Installation and Operating Manual

(Translation of the original installation and operating manual)

TRI…

TR…

Turbo Coupling with Constant Fill and Pulley

including design as per ATEX directives:
Directive 94/9/EC (valid until April 19, 2016), Directive 2014/34/EU (valid from April 20, 2016)

Version 5 , 2016-01-11
3626-011200 en, Protection Class 0: public

Serial No. [1]		
Coupling type [2]		
Year of manufacture		
Mass (weight)		kg
Power transmission		kW
Input speed		rpm
Operating fluid	☐ mineral oil ☐ water: Please contact Voith ☐	
Filling volume		dm^3 (liters)
Number of screws z [3]		
Nominal response temperature of fusible plugs		°C
Pulley	Diameter: Profile: Number of grooves:	mm
Sound pressure level $L_{PA,1m}$		dB
Installation position	☐ horizontal ☐ vertical	
Drive via	☐ outer wheel ☐ inner wheel	

1) Please indicate the serial number in any correspondence (→ Chapter 18).
2) T...: oil / TW...: water.
3) Determine and record the number of screws z (→ Chapter 10.1).

Please consult Voith Turbo in case that the data on the cover sheet are incomplete.

Contact

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3626-011200 en

This document describes the state of design of the product at the time of the editorial deadline on 2016-01-11.

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en / Protection Class 0: public / 2016-01-11

Contents

1 Voith Turbo Coupling with Constant Fill

1.1 Function

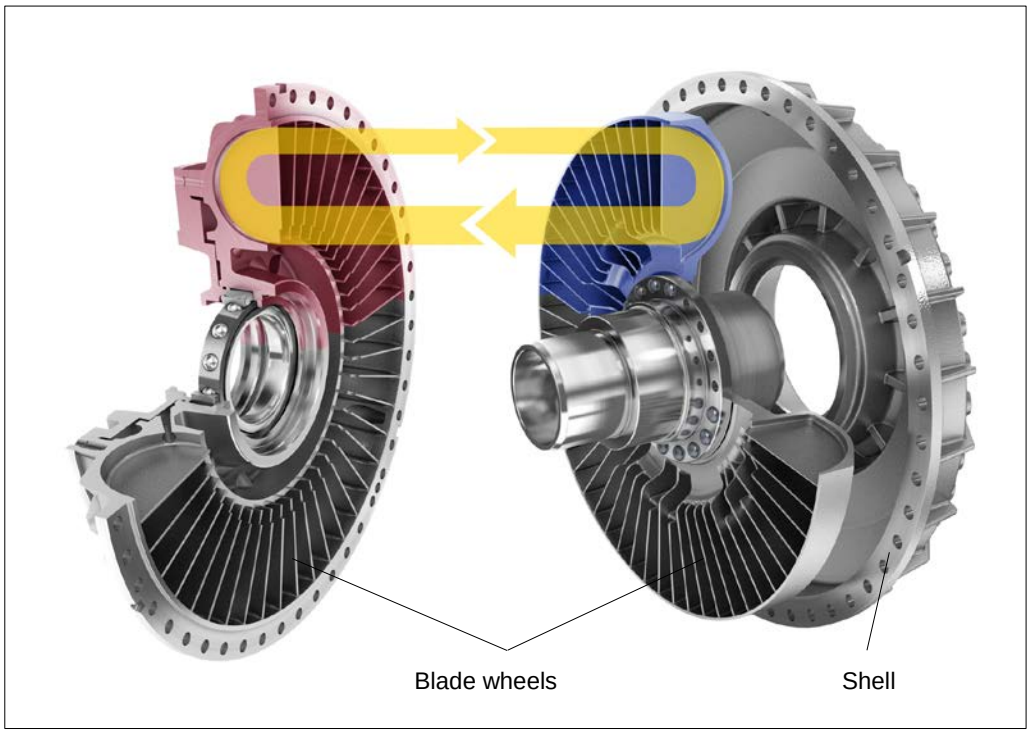

Fig. 1

The Voith turbo coupling is a hydrodynamic coupling working to the Föttinger principle. Its main elements consist of two blade wheels - the pump impeller and the turbine wheel - enclosed by a shell. Both wheels are provided with bearings relative to each other. The power is transmitted with hardly any wear, there is no mechanical contact between the power-transmitting parts. A constant amount of operating fluid is in the coupling.
The mechanical energy provided by the drive motor is converted into kinetic energy of the operating fluid in the connected pump impeller. In the turbine wheel, this kinetic energy is reconverted into mechanical energy.

Three conditions are to be considered with regard to the coupling function:

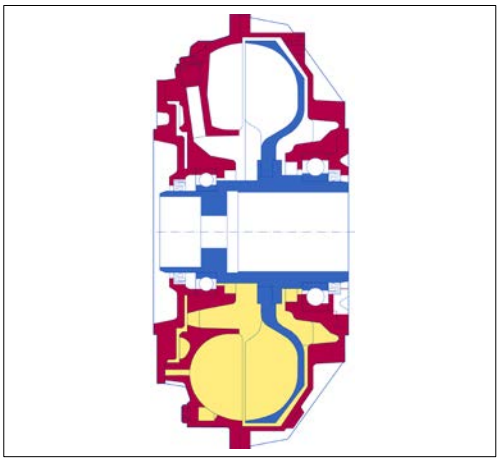

Fig. 2

Standstill
The whole operating fluid rests in the coupling.

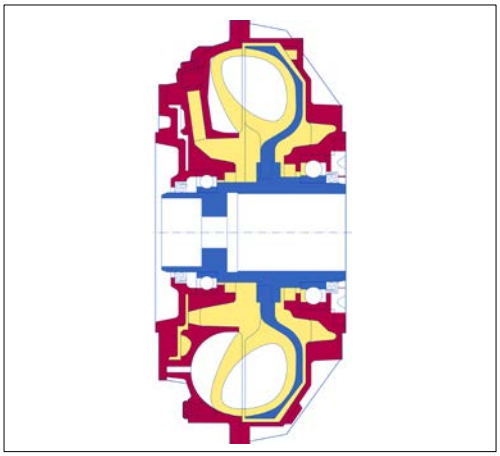

Fig. 3

Starting condition
The pump impeller accelerates the operating fluid with increasing motor speed causing a circulating flow in the working chamber. The whole blade space of the turbine wheel is flooded, and the turbine wheel starts to move as a result of the kinetic energy of the fluid flow. The coupling characteristic curve determines the torque curve during start-up.

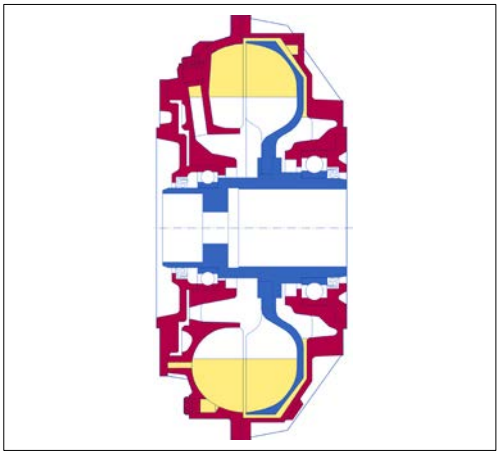

Fig. 4

Nominal operation
During nominal operation, only the torque required by the driven machine is transmitted. The low speed difference between pump impeller and turbine wheel (the so-called rated slip) results in a stationary flow condition in the coupling.

1.2 Type designation

Type designation
→ Cover sheet

For hydrodynamic couplings with constant fill, the type designation is determined as follows:

1	2	3	4	5	6	7	8	9	10	11	12
Example: 562 TVVS RI03											
562	T			VV		S	RI	03			

1	**Coupling size (profile diameter in mm)** Possible sizes: 154, 206, 274, 366, 422, 487, 562, 650
2	**Number of hydrodynamic circuits** T: single-circuit coupling DT: double-circuit coupling
3	**Material** "no code letter": Silumin U: ferrous material
4	**Operating fluid** "no code letter": mineral oil W: Water (special case - please consult Voith).
5	**Delay chamber** "no code letter": without delay chamber V: with delay chamber VV: with enlarged delay chamber
6	**Draining of delay chamber** "no code letter": time-dependent draining without dynamic refill Y: with dynamic refill
7	**Shell** "no code letter" standard design S: designed as annular chamber
8	**Pulley bearings** R: pulley without bearings RI: pulley with bearings
9	**Design status** “no code letter“: first design old: A, B, C, E, G, H, J new: 01, 02, 03, 04, 05, 06, 07, 08, 09, 10, …
10	**Throttle plate** "no code letter": without throttle plate D: with throttle plate
11	**Design** "no code letter": standard design X: special constructional design Z: special hydrodynamic design
12	**Possible supplementary information in plain text**

1.3 Constructional examples

Type TR (basic type)**:**

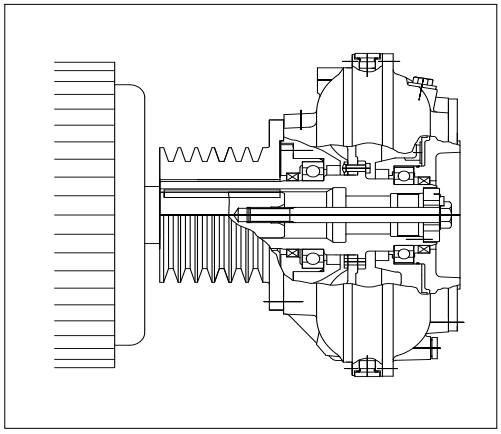

Fig. 5

Type TRI (basic type)**:**

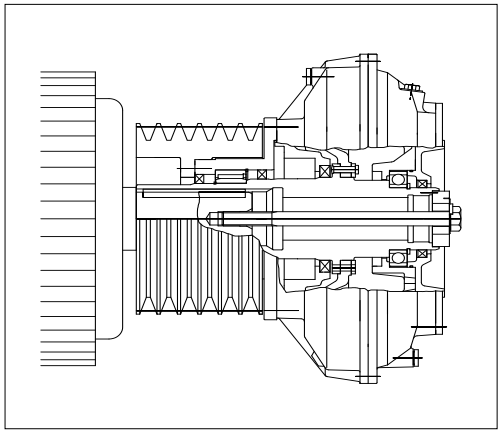

Fig. 6

Type TVRI:

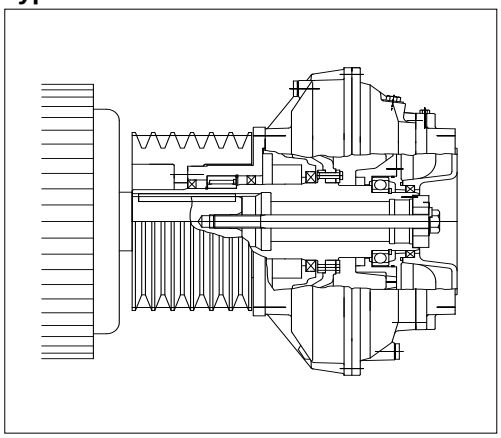

Fig. 7

Type TVVRI:

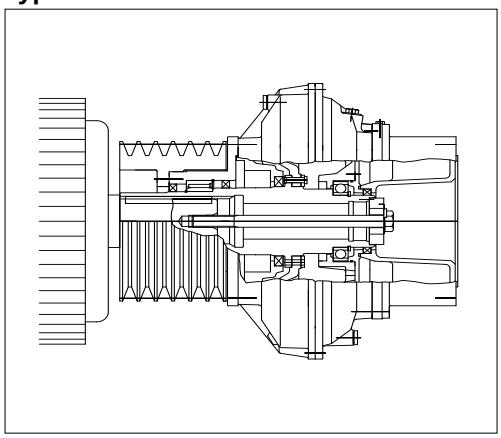

Fig. 8

Type TVVSRI:

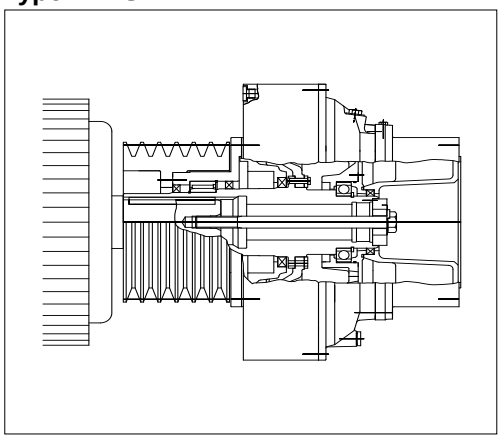

Fig. 9

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Type DTR / DTVR:

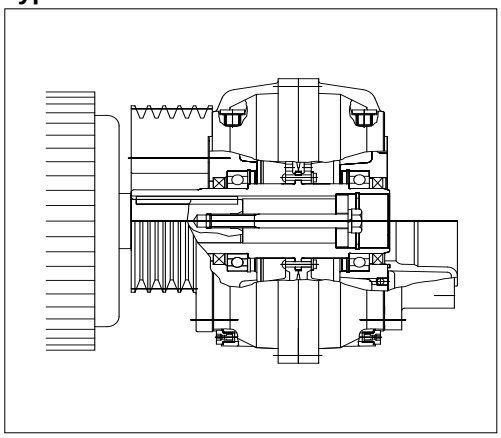

Fig. 10

Type DTRI / DTVRI:

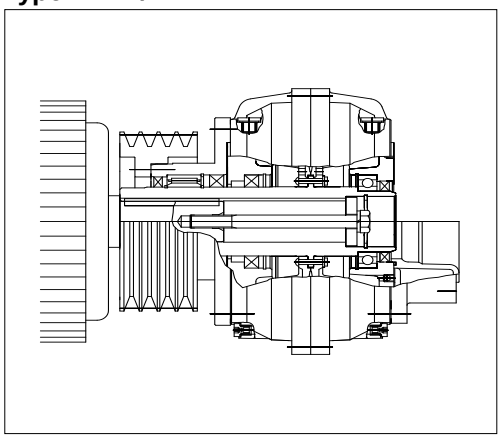

Fig. 11

2 Technical data

Information required for use in potentially explosive atmospheres:

CE Ex marking:		
Ambient temperature, if deviating from -25 °C T_a 40 °C		°C
max. surface temperature (T3= 200 °C, T4= 135 °C, or deviating)		°C
Temperature monitoring	☐ MTS [1] for pre-warning	
	☐ BTS [2] for pre-warning	
	☐ BTS-Ex [2] for limitation of the max. surface temperature for Voith turbo couplings acc. to ATEX Directive. Maximum permissible temperature of turbo coupling when switching on the motor:	°C
Nominal response temperature of temperature monitoring		°C
Max. permissible filling volume [3]		dm^3 (liters)
Overload (à Chapter 6.8), causing the thermal fuse (fusible plug/s and/or BTS-Ex) to respond, requires the power supply to be switched off after		s (sec)
An additional monitoring of the output speed is required to switch off the power supply before the fusible plugs respond.	☐ Yes ☐ No	
After switching on the motor, monitoring of output speed has to begin after		s (sec)
Diameter of input (output) [4]		mm
Diameter of pulley	(see cover sheet)	mm
For turbo couplings of type TRI only: Re-lubrication interval for the bearing underneath the pulley	Ask for a Voith service engineer	h
Replacement of ball and roller bearings after		h

Table 1

1) MTS: Mechanical thermal switch unit (→ Chapter 19.1).
2) BTS: Non-contacting thermal switch unit (→ Chapter 19.2).
3) Applies if filling volume is not indicated on the cover sheet.
4) Diameter and fit of hub or shaft to be joined by means of shaft-hub connection.

Additional information/data required for use in potentially explosive atmospheres:

3 Tightening torques

NOTICE

Damage to property

The turbo coupling may be damaged by incorrectly tightened screws.

- Tighten all screws using a torque-adjustable torque wrench!

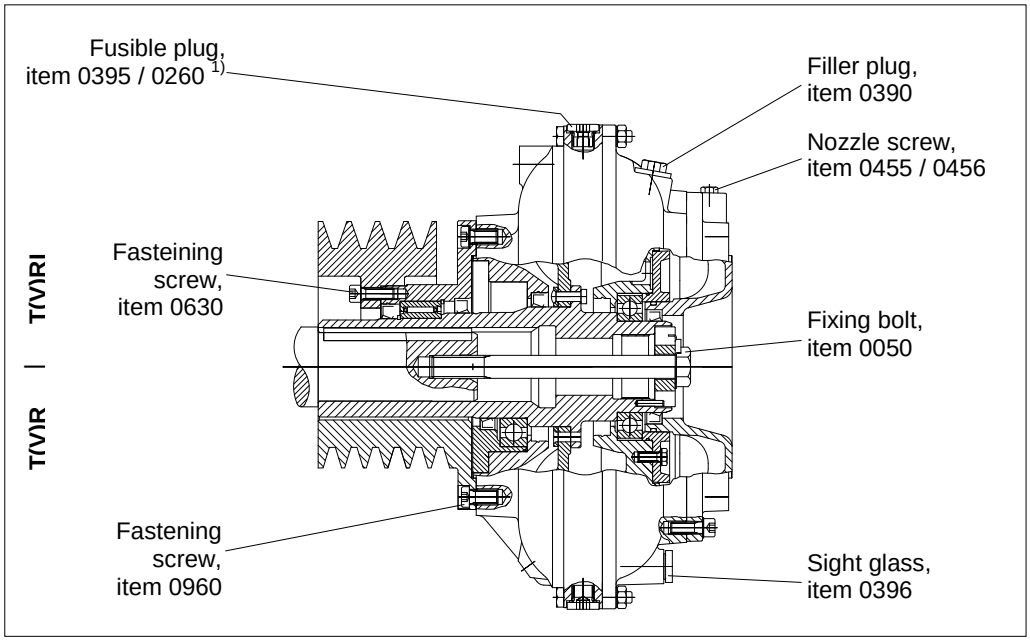

Fig. 12

1) For arrangement and quantity, → Chapter 13.4.

3.1 Fixing bolts

	Tightening torque in Nm						
Thread	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M30**
Fixing bolt, item 0050	23	46	80	195	380	660	1350

Table 2

The tightening torques for fixing bolts apply to screws with property class 8.8 or higher (as per EN ISO 898-1), oil-moistened and relevant shaft journal material.

3.2 Fusible plugs, filler plugs, sight glasses, blind- and nozzle screws

	Tightening torque in Nm (dimension of thread)				
Coup-ling size	**Fusible plug, item 0260, item 0395**	**Filler plug, item 0390**	**Blind screw, item 0265, item 0394**	**Sight glass, item 0396**	**Nozzle screw, item 0455, item 0456**
154	8 (M8)	13 (M10)	8 (M8)	-	-
206	13 (M10)	20 (M12x1.5)	13 (M10)	-	-
274	13 (M10)	30 (M14x1.5)	13 (M10)	-	-
366 to 562	50 (M18x1.5)	80 (M24x1.5)	50 (M18x1.5)	50 (M18x1.5)	48 (M16x1.5)
650	144 (M24x1.5)	80 (M24x1.5)	144 (M24x1.5)	144 (M24x1.5)	48 (M16x1.5)

Table 3

3.3 Fastening screws

	Tightening torque in Nm (dimension of thread)	
Coupling size and type	**Fasening screw, Item 0630**	**Fasening screw, item 0960**
154 T	-	-
206 T	23 (M8)	18 (M8)
274 T	23 (M8)	62 (M12)
274 DT	46 (M10)	62 (M12)
366 T	46 (M10)	62 (M12)
422 T	46 (M10)	62 (M12)
487 T	80 (M12)	62 (M12)
562 T	80 (M12)	62 (M12)
650 T	195 (M16)	152 (M16)

Table 4

Screws with property class 8.8 or higher as per EN ISO 898-1 are used.

4 Declarations of Manufacturer

4.1 Declaration regarding assemblies and components

Since 29 December 2009, a new Machinery Directive 2006/42/EC has to be applied bindingly in the member states of the European Community.

Voith turbo couplings of Product Group "Start-up Components", as defined by the new Machinery Directive 2006/42/EC and the explanations of the guidelines published in December 2009 to implement the Machinery Directive, are neither "machines" nor "incomplete machinery", but rather assemblies or components.

As our products are no incomplete machinery, we do not issue a declaration of incorporation as per Machinery Directive 2006/42/EC.

An EC Declaration of Conformity must not be issued for these products either, nor CE marking be provided, unless specified by other EC directives or regulations.

Voith as certified company ensures that the basic safety and health requirements for their products are always met by internal quality management systems and by applying harmonized standards.

The technical documentation for Voith products is so comprehensive that they may be installed reliably into machinery or incomplete machinery. Safe operation of the complete machinery with regard to Voith products is also ensured at a later date when observing this documentation.

Issued in	Crailsheim, Germany
On	January 10, 2014
Name of the undersigned	Mr. J. Hagedorn, General Manager - Start-up Components

4.2 Conformity Declaration

EC Conformity Declaration as per Directive 94/9/EC (valid until April 19, 2016),
EU Conformity Declaration as per Directive 2014/34/EU (valid from April 20, 2016)

The manufacturer	Voith Turbo GmbH & Co. KG, Voithstraße 1, 74564 Crailsheim / Germany

hereby declares that the machinery described below:

Designation	TRI… TR… Turbo coupling with constant fill and pulley
Serial number	see shipping documents

complies with the provisions of the following harmonized standards in the version valid on the date of signature:

EN ISO 12100-1 / -2	Safety of machinery - basic concepts and general principles for design Part 1: Terminology, methodology Part 2: Technical principles
EN 1127-1 / -2	Explosive atmospheres, explosion prevention, basic concepts and methodology
EN 13463-1	Non-electrical equipment for use in potentially explosive atmospheres, Part 1: Basic method and requirements
EN 13463-5	Non-electrical equipment intended for use in potentially explosive atmospheres, Part 5: Protection by constructional safety 'c'
EN 13463-8	Non-electrical equipment for potentially explosive atmospheres, Part 8: Protection by liquid immersion "k"
EN 1710	Equipment and components intended for use in potentially explosive atmospheres in underground mines

as well as with the following European and national standards and technical specifications in the version valid on the date of signature:

TRBS 2153	Avoidance of ignition hazards resulting from electrostatic charging

Each modification by the customer on the parts supplied, invalidates the declaration.

Issued in	Crailsheim, Germany
On	November 25, 2015
Name of the undersigned	Mr. J. Hagedorn, General Manager - Start-up Components

5 User information

This manual will support you in using the turbo coupling with pulley in a safe, proper and economical way.

If you observe the information contained in this manual, you will
- increase the reliability and lifetime of the turbo coupling and installation,
- avoid any risks
- reduce repairs and downtimes.

This manual must
- always to be available at the machine jobsite
- be read and used by every person who transports the turbo coupling, works on the turbo coupling or commissions the same.

The turbo coupling has been manufactured according to the latest design standard and approved safety regulations. Nevertheless, the user's or third party's life may be endangered or the machine or other property impaired in case of improper handling or unintended use.

Spare parts:
Spare parts must comply with the technical requirements determined by Voith. This is guaranteed when original spare parts are used.
Installation and/or use of non-original spare parts may negatively change the mechanical properties of the **Voith turbo coupling** and thus have an adverse impact on safety.
Voith is not liable for any damages resulting from the use of non-original spare parts.

Use only appropriate workshop equipment for maintenance. Professional maintenance and/or repair can only be guaranteed by the manufacturer or an authorized specialist workshop.

This manual has been issued with the utmost care. However, should you need any further information, please contact:

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Fax +49 7951 32 480
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www.voith.com/fluid-couplings

Voith Turbo reserves the right for modifications.

6 Safety

6.1 Safety information

Safety information indicating the descriptions and symbols as described in the following are used in the operating manual.

6.1.1 Structure of safety information

⚠ DANGER WORD
Hazard consequences Source of hazard • Warding off of danger

Danger word
The danger word divides the severity of the danger in several levels:

Danger word	Severity of danger
⚠ DANGER	Death or serious injury (irreversible personal injury)
⚠ WARNING	Death or serious injury possible
⚠ CAUTION	Minor or moderate injury possible
NOTICE	Possibly damage to property of - the product - its environment
SAFETY INFORMATION	General applications details, useful information, safe job procedure and proper safety measures

Table 5

Hazard consequences
Hazard consequences indicate the kind of hazard.

Source of hazard
The source of hazard indicates the cause of hazard.

Warding off of danger
Warding off of danger describes the measures to be taken to ward off a danger

6.1.2 Definition of safety symbols

Symbol	Definition
	Danger of explosion Marking with the Ex-symbol indicates possible hazards which have to be observed for the use in potentially explosive atmospheres.

Table 6

6.2 Intended use

The turbo coupling with constant fill and pulley is provided to transmit the torque from the drive motor to the driven machine.
The **power** permitted during stationary operation at a specific **input speed** and a specific **coupling filling** (operating fluid and filling) is entered on the cover sheet of this manual. Any use beyond that is deemed unintended (→ Chapter 6.3 Unintended use).
Intended use also includes observing this installation and operating manual and complying with the inspection and maintenance conditions.
The manufacturer is not liable for any damages resulting from unintended use. The risk has to be borne solely by the user.

SAFETY INFORMATION

- If not indicated accordingly in → Chapter 2, it is not allowed to use this turbo coupling in potentially explosive atmospheres!
- Please check with reference to the marking whether the turbo coupling is approved for potentially explosive atmospheres.
- If the zonal classification changes, the operator has to check whether it is still allowed to operate the turbo coupling in that zone.

A marking according to ATEX Directive and EN13463 has been provided on the periphery of the turbo couplings. The marking specifies in what potentially explosive atmospheres and under what conditions the use is permitted.

Example: CE  II 2D c 180 C X
Industrial area in which during normal operation an explosive atmosphere may form ocassionally in form of a cloud of combustible dust in the air. Mechanical explosion protection by constructional safety. Maximum surface temperature: 180 °C.

6.3 Unintended use

The power transmission permitted during stationary operation at a specific input speed and a specific coupling filling (operating fluid and quantity) is entered on the cover sheet of this manual.
Any use beyond that described herein, e.g. for higher powers, higher speeds, other operating fluids or operating conditions that have not been agreed upon, is deemed unintended.
Moreover, it is not permitted to use BTS-Ex non-contacting thermal switch units from third parties.

6.4 Structural modifications

⚠ WARNING

Risk of personal injuries and damage to property
Structural modifications not done properly on the turbo coupling may cause personal injury and damage to property.

- Modifications, attachments or conversions on the turbo coupling are only allowed with the approval of Voith Turbo GmbH & Co. KG, Crailsheim.

6.5 General information as to dangerous situations

For all work performed on the turbo coupling, please observe the local regulations for the prevention of accidents!

Hazards while working on the turbo coupling:

⚠ WARNING

Risk of injury
While working on the turbo coupling, there is the risk of injury through cutting, crushing, burns and cold burns in case of minus degrees.

- Never touch the turbo coupling without wearing protective golves.
- Start to work on the turbo coupling only after it has cooled down to below 44 °C!
- Ensure that there is sufficient light, a sufficiently large working space and good ventilation when working on the turbo coupling.
- Switch off the unit in which the turbo coupling is installed and secure the switch against inadvertent switch-on.
- For all work performed on the turbo coupling ensure that both the drive motor and the driven machine have stopped running and that a re-start is absolutely impossible!

Hot surfaces:

WARNING

Risk of burning
The turbo coupling gets warm during operation.
- Please provide a guard for protection against contact with the turbo coupling! However, ventilation of the turbo coupling must not be impaired.

NOTICE

Damage to property
Thermal distorsion or tensions if the warm turbo coupling is cooled down by means of fluids.
- Never use fluids to cool down the turbo coupling!
- Let the turbo coupling cool down at ambient temperature.

Rotating parts:

Protective cover
→ Chapter 11

WARNING

Entanglement hazard
Rotating parts, such as the turbo coupling itself and exposed shaft parts need to be protected by a protective cover against contact with and entry of loose parts.
- Never operate the turbo coupling without these protective covers.

Noise:

Sound pressure level
→ Cover sheet

WARNING

Hearing loss, permanent impairment of hearing
The turbo coupling generates noise during operation. If the A-classified equivalent sound pressure level $L_{PA,\ 1m}$ exceeds 80 dB(A), this may cause impairment of hearing!
- Wear ear protection.

Electric shock:

DANGER

Electric shock
On account of incorrectly mounted or incorrectly connected electrical components, and disconnected electric connections, persons could get an electric shock and be severely injured, possibly with fatal consequences.
Incorrectly mounted or incorrectly connected electrical components and disconnected electric connections may cause damages to the machine.

- A qualified electrician has to properly carry out the connection to the electric supply network considering the system voltage and the maximum power consumption!
- The system voltage has to be in conformity with the system voltage indicated on the nameplate!
- There has to be a corresponding electrical protection by a fuse on the network side!

DANGER

Electrostatic processes
Electrostatic charging may injure persons by an electric shock.

- Allow only a qualified electrician to install the equipment into which the turbo coupling is installed.
- Machine and electric installation are provided with grounding connections.

Overspeed:

NOTICE

Damage to property
Non-recognition of overspeed, wrong direction of rotation or parameters outside the tolerance due to incorrect programming, may destroy the turbo coupling.

- Check wheter the entire system is equipped with a device which safely prevents overspeed (for example brake or backstop).
- For rated speed, → cover sheet..

This refers only to installations where overspeed (exceeding the rated speed) is possible.

Extreme ambient temperatures:

Ambient temperature → Chapter 2

⚠ WARNING

Risk of personal injuries and damage to property
Extreme ambient temperatures may result in thermal overload of the turbo coupling, thus causing the fusible plugs to melt and seriously injure any persons in their immediate surroundings, and to cause damage to the turbo coupling.

- Observe the permissible ambient temperature.

Only when water is used as operating fluid

NOTICE

Damage to property
The turbo coupling may be damaged by frozen operating fluid.

- The ambient temperature must be above the freezing point of the operating fluid.
- Adhere to the temperature limits indicated (→ Chapter 6.8).

Operating fluid which sprays off or leaks out:

⚠ WARNING

Risk of losing sight due to operating fluid spraying off, risk of burning
In case of thermal overload of the turbo coupling, the fusible plugs respond. Operating fluid leaks out through these fusible plugs.

- Persons close to the turbo coupling must wear safety goggles.
- Please make sure that the spraying-off operating fluid cannot get in contact with persons.
- If the fusible plugs spray off, switch off the drive immediately.
- Electrical devices located near the coupling need to be splash-guarded.

⚠ WARNING

Fire hazard

After the fusible plugs responded, spraying off oil may ignite on hot surfaces causing fire, as well as releasing toxic gases and vapor.

- Make sure that spraying off operating fluid cannot get into contact with hot machine parts, heaters, sparks or open flames.
- Immediately switch off the driving machine when the fusible plugs respond.
- Please pay attention to the information contained in the safety data sheets.

⚠ CAUTION

Danger of slipping

Slipping hazard due to spraying off solder of fusible plugs and leaking out operating fluid.

- Please provide a catch pan of sufficient size.
- Immediately remove any leaking out solder and operating fluid.
- Please pay attention to the information contained in the safety data sheets.

Checking the methane content before working on the turbo coupling:

⚠ WARNING

Explosion hazard

For turbo couplings with housings made of aluminum alloys and when the protective cover was removed, if the permissible methane content is exceeded, there is the risk of explosion.

- Before and during all work performed on the turbo coupling, check the methane content around the turbo coupling.
- Should this permissible limit value be exceeded, the work has to be stopped until the value is again below the limit value.

Permissible limit values according to local regulations

6.6 Remaining risks

⚠ WARNING

Risk of personal injuries and damage to property
Improper use or incorrect operation may cause death, serious injuries or minor injuries as well as damage to property and the environment.

- Only persons who are sufficiently qualified, trained and authorized are allowed to work on or with the turbo coupling.
- Please observe the warnings and safety information.

6.7 What to do in case of accidents

SAFETY INFORMATION

- In case of accidents, please observe the local regulations, the operating manuals and the operator's safety measures.

6.8 Information with regard to operation

SAFETY INFORMATION

- If irregularities are found during operation, immediately switch off the drive unit.

Power transmission:

The cover sheet of this manual indicates the possible power transmission at a specific input speed and a specific coupling filling (operating fluid and quantity).
These values describe a permissible working point for the stationary operation of the turbo coupling.

NOTICE

Damage to property
Deviations from the permissible working point cause damage the turbo coupling.

- Voith Turbo's approval is required for a stationary operation of the turbo coupling at a different working point.

Operating fluid:

NOTICE

Damage to property
Too little filling results in thermal overload of the turbo coupling, and in case of too much filling, the turbo coupling may be damaged by internal pressure.

- Operate the turbo coupling only with the filling quantity stated on the cover sheet of this manual.
- Use only the operating fluid indicated on the cover sheet of this manual.

Heating up during start-up:

NOTICE

Damage to property
During start-up, the turbo coupling heats up more than during stationary operation due to the increased slip.

- Please provide sufficient intervals between start-ups to avoid thermal overload.

Starting characteristic of turbo couplings with delay chamber:

On start-up, the operating fluid flows from the delay chamber into the turbo coupling working chamber. On standstill, the operating fluid returns into the delay chamber.
Please provide sufficient intervals (a few minutes) between the starts to get a correct starting characteristic.

Coupling temperature:

WARNING

Explosion hazard
Explosion hazard due to high temperature of turbo coupling.
- Make sure that the air surrounding the turbo coupling does not exceed the permissible value.

Technical data → Chapter 2 and ordering documents

NOTICE

Damage due to under temperature
The turbo coupling may be damaged by under temperature.
- Please consult Voith Turbo if the turbo coupling shall be used at ambient temperatures
  - below -25 °C for operating fluid 'oil'
  - below 1 °C for operating fluid 'water'

NOTICE

Damage due to overheating
Overheating (nominal temperature is exceeded) may damage the turbo coupling.
- Provide sufficient ventilation / aeration of the turbo coupling.

Fusible plugs:

The fusible plugs protect the turbo coupling against damage due to thermal overload.

Technical data → Chapter 2

NOTICE

Damage to property
The turbo coupling will be damaged if operation is continued after a fusible plug responded.
- Switch off the drive motor immediately on response of one of the fusible plugs!
- Use original fusible plugs only with the response temperature indicated on the → cover sheet of this operating manual.

Monitoring devices:

Monitoring devices
→ Chapter 19

NOTICE

Damage to property
Damage to turbo coupling due to monitoring devices not ready for service.
- Check whether existing monitoring devices are in a state ready for service.
- Repair any defective monitoring device immediately.
- Never bypass safety devices.

Blocking:

NOTICE

Damage to property
Blocking of the driven machine may cause overheating of the turbo coupling and response of the fusible plugs thus endangering persons as well as the turbo coupling and environment.
- Immediately switch off the driving machine.

Overload of turbo coupling:

After the thermal fuse responded, switch off the power supply after the time required in → Chapter 2 at the latest.
In case of multi-motor drive, switch off the whole system!

If an additional monitoring of the overload is required, monitor the output speed.
If the output speed falls below the input speed by more than 10%, immediately switch off the power supply.

It is necessary to switch off the power supply as otherwise the permissible surface temperature indicated cannot be met.

Permissible surface temperature,
→ Chapter 2

NOTICE

Overload of turbo coupling
The turbo coupling will be overloaded in cases where
- the driven machine blocks
- the driven machine is loaded excessively during nominal operation and/or during start-up.

Please consult Voith Turbo in case of unforeseeable turbo coupling overload.

6.9 Qualification of staff

Only qualified and authorized professional staff are allowed to perform work, such as transportation, storage, installation, electrical connection, commissioning, operation, maintenance, servicing and repair.

Qualified professional staff in the sense of this operating manual are persons who are familiar with transportation, storage, installation, electrical connection, commissioning, maintenance, servicing and repair and who have got the necessary qualifications relevant to their job performed. Qualification has to be ensured by performing training and giving instructions on the turbo coupling.

This staff must be trained, instructed and authorized to:
- operate and service machines in a professional manner in accordance with the technical safety standards.
- use lifting appliances, slings (ropes, chains, etc.) and lifting points in a professional manner.
- properly dispose of media and their components, e.g. lubricating grease.
- service and use safety devices in a manner that ensures compliance with safety standards.
- prevent accidents and provide first aid.

Staff to be trained may only perform work on the turbo coupling under the supervision of a qualified and authorized person.

The staff in charge of any work to be done on the coupling must
- be reliable,
- have the legal age,
- be trained, instructed and authorized with regard to the intended work.

6.10 Product monitoring

We are under legal obligation to keep the performance of our products under observation, even after shipment.
Therefore, please inform us about anything that might be of interest to us. For example:
- Change in operating data,
- experience gained with the machine,
- recurring problems,
- problems experienced with this installation and operating manual.

Our address,
→ Page 2

7 Transport and Storage

7.1 As delivered condition

- The turbo coupling is delivered completely, with mounted pulley (if included in the scope of supply).
- The turbo coupling is not filled. If the scope of supply includes the operating fluid, it will be delivered in a separate container.
- Other accessories will be supplied as loose parts.

Packaging
→ Chapter 7.5

7.2 Scope of supply

The turbo coupling will be supplied as indicated on the cover sheet.
A set of fusible plugs is supplied as spare one.

Additional parts belonging to the scope of supply, such as connecting coupling, fusible plugs, temperature monitoring, mounting and removal device, etc. will be stated in the order confirmation.

7.3 Transport

⚠ WARNING

Explosion hazard
For turbo couplings with housings made of aluminum alloys, there can be the risk of explosion when being transported in / through explosive atmospheres.

- In potentially explosive atmospheres it is only allowed to transport the turbo coupling in suitable packing.
- This transport packing has to meet the same minimum requirements as the protective cover.

Protective cover
→ Chapter 11

⚠ WARNING

Risk of injury
Falling parts may seriously injure or kill you.

- Secure the turbo coupling sufficiently.
- Pay attention to the center of gravity position.
- Use the provided lifting points.
- Use appropriate transportation means and slings (ropes, chains, etc.).

⚠ WARNING

Risk of crushing
Incorrect handling of the turbo coupling may cause bruising of upper and lower limbs and seriously injure persons.
- Skilled staff only is allowed to carry out transportation!

7.4 Lifting

Lifting appliances, load carrying attachments, lifting points

For weight of the Turbo coupling → cover sheet. Weights of over 100 kg will be stamped on the turbo coupling.

Observe the turbo coupling weight!

Lifting appliances (e.g. crane, high-lift truck), slings (ropes, chains, etc.) and lifting points (swivels, thread size as for item 0960, → Chapter 3.3) need to be
- checked and approved
- sufficiently dimensioned and in sound condition,
- and may only be operated by authorized and trained persons.

It is not allowed to use eyebolts!

Read the operating instructions for lifting appliances, slings (ropes, chains, etc.) and lifting points!

⚠ WARNING

Risk of injury
Damaged load carrying attachments or those with insufficient carrying capacity may break under load, with the consequence of serious or even fatal injuries!
- Check the lifting appliances and load carrying attachments for
  - sufficient carrying capacity (for weight, → cover sheet).
  - sound condition.

Fixing the turbo coupling

⚠ WARNING

Risk of injury
Falling parts may seriously injure or kill you.
- Do not walk under suspended loads.

NOTICE

Personal injury and damage to property

Improper fixing and lifting of the turbo coupling may cause personal injury and damage to property

- It is only allowed to lift the turbo coupling at the lifting points provided for this purpose (see the following pictures).
- When fastening and lifting the turbo coupling, do not damage the ribbing of the turbo coupling through lifting appliances or load carrying attachments.
- Damaged ribs may result in unbalance of the turbo coupling, thus causing uneven running of the machine.

- Screw suitable swivels (thread size as for item 0960, → Chapter 3.3) into the turbo coupling.
  Do not unscrew existing screws for this purpose; please use the threads provided.
- Fix the slings (ropes, chains, etc.).

Fig. 13

⚠ WARNING

Risk of injury

Danger to life and risk of injury caused by falling load, tilting or sliding of the turbo coupling.

- Slings (ropes, chains, etc.) must not be slung around the turbo coupling for lifting.
- Always use at least 2 slings (ropes, chains, etc.) for fixing.
- Do not walk under suspended loads.
- Observe the general guidelines for the prevention of accidents.
- Secure the turbo coupling against tilting and sliding as long as it is not mounted between the driving and driven machine.

Turning the turbo coupling

- Screw suitable swivels (thread size as for item 0960, → Chapter 3.3) into the turbo coupling.
  Do not unscrew existing screws for this purpose; please use the threads provided.
- Fix the slings (ropes, chains, etc.).

Fig. 14

⚠ WARNING

Risk of crushing

Incorrect handling of the turbo coupling may cause bruising of upper and lower limbs and seriously injure persons.

- Always use at least 2 slings (ropes, chains, etc.) for fixing.
- For turning, please use 2 slings (ropes, chains, etc.) on each side.

- On the opposite side, screw suitable swivels (thread size as for item 0960, → Chapter 3.3) into the turbo coupling.
  Do not unscrew existing screws for this purpose; please use the threads provided.
- Fix the turbo coupling to the second slings.

Fig. 15

- Align the turbo coupling horizontally using the two lifting appliances.

Fig. 16

- Carefully set the turbo coupling down on a wooden board / pallet, and secure it against tilting.
  The turbo coupling has been turned.

7.5 Storage / Packing / Preservation

As delivered condition

The as delivered condition of the Voith Turbo Couplings depends on the mode of transport and the storage period:

Condition No. 1 represents the delivered standard, for deviations, → ordering documents.

Condition No.	- Transport - Admissible storage period	Packing / Measures taken
1	- Overland / air transport - Storage up to **6 months** indoors (building)	- Device to suit transportation - Weather protection provided by the means of transport - Packed in PE foil
2	- Sea transport - Storage up to **6 months** indoors (building)	- Device to suit transportation - Sharp edges protected - Shrink-wrapped in PE foil - Desiccant according to DIN 55473 / 55474 - Water-proof cardboard or wooden box/crate - Line the inside of the crate lid with sealed ribbed PE sheets (Akylux). Put PVC foil underneath at butt joints
3	- Sea transport - Storage up to **12 months** indoors (building)	- As for Condition No. 2 - Improved preservation
4	- Sea transport - Storage up to **24 months** indoors (building)	- As for Condition No. 2 - Shrink-wrapped in aluminum sandwich foil instead of PE foil

Table 7

Opening of the packaging

Foils that have been opened for inspection upon receipt are to be re-closed airtight for further storage. Use a new desiccant, if necessary.

Disposal of the packaging

Dispose of packaging material according to the local regulations.

Notes on disposal
→ Chapter 16

Extension of storage period

The allowable storage period may be extended maximal three times according to the following descriptions. To do so, it is necessary to check the packaging and to possibly replace it.

After replacing the desiccant, close the foil packings airtight.

External preservation / re-preservation

Renew the external preservation according to the allowable storage period. Spray bright metal parts (hub bores, brake disks, etc.) with Houghton Ensis DWG2462.

Internal preservation / re-preservation:
Renew the internal preservation annually (for Condition No. 4: every 2 years). Wet the turbo coupling inside with an oil selected from the selection list.

Selection list for internal preservation agents

Producer	Designation
ARAL	Aral Oil KONIT SAE 20W-20
Mobil	Mobilarma 524 (SAE 30)
Houghton	Ensis Engine Oil 20
Wintershall	Wintershall Antikorrol 20W-20

The recommended operating fluids may also be used for preservation.

Table 8

Turbo coupling on bearings or mounted (turnable)
For re-preservation, fill the turbo coupling with oil above the axis of rotation center and rotate the turbo coupling input and output at least once.

Turbo coupling mounted (not turnable)
Fill the turbo coupling up to the upper fusible plug.

Then drain the oil and close the plug on the turbo coupling according to the specified procedure. The oil may remain in the turbo coupling for another scheduled re-preservation if it is ensured that prior to commissioning, the turbo coupling is filled with fresh oil (oil quantity according to design documents).

Protect the turbo coupling against weather and environmental influences if it is installed in a machine that is not set into operation. Renew the external re-preservation every 6 months, internal re-preservation once a year.
If necessary, clean the turbo coupling outside before performing re-preservation. Proceed for external and internal re-preservation as described above.

Outside cleaning
→ Chapter 13.1

NOTICE

Damage to property
Danger of frost
- When storing turbo couplings of type "TW" below 1 °C, drain the water.

8 Installation and alignment

⚠ WARNING

Risk of injury
Please observe, in particular, → Chapter 6 (Safety) when working on the turbo coupling!

8.1 Tools

⚠ WARNING

Explosion hazard
There is the risk of explosion when using unsuitable tools.
- When using or assembling an Ex-coupling, use only tools approved for application in potentially explosive atmospheres.
- Observe the locally applicable regulations.
- Avoid formation of sparks.

The following tools are required; check in detail with the assembly plan.

Tools:
Set of open-end wrenches
Set of ring spanners
Socket wrench box (containing hexagon spanners, ratchet, etc.)
Set of Allan keys
Screwdrivers
Torque wrenches
Hammer, rubber mallet
Set of files
Wire brush

Dimension of thread
→ Chapter 3

Measuring equipment:
Caliper gauge
External screw-type micrometer according to shaft diameter
Inside micrometer according to hub diameter

Mounting auxiliaries:
Auxiliaries for alignment of motor and gearbox (fastening screws),
e.g. shims for motor and gearbox pedestals (0.1 - 0.3 - 0.5 - 1.0 - 3.0mm).
Grinding cloth, graining 100, 240.

Lifting appliances and load carrying attachments:

For swivel sizes, → Chapter 3.3, Item 0960

Crane.
Two shackles with appropriate slings (ropes, chains, etc.) for lifting the coupling.
Observe the pictures → 8.3.1!
Adjustable chains or ropes with sufficient tensile strength (see individual weights).

8.2 Preparation

Weight of turbo coupling → cover sheet. Weights of more than 100 kg are stamped on the turbo coupling.

- Prepare suitable tools and lifting appliances.
- Observe the turbo coupling weight.
- Check the shaft journals of drive motor and driven machine for true radial running.
- Check the length of fixing bolt if the length of the shaft journal, on which the turbo coupling is mounted, was changed or not indicated to Voith Turbo.
- Clean fitting surfaces on shaft journals and hubs using emery cloth.
- Degrease flanges which will be bolted.
- Clean all preserved surfaces.
- Slightly oil the threads of bolts.
- Apply a thin film of lubricant to the shaft journals.

SAFETY INFORMATION

Use a lubricant with the following characteristics:
- Operating temperature range: -20 °C…180 °C,
- Water- and wash-out-resistant
- Protection against fretting corrosion and corrosion

Proposed lubricants:

Producer	Designation	Note
Dow Corning	Molykote G-N Plus Paste Molykote G-Rapid Plus Paste Molykote TP 42	
Fuchs	Gleitmo 815	
Liqui Moly	LM 48 Montagepaste	
Dow Corning	Molykote D 321 R Anti-Friction Coating	**Hazardous substance!** Observe the data sheet for hazardous substances!
Castrol Optimol	Molub-Alloy Paste White T Molub-Alloy Paste MP 3	

Table 9

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8.2.1 Keys

Requirement
Keys must
- have sufficient back clearance,
- be axially fixed and
- move easily in the grooves.

Marking
When using a shaft-hub connection with key, the hub is marked at the face side according to DIN ISO 8821:
- H: Half-key convention
- F: Full-key convention

This mark should comply with the mark on the shaft.

Inserting keys

SAFETY INFORMATION

Remove the key to avoid an unbalance in case of a shaft-hub connection with:
- one key
- balancing according to half-key convention
- and if the key is longer than the hub.

- For coupling hubs with a key or half-key convention, a compensation groove can be provided opposite for balancing of unbalance.

- For coupling hubs with a key and full-key convention, an identical compensation groove is provided opposite for balancing of unbalance.

- Clean the keyway.
- Insert the key straight into the keyway.
- Do not cant the key.
- If necessary, secure the inserted key against falling out.

8.3 Turbo coupling installation

Inner wheel drive:
The turbo coupling is mounted on the drive motor shaft, and then the turbo coupling pulley is coupled through belts with the pulley of the driven machine.

Outer wheel drive (special case):
The turbo coupling is mounted on the driven machine shaft, and then the turbo coupling pulley is coupled through belts with the pulley of the drive motor.

8.3.1 Mounting

Qualification
→ Chapter 6.9

⚠ WARNING

Risk of crushing, injuries by cuts
During mounting and assembly, manual turning and positioning the turbo coupling, persons could bruise fingers or cut themselves on sharp edges thus getting seriously injured!

- Sufficiently qualified, instructed and authorized persons only are allowed to mount the turbo coupling!
- Proceed carefully.

NOTICE

Damage to property
The use of unsuitable working means or methods may cause damage to property.

- Only use tools suitable for mounting:
  - Mounting and removal device (from coupling size 274) available as accessory
- For mounting, **do not** use:
  - hammers
  - welding torches
  - pressure plates

SAFETY INFORMATION

Record the mounting process
For use in areas with potentially explosive atmosphere, it is mandatory to record the mounting process of the turbo coupling.
We recommend recording the process also for all other applications.

- For required records, → Chapter 14.

For operating fluid 'water' only

For turbo couplings using water as operating fluid, the hub bore is provided with a solid film lubricant. The lubricant must not be removed!

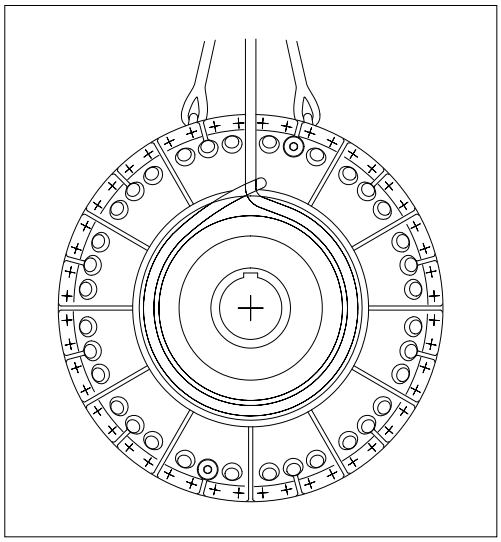

Fig. 17

- Fix the turbo coupling to a suitable lifting appliance.

⚠ WARNING

Risk of burning
The surface is hot due to getting warm.
- Do not touch the hub.

- Warm up carefully the hub to approx. 80 °C (facilitates mounting).
- Mount the turbo coupling on the relevant shaft journal.
- Insert the supplied holding disk:
  - For couplings **up to size 274** remove the circlip (item 0046) before inserting the holding disk, and then re-insert it.
  - For couplings **from size 366**, secure the holding disk against twisting by means of a roll pin (item 0070).
- Depending on the design of the shaft, ensure that the coupling hub is in contact with the shaft collar or the end face of shaft journal.

Coupling sizes 154 and 206:
- Insert a suitable and slightly oiled threaded rod in the shaft of the relevant machine.
- Mount the coupling on the shaft journal using a nut and a spacer tube.

Mounting device
→ Chapter 8.3.2

Coupling size 274 to 650:

- Slightly oil the mounting spindle.
- Mount the coupling on the shaft journal using the mounting spindle, the spacer tube and the holding disk.

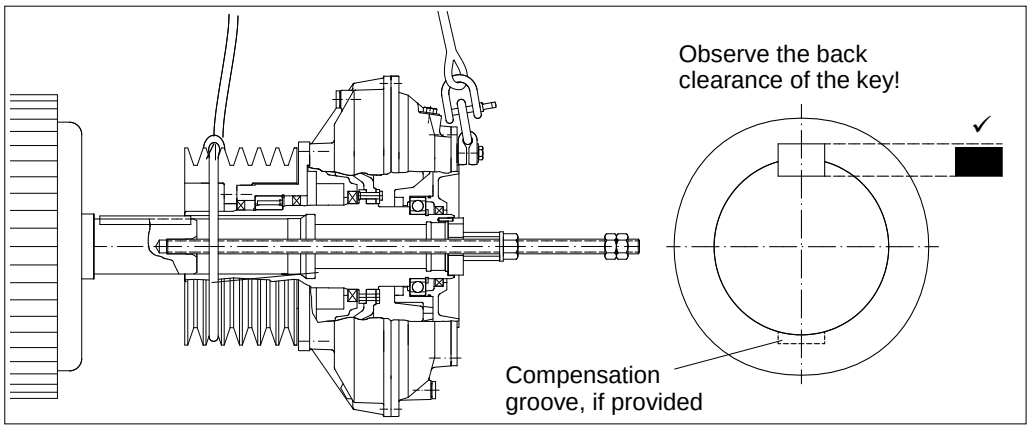

Fig. 18

Tightening torque
→ Chapter 3.1

- Check the holding disk for proper seat.
- Put the locking plate and/or lock washer underneath the fixing bolt and tighten with the specified tightening torque.
- Secure the fixing bolt with the locking plate, if necessary.

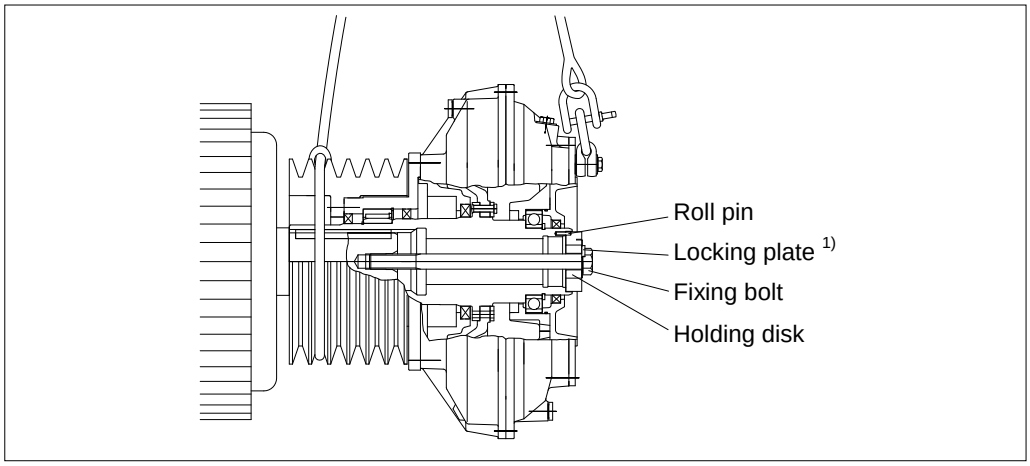

Fig. 19

1) Lock washer up to coupling size 274

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8.3.2 Mounting device

Mounting device for basic type TR or TRI turbo couplings is available at Voith Turbo.

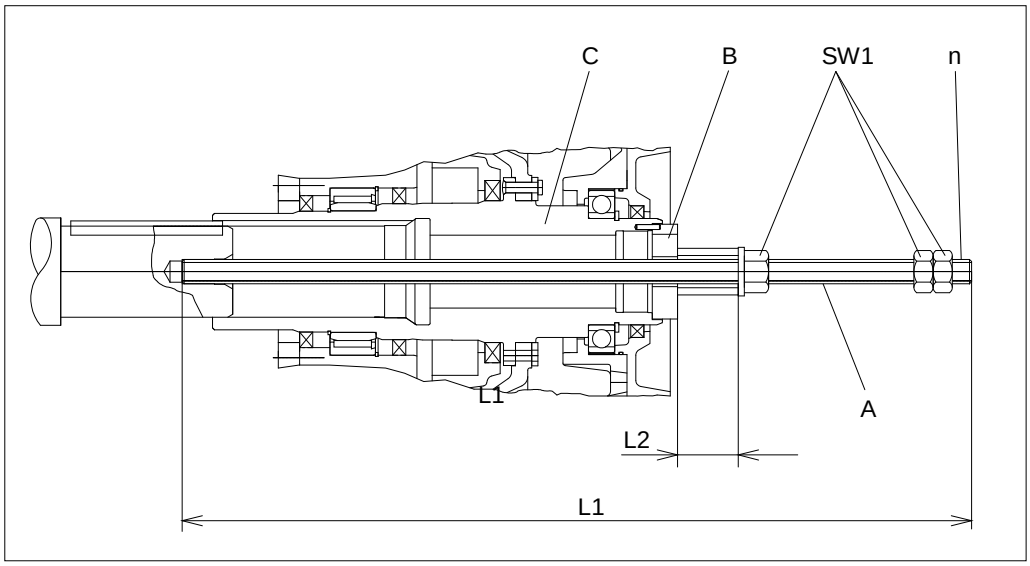

Fig. 20

A:	Mounting spindle	L1:	Total length
B:	Original holding disk	L2:	Length of spacer tube
C:	Coupling hub	n:	Dimension of mounting spindle thread
		SW1:	Width across flats

Coupling size	L1 in mm	L2 in mm	n	SW1 in mm	Article No. of mounting spindle	Article No. of spacer tube
274	520	135	M10 M12 M16 M20	17 19 24 30	TCR.10659840 TCR.10659850 TCR.10659860 TCR.10659870	TCR.10659880 TCR.10659890 TCR.10659900 TCR.10659910
366, 422, 487	780	190	M16 M20 M24 M30	24 30 36 46	TCR.11110620 TCR.10457720 TCR.10457730 TCR.10457740	TCR.11054200 TCR.11054210 TCR.10457920 TCR.11110770
562, 650	1150	245	M20 M24 M30	30 36 46	TCR.11110630 TCR.11110640 TCR.11071880	TCR.10457860 TCR.10457870 TCR.10457880

Table 10

8.4 Mounting of belts and belt tension

- Correct dimensioning of the belt drive depends on a number of factors and environmental conditions. Please observe the system and belt manufacturer's instructions!
- Please observe the system and belt manufacturer's instructions regarding mounting of belts and adjustment of belt tension.
- Belts must neither slip on startup nor during continuous operation.
- The pulleys must be in alignment during operation. Pulleys which are not in alignment may reduce the lifetime of the belts.
- Replace belts in sets.

NOTICE

Damage to property

For turbo couplings with pulleys that have no bearings (type "TR"), please observe the radial load acting on the coupling caused by the belt tension.

- It is vital to consult Voith Turbo to determine the effective diameter of the pulley as it depends on the power and speed.

- Clean the pulley grooves. The grooves must be free from burrs, grease and other impurities.
- Check the alignment of the pulleys.
- Adjust the center distance of the pulleys so that the belts can be mounted without exerting any excessive force.
- Put the belts individually on the pulleys.
- Pretension the belts properly (→ Chapter 8.4.1).
- Check the alignment of the pulleys (→ Chapter 8.5).
- Operate the system for some time, and pay attention to irregularities (noise, vibrations, excessive heating of belts, etc.).
- Then check the pretension of the belts.

Commissioning
→ Chapter 11

8.4.1 Permissible radial force

Permissible radial force F_r caused by the belt drive as a function of the lever arm h.

Basis: nominal lifetime L_{10h} = 25000 h.

When the radial force indicated in the following diagrams is reduced by approx. 20%, the bearing lifetime increases to L_{10h} = 50000 h.

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SAFETY INFORMATION

The permissible radial force only applies to the turbo coupling. Reaction forces on adjacent components have to be regarded separately.

The lever arm h is defined as distance between the connection of bearing cover / pulley and the load application point in the (V-belt) pulley center; see the following illustration.

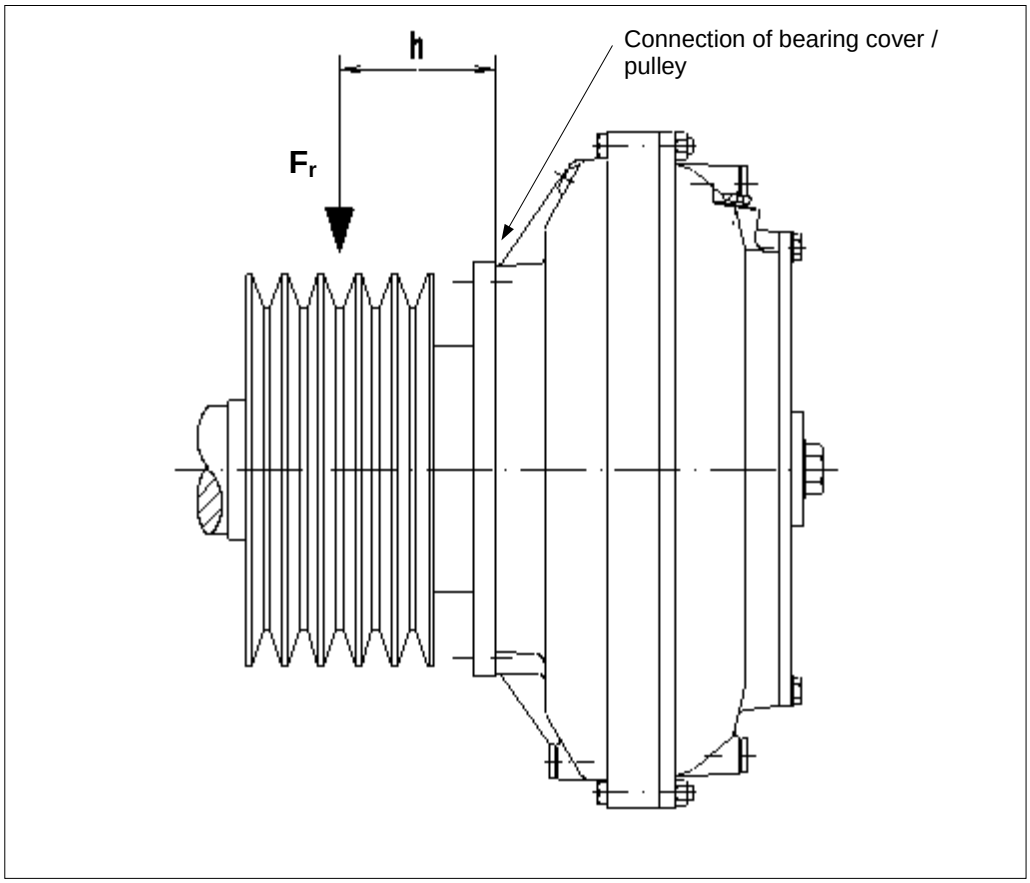

Fig. 21

NOTICE

Damage to property

If the belt pull of the system is higher than the permissible radial forces (→ diagrams):

- Please consult Voith Turbo.

Diagram for TR…, DTR… couplings

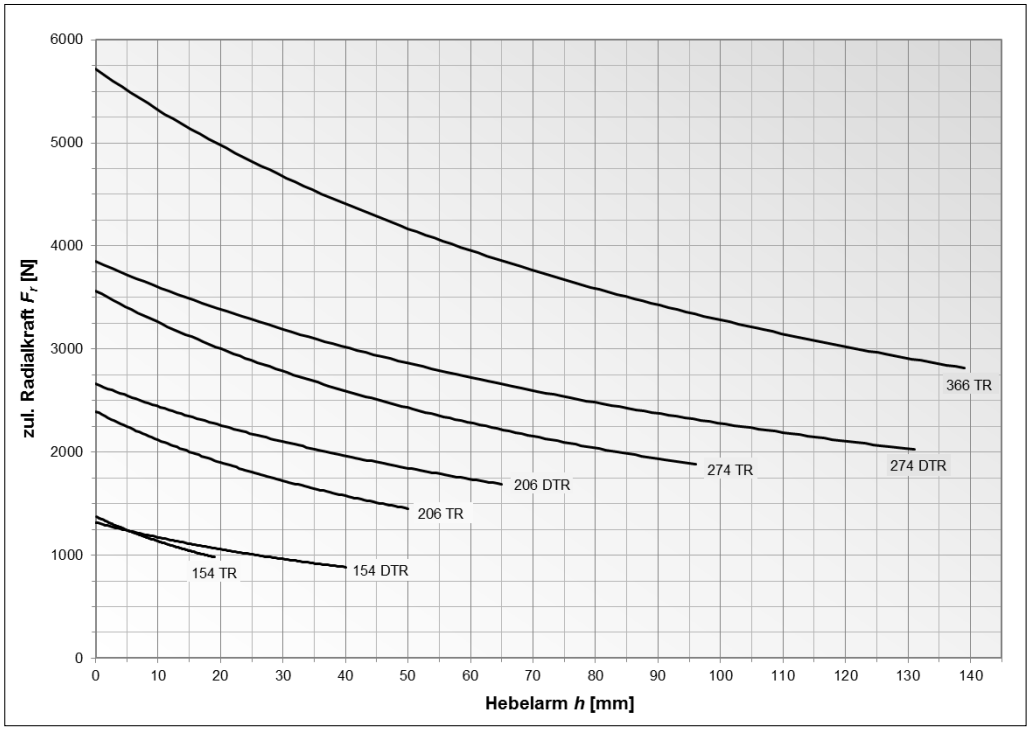

Fig. 22

Diagram for TRI…, DTRI… couplings

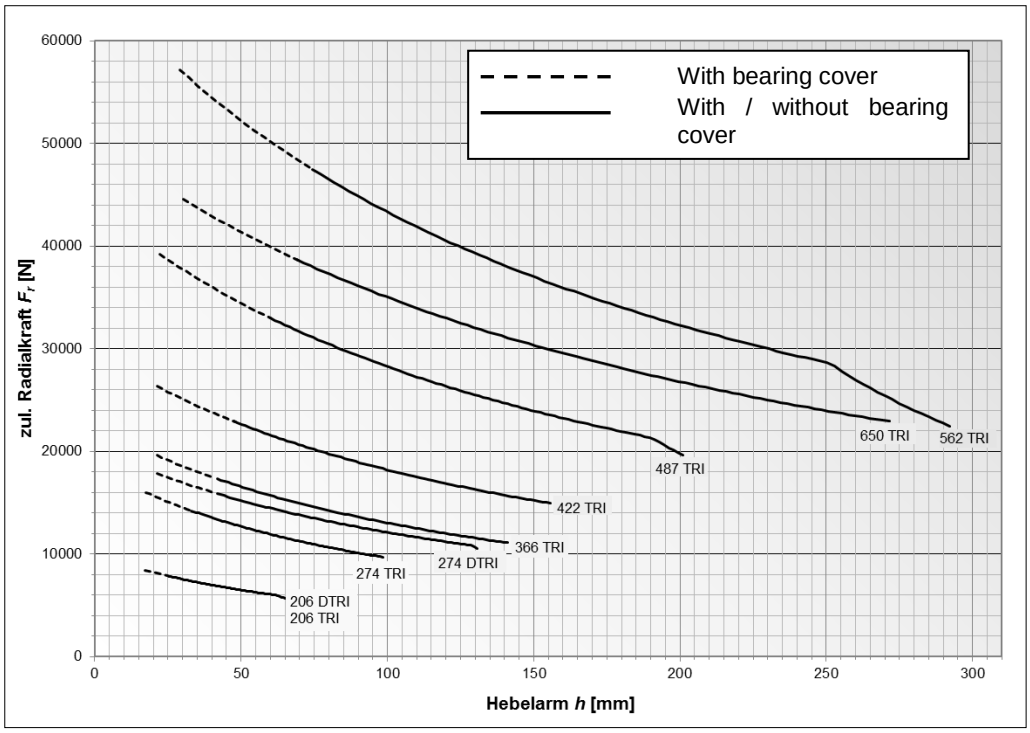

Fig. 23

8.5 Alignment

8.5.1 Alignment tolerances

⚠ WARNING

Explosion hazard
Explosion hazard due to damage to the material caused by excessive misalignments.

- Please observe the system and belt manufacturer's instructions!
- Pulleys which are not in alignment may reduce the lifetime of the system and the belts.
- In particular, observe any displacements due to changes in temperature.

SAFETY INFORMATION

Misalignments
The smaller the radial and angular displacement between turbo coupling and shaft journal

- the higher the lifetime and reliability of the machine.
- the smoother the operation.

8.5.2 Alignment

For alignment, support the motor feet using shims or foil sheets. It is advantageous to use claws for the adjusting screws on the foundation for lateral movement of the drive unit.

- Mount the turbo coupling.
- Align the input and output shafts with each other. The pulleys must be in alignment.
- Securely fix the motor and gearbox (input and output unit) to the foundation. **Stability depends on the whole unit and has to be guaranteed!**
- Tighten all screws.
- Check the alignment, and correct, if necessary.
- Fill in the assembly check report.

Protocols/reports
→ Chapter 14

9 Operating fluids

⚠ WARNING

Risk of injury
Hot operating fluid could spray off from defective components or fusible plugs, seriously injuring persons!
- Maintain the turbo coupling regularly!
- Experts only are allowed to work on the turbo coupling!

NOTICE

Damage to property
Use only the operating fluid for the turbo coupling which is indicated on the cover sheet!
- Unsuitable operating fluids may damage the turbo coupling permanently!
- Consult Voith Turbo if you want to use an operating fluid not mentioned.

NOTICE

Environmental pollution
Operating fluids are detrimental to health and may pollute the environment.
- Dispose of used operating fluid via an authorized collecting station in accordance with the national statutory provisions.
- Make sure that no operating fluid gets into the ground or water!

SAFETY INFORMATION

The values mentioned for the pour point, flash and fire point are approximate values and data originating from the oil suppliers. These may vary and Voith Turbo does not assume any warranty!
Country-specific production of the basic oil may result in different values.
- We recommend comparing the data with out specifications at any rate.
- In case of deviations, we urgently recommend consulting the respective oil producer.

9.1 Requirements to be fulfilled by the operating fluid 'mineral oil'

Requirement to	
Viscosity class	ISO VG 32 nach DIN ISO 3448 *)
Viscosity on start-up	less than 15000 mm^2/s (cSt)
Pour point	4 °C below the minimum ambient temperature or lower
Flash point	greater than 180 °C and at least 40 °C above the nominal response temperature of the fusible plugs
Resistance to aging	aging-resistant refined product
Cleanliness grade	Minimum requirements: 21/19/16 acc. to ISO 4406
Sealing compatibility	NBR (Nitril-Butadien caoutchouc) and FPM/FKM (fluor caoutchouc)
Fire point	at least 50 °C above the max. surface temperature (→ Chapter 2)

*) In special cases, ISO VG 10 - 46 can be used

Advantageous additional qualities

Check for	Abrasion of rolling elements	< 30 mg
FE 8: D7,5 / 80-80	Abrasion of cage	<100 mg

9.1.1 Usable operating fluids

- Hydraulic oils HLP 32 to DIN 51524, Part 2 *)
- Lubricating oils CLP 32 to DIN 51517, Part 3
- Steam turbine oils LTD 32 to DIN 51515, Part 1 *)
- HD engine oils SAE 10 W
- ATF type A Suffix A (TASA) and type Dexron II, IID, IIE, III, MERCON
- M 891205 and M 921253

*) In special cases, ISO VG 10 - 46 can be used

9.1.2 Operating temperature frequently above 100 °C

FPM/FKM is recommended as sealing material; when selecting the mineral oil, ensure that it provides excellent oxidation resistance.
This is ensured if original Voith sealings are used.

9.1.3 Proposed operating fluids

Producer	Designation	Pour point in °C	Flash point in °C	Fire point in °C	Class	FE8 Test fulfilled
Addinol	Hydraulic oil HLP 32	-21	195	-	HLP	-
Agip	Agip Oso 32 Agip Blasia 32	-30 -29	204 215	260 265	HLP CLP	-
Avia	Avia Fluid RSL 32 Gear RSX 32 S	-27 -33	214 210	237 231	HLP CLP	-
Castrol	Alpha EP 32 Alpha VT 32 Hyspin ZZ 32 Hyspin AWS 32	-27 -42 -30 -27	218 234 216 200	250 252 238 -	CLP CLP HLP HLP	JA JA JA -
Cepsa	HIDROSIC HLP 32 EP 125	-24 -30	204 206	316 316	HLP HLP	- -
Exxon Mobil	DTE 24 Mobilfluid 125 Mobil SHC 524	-27 -30 -54	220 225 234	- - 234	HLP CLP/HLP HLP	- - -
Fuchs	Renolin MR10 Renolin B10	-30 -24	210 205	- -	HLP HLP	- -
Klüber	Lamora HLP 32	-18	200	-	HLP	-
Kuwait Petroleum	Q8 Haydn 32 Q8 Holst 32	-30 -30	208 208	232 234	HLP HLP	- -
Ravenol	Hydr. oil TS32	-24	220	-	HLP	-
Shell	Tegula V32 Tellus S3 M 32 Tellus S4 ME 32	-33 -39 -54	211 236 240	- - -	HLP HLP HLP	JA - -
SRS – Salzbergen	Wintershall Wiolan HS 32 Wintershall Wiolan HF 32	-24 -27	220 200	240 240	HLP HLP	- JA
Texaco	Rando HD 32	-30	196	246	HLP	-
Total	Azolla ZS 32 Azolla VTR 32 Preslia GT	-27 -36 -15	210 230 225	220 - -	HLP CLPD LTD	- JA JA

Table 11

The above oil list is a recommendation and does not claim to be complete.

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9.2 Proposed operating fluids for special requirements

Operating fluid suitable for the use in the food industry

Producer	Designation	Pour point in °C	Flash point in °C	Class
Klüber	Summit HySyn FG 32	-45	>230	HLP

Table 12

Note: USDA H1-Registration satisfies the FDA requirements.

High-flash point operating fluid

Producer	Designation	Pour point in °C	Flash point in °C	Fire point in °C	Class
Fuchs	Renosafe DU 46	-33	305	354	HFD-U

Table 13

Note: Fuchs Renosafe DU 46 is a high-flash point pressure fluid of viscosity class ISO VG 46 and contains neither chlorinated hydrocarbons nor phosphorus acid ester. The density of this fluid is lower than the density of water.

Biodegradable operating fluid

Producer	Designation	Pour point in °C	Flash point in °C	Class
Fuchs	Plantosyn 3268	-36	230	HEES

Table 14

Note: Fuchs Plantosyn 3268 is a quickly biodegradable fluid of viscosity class ISO VG 46 corresponding to VDMA 24568. The water risk class is 1 and the density of this fluid is lower than the density of water.

9.3 Requirements to be fulfilled by the operating fluid 'water'

Requirement to	
Sealing compatibility	NBR (Nitril-Butadien caoutchouc)
ph value	5…8

The water used should
- to the greatest possible extent, be free from solid matters,
- contain only a low amount of salt,
- contain only a low concentration of other additives.

9.3.1 Usable operating fluids

Normally, drinking water satisfies these requirements.

10 Filling, Filling Check and Draining

The quantity and type of operating fluid used substantially determines the performance of the turbo coupling.

- A too high quantity stresses the drive motor more on start-up and results in a higher stall torque.
- A too low quantity thermally loads the turbo coupling more and results in a lower stall torque.

⚠ WARNING

Risk of burning

The turbo coupling gets warm during operation.

- Please observe, in particular, → Chapter 6 (Safety) when working on the turbo coupling!
- Start to work on the turbo coupling only after it has cooled down to below 44 °C.

⚠ CAUTION

Danger to health

Operating fluids may cause irritations or inflammation if coming into contact with skin and mucous membranes.

- Please pay attention to the information contained in the safety data sheets.
- Please always wear safety goggles when working with the operating fluid!
- Should you get any operating fluid in your eyes, rinse them immediately using plenty of water and consult a physician without delay!
- After finishing work, carefully clean your hands with soap.

Impurities in the operating fluid cause higher wear on the coupling as well as damages to bearings so that explosion protection can no longer be guaranteed.

– Make sure that any containers, funnels, filling tubes, etc. used for filling the coupling, are clean.

NOTICE

Damage to property
Non-compliance with specifications.
- Observe the quantity to be filled in that is indicated on the cover sheet of this operating manual.
- An overfilling is not permitted! This would lead to an undue high internal pressure in the coupling, which may destroy the coupling.
- An underfilling is not permitted! This will result in an improper operation of the coupling.
- Do not mix different types of operating fluids.
- Use only the operating fluid indicated on the cover sheet of this manual.
- Ensure that the original sealing rings used are in sound condition.

10.1 Filling the turbo coupling

SAFETY INFORMATION

Turbo couplings are shipped unfilled.
- If operating fluid is included in the scope of supply, it is shipped in a separate container.

10.1.1 How to fill turbo couplings installed in horizontal position, inclination < = 30°

- Turbo couplings of sizes 154 – 274:
  Turn the turbo coupling until the filler plug (item 0390) is on top.
- Turbo couplings of sizes 366 – 650:
  Turn the turbo coupling until the filler plug (item 0390) that is closest to the sight glass (item 0396) is on top.
- Remove the filler plug (item 0390).
- Remove the top fusible plug (item 0260 or item 0395) for pressure compensation.

- Fill in the specified quantity of operating fluid (→ Chapter 9) through a fine strainer
  - mesh size ≤ 25 µm for turbo couplings using oil and operating medium (type T...)
  - mesh size ≤ 50 µm for turbo couplings using water as operating medium (type TW…)

  via the opening in the filler plug (item 0390).

Operating fluid and filling volume
→ Cover sheet

- Tighten the filler plug (item 0390).
- If the coupling is provided with a sight glass (item 0396), tighten the fusible plug.

Tightening torques
→ Chapter 3.2

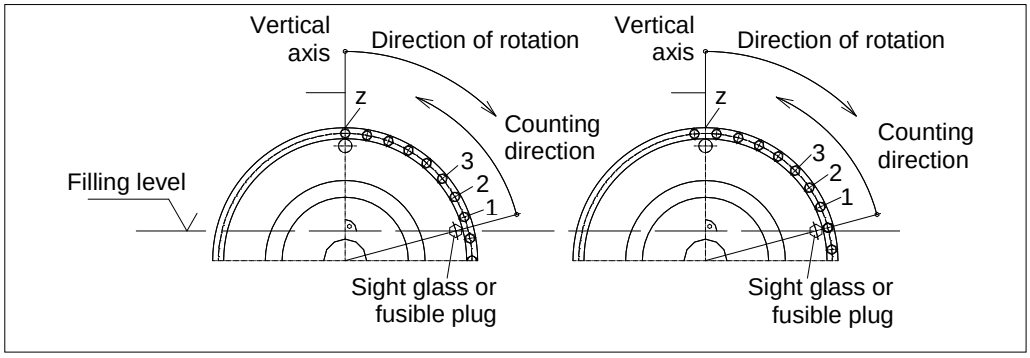

Fig. 24

- Turn the turbo coupling until the operating fluid is just visible on the sight glass (if existing) or until the operating fluid can be seen on the (still) removed fusible plug, but is not yet leaking out.
- Determine the **number z** of the flange screws from the sight glass or fusible plug to the vertical axis. The first screw is the one which center line is in counting direction, **after** the intersection line through the sight glass or the fusible plug.

z = _____

- For later filling level checks, record the **number z** of screws determined. In addition, mark the turbo coupling or the protective cover.

Assembly check report
→ Chapter 14.1 or cover sheet

- Tighten the fusible plug (items 0260 or 0395).
- Check the coupling for leaks during a test run (with protective cover!).

Tightening torques
→ Chapter 3.2

10.1.2 How to fill turbo couplings installed in vertical position, inclination > 30°

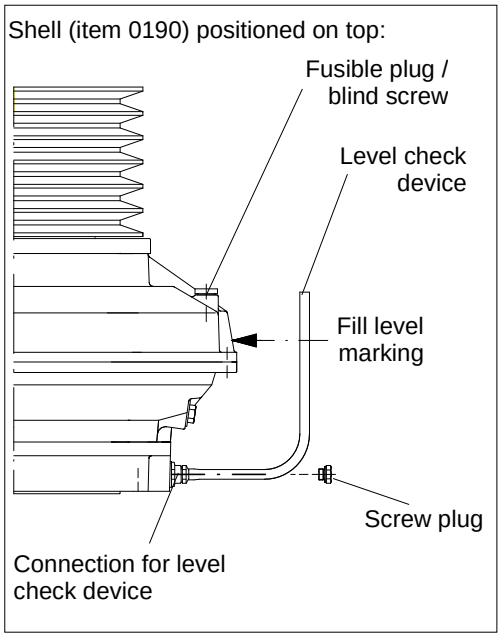

Fig. 25

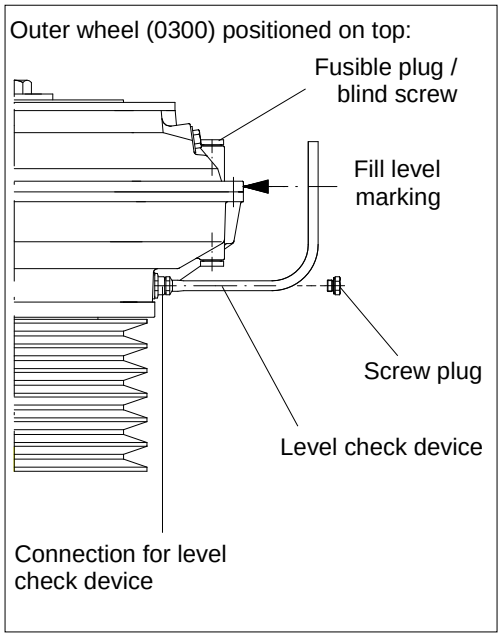

Fig. 26

- Remove two screws being on top.
  - For an **upper pulley** up to coupling size 274 these are one blind screw and one filler plug, and from coupling size 366 these are two blind screws.
  - For a **lower pulley,** up to coupling size 274, these are one fusible plug and one filler plug, for coupling sizes 366 and 422 these are two blind screws, and from coupling size 487 two fusible plugs.
- Fill in the specified quantity of operating fluid (→ Chapter 9) through a fine strainer
  - mesh size ≤ 25 µm for turbo couplings using oil as operating medium (type T…)
  - Mesh size ≤ 50 µm for turbo couplings using water as operating medium (type TW…)

  via a screw hole. The second screw hole serves for pressure compensation.
- Re-close the screw holes on top using the screws (items 0260, 0265, 0394, or 0395). Rotate the turbo coupling with nominal speed for a short time to let the operating fluid **spread evenly**.
- Remove the screws being on top once again.
- Fit the level check device to the connection provided for this purpose. (→ schematic sketch above).
- Provide the level mark on the turbo coupling or protective cover for later level checks.
- Remove the level check device.
- Tighten slackened screws.
  Tightening torque for the screw plug: **30 Nm** (M14x1.5).
- Check the coupling for leaks during a test run (with protective cover!).

The level check device is available at Voith Turbo as accessory for couplings from size 366.

Tightening torques → Chapter 3.2

10.2 Level check

You will find the **filling volume** on the **cover sheet** of this operating manual.

10.2.1 Level check for turbo couplings installed in horizontal position

SAFETY INFORMATION

From size 366, turbo couplings are equipped with a sight glass in the outer wheel.

- The sight glass position is marked by an arrow.

- If no sight glass is provided, turn the turbo coupling until a fusible plug is on top. Then unscrew and remove this fusible plug.
- Turn the turbo coupling until the operating fluid is just visible on the sight glass or until the operating fluid can be seen on the removed fusible plug, but is not yet leaking out.
- Determine the **number z** of the flange screws from the sight glass or fusible plug to the vertical axis. The first screw is the one which center line is in counting direction, **after** the intersection line through the sight glass or the fusible plug.
- Compare the number of screws determined with the number of screws determined during filling. Please observe the marking provided additionally on the coupling or guard.
- Correct the quantity filled in, if necessary.
- Re-insert and tighten any removed fusible plug.
- Check the coupling for leaks during a test run (with protective cover!).

Number z
→ Chapter 10.1

Tightening torques
→ Chapter 3.2

10.2.2 Level check for turbo couplings installed in vertical position

SAFETY INFORMATION

The level of turbo couplings **from size 366** is checked using a level check device. This level check device is available as accessory at Voith Turbo (→ schematic sketch, Chapter 10.1.2).
Turbo couplings **up to size 274** need to be drained to check the filling, and then be re-filled.

- Remove a screw being on top (fusible plug items, 0260 / 0395 or blind screw, items 0265 / 0394) for ventilation purposes.
- Remove the screw plug.
- Fit the level check device to the connection provided for this purpose.
- Compare the level with the marking that was provided when filling in.
- Correct the quantity filled in, if necessary.
- Remove the level check device.

Tightening torques
→ Chapter 3.2

- Tighten slackened screws.
  Tightening torque for the screw plug: **30 Nm** (M14x1.5).
- Check the coupling for leaks during a test run (with protective cover!).

10.3 Draining the turbo coupling

NOTICE

Notes on disposal
→ Chapter 16

Environmental pollution
Improper disposal of operating fluid may cause damages to the environment!

- On disposal, please observe the applicable laws and the producer's or supplier's instructions.
- Provide suitable containers to collect the operating fluid.

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10.3.1 Draining of turbo couplings without delay chamber installed in horizontal position

- Put a catch pan underneath.
- Turn the turbo coupling until one fusible plug it at the bottom.
- Remove this fusible plug.
- For aeration, remove one opposite fillter of fusible plug.
- The operating fluids flows out from the turbo coupling.
- Wait until no more operating fluid comes out.
- Only use original seals.
- Re-tighten all screws.

Tightening torques
→ Chapter 3.2

10.3.2 Draining of turbo couplings with delay chamber installed in horizontal position

- Put a catch pan underneath.
- Turn the turbo coupling until one fusible plug it at the bottom.
- Remove this fusible plug.
- For aeration, remove one opposite fillter of fusible plug.
- The operating fluid flows out from the working chamber of the turbo coupling.
- Wait until no more operating fluid comes out.

Coupling size 274:

- Re-tighten the fusible and filler plugs.
- Switch on the drive motor for about half a minute to maximal one minute. The operating fluid in the delay chamber drains into the working chamber.
- Remove the fusible plug again.

Coupling sizes 366 to 650:

- Remove the nozzle screw (item 0455 / 0456).
- Turn the turbo coupling until the opening of the nozzle screw is at the bottom.
- The operating fluid flows out from the delay chamber of the turbo coupling.
- Wait until no more operating fluid comes out.
- Only use original seals.
- Tighten the nozzle screw.

- Turn the turbo coupling until the opening of the fusible plug is at the bottom.
- The remaining operating fluid flows out from the working chamber of the turbo coupling.
- Wait until no more operating fluid comes out.
- Only use original seals.
- Re-tighten all screws.

Tightening torques
→ Chapter 3.2

10.3.3 How to drain turbo couplings installed in vertical position

SAFETY INFORMATION

On account of its design, the turbo coupling cannot completely drain when installed!

- Put a catch pan underneath.
- For aeration, remove one blind screw or fusible plug at the top of the coupling.

Up to coupling size 274:

- Remove one blind screw or fusible plug being at the bottom.

From coupling size 366:

- Remove the connection for the level check device.

- The operating fluids flows out from the turbo coupling.
- Wait until no more operating fluid comes out.
- Only use original seals.
- Tighten slackened screws.
  Tightening torque for the screw plug: **30 Nm** (M14x1.5).
  Tightening torque for the connection: **80 Nm** (M24x1.5).

Tightening torques
→ Chapter 3.2

11 Commissioning

⚠ WARNING

Risk of injury
Please observe, in particular, → Chapter 6 (Safety) when working on the turbo coupling!

- A commissioning not performed properly could cause injury to persons, or harm to property and the environment!
- Experts only are allowed to perform commissioning, in particular, first starting of the turbo coupling!
- Secure the machine against unintentional switching on!

Explosion hazard

Marking
→ Chapter 6.2

- Please check with reference to the marking whether the turbo coupling is approved for use in potentially explosive atmospheres.
- Provide the turbo coupling with a protective cover (e.g. perforated sheet, size of holes approx. 10 – 12 mm). This protective cover has to
  - prevent intrusion of damaging foreign particles (stones, corrosive steels, etc.).
  - withstand expected impacts without any major damages, thus preventing contact of the turbo coupling with the protective cover. Especially turbo couplings with outer parts made of aluminum must not get in contact with corrosive steel or iron.
  - collect spraying solder of fusible plugs.
  - collect any operating fluid leaking out to prevent contact with parts (motor, belt) that might ignite or catch fire.
  - provide sufficient ventilation to maintain the maximum surface temperature specified.
    A perforated sheet with 65% hole cross section enclosing the coupling on all sides does not reduce the ventilation (consult Voith Turbo, if necessary).
  - guarantee safety distances to prevent hazard zones from being reached (DIN EN ISO 13857).

  For constructional proposals for protective covers, please contact Voith Turbo.
- The turbo coupling is not equipped with insulated ball and roller bearings! The passage of current and stray currents may come from connected machines (e.g. VFD motor).
- In order to avoid electrostatic charging, it is not allowed to install the turbo coupling with an insulation on both sides.
- Provide an equipotential bonding between the input and output end.
- Provide machines on which overspeed is possible, with a device preventing reliably overspeed (e.g. brake or backstop).

⚠ WARNING

Hazard by being pulled in

Slack clothing, long hair, necklaces, rings or loose parts may get caught and be drawn in or wound up causing serious injuries or damage to the turbo coupling and the environment.

- Only wear close-fitting clothes when working!
- Cover long hair with a hair net!
- Do not wear any jewelry (e.g. necklaces, rings, etc.)!
- Never operate the turbo coupling without protective cover!
- Fix a protective cover (e.g. plate with a hole size of about 10-12 mm) around the belt drive and exposed shaft parts.

Technical data
→ Chapter 2

⚠ WARNING

Explosion hazard

Explosion hazard due to frictional heat or overheating.

- Check the belt tension and readjust, if necessary.
- If you use a BTS-Ex to limit the maximum surface temperature, make sure not to exceed the maximum permissible temperature of the turbo coupling when switching on the motor.

NOTICE

Damage to property

Never operate the turbo coupling without operating fluid.

- On account of the type of bearings used for standard turbo couplings of sizes 366, 422, 487, 562, 650, at least one standstill within three months is required.
- On account of the type of bearings used for the standard turbo couplings of sizes 154, 206 and 274, at least one standstill per week is required.

Information with regard to commissioning

- The turbo coupling may be used for any direction of rotation.
- The direction of rotation of the driven machine may be specified! The direction of rotation of the motor must be in accordance with the specified direction of rotation of the driven machine!
- If the motor is started with star/delta connection, switch over from star to delta after 2...5 seconds at the latest.
- In case of a multi-motor drive, you should determine the load of the individual motors. Great differences regarding motor load may be balanced by an appropriate adjustment of the respective coupling filling volumes. **However, do not exceed the maximum permissible coupling filling level!**

Operating fluid and filling volume
→ Cover sheet

Commissioning

- Perform all commissioning work according to the commissioning report.
  Pay special attention to:
  - a normal machine operation
  - normal noise
- Record the commissioning process.

Commissioning report
→ Chapter 14.2

12 Operation

⚠ WARNING

Risk of injury
Please observe, in particular, → Chapter 6 (Safety) when working on the turbo coupling!

- An operation presupposes the successful commissioning according to → Chapter 11.

Information with regard to operation

NOTICE

Damage to property
Never operate the turbo coupling without operating fluid.

- On account of the type of bearings used for standard turbo couplings of sizes 366, 422, 487, 562, 650, at least one standstill within three months is required.
- On account of the type of bearings used for the standard turbo couplings of sizes 154, 206 and 274, at least one standstill per week is required.

During normal operation, no operator actions on the turbo coupling are required.

Perform the necessary maintenance work time-/operating time-based according to → Chapter 13.

If malfunctions occur, eliminate such according to → Chapter 17.

13 Maintenance, Servicing

Definition of the maintenance work described in the following (as per IEC 60079):

Maintenance and Servicing: A combination of all activities conducted in order to maintain an object in a condition or to re-store it to such a condition which meets the requirements of the respective specification and ensures performance of the required functions.

Inspection: An activity involving the thorough examination of an object in order to provide a reliable statement as to the condition of said object, performed without disassembly or, if necessary, with only partial disassembly, supplemented by measures such as the taking of measurements.

Visual inspection: A visual inspection is an inspection in which visible defects, such as missing screws or bolts, are identified without the use of access equipment or tools.

Close-up inspection: An inspection in which, in addition to the areas covered by the visual inspection, defects such as loose bolts, that can only be detected by using access equipment, e.g. mobile stair steps (if required) and tools are identified. For close-up inspections, usually a housing does not need to be opened or the power to the equipment be cut off.

Detailed inspection: An inspection in which, in addition to the areas covered by the close-up inspection, defects such as loose connections, that can only be detected by opening housings and/or using tools and test equipment (if required) are identified.

⚠ WARNING

Risk of injury
Please observe, in particular, → Chapter 6 (Safety) when working on the turbo coupling!

- Please always keep access paths free to the turbo coupling!

Qualification
→ Chapter 6.9

- Skilled and authorized persons only are allowed to carry out maintenance and repair work! Qualification is ensured by performing training and giving instructions on the turbo coupling.
- Possible consequences of improper servicing and maintenance could be death, serious or minor injuries, damage to property and harm to the environment.
- Switch off the unit in which the turbo coupling is installed and secure the switch against inadvertent switch-on.
- For all work performed on the turbo coupling ensure that both the drive motor and the driven machine have stopped running and that a re-start is absolutely impossible!
- Components may only be replaced by original spare parts.

Re-mount all protective covers and safety devices in their original position immediately after completion of the servicing and maintenance work. Check them for proper functioning.

Maintenance schedule:

Time	Maintenance work
Routine inspection after 500 operating hours, every 3 months at the latest.	Inspect the machine for irredularities visual inspection: for leaks, noise, vibrations). Check the foundation bolts of the machine, and if necessary, re-tighten them with the specified torque.
3 months after commissioning, at the latest, then every year	Check the electrical system for sound condition if temperature monitoring is required in Chapter 2 (detailed inspection).
When mineral oil is used as operating fluid: After every 15000 operating hous	- change the operating fluid or check it for aging and - determine the remaining service life (see records → Chapter 14)! Consult the operating fluid supplier with regard to the permissible values (see Chapters 9 and 10).

Time	Maintenance work
On response of a fusible plug	Replace all fusible plugs and change the operating fluid (→ Chapter 13.4). Check the operating conditions (→ Chapter 2). Check the devices provided for temperature monitoring (see Chapter 19: MTS, BTS(ex), BTM).
In case of leaks	On the occasion of an overhaul of the turbo coupling, have shaft sealing rings, sealing rings and flat seals replaced by skilled persons authorized by Voith.
In case of noise, vibrations	Have the cause determined and eliminated by skilled persons authorized by Voith.
In case of impurities	Cleaning (→ Chapter 13.1).
Upon the system and belt manufacturer's request	Check the belt drive (→ Chapter 13.3).

Table 15

- Carry out any maintenance work and routine inspections according to the report.
- Record the maintenance work carried out.

Report samples
→ Chapter 14.3

For explosion-proof turbo couplings, the following maintenance work needs to be carried out in addition:

Maintenance intervals	Maintenance work
In case of impurities or dusting: Clean the turbo coupling when used in potentially explosive atmospheres in regular intervals. The intervals are specified by the operator according to the environmental impact to which the equipment is exposed on the jobsite, e.g. in case of a dust accumulation of approx. 0.2 ... 0.5 mm or more.	Cleaning (→ Chapter 13.1).
Maintenance interval → Chapter 2	- Replacement of ball and roller bearings (→ Chapter 13.2.3). - Re-lubricate the bearings underneath the pulleys (please call for a Voith service engineer).

Table 16

WARNING

Explosion hazard
Explosion hazard due to maintenance work not performed according to schedule.
It is vital to carry out all maintenance work according to the schedule in order to guarantee proper operation within the meaning of explosion-protection.

- Immediately remove any combustible layers of dust on the turbo couplings.
- To ensure a good aeration of the turbo coupling, it is vital to check and clean the protective cover in regular intervals.
- If a fusible plug has responded, immediately cover or close the opening that occurred in order to prevent the ingress of combustible dust into the turbo coupling.

13.1 Outside cleaning

NOTICE

Damage to property
Damage to the turbo coupling due to an improper, unsuitable outside cleaning.

- Please ensure that the cleaning agent is compatible with the sealing materials used, NBR and FPM/FKM!
- Do not use high-pressure cleaning equipment!
- Be careful with gaskets. Do not apply a water and compressed-air jet.

- Clean the turbo coupling with a grease solvent, as and when required.

13.2 Bearings

13.2.1 Bearing lubrication when mineral oil is used as operating fluid

Please observe the following in order to guarantee lubrication of the bearings:

NOTICE

Damage to property
Danger of bearing damage.
- On account of the type of bearings used for standard turbo couplings of sizes 366, 422, 487, 562 and 650, at least one standstill is required within three months.
- On account of the type of bearings used for the standard turbo couplings of sizes 154, 206 and 274, at least one standstill is required once a week.

SAFETY INFORMATION

Lifetime grease filling
- Turbo couplings can be provided with special bearings that allow continuous operation and contain a lifetime grease filling.

13.2.2 Bearing lubrication when water is used as operating fluid

The turbo coupling bearings are filled with lifetime grease when water is used as operating fluid. Re-lubrication is not necessary.

13.2.3 Replacement of bearings / re-lubrication

SAFETY INFORMATION

On the occasion of an overhaul of the turbo couplings, have the bearings replaced / re-lubricated by skilled persons authorized by Voith.

Replacement interval of ball and roller bearings
→ Chapter 2

13.3 Belts

- Check the pretension of the belts in regular intervals.
- Replace any worn belts in sets.

SAFETY INFORMATION

Unusually quickly worn belts may be a sign of improper alignment!

13.4 Fusible plugs

Nominal response temperature of fusible plugs
→ Cover sheet

– The fusible plugs protect the turbo coupling against damage due to thermal overload.
– When the nominal response temperature is reached, the solder core of the fusible plugs melts and the operating fluid leaks out.

Fusible plugs are identified by
– the engraved nominal response temperature in °C,
– a color coding:

Nominal response temperature	Color coding	Operating fluid Oil	Operating fluid Water
95 °C	without (tinned)	X	X
110 °C	yellow	X	X
125 °C	brown	X	-
140 °C	red	X	-
160 °C	green	X	-
180 °C	blue	X	-

Table 17

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SAFETY INFORMATION

- Use only original fusible plugs SSS-X with the required nominal response temperature!
- Do not replace any fusible plugs by blind screws!
- Do not alter the arrangement of the fusible plugs.
- When water is used as operating fluid, only fusible plugs with a max. nominal response temperature of 110 °C are permitted!
- Never operate the turbo coupling without fusible plugs!

Design
→ Chapter 2

SAFETY INFORMATION

Switching elements, unbalance

- There is a MTS and/or BTS switching element or a blind screw opposite the sight glass (position is marked by an arrow).
- Insert a weight-tolerated BTM blind screw opposite the BTM switching element. Do not insert the BTM switching element opposite a sight glass, blind screw or fusible plug having a lighter weight.

On response of a fusible plug:

- Replace all fusible plugs.
- Change the operating fluid.

Tightening torques
→ Chapter 3.2

13.4.1 Arrangement of fusible plugs

Number and position of fusible plugs, blind screws and switching elements for inner wheel drive (outer wheel drive):

	Shell (item 0190)			
Coupling size and type	**Fusible plug Item 0260**		**Blind screw item 0265**	
154 TR	-	(-)	-	(-)
154 DTR	-	(-)	-	(-)
206 TR / TRI	1	(1)	-	(-)
206 DTR / DTRI	-	(-)	-	(-)
274 TR	1	(1)	-	(-)
274 TRI	-	(-)	-	(1)
274 DTR / DTRI	-	(-)	-	(-)
366 TR / TRI	-	(-)	2	(2)
422 TRI	-	(-)	2	(2)
487 TRI	-	(-)	2	(2)
562 TRI	-	(-)	2	(2)
650 TRI	-	(-)	3	(3)

	Outer wheel (item 0300)						
Coupling size and type	**Fusible plug item 0395**		**Blind screw item 0394**		**MTS, BTS, BTM [3]- switching element [2]**		**Sight glass [4] item 0396**
154 TR	1 [1]	(1)	2	(-)	-	(-)	-
154 DTR	2 [1]	(1)	2	(1)	1	(-)	-
206 TR / TRI	-	(-)	1	(1)	-	(-)	-
206 DTR / DTRI	2 [1]	(1)	2	(1)	1	(-)	-
274 TR	-	(-)	1	(1)	-	(-)	-
274 TRI	1 [1]	(1)	2	(-)	1	(-)	-
274 DTR / DTRI	2 [1]	(1)	2	(1)	1	(-)	-
366 TR / TRI	2	(2)	3	(3)	1	(1)	1
422 TRI	4	(4)	3	(3)	1	(1)	1
487 TRI	4	(4)	3	(3)	1	(1)	1
562 TRI	4	(4)	3	(3)	1	(1)	1
650 TRI	2	(2)	3	(3)	1	(1)	1

Table 18

1) Radial arrangement
2) The MTS, BTS or BTM switching element is inserted instead of a blind screw.
3) The blind screw opposite the BTM has to be replaced by the counterweight (the BTM is not approved for use in potentially explosive atmospheres (→ Chapter 19.3).
4) Position is marked by an arrow.

14 Assembly Check, Commissioning and Maintenance Report

⚠ WARNING

Risk of injury
Please observe, in particular, → Chapter 6 (Safety) when working on the turbo coupling!

Document all assembly work performed in the assembly check report (→ Chapter 14.1).
Document the commissioning process in the commissioning report (→ Chapter 14.2).

SAFETY INFORMATION

Document all **maintenance work** performed on the
- Turbo coupling
  in the maintenance report for the general maintenance (→ Chapter 14.3).

Use copies of the samples, if necessary.

14.1 Assembly check report

Confirm the check or performance of the work by an "**X**" and/or enter the respective values.

Voith turbo coupling

Size / type (→ Chapter 18):	
Serial No. (→ Chapter 18):	

Operating fluid of turbo coupling

Filling:		l
Producer:		
Designation:		

Turbo coupling approved for potentially explosive atmospheres: yes ☐ / no ☐

Motor

Serial No.		
Input speed		rpm
Rated power		kW

Assembly work was performed:

Name:	
Date:	
Signature:	

Driven machine / gearbox

Serial No.	

The following applies to the table below:
The shaft is the input shaft, if the coupling is driven by the shaft.
The shaft is the output shaft, if the coupling is driven by belts.

Mounting - check step	**Explanations**	**Completion notice / dimensions**
Check of fixing bolt length (item 0050)	→ order documents	☐
Measurement of radial runout of the shaft.	Manufacturer's specification	Desired: [mm] ACTUAL: [mm]
Measurement of diameter of the pulley.	Chapter 2	Desired: [mm] ACTUAL: [mm]
Measurement of diameter [1) of shaft].	Chapter 2	Desired: [mm] ACTUAL: [mm]
Check of back clearance of key (input side).	Chapter 8.2	☐
Check of back clearance of key (output side).	Chapter 8.2	☐
Key moves easily in the keyway of the input hub.	Chapter 8.2	☐
Key moves easily in the keyway of the output hub	Chapter 8.2	☐
Check of shaft-hub connection. Balancing method corresponds to DIN ISO 8821 and ISO 8821.	Chapter 8.2	Method applied: ☐ Half-key convention ☐ Full-key convention
Check of connection: bearing cover (item 0950) - pulley (item 0620).	Chapter 8.2	☐
Check of alignment of pulley. Alignment tolerances comply with the specifications of the belt manufacturer.	Manufacturer's specifications	☐
Cleaning of shaft and hub, and application of lubricant.	Chapter 8.2	☐

1) Dimensions of shaft and/or hub to be connected by means of the shaft-hub connection.

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Mounting - check step	**Explanations**	**Completion notice / dimensions**
Fixing bolt (item 0050) was tightened with torque.	Chapter 3.1	☐
Foundation bolts were tightened.	Chapter 8.5.2	☐
Mounting of coupling Screws (item 0960) were tightened.	Chapter 3.3	☐
MTS / BTS / BTM (if required) Check of installation position according to operating manual.	Chapter 2 Chapter 19	☐
MTS / BTS / BTM (if required) Check of electrical functioning.	Chapter 2 Chapter 19	☐
A guard was mounted as recommended.	Chapter 11	☐
Equipotential bonding between input and output was realized.	Chapter 11	☐
Operating fluid was filled into the coupling.	Chapter 10	☐
For **horizontally** installed turbo couplings only: Number of screws "z" for filling was determined.	Chapter 10.1	**z** = screws
For **vertically** installed turbo couplings only: Level check device was used. Fill level was marked on the coupling.	Chapter 10.1.2	☐
Alignment of turbo coupling was checked.	Chapter 8.5.1	☐
Radial running of motor shaft is OK		☐
Displacements during operation (are to be indicated by the machine manufacturer): Observe displacements resulting from an increase in temperature or from mechanical movements. Enter only those values that change the above-ascertained alignment values.		

14.2 Commissioning report

Confirm the check or performance of the work by an "**X**" and/or enter the respective values.

Voith turbo coupling

Size / type (→ Chapter 18):	
Serial No. (→ Chapter 18):	
Turbo coupling approved for potentially explosive atmospheres	yes ☐ / no ☐

Commissioning was performed by:

after	Oper. hrs.
Name:	
Date:	
Signature:	

Commissioning - check step	**Explanations**	**Completion notice**
Checks prior to switching on the drive motor:		
Assembly/mounting check steps were carried out. Fill in the assembly check report.	Chapter 14.1	☐
Applies only to turbo couplings that are used in potentially explosive atmospheres: Check according to the marking whether the turbo coupling is approved for the use in potentially explosive atmospheres.	Chapter 6.2	☐
For **horizontally** installed turbo couplings only: Check the filling level / determine the number of screws "**Z**" for filling.	Chapter 10.2	☐ / **z** = screws
For **vertically** installed turbo couplings only: Use the fill level check device. Compare the fill level with the previously made fill level marking.	Chapter 10.2.2	☐ / Difference = mm
Fix a guard over the turbo coupling (for design, → Chapter 11).	Chapter 11	☐
Check whether the machine was earthed with a grounding cable (16mm²).		☐
Applies only to installations where overspeed is possible: Provide the unit with a device that reliably prevents overspeeds (e.g. brake or backstop).		☐
Determine the next standstill of coupling for maintenance services.	Chapter 13	☐
Check the belt tension, and readjust, if necessary. Observe the system and belt manufacturer's instructions.	Chapter 8.4 Chapter 8.4.1	
Applies only when a BTS-Ex is used as temperature monitoring system: Make sure that the maximum permissible turbo coupling temperature is not exceeded when switching on the motor!	Chapter 2	☐
Check of foundation bolts.		☐

Commissioning - check step	Explanations	Completion notice
Checks during the test run:		
Motor run-up is normal.		☐
Turbo coupling is tight. Check of floor and environment for oil moistening, oil did not leak out.		☐
Machine operation is normal.		☐
Noises are normal.		☐
Checks after switching off the drive motor:		
Turbo coupling is tight. Check of floor and environment for oil moistening, oil did not leak out.		☐
Check of switch units for temperature monitoring [1], if applicable:		
Performance of a visual inspection.	[1]	☐
Removal of dust deposits.	[1]	☐
Check of electrical system.	[1]	☐

1) See separate operating manual / → Chapter 19

14.3 Maintenance report for general maintenance

Confirm the check or performance of the work by an "**X**" and/or enter the respective values.

Voith turbo coupling

Size / type (→ Chapter 18):	
Serial No. (→ Chapter 18):	

Turbo coupling approved for potentially explosive atmospheres: yes ☐ / no ☐

The maintenance work was performed by:

after	Oper. hrs.
Name:	
Date:	
Signature:	

Maintenance - check step	**Explanations**	**Completion notice**
Check for irregularities (every **500 h**, every **3 months** at the latest)		
- Turbo coupling is tight. Check of floor and environment for oil moistening, oil did not leak out.		☐
- Machine operation is normal.		☐
- Noises are normal		☐
- Check of protective cover.	Chapter 11	☐
- Check of foundation bolts.		☐
Check of switch units for temperature monitoring [1)], if applicable (**every 3 months**)		
- Performance of a visual inspection.	[1)]	☐
- Removal of dust deposits.	[1)]	☐
- Check of electrical system (after **3 months**, then **every year).**	[1)]	☐
Operating fluid (**every 15000 h**)		
- Check of operating fluid.		☐
- Determination of remaining operating time.		☐ / hours
- Change of operating fluid.	Chapter 10	☐
Ball and roller bearings (for the intervals, → Chapter 2)		
- Replacement of ball and roller bearings.	Chapter 13.2.3	☐
- Re-lubrication of bearings underneath the pulley.	Ask for a Voith service engineer.	☐
Cleaning of turbo coupling (**after every contamination**)		
- Cleaning was performed.	Chapter 13.1	☐

1) See separate operating manual / → Chapter 19

15 Disassembly of Turbo Coupling

⚠ WARNING

Risk of injury
Please observe, in particular, → Chapter 6 (Safety) when working on the turbo coupling!

- Before beginning to work on the turbo coupling, switch off the main switch of the drive motor and secure it against being switched on!
- For all work performed on the turbo coupling ensure that both the drive motor and the driven machine have stopped running and that a re-start is absolutely impossible!

15.1 Preparation

- Prepare suitable tools and lifting appliances.
  Observe the turbo coupling weight!
- Remove the belts.

Weight of turbo coupling → cover sheet. Weights of more than 100 kg are stamped on the turbo coupling.

⚠ WARNING

Risk of injury
Damaged load carrying attachments or those with insufficient carrying capacity may break under load, with the consequence of serious or even fatal injuries!

- Check the lifting appliances and load carrying attachments for
  - sufficient carrying capacity (for weight, → cover sheet),
  - sound condition.

⚠ WARNING

Risk of injury
Falling parts may seriously injure or kill you.

- Do not walk under suspended loads.

- Fix the turbo coupling to a suitable lifting appliance.

Lifting appliances → Chapter 7.4

15.2 Disassembly of basic type TR(I) turbo coupling

NOTICE

Damage to property
Turbo coupling may be damaged due to improper use of the removal device.
- It is not allowed to use an impact screwdriver to apply the torque.

Removal device
→ Chapter 15.2.1

SAFETY INFORMATION

From **size 274,**
- the use of a mounting and removal device is recommended and can be procured as accessory from Voith Turbo.
- For holding the motor shaft, we recommend using the **spanner wrench** (→ schematic sketch below) which is available as special accessory from Voith Turbo.

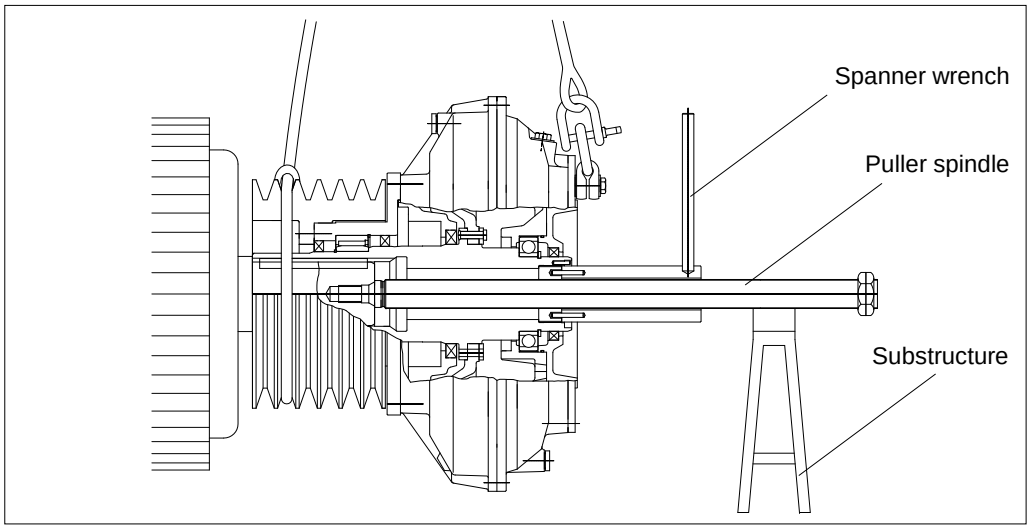

Fig. 27

- **Coupling sizes 154 and 206:**
  - Remove the fixing bolt.
  - Screw a suitable and slightly oiled screw into the internal thread of the holding disk and remove the turbo coupling.

- **Coupling size 274:**
  - Remove the circlip, fixing bolt and holding disk.
  - Put the threaded ring (item G), supplied together with the removal device, into the coupling hub.
  - Secure the threaded ring using the circlip.
  - Apply lubricant to the thread of the puller spindle.
  - Screw the puller spindle into the internal thread of the threaded ring.
  - Support the puller spindle by a substructure.
  - Remove the turbo coupling using the puller spindle.

Lubricant
→ Chapter 8.2

- **Coupling sizes 366 to 650:**
  - Remove the fixing bolt and holding disk.
  - Screw the threaded ring (item G), supplied together with the removal device, into the coupling hub.
  - Apply lubricant to the thread of the puller spindle.
  - Screw the puller spindle into the internal thread of the threaded ring.
  - Support the puller spindle by a substructure.
  - Remove the turbo coupling using the puller spindle.

Lubricant
→ Chapter 8.2

15.2.1 Removal device

Removal device available at Voith Turbo for turbo couplings of basic type TR(I):

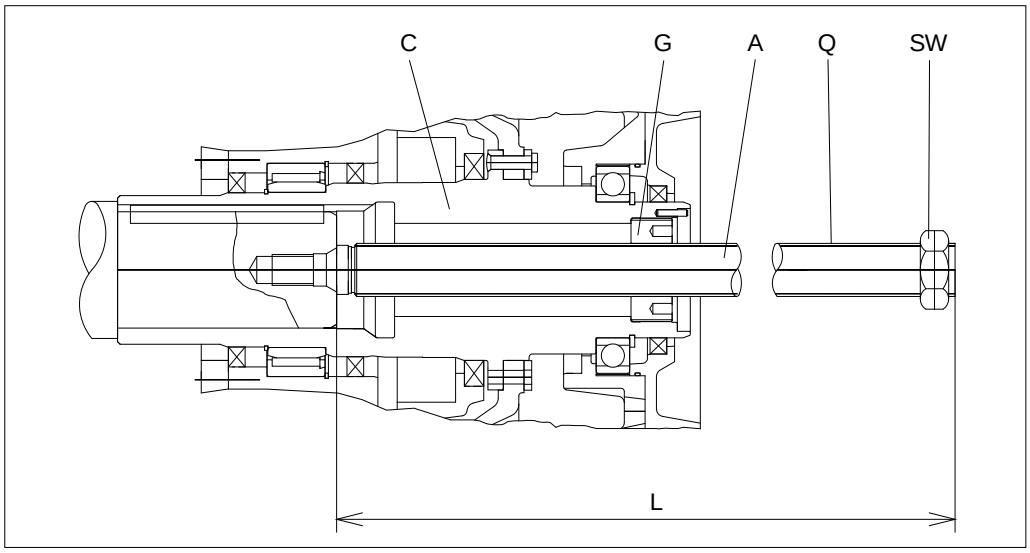

Fig. 28

A:	Puller spindle	L:	Total length
C:	Coupling hub	Q:	Dimension of thread of puller spindle
G:	Threaded ring	SW	Width across flats

Coupling sizes	L in mm	Q in inches	SW in mm	Article No. of puller spindle	Hub bore in mm
274	360	G ½	34	TCR.11947150	For hub bore Ø 22-26
274	360	G ¾	36	TCR.10657260	For hub bore > Ø 26
366	520	G 1	46	TCR.11071730	-
422	700	G 1 ¼	55	TCR.11071760	-
487	700	G 1 ¼	55	TCR.11071790	-
562	910	G 1 ½	60	TCR.11071800	-
650	910	G 1 ½	60	TCR.11071830	-

Table 19

15.3 Reassembly of turbo coupling

Procedure for reassembly of the turbo coupling is described in → Chapter 8.3.

16 Disposal

Disposal of the packaging
Dispose of packaging material according to the local regulations.

How to dispose of operating fluids
On disposal, please observe the applicable laws and the producer's or supplier's instructions.

How to dispose of the turbo coupling
Clean the turbo coupling carefully to ensure a purity of material.
Dismantle the turbo coupling, if necessary.
Dispose of the turbo coupling according to the local regulations.

For special information on the disposal of the substances and materials used, please see the following table:

	Kind of disposal		
Material / substance	**Reuse**	**Residual waste**	**Special waste**
Metals	x	-	-
Cables	x	-	-
Seals	-	x	-
Plastics	x [1)]	(x)	-
Operating media	-	-	x [1), 2)]
Packaging	x	-	-

Table 20

1) If possible
2) Disposal according to the safety data sheet or the manufacturer's instructions

17 Malfunctions - Remedial Actions

WARNING

Risk of injury
Please observe, in particular, → Chapter 6 (Safety) when working on the turbo coupling!

The following table is intended to help finding the cause of malfunctions or problems quickly and to take remedial action, if necessary.

Malfunction	Possible cause(s)	Remedial action	See
Starting behavior of driven machine is not as expected.	Turbo coupling is not filled with the correct quantity of operating fluid.	Check and correct the quantity filled in.	Chapter 10.1
	The operating conditions have changed.	Please consult Voith Turbo.	Chapter 18
Driven machine does not reach the specified speed.	Driven machine is blocked or overloaded.	Eliminate blocking or the cause of overload.	
	Turbo coupling is not filled with the correct quantity of operating fluid.	Check and correct the quantity filled in.	Chapter 10.1
	The belts are damaged and/or the belt tension is incorrect.	Replace the belts in sets and/or apply the correct tension to the belts.	Observe the belt manufacturer's instructions.
Drive motor does not reach normal operation within the expected time.	Changeover from star to delta too late.	Changeover from star to delta should be made after 2...5s at the latest.	
	Drive motor is electrically or mechanically not in order.	Have the drive motor checked by authorized personnel.	

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Malfunction	Possible cause(s)	Remedial action	See
Operating fluid leaks out of the turbo coupling.	A fusible plug responded due to overload (excess temperature).	Clarify the cause for the overload. Replace **all** fusible plugs and change the operating fluid.	Chapter 13.4
	The turbo coupling is leaky.	Eliminate the leak, check, in particular, tightening torques and seal rings of fusible and filler plugs as well as sight glasses and, if necessary, check the switching element of the thermal switch unit. If the leak cannot be eliminated, please consult Voith Turbo.	Chapter 3 Chapter 18
An existing thermal monitoring unit (MTS, BTS or BTM) has responded.	The turbo coupling was overloaded.	Clarify the cause for the overload, and avoid another overload. Check and correct the quantity filled in.	Chapter 19 Chapter 10.2
	Thermal monitoring unit (MTS, BTS or BTM) is defective.	Check the monitoring unit.	Chapter 19
Uneven running of the machine (increased vibration).	Foundation fixing is loose.	Retighten the foundation fixing. Align the machine.	
	The machine is not aligned.	Align the machine.	Chapter 8.5
	Machine is not balanced.	Clarify the cause and eliminate the unbalance.	
	The belts are damaged and/or the belt tension is incorrect.	Replace the belts in sets and/or apply the correct tension to the belts.	Observe the belt manufacturer's instructions.
	Bearings are damaged.	Eliminate the bearing damage; consult Voith Turbo in case of a bearing damage on the turbo coupling.	Chapter 18
	Loose screw connections.	Check the coupling components for damages, and replace the same, if necessary. Check the alignment of the machine. Tighten the screws and bolts with the specified tightening torque.	Chapter 3

Malfunction	Possible cause(s)	Remedial action	See
Premature wear of the belt drive.	Alignment error.	Eliminate the cause for alignment error. Re-align the machine. Check the belts for wear.	
	Impermissible temperatures.	Eliminate the cause for excessive temperature. Replace all belts. Re-align the machine, if necessary.	
	Contact with aggressive media.	Check the coupling components for damages, and replace the same, if necessary. Replace all belts. Re-align the machine, if necessary. Eliminate the cause for contact with aggressive media.	Chapter 8.5
	Excessive torque	Eliminate the cause for excessive torque. Check the filling level.	Chapter 10.2
Wear / fracture of pulleys / screws (item 0630 / bearing cover (item 0950) / bearing (item 0140).	Belt drive is worn / coupling parts are worn.	Replace damaged coupling components. Re-align the machine. Shorten maintenance intervals.	Chapter 8.5
	Excessive torque	Check the coupling design. Please consult Voith Turbo. Install the new coupling. Re-align the machine.	Chapter 18
Please consult Voith Turbo (→ Chapter 18), in case of a malfunction which is not included in this table.			

Table 21

18 Queries, Orders Placed for Service Engineers and Spare Parts

For

- Queries
- Ordering a service engineer
- Spare parts orders
- Commissionings

we need:

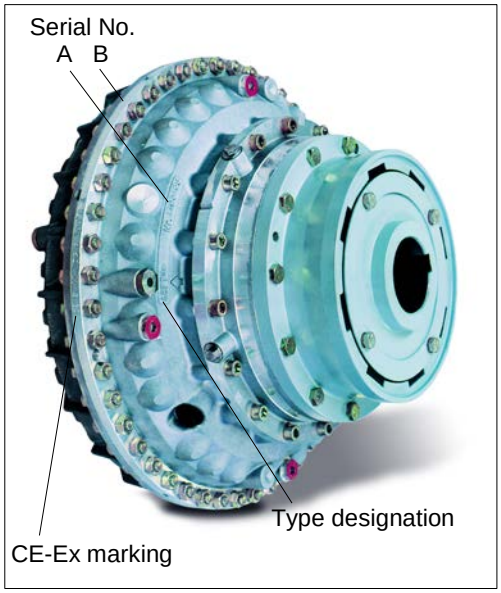


Fig. 29

the **serial number** and **type designation** of the turbo coupling.

→ You will find the serial number and type designation either on the outer wheel / coupling shell (A) or on the turbo coupling periphery (B).
→ The serial number is stamped in with figure stamps.
→ For turbo couplings, intended for the use in potentially explosive atmospheres, you will find the CE-Ex marking on the turbo coupling periphery.

When placing an order for a **service engineer**, **commissioning** or a **service**, we need, in addition

- the turbo coupling installation site,
- the name and address of a contact person,
- details of the malfunction/problem occurred.

When placing a **spare parts order**, we need, in addition,

- the destination for the spare parts shipment.

Please contact the local Voith representative
(outside business hours: the emergency hotline).

Representatives
→ Chapter 21

19 Temperature monitoring

SAFETY INFORMATION

The thermal switch units MTS and BTS can be used in potentially explosive atmospheres to monitor the temperature. The signals serve for pre-warning. The MTS or BTS do not limit the maximum surface temperature.
The BTS-Ex is available as safety device to limit the maximum surface temperature, and it can be used as thermal switch-off device.
Also in this case, it is not allowed to replace the existing fusible plugs by fusible plugs with different nominal response temperatures or by blind screws.
Never bypass safety devices!

DANGER

Electric shock
Electric voltage may kill or severely injure you

- A qualified electrician has to properly carry out the connection to the electric supply network considering the system voltage and the maximum power consumption.
- The system voltage has to be in conformity with the system voltage indicated on the nameplate.
- There has to be a corresponding electrical protection by a fuse on the network side.

The temperature in the turbo coupling can be monitored by means of a limit switch or a temperature instrument.
The following systems are available as limit switch:

– a mechanical MTS system
– an electronic BTS system

These limit switches serve to monitor the temporarily permissible peak temperature, and to prevent a response of the fusible plugs provided the overload is eliminated promptly (e.g. by switching off the drive).
The BTM can be used as temperature measuring device. This way, not only the temporarily permissible peak temperature can be monitored, but also the nominal operation.

19.1 MTS mechanical thermal switch unit for pre-warning

**For the MTS, Operating Manual 3626-011800 is available at Voith Turbo.
Or download it at www.voith.com/fluid-couplings.**

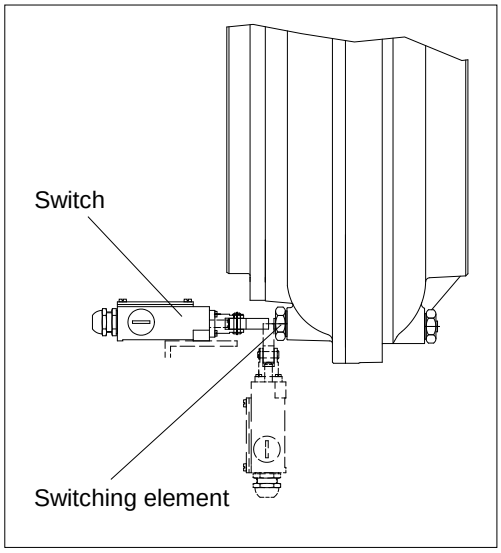


Fig. 30

Functioning:
On excess temperature, the switching element releases a pin. The pin activates a switch on coupling rotation. This signal, for example, may trip an alarm or switch off the drive motor. The switching element needs to be replaced.

In case of inner wheel drive and blocking of driven machine, the function is no longer guaranteed!

The MTS is available for turbo couplings of all sizes.

For arrangement, see the table in → Chapter 13.4.1.

The switch is available in two designs:
- enclosed [protection IP 65],
- suitable for use in potentially explosive atmospheres
  type of protection: ⟨Ex⟩ II 2G EEx d IIC T6 (PTB 03 ATEX 1067 X).
  ⟨Ex⟩ II 2D IP65 T 80 C (PTB 03 ATEX 1067 X).

**For the BTS, Operating Manual 3626-011500 is available at Voith Turbo.
Or download it at www.voith.com/fluid-couplings.**

19.2 BTS non-contacting thermal switch unit

19.2.1 BTS non-contacting thermal switch unit for pre-warning

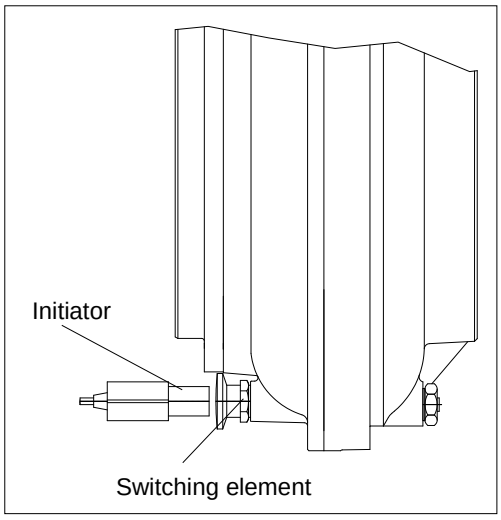


Fig. 31

Functioning:
On excess temperature, the switching element gives a specific signal to the initiator. This signal is transferred to an evaluator and may, for example,
- trigger an alarm
- or switch off the drive motor.

After the turbo coupling has cooled down, the switching element is again ready for service; it does not have to be replaced.

The BTS is provided for turbo couplings from **size 206**.

For arrangement, see the table in → Chapter 13.4.1.

Switching element and initiator are
- cast in plastic,
- insensitive to dirt,
- suitable for use in potentially explosive atmospheres
  type of protection: Ex II 2G EEx ia IIC T6 (PTB 00 ATEX 2048 X).
  Ex II 1D Ex iaD 20 T... C (ZELM 03 ATEX 0128 X).

SAFETY INFORMATION

As the control circuit of the evaluator is **not** intrinsically safe, provide an appropriate isolating switch amplifier between evaluator and initiator!

- Isolating switch amplifier type KFD2-SOT2-Ex2 (24 V DC)
  type of protection: Ex II (1) GD [EEx ia] IIC (PTB 00 ATEX 2035).

- Isolating switch amplifier type KFA6-SOT2-Ex2 (230 V AC)
  type of protection: Ex II (1) G [EEx ia] IIC (PTB 98 ATEX 2164).

19.2.2 BTS-Ex non-contacting thermal switch unit for limiting the maximum surface temperature

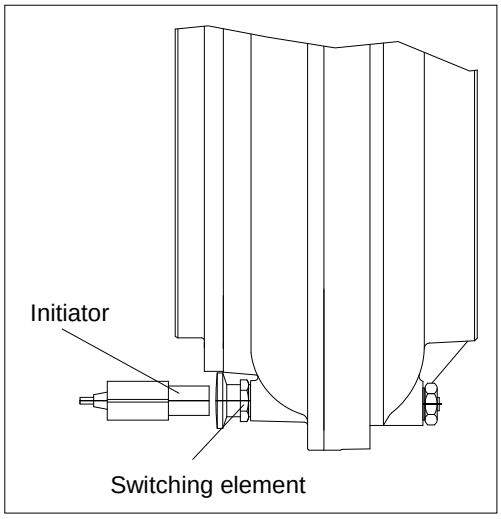


Fig. 32

Functioning:
On excess temperature, the switching element gives a specific signal to the initiator. This signal is sent to an isolating switch amplifier and has to enforce the switch-off of the drive motor.
Use a BTS-Ex approved by Voith for this application.
After the turbo coupling has cooled down, the switching element is again ready for service; it does not have to be replaced.

For the BTS-Ex, Operating Manual 3626-019600 is available at Voith Turbo.

Or download it at www.voith.com/fluid-couplings.

The BTS-Ex is provided for turbo couplings from **size 366**.

For arrangement, see the table in → Chapter 13.4.1.

The BTS-Ex is provided for use in potentially explosive atmospheres as per ATEX Directive in Equipment Group II, Equipment Category 2G and 2D (Ex II 2GD).

SAFETY INFORMATION

The BTS-Ex for limiting the maximum surface temperature is approved only in connection with the components supplied by Voith according to BTS-Ex operating manual.
Use of original Voith spare parts is imperative in case of a replacement demand.
The evaluator serves to transmit control commands from potentially explosive atmospheres into non-explosive areas and to safely isolate intrinsically safe and non-intrinsically safe circuits.

- Make sure not to exceed the maximum permissible temperature of the turbo coupling when switching on the motor.

Technical data → Chapter 2

**For the BTM, Operating Manual 3626-019800 is available at Voith Turbo.
Or download it at www.voith.com/fluid-couplings**

19.3 BTM non-contacting thermal measuring device for pre-warning

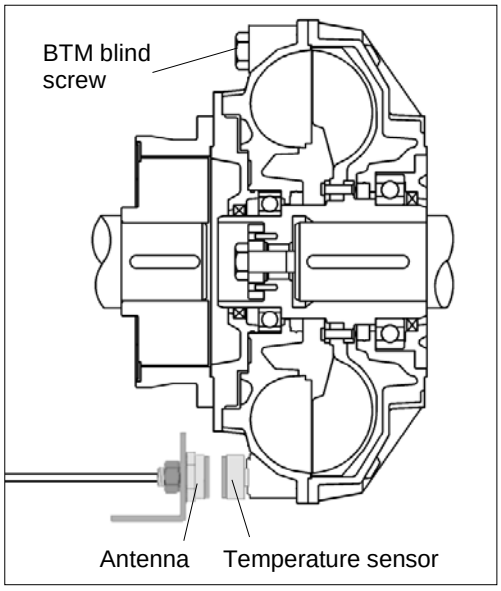


Fig. 33

Functioning:
The temperature sensor permanently transmits a measuring signal to the antenna. This signal is sent to an evaluator with 4 channels.
The measured temperatures of every channel are indicated on the evaluator. In addition, the measured temperatures are output as 4-20 mA signals.

Furthermore, two relay outputs are available per measuring channel with switching thresholds (e.g. pre-warning, switch-off) adjustable via the keyboard on the evaluator.

The BTM is provided for turbo couplings from **size 366**.

For arrangement, see the table in → Chapter 13.4.1.

SAFETY INFORMATION

The BTM is not provided for use in potentially explosive areas as per ATEX Directive.

20 Spare Parts Information

SAFETY INFORMATION

Variety of variants
Considering the great variety, please find in the following only the basic designs of turbo couplings with constant fill and pulley.

- Spare parts must comply with the technical requirements determined by Voith. This is guaranteed when original spare parts are used.
  Installation and/or use of non-original spare parts may negatively change the mechanical properties of the **Voith turbo couplings**, and may thus impair safety.
  Voith is not liable for any damages resulting from the use of non-original spare parts.
- You will find the type of your turbo coupling and the pulley design on the cover sheet of this operating manual.
- Observe → Chapter 1.2 (type designation) and → Chapter 18 (Queries, Orders places for Service Engineers and Spare Parts).
- The customer is only allowed to perform the following work:
  - Replacement of fusible pluts (item 0395 / 0260) (→ Chapter 13.4).
  - Work according to maintenance report (→ Chapter 14.3).
  - Change of operating fluid (→ Chapter 10).
  - Mounting of parts for which tightening torques are indicated (→ Chapter 3).

  All remaining work may be performed by Voith staff only.

NOTICE

Unauthorized changes or retrofits are not allowed to be performed on the coupling!
Do not retrofit accessories or equipment originating from other manufacturers!
Any changes or conversions performed without the prior written consent of Voith Turbo will result in the loss of any warranty! Any claims will forfeit.

- Professional maintenance or repair can only be guaranteed by the manufacturer!

SAFETY INFORMATION

If the turbo coupling is used in potentially explosive atmospheres (as per ATEX Directive), the use of original parts that have been released for use in hazardous areas is allowed only.

20.1 Components overview - Voith turbo coupling 154 – 650

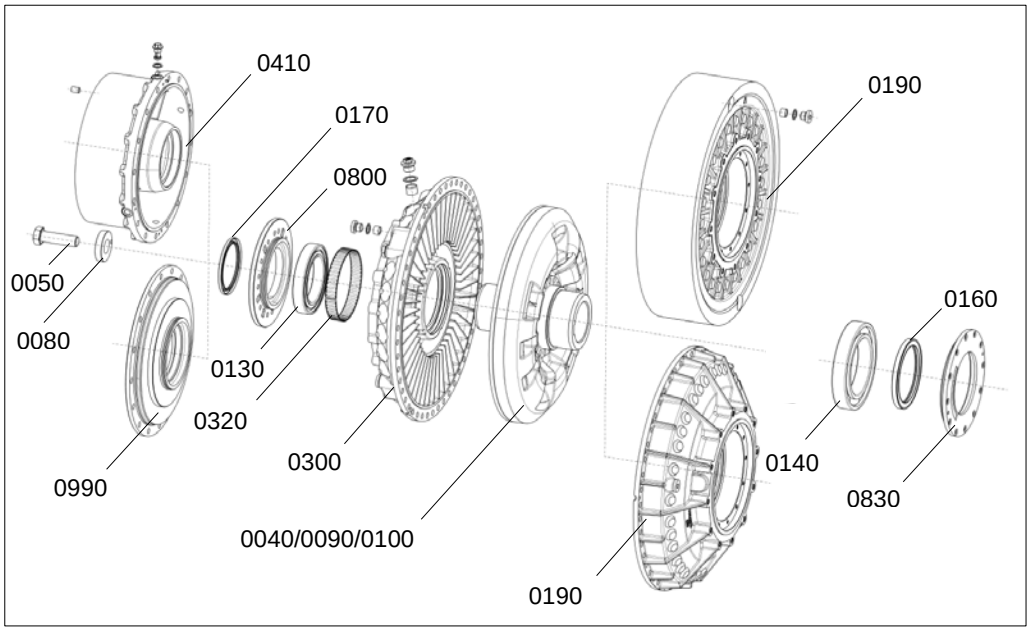


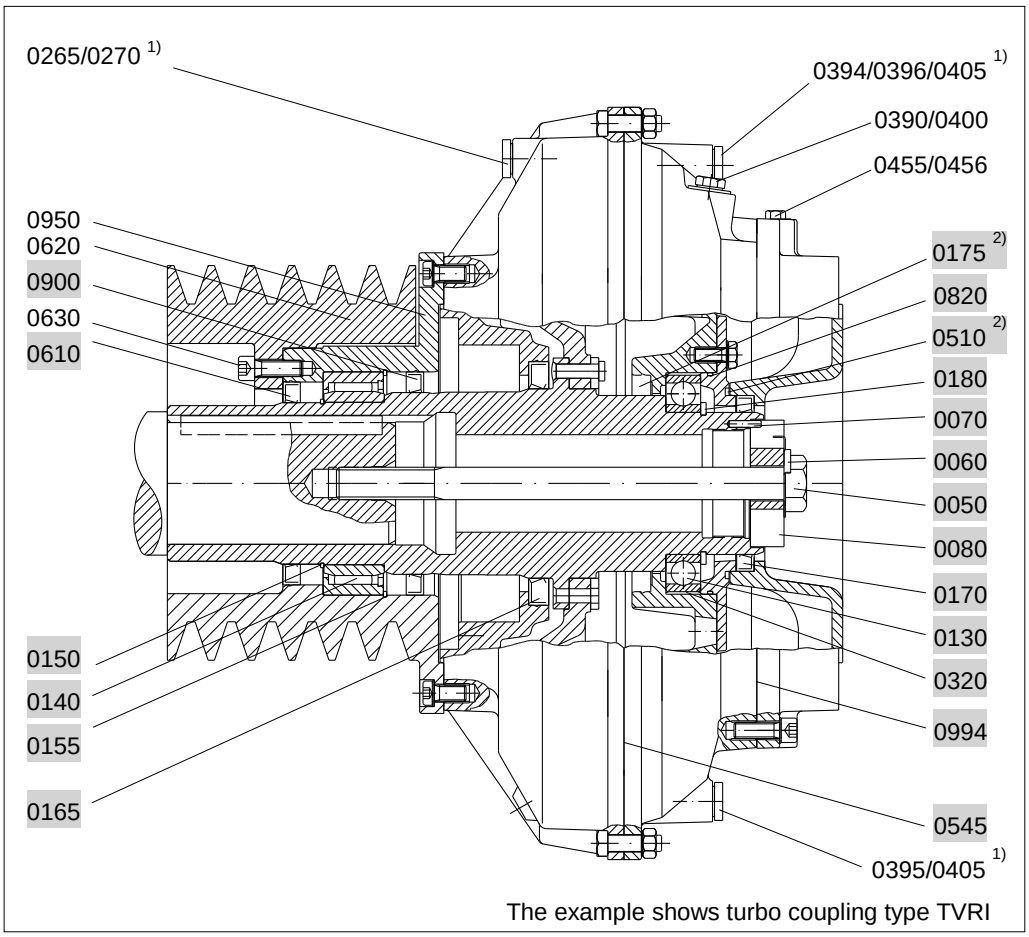
Fig. 34

Item No.	Description	Item No.	Description
0040	Coupling hub	0190	Coupling shell
0050	Fixing bolt	0300	Outer wheel
0080	Holding disk	0320	Tolerance ring
0090	Inner wheel	0410	Delay chamber cover
0100	Riveting ring/threaded ring/clamping ring	0800	Bearing support cover
0130	Grooved ball bearing	0830	Sealing ring cover
0140	Grooved ball bearing/needle bearing	0990	Connecting cover
0160	Radial shaft sealing ring		
0170	Radial shaft sealing ring		

Table 22

Spare parts for Voith turbo copupling, → Chapter 20.2.

20.2 Spare parts for Voith turbo coupling 154 – 650



Upper part of illustration:
With bearing cover

Lower part of illustration:
Without bearing cover

Fig. 35

1) For arrangement and quantity, see the tables → Chapter 13.4
2) Only for continuous operation or operating fluid 'water' (TW…).

xxxx Nonrepairable items (→ the following table)
xxxx Repair parts / wearing parts (V) (→ the following table)

Item No.	Nonrepairable items	Item No.	Repair parts / wearing parts (V)	
0265	Blind screw	0050	Fixing bolt	
0270	Sealing ring	0060	Locking plate/lock washer	
0390	Filler plug	0070	Roll pin	
0394	Blind screw	0080	Holding disk	
0395	Fusible plug	0130	Grooved ball bearing	**(V)**
0396	Sight glass	0140	Needle bearing	**(V)**
0400	Sealing ring	0150	Snap ring	
0405	Sealing ring	0155	Snap ring	
0455	Nozzle screw	0165	Radial shaft sealing ring	**(V)**
0456	Nozzle screw	0170	Radial shaft sealing ring	**(V)**
		0175	Radial shaft sealing ring	**(V)**
		0180	Circlip	
		0320	Tolerance ring	**(V)**
		0510	O-ring	**(V)**
		0545	Sealing tape	**(V)**
Item No.	**Description**	0610	Radial shaft sealing ring	**(V)**
0620	Pulley	0820	O-ring	**(V)**
0630	Socket head screw	0900	Radial shaft sealing ring	**(V)**
0950	Bearing cover	0994	Sealing tape	**(V)**

Table 23

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