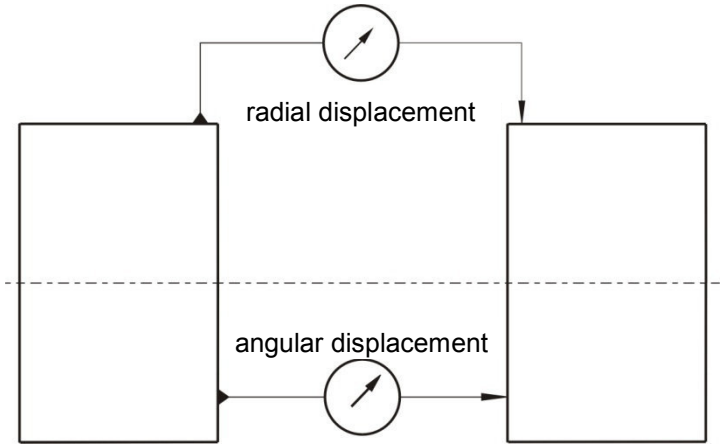
Type 328 - ServoFlex						
Size	**08**	**10**	**14**	**16**	**19**	**25**
Δ S	0.07	0.10	0.12	0.14	0.15	0.2
S	1.9± 0.2	2.5± 0.2	3.1± 0.2	4.1± 0.3	4.1± 0.4	5 ± 0.4

Aligning the clutch with a feeler gauge



- Take measurements at several points of the circumference.

Aligning the clutch with dial gauge



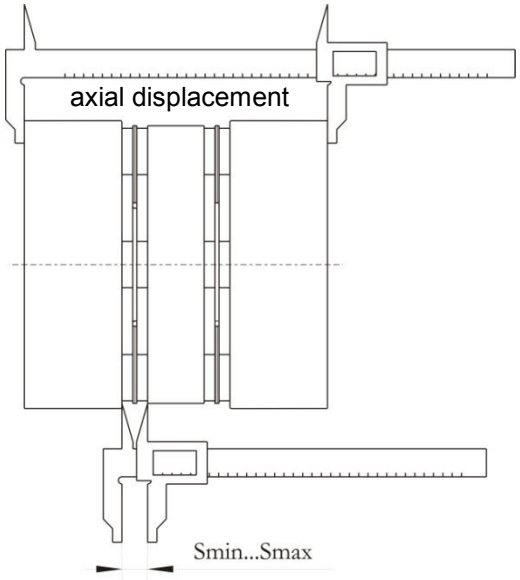
- To align the clutch with the help of a dial gauge, a clutch side must be turned.

	NOTE
	To optimise mounting, turn the screws and not the nuts when screwing the diaphragm assembly set.

Aligning a double cardan clutch

To align a double cardan clutch, proceed as follows:

- Determine dimension "S" (angular displacement), make sure that the diaphragm assemblies are tension free axial and adjust if necessary.

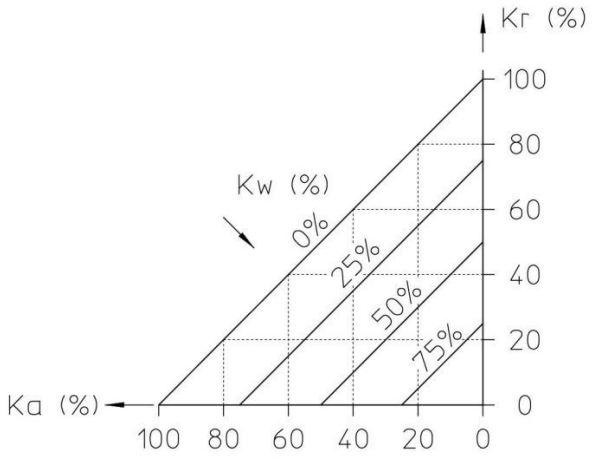


6.3.6 Displacement and transmission torque diagram

The permissible displacement values (angled K_w, axial K_a, radial K_r) are listed in the "Technical data" table.

The maximum permissible displacement values may not occur simultaneously.

Refer to the diagram for the percentage displacement.



Kw ges = Kw + Ka + Kr = 100 %

7 Startup

Danger from rotating components

⚠CAUTION!

Damage to persons from moving components!

Rotating components can cause injury.

- ► 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

A strong development of noise is an indication of inadequate alignment of the clutch or subsequent settling of the input or output.

In this case, stop the trial run **immediately** and check the installation positions, installation dimension and alignment.

- After 10 hours trial running under normal operating conditions, check the screw connections. Pay attention to the tightening torques (see section "**Technical data**"). to the specified tightening torques.
- The clutch can be put into continuous operation after checking for proper function.

ATTENTION

- ► 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

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.

8.2 Control events

During visual checking, check the diaphragm assemblies for cracks, deformation and loosening cylinder-head screws. Loosened cylinder screws must be tightened again according to the specified tightening torque TA. Damaged cylinder-head screws and diaphragm assemblies must be replaced **immediately** (use original spare parts only!).

ATTENTION

Damage to the clutch from inaccurately aligned shaft ends!

The function and service life of the clutch depends significantly on tension-free installation of the diaphragm assemblies.

► 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.

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 from rotating components

⚠CAUTION!

Damage to persons from moving components!

Rotating components can cause injury.

- ► 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 Design of the clamping hubs

Select the clamping hub so that there is a safety of at least s = 2 between the nominal torque of the clamping hub and the system peak torque including all operating parameters.

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 **3G** and **3D** are:

Temperature class	Max. temperature (°C)
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 **3G** and **3D**. At an ambient or operating temperature of Ta = 80 °C, the maximum permitted surface temperature of 100 °C is not exceeded for device class **II**. The clutches are suitable for use under harsh and changing operating conditions in mining operations. The Ex marking for the clutches is summarised as follows:

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	ArcOflex-Kupplung
Type:	328.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-N0. 0637) under the no. IB-03-4-574.

EC type examination certificate: IBExU03ATEXB028 X

IBExU
Institut für Sicherheitstechnik GmbH
Fuchsmühlenweg 7
09599 Freiberg

Bochum, den 12.09.2013

Signature.....

Managing director: Dipl.-Staatswissenschaftler Kai Neubauer

9 Operating

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 from rotating components

⚠CAUTION!

Damage to persons from moving components!

Rotating components can cause injury.

- ► 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 2.

10.1 Safety

Staff

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

Danger from rotating components

	**⚠CAUTION!** **Damage to persons from rotating components!** Rotating components can cause injury. ► 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:

	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.
	Goggles to protect the eyes from flying parts and liquids.
	Safety footwear with protective caps and oil-resistant soles.

Improperly performed work on elimination of faults

⚠WARNING

Risk of injury from improperly performed work on elimination of faults!

Improperly performed work can cause severe damage to persons and property.

- ► Before beginning work, make sure that sufficient assembly workspace is available.
- ► The following applies to the system, in which clutch is to be operated: never disable the safety devices in the system.
- ► Pay attention to tidiness and cleanliness at the workplace! Components and tools lying around or on top of each other can be sources of accidents.
- ► If components are removed, pay attention to correct assembly and replace all fixing elements.
- ► Use new fitting screws and adhere to all tightening torques.
- ► In the event of malfunctions or irregularities, stop the system and inform the person responsible. If faults cannot be rectified, contact the service department of the Maschinenfabrik Mönninghoff GmbH & Co. KG.

10.2 Malfunctions

The following table provides an overview of possible faults and their causes. If there any 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!

Damage to persons from rotating components!

Rotating components can cause injury.

- ► 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 "**Technical data**" section for tightening torques.
- Check alignment of the clutch.
- Check diaphragm assemblies for mechanical damage.

NOTE

Deformation or damage that deviates from the initial installation condition of the diaphragm assemblies are a result of overloading or inadmissible displacement.

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

NOTE

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. Also pay attention to further specifications on storing the components.

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

Environmental damage due to improper disposal!

► Electrical scrap, electronic components, lubricants and other accessories are subject to special waste handling and must be disposed of by authorised 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 the 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	EC directive concerning equipment and protective systems intended for use in potentially explosive areas.

14 Appendix

15 Index

Maschinenfabrik Mönninghoff GmbH & Co. KG

Bessemerstrasse 100 Postfach 101749

D – 44793 Bochum D – 44717 Bochum

Telephone: +49 (0) 234 3335-186

Fax: +49 (0) 234 3335-215

Email: service@moenninghoff.de

Internet: www.moenninghoff.de