

CENTADISC-T

Assembly and operating instructions

025T-.....

M025-00001-EN

Rev. 1



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1 General remarks

These assembly and operating instructions form a constituent part of the coupling delivery and must be kept in an easily accessible place at all times.

CENTA products are developed and produced to quality standard DIN EN ISO 9001:2000.

In the interests of further development, CENTA reserves the right to make technical changes.



IMPORTANT

CENTA is unable to accept liability for damage and operating faults caused by failure to observe the operating instructions.

These operating instructions are protected under copyright to CENTA Antriebe Kirschey GmbH.

In case of technical questions, please enquire with our head office:

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2 Safety

The purpose of these operating instructions is to enable users to:

- use the coupling safely and correctly
- maximize efficiency
- ensure that care and maintenance are carried out correctly

For this reason, these operating instructions must be thoroughly read and understood prior to work on and with the coupling.

WARNING

**Injury and material damage can occur as a result of:**

- Failure to adhere to the safety and accident prevention regulations valid at the relevant installation site

The safety and accident prevention regulations valid at the installation site in question must be adhered to when performing any of the tasks described in these operating instructions.

2.1 Safety remarks

In these operating instructions, safety remarks are indicated by a pictogram and a signal word.

2.1.1 Signal words

The following signal words are used in the safety remarks:

DANGER

Denotes the immediate threat of danger.
If not prevented, fatal or extremely serious injuries can result.

WARNING

Denotes a potentially dangerous situation.
If not prevented, fatal or extremely serious injuries can result.

CAUTION

Denotes a potentially dangerous situation.
If not prevented, minor injuries and/damage to property may result.

IMPORTANT

Denotes application tips and particularly useful information. This is not a signal word denoting a dangerous or damaging situation.

2.1.2 Pictograms

Possible pictograms in the safety precautions:



Warning of a hazardous area



Do not switch




Use protective gloves




Use protective goggles

2.2 Qualification of deployed personnel

All the work described in these operating instructions may only be performed by authorized persons with adequate training and instruction.

WARNING	
	<p>Injury and material damage can occur as a result of:</p> <ul style="list-style-type: none"> ▪ Work at the coupling which is not described in these instructions <p>Only carry out work which is described in these operating instructions.</p>

2.3 Intended application

WARNING	
	<p>Injury and material damage can occur as a result of:</p> <ul style="list-style-type: none"> ▪ Application not in compliance with the intended use <p>The couplings are intended exclusively for use in accordance with the relevant design. They may only be used under the specified conditions.</p>

WARNING**Injuries can occur as a result of:**

- Contact with rotating parts

Shield the coupling in accordance with the applicable accident prevention regulations with an enclosure.

Exceptions:

The coupling is encased by the driving and driven units.

It is impossible for people to stay in the working area of the coupling during operation.

The scope of delivery provided by CENTA does not include a protective enclosure.

This enclosure must fulfil the following criteria:


- Provide protection against persons gaining access to rotating parts
- Restrain any rotating parts which may be work loose

This enclosure must be made of stable steel components.

The enclosures must be positioned a minimum of 15 mm distant from rotating parts. The enclosure must be electrically conductive and be included in the equipotential bonding.

Before commencing long-term operation, the plant must successfully complete a test run.

2.4 Application not in compliance with the intended use

WARNING	
	<p>Injury and material damage can occur as a result of:</p> <ul style="list-style-type: none">▪ Inadmissibly high torque▪ Inadmissibly high or low speeds▪ Exceeding the specified ambient temperature▪ Inadmissible ambient medium▪ Inadmissible coupling enclosure▪ Exceeding the admissible overall misalignment values <p>Only use the coupling for the specified application.</p>

CENTA bears no liability for damage resulting from application not in compliance with the intended use of the equipment.

Should there be a change of plant parameters, the coupling design must be reviewed by CENTA (address see chapter 1).



3 Delivery, transport, storage and disposal

3.1 Delivery

After delivery, the coupling:

- must be checked for completeness and correctness of the delivery.
- must be examined for possible transport damage (which must be reported immediately to the carrier).


3.2 Transport

CAUTION	
	<p>Injury and material damage can occur as a result of:</p> <ul style="list-style-type: none">▪ Incorrect transportation of couplings <p>Ensure that the coupling is correctly transported.</p>
CAUTION	
	<p>Material damage to coupling components can occur as a result of:</p> <ul style="list-style-type: none">▪ Contact with sharp-edged objects <p>Protect coupling components for transportation. Only hoist coupling components with nylon belts or ropes. Always cushion parts when supporting them from below.</p>

Following transportation damage:

- Check the coupling carefully for damage.
- Consult the manufacturer (Address see chapter 1).

3.3 Storage

CAUTION	
	<p>Material damage to coupling components can occur as a result of:</p> <ul style="list-style-type: none">▪ Incorrect storage <p>These parts must be stored without deformation and protected from moisture and solvents.</p>

3.3.1 Storage location

Requirements imposed on the storage location:


- Moderately ventilated and low in dust
- Dry (max. 65% humidity)
- Temperature stabilized (-10°C to +25°C)
- Do not store solvents and disinfectants, fuels or lubricants, acids, chemicals etc. in the same location

For more details, refer to DIN 7716.

3.3.2 Storage of couplings

- Unpack the parts.
- Check the packaging for damage. Replace if necessary.
- Check that the wax protection on steel components is intact. If necessary, patch or renew.
- Package the parts (for prolonged periods of storage, enclose desiccant and weld into film).
- Place the parts into storage, as delivered.

3.4 Disposal

RECYCLING	
	<p>Ensure safe, environmentally responsible disposal of operating supplies and exchange parts. For this, locally provided recycling facilities and regulations must be utilized.</p>

For disposal, the coupling parts must be separated where possible and sorted according to material type.



4 Technical description

4.1 Characteristics

The CENTADISC-T series have following excellent characteristics:

- Simple, compact smooth-faced design
- Made of high-tensile, tempered steel
- Robust
- Made with a high balancing quality
- Corrosion protected
- Torsional stiff
- Radially stiff, transfers support forces of shafts connected
- Axial and angular displacement is accepted without wear within the tolerable limits
- Easy to assemble
- Very low maintenance

4.2 Specifications

The specifications can be found in the catalogue and the dimensions in the installation drawing.

5 Alignment of the units being connected



IMPORTANT

The alignment must be recorded.

5.1 Checking the installation position of the units being connected

WARNING



Injury and material damage can occur as a result of:

- Connected units, which are out of permissible alignment tolerances, when assembled.

Make sure that the units being connected are within the permissible alignment tolerances of the coupling.

- Before starting the mounting, check whether the position of the units to be connected are within the permissible alignment tolerances of the coupling.
- Check, whether the determined misalignment values exceed the permissible axial and angular tolerances of the coupling (see chapter 5.2).
- If a permissible tolerance is exceeded, the units to be connected must be corrected correspondingly.
- Before commissioning, ensure that the position of the units being connected are within the permissible alignment tolerances of the coupling.

5.2 Permissible axial misalignment

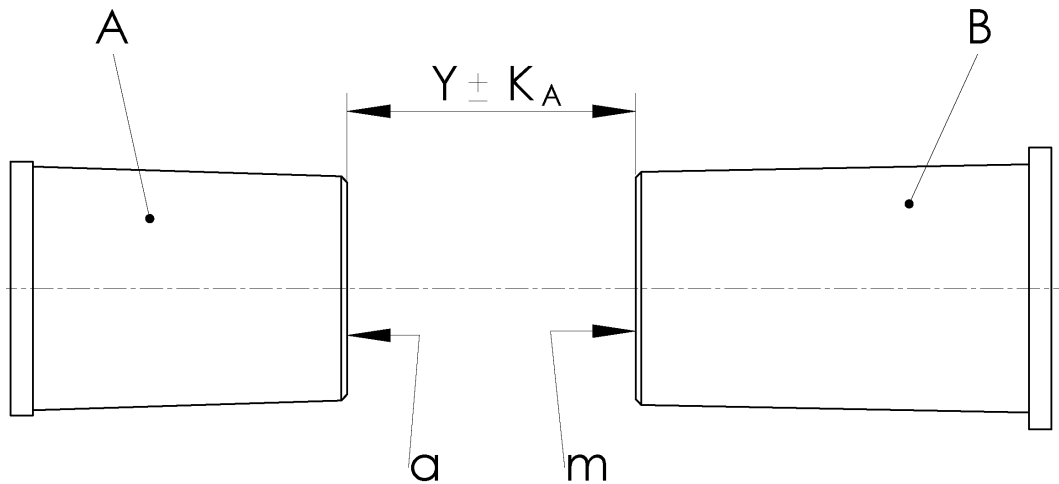


Fig. 5-1 Permissible axial misalignment

Item	Info	Designation	Remark
A		Gear shaft	Customer part
B		Engine shaft	Customer part
Y		Desired distance between face (a) of gear shaft (A) and face (m) of engine shaft (B)	Measure of customer
	a	Face of gear shaft (A)	Customer part
	m	Face of engine shaft (B)	Customer part

Permissible axial alignment tolerance: $K_A=0.02$ mm

5.3 Permissible angular misalignment

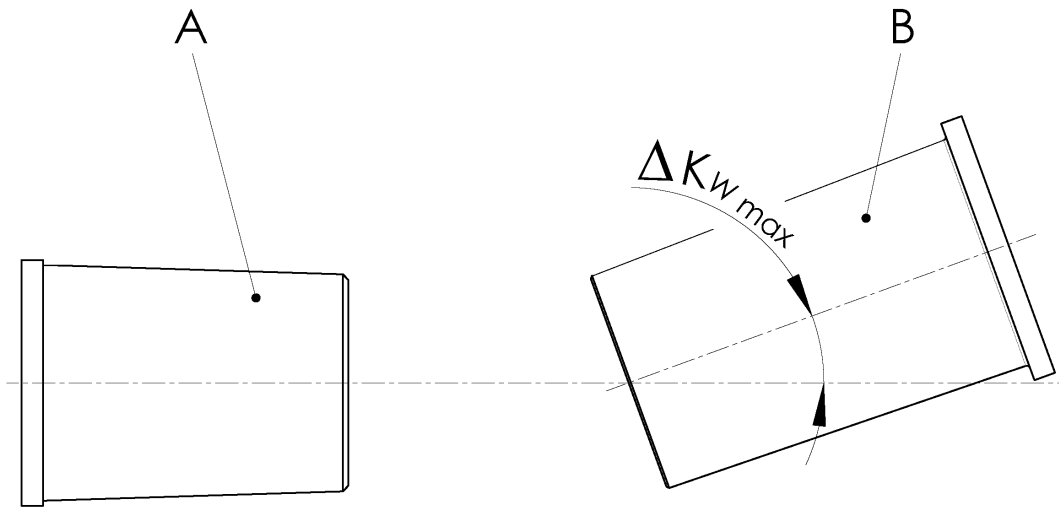


Fig. 5-2 Permissible angular misalignment

Item	Info	Designation	Remark
A		Gear shaft	Customer part
B		Engine shaft	Customer part

Permissible angular alignment tolerance:

$$\Delta K_{w \max} = 0.02^\circ$$

6 Mounting

6.1 General assembly instructions

Any work method which impairs the safety of the coupling is prohibited.
The user undertakes to notify the manufacturer immediately of any changes occurring at the coupling which could impair safety (address see chapter 1).

WARNING

**Injuries can occur as a result of:**

- Contact with rotating parts

Before starting work at the coupling, switch off the plant and secure against unintentional start-up.

WARNING

**Injury and material damage can occur as a result of:**

- Assembly of the coupling in the wrong sequence

Only ever assemble the coupling in the described sequence.

WARNING

**Injury and material damage can occur as a result of:**

- Falling coupling components

Secure coupling components against falling to the floor.

CAUTION

**Material damage to coupling components can occur as a result of:**

- Contact with sharp-edged objects

Protect coupling components for transportation.

Only hoist coupling components with nylon belts or ropes.

Always cushion parts when supporting them from below.

CAUTION

**Material damage can occur as a result of:**

- Soiled joint surfaces

The surfaces that are to be joined must be free of dirt, preservatives and lubricants.

 **IMPORTANT**

- Screw preparation and tightening torque levels in accordance with CENTA data sheet D013-016 (see chapter 11.1).
- Use suitable lifting devices for assembly.
- The following assembly stages are described for coupling 025T-00258-2200.
- Part illustration and marking may differ slightly from installation drawing and delivery state.

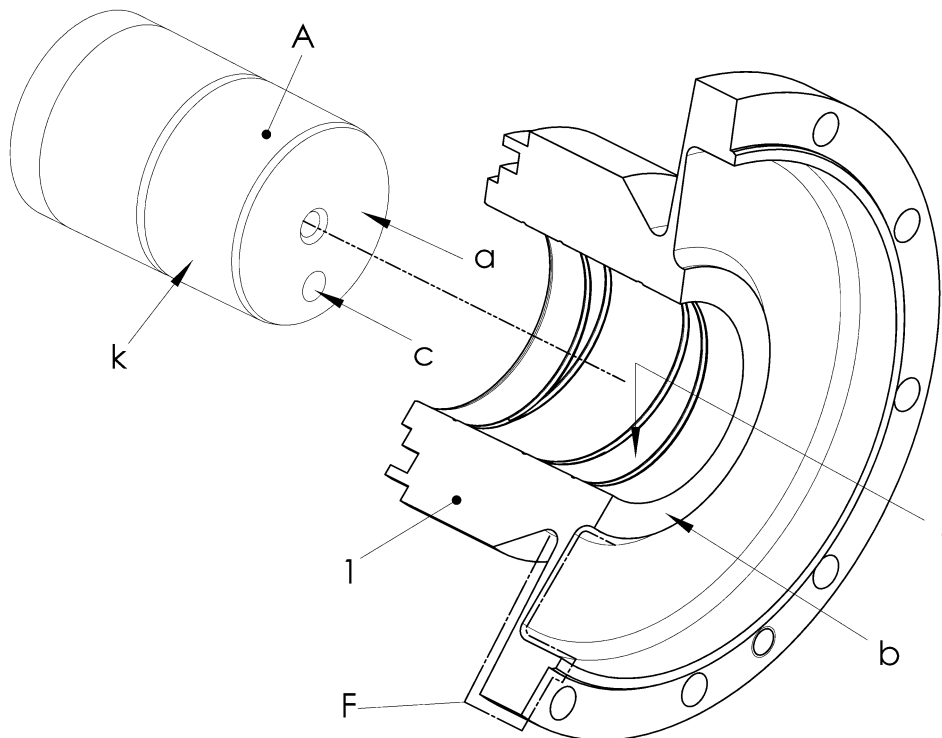
6.2 Mounting the membrane (1) with conical interference fit

Fig. 6-1 Mounting the membrane (1) with conical interference fit

Item	Info	Designation	Remark
1		Membrane	
A		Gear shaft	Customer part
F		Marked area, into which no force has to be transferred	
	a	Face of gear shaft	
	b	Face of membrane, face for force transferring	
	c	Thread	
	j	Conical surface of the membrane	
	k	Conical surface of the gear shaft	


IMPORTANT

Mounting/dismantling fluid to be used:

- Glycerol $\geq 98\%$; anhydrous

- Clean and degrease the conical surfaces (j and k).
- Moisten the conical surfaces (j and k) with glycerol.
- Push the membrane (1) onto the gear shaft (A).
- Remove the screw plug (if existing) from the thread (c) of the gear shaft (A).

WARNING

Injury and material damage can occur as a result of:

- Non-compliance with the operating instructions for the hydraulic pumps

Before carrying out work with the hydraulic pumps, do not fail to read their operating instructions. Only ever work with hydraulic pumps as described in their operating instructions.

WARNING

Injury and material damage can occur as a result of:

- Hydraulic fluid spraying out
- Use protective goggles.

- Connect the pump ($p_{max} = 3000 \text{ bar}$) for expanding the membrane (1) to the thread (c).

CAUTION**Material damage to the membranes can occur as a result of:**

- Transferring force within the marked area (F), see figure 6-1
- Only transfer force onto the face (b).

- Screw the pump for pushing on the membrane to the gear shaft.
- Build up the pressure for pushing on the membrane.

WARNING**Material damage can occur as a result of:**

- Insufficient expanding pressure in the membrane
- If the expanding pressure is too low, the necessary pushing pressure is too high.

- Build up the pressure for expanding the membrane.
- Build up the pressure alternately until the lift path (p up) of the membrane (1) is reached (p up see installation drawing). Faces (a) and (b) have to be flush.
- Decrease the pressure for expanding the membrane.
- Remove the pump for expanding the membrane (1) from the gear shaft.
- Maintain the pressure for pushing on the membrane for one hour.
- Decrease the pressure for pushing on the membrane.
- Remove the pump for pushing on the membrane from the gear shaft.
- Turn the membrane (1) allow the glycerol running out of the thread (c) and dispose of it correctly.
- Screw the screw plug into the thread (c) of the gear shaft (A).

**IMPORTANT**

Do not place a load on the hub for 24 hours.

6.3 Mounting the hub (2) with conical interference fit

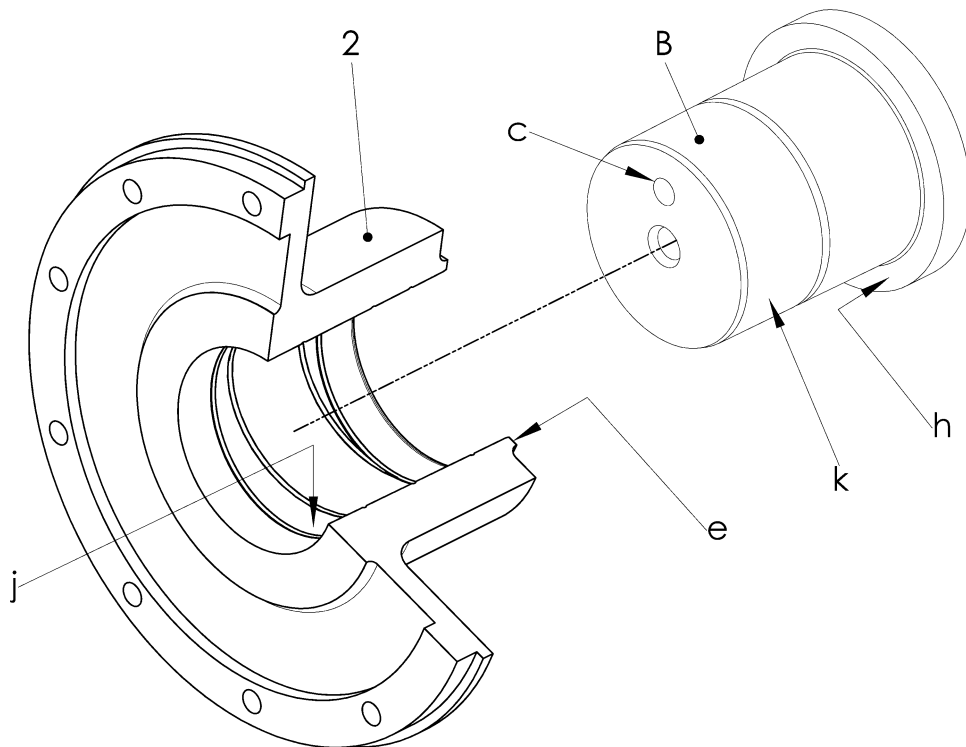


Fig. 6-2 Mounting the hub (2) with conical interference fit

Item	Info	Designation	Remark
2		Hub	
B		Engine shaft	Customer part
	c	Thread	
	e	Face of hub	
	h	Shaft shoulder	
	j	Conical surface of the hub	
	k	Conical surface of the engine shaft	

 **IMPORTANT**

Mounting/dismantling fluid to be used:

- Glycerol \geq 98%; anhydrous

- Clean and degrease the conical surfaces (j and k).
- Moisten the conical surfaces (j and k) with glycerol.
- Push the hub (2) onto the engine shaft (B).
- Remove the screw plug (if existing) out of the thread (c) from the engine shaft (B).

WARNING**Injury and material damage can occur as a result of:**

- Non-compliance with the operating instructions for the hydraulic pumps

Before carrying out work with the hydraulic pumps, do not fail to read their operating instructions. Only ever work with hydraulic pumps as described in their operating instructions.

WARNING**Injury and material damage can occur as a result of:**

- Hydraulic fluid spraying out
- Use protective goggles.

- Connect the pump ($p_{\max} = 3000 \text{ bar}$) for expanding the hub (2) to the thread (c).
- Screw the pump for pushing on the hub to the engine shaft.
- Build up the pressure for pushing on the hub.

WARNING**Material damage can occur as a result of:**

- Insufficient expanding pressure in the hub

If the expanding pressure is too low, the necessary pushing pressure is too high.

- Build up the pressure for expanding the hub.
- Build up the pressure alternately until the lift path (p up) of the hub (2) is reached (p up see installation drawing).
- The face (e) of the hub touches the shaft shoulder (h).
- Decrease the pressure for expanding the hub.
- Remove the pump for expanding the hub from the engine shaft (B).
- Maintain the pressure for pushing on the hub for one hour.
- Decrease the pressure for pushing on the hub.

- Remove the pump for pushing on the hub from the engine shaft.
- Turn the hub (2) allow the glycerol running out of the thread (c) and dispose of it correctly.
- Screw the screw plug into the thread (c) of the engine shaft (B).

 IMPORTANT

Do not place a load on the hub for 24 hours.

6.4 Connecting the membrane (1) and the hub (2)

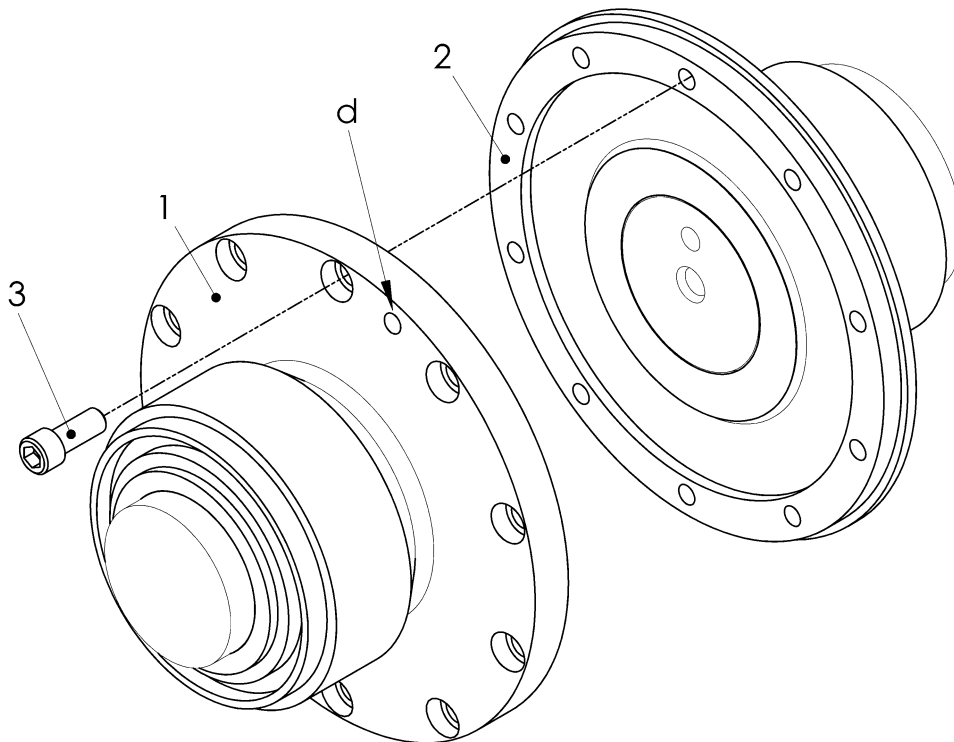


Fig. 6-3 Connecting the membrane (1) and the hub (2)

Item	Info	Designation	Remark
1		Membrane	
2		Hub	
3		Screw ISO4762-10.9 M12x30	
	d	Forcing thread M12	for dismantling

- Push the membrane (1) into the centring of the hub (2).
- Screw the membrane (1) to the hub (2) using the screws (3).

6.5 After completed mounting

WARNING



Injury and material damage can occur as a result of:

- Loose screw connections

Before commissioning, the tightening torque levels of all screws must be checked and corrected if necessary.

Before commencing long-term operation, the plant must successfully complete a test run.

7 Operation

WARNING



Injury and material damage can occur as a result of:

- Worn coupling components

If the running noises change and/or vibrations occur turn the plant off immediately.

Determine the fault and its root cause, and remedy.
 The troubleshooting process is simplified by the table in the next chapter.
 On principle in case of a fault, an analysis of the entire plant should be performed.

7.1 Operating faults, root causes and remedy

Faults	Possible root causes	Remedy
Running noises or vibrations in the plant	Loose bolts	<ol style="list-style-type: none"> 1. Switch off the plant 2. Check alignment, correct if applicable 3. Check screw torque levels and correct if necessary 4. Trial run
Membrane damaged	Alignment error or inadmissibly high torque	<ol style="list-style-type: none"> 1. Switch off the plant 2. Replace defective parts 3. Check alignment, correct if applicable 4. Trial run

Table 7-1 Troubleshooting table

In case of uncertainty or if you have questions, please contact our head office (address see chapter 1).

7.2 Admissible overall misalignment of the coupling

The overall misalignment values can be found in the drawing.

8 Care and maintenance

WARNING

**Injuries can occur as a result of:**

- Contact with rotating parts

Before starting work at the coupling, switch off the plant and secure against unintentional start-up.

The coupling requires low maintenance. We recommend a visual inspection if the driving and driven units have to be separated.

8.1 Work to be performed

8.1.1 Cleaning the coupling

- Remove any loose dirt from the coupling.

8.1.2 Visual inspection of the coupling

- Inspect the coupling for cracks, chips or missing parts.
- Replace faulty and missing parts.

8.1.3 Check the protection against corrosion

- Check the corrosion protection coating for damages.
- Eliminate the damages according to the regulations of the operator.

8.1.4 Inspection of the screw connections

- Check the tightening torque levels of all screws and if necessary, correct.

8.2 Replacing defective parts

- Remove the coupling as described in chapter 9 .
- Replace wearing parts.
- Mount the coupling as described in chapter 6 .

9 Dismantling

9.1 General dismantling instructions

Any work method which impairs the safety of the coupling is prohibited.
The user undertakes to notify the manufacturer immediately of any changes occurring at the coupling which could impair safety (address see chapter 1).



IMPORTANT

The coupling is dismantled in reverse order to the assembly process.
Please refer to the illustrations in chapter 6.

WARNING

**Injuries can occur as a result of:**

- Contact with rotating parts

Before starting work at the coupling, switch off the plant and secure against unintentional start-up.

WARNING

**Injury and material damage can occur as a result of:**

- Dismantling of the coupling in the wrong sequence

Only ever dismantle the coupling in the described sequence.

WARNING

**Injury and material damage can occur as a result of:**

- Falling coupling components

Secure coupling components against falling to the floor.

CAUTION

**Material damage to coupling components can occur as a result of:**

- Contact with sharp-edged objects

Protect coupling components for transportation.

Only hoist coupling components with nylon belts or ropes.

Always cushion parts when supporting them from below.



IMPORTANT

Use suitable lifting devices for dismantling.





9.2 Disconnecting the membrane (1) from the hub (2)

See Fig. 6-3:

- Loosen and remove the screws (3) of the connection membrane (1) and hub (2).
- Loosely screw one screw (3) into each forcing thread (d; 2x 180°).
- Push the membrane (1) off the hub (2) with the help of the screws (3) in forcing threads (d).
- Remove the screws (3; 2x 180°) out of the forcing threads (d) of the membrane (1).

9.3 Dismantling the hub (2) with conical interference fit (if necessary)




See Fig. 6-2:

WARNING	
	<p>Injury and material damage can occur as a result of:</p> <ul style="list-style-type: none"> ▪ Non-compliance with the operating instructions for the hydraulic pumps <p>Before carrying out work with the hydraulic pumps, do not fail to read their operating instructions. Only ever work with hydraulic pumps as described in their operating instructions.</p>
WARNING	
	<p>Injury and material damage can occur as a result of:</p> <ul style="list-style-type: none"> ▪ Hydraulic fluid spraying out <p>Use protective goggles.</p>
WARNING	
	<p>Injuries and material damages can occur by:</p> <ul style="list-style-type: none"> ▪ Suddenly loosening hubs <p>Secure the hub with a hydraulic tool against sudden axial loosening.</p>
 IMPORTANT	
<p>Mounting/dismantling fluid to be used:</p> <ul style="list-style-type: none"> • Glycerol ≥ 98%; anhydrous 	

- Remove the screw plug (if existing) from the engine shaft (B).
- Connect the pump (**p_{max} = 3000 bar**) for expanding the hub to the thread (c) of the engine shaft (B).
- Screw the pump for holding the hub to the engine shaft (B).
- Build up pressure for holding the hub.
- Build up the pressure for expanding the hub (**p_{max} = 1500 bar**).
 - Slowly reduce the pressure for holding the hub.
 - Reduce the pressure for expanding the hub.
- Repeat the mounting section described above until the hub is completely released from the engine shaft.
- Remove the pump for holding the hub from the engine shaft (B).
- Remove pump for expanding the hub from the engine shaft (B).
- Turn the engine shaft (B) allow the glycerol running out of the thread (c) and dispose of it correctly.
- Screw the screw plug into the thread (c) of the engine shaft (B).
- Remove the hub (2) from the engine shaft (B).

9.4 Dismantling the membrane (1) with conical interference fit (if necessary)

See Fig. 6-1:

WARNING	
	<p>Injury and material damage can occur as a result of:</p> <ul style="list-style-type: none"> ▪ Non-compliance with the operating instructions for the hydraulic pumps <p>Before carrying out work with the hydraulic pumps, do not fail to read their operating instructions. Only ever work with hydraulic pumps as described in their operating instructions.</p>
WARNING	
	<p>Injury and material damage can occur as a result of:</p> <ul style="list-style-type: none"> ▪ Hydraulic fluid spraying out <p>Use protective goggles.</p>
WARNING	
	<p>Injuries and material damages can occur by:</p> <ul style="list-style-type: none"> ▪ Suddenly loosening membrane <p>Secure the hub with a hydraulic tool against sudden axial loosening.</p>

**IMPORTANT**

Mounting/dismantling fluid to be used:

- Glycerol $\geq 98\%$; anhydrous

- Remove the screw plug (if existing) from the gear shaft (A).
- Connect the pump (**$p_{\max} = 3000 \text{ bar}$**) for expanding the membrane (1) to the thread (c) of the gear shaft (A).
- Screw the pump for holding the membrane to the gear shaft (A).
- Build up pressure for holding the membrane.
- Build up the pressure for expanding the membrane (**$p_{\max} = 1500 \text{ bar}$**).
 - Slowly reduce the pressure for holding the membrane.
 - Reduce the pressure for expanding the membrane.
- Repeat the mounting section described above until the membrane is completely released from the gear shaft.
- Remove the pump for holding the membrane from the gear shaft (A).
- Remove the pump for expanding the membrane from the gear shaft (A).
- Turn the gear shaft (A), drain glycerol out of the thread (c) and dispose correctly.
- Screw the screw plug (c) into the gear shaft (A).
- Remove the membrane (1) from the gear shaft (A).

9.5 Reassembling the coupling

- Reassemble the coupling as described in chapter 6.

10 Wearing and spare parts**WARNING****Injury and material damage can occur as a result of:**

- Mounting and/or utilization of non-original CENTA parts
- Never use parts from other manufacturers.

A stock of the most spare parts is the most important condition to ensure that the coupling is functional and ready for operation at all times.

We only provide a warranty for CENTA original parts.

Wearing part is:

- Coupling
This is delivered ready for installation.

When ordering a spare, specify:

- Order no.
- Coupling order no.
- Drawing no.



11 Annex

11.1 CENTA data sheet D013-016 (unlubricated screw connections)

Validity:

For all non-dynamically stressed screw connections with **not lubricated** shank bolts in accordance with ISO 4014, ISO 4017 and ISO 4762 (DIN 912) with metric standard thread in accordance with DIN ISO 262, unless other specifications are given on CENTA documents.

Preparation of parts that are to be screwed together:

The joining areas must be free of dirt, preservatives and lubricants.

Preparation of screws that ARE NOT secured with liquid screw locking medium:

Use screws as delivered.

Preparation of screws that ARE secured with liquid screw locking medium:

Remove all grease from the thread.

Screw tightening method:

Screw in (by hand with torque wrench).

d	Thread size		d	Thread size		
	Strength class	Tightening torques		Strength class	Tightening torques	
		[Nm] ±5%			[Nm] ±5%	[in lbs] ±5%
M6	8.8	10	M22	8.8	470	4160
	10.9	14		10.9	670	5930
	12.9	17		12.9	780	6900
M8	8.8	23	M24	8.8	600	5310
	10.9	34		10.9	850	7520
	12.9	40		12.9	1000	8850
M10	8.8	46	M27	8.8	750	6640
	10.9	68		10.9	1070	9470
	12.9	79		12.9	1250	11060
M12	8.8	79	M30	8.8	1000	8850
	10.9	117		10.9	1450	12830
	12.9	135		12.9	1700	15050
M14	8.8	125	M33	8.8	1400	12400
	10.9	185		10.9	1950	17250
	12.9	215		12.9	2300	20350
M16	8.8	195	M36	8.8	1750	15500
	10.9	280		10.9	2500	22150
	12.9	330		12.9	3000	26550
M18	8.8	245	M39	8.8	2300	20350
	10.9	350		10.9	3300	29200
	12.9	410		12.9	3800	33650
M20	8.8	350				
	10.9	490				
	12.9	580				



11.2 CENTA data sheet D025-901

Declaration of incorporation according to the EC Machinery Directive 2006/42/EC, Appendix II B

Manufacturer:

**CENTA Antriebe
Kirschey GmbH**
Bergische Strasse 7
42781 Haan / GERMANY

Contact:

Phone +49-2129-912-0
Fax +49-2129-2790
centa@centa.de
www.centa.info

We herewith declare that the **incomplete** machine

Product: Torsionally stiff coupling CENTADISC-T

Model / series code: CD-T / 025T

Installation size: all

Design: all

Serial number: according to shipping documents, if applicable

- provided this is possible as far as the scope of supply is concerned - complies with the following basic requirements of the **Machinery Directive 2006/42/EC** Appendix I, subchapters 1.1.2, 1.1.3, 1.1.5, 1.3.2, 1.3.3, 1.3.4 and 1.5.4.

In addition, we declare that the special technical documents for this incomplete machine were compiled according to Appendix VII Part B and undertake to forward these to the market monitoring authorities by request via our "Documentation Department".

Commissioning of the incomplete machine is interdicted until the incomplete machine has been incorporated in a machine and the latter complies with the provisions of the EC Machinery Directive and the EC Declaration of Conformity according to Appendix II A is on hand.

The declaration is invalidated by every modification to the delivered parts.

Authorised representative for the compilation of the relevant technical documents:

i.A. J. Anderseck

by order of Gunnar Anderseck
(Authorised Person Documentation)

Declaration of incorporation was issued:

i.v. J. Exner

by proxy Dipl.-Ing. Jochen Exner
(Design Management)

Haan, 11.04.2014