

Voith Turbo

VOITH

Maintenance Manual DIWA.5

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Table of Contents

1	General notes	1
1.1	Safety notes	1
1.2	Symbols	6
2	Maintenance Schedule	8
3	Position of the oil dipstick	9
3.1	Oil dipstick on one side of the transmission	9
3.2	Oil dipstick on top the transmission	9
4	Checking the oil level	10
5	Draining the transmission oil	12
6	Position of the oil filling orifice	15
6.1	Oil filling orifice on the side	15
6.2	Oil filling orifice on top	15
7	Fill the transmission with oil.	16
8	Replace the oil filter.	17
9	Oil hoses	21
10	Cooling water quality	22

1 General notes

1.1 Safety notes

Operation, maintenance and repair of the transmission are always subject to the relevant local safety regulations and accident prevention regulations.

These regulations can for example concern handling of hazardous materials, provision and wearing of personal protective gear or motor vehicle regulations.

Anyone operating the transmission or any persons involved in installation, repair or maintenance have to familiarize themselves with the warning notes and precautions described in this document.

Any person involved in operation, installation, repair or maintenance of the transmission must exercise utmost diligence in making sure that his or her own personal safety or the safety of other persons is not in danger.

State of the art

This transmission is designed and constructed according to the state of the art in technology and acknowledged safety regulations. Nevertheless, operation, installation, repair and maintenance of the transmission can involve the risk of injury and death of persons or damage the transmission and other material assets if:

- the transmission is put to different use than prescribed,
- the transmission is operated, serviced or repaired by unqualified staff,
- the transmission is modified or reconstructed improperly and/or
- the safety notes are not observed.

Proper use

The proper use of the DIWA transmission is its application as an automatic drive for busses.

Any use other than the one described above is considered improper. Voith Turbo GmbH & Co. KG does not assume any liability for improper use. In this case, the risk lies solely with the user.

The persons in charge, in particular the staff engaged in operation and maintenance, must by all means heed the guidelines for the proper and correct use of the transmission.

Conditions for usage

The transmission may only be operated:

- in technically flawless condition,
- for its intended purpose,
- with respect to the safety instructions and the dangers involved and in compliance with the technical manual and other technical documents.

Malfunctions that impair the safety must be eliminated immediately.

Staff qualification

Work on the transmission may only be carried out by staff that is properly trained, instructed and authorized by the operator. The legally prescribed minimum age must be observed.

Maintenance and repair require special knowledge and training (e.g. a Voith diagnostics and repair training) and may only be carried out by accordingly qualified personnel.

Personnel that is currently being trained, instructed, broken in or undergoes a general training, may work on the transmission only under the permanent supervision of a person assigned to this purpose.

Responsibilities

The responsibilities of the personnel working on the transmission must be clearly defined and complied with.

Only such personnel as is explicitly ordered, authorised and trained to do so is allowed to work on the transmission.

Work on the chassis, brakes or steering systems may only be conducted by accordingly qualified personnel.

Unsafe instructions

The personnel working on the transmission must refuse unsafe instructions of third parties.

Hoisting devices

Use only appropriate and technically immaculate hoisting devices and load suspension devices with sufficient load capacity.

When replacing transmission, assemblies or individual parts, these must be carefully attached to hoisting devices and secured such that they do not present any risk.

Never stay or work under suspended loads.

Risk of burning

The oil can become very hot - in extreme cases up to 130 °C.

Improper handling may cause burns of the skin.

Therefore, let the transmission cool down to approx. 60 °C before changing the oil.

Further risks of accidents due to oil

Oil that escapes through lines, gaskets or O-rings which were not installed correctly or which have become leaky after prolonged time in operation, can cause accidents.

The oil can be under high pressure in pipes and conduits as well as in the converter.

Shut off the drive motor before conducting maintenance work or repairs.

Spare parts

Use only original spare parts for repairs since they only can guarantee that the transmission complies with the road safety regulations and the technical state on delivery.

When replacing parts, it is crucial to observe the notes in the spare parts catalogue.

Original spare parts are designed especially for the Voith transmission. We would like to point out that original spare parts which are not supplied by Voith are neither tested nor approved by Voith. The installation and/or use of non-original spare parts might affect the specified features of the transmission and thus impair safety.

In case of any damage due to the use of non-original spare parts, Voith does not assume any liability.

Work on the transmission

Prior to maintenance or inspection at the installed transmission and during installation and removal of the transmission the engine of the bus must be secured against starting.

Prior to performing maintenance or inspection operations on the installed transmission and during installation and removal of the transmission, the bus must be secured such that it cannot be put in motion, neither deliberately nor accidentally (slope!).

The prescribed service work must be carried out regularly, on time and with the intended fuels and fluids.

The work must be performed in accordance with Voith provisions, e.g. the customer service information that describes improvements and modifications to the transmission so that no parts and tools take damage.

Performing work on the transmission requires a suitable workshop equipment.

After having worked on the transmission, all transmission oil lines must be checked for leaks, loose connections, chafing and damage. Any defects must be eliminated immediately.

After having worked on the transmission, all joints must be checked for leakage.

All screwed connections loosened during work on the transmission must be tightened to the tightening torques indicated in the technical documents on the transmission.

Cleaning the transmission

Before cleaning the transmission with water or steam jet (high-pressure cleaner) or other cleaning agents, any openings into which no water, steam or cleaning agent must penetrate for reasons of safety and functioning must be sealed.

Oil hose lines lying outside must not be directly exposed to the jet of the high-pressure cleaner.

After cleaning, remove all covers/adhesives completely.

Conversion or modification of the transmission

Any modifications, attachments or conversions of the transmission must not be implemented without approval from Voith Turbo GmbH & Co. KG.

Disposal

Fluids and auxiliary substances (e.g. used oil) and disassembled parts must be disposed of in a safe and environmentally sound manner.

The local regulations and laws on environmental protection and disposal of hazardous materials must be observed.

Towing

Shift the transmission to idle gear (N key).

Unplug the connecting cable between control and transmission from the control unit.

If the transmission is damaged: Dismount the cardan shaft or stub shaft of the rear axle.

If no transmission damage is detected, the vehicle can also be towed with the cardan shaft:

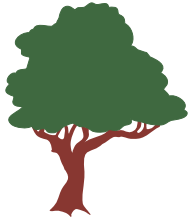
- max. permissible distance: 10 km
- max. permissible speed: 30 km/h.

For transmissions with angle drives it is in any case necessary to remove the cardan shaft or stub shaft of the rear axle.

If this is not possible, please contact the Voith customer service.

1.2 Symbols

	 DANGER DANGER indicates imminent danger for life and health of people. The non-compliance with this note results in serious damage to your health as well as life-threatening injuries.
	 WARNING WARNING indicates possible danger for life and health of people. The non-compliance with this note might result in serious damage to your health as well as life-threatening injuries.
	 CAUTION CAUTION indicates a potentially dangerous situation. The non-compliance with this note might result in minor injuries or property damage.
	NOTE Note points out information on the proper handling of the transmission. It does not indicate dangerous situations.



ENVIRONMENT

Environment

indicates a potentially harmful situation for the environment owing to operation, maintenance or repair of the transmission.

- ➔ Meaning: an activity to be performed.
- ↩ Meaning: the result of an activity.
- Meaning: please note especially.

2 Maintenance Schedule

Checking the oil level

monthly [⇒ Page 10] .

Replacing the oil and the oil filter

- After each 60,000 km or after 2 years whatever happens first
 - List of lubricants for normal oil change intervals H55.6335..
- After each 120,000 km or after 3 years whatever happens first
 - List of lubricants for prolonged oil change intervals H55.6336..
- After each 180,000 km or after 3 years whatever happens first under the following requirements:
 - DIWA.5 with E300.1,
 - Initial filling and refilling with 100% Shell Donax TV,
 - vehicle is driven in Europe,
 - for articulation busses and vehicles with T2R2 brake element only after carrying out an oil analysis and an evaluation of operating data at 120,000 km mileage - evaluation by Voith.

General limitations

- Voith reserves the right to adjust the oil change intervals stated above in individual cases depending on the usage conditions.
- Oil change intervals are not valid for the activation of internal transmission protection functions.

Checking the oil hose lines

- every 3 months [⇒ Page 21] .

3 Position of the oil dipstick

3.1 Oil dipstick on one side of the transmission

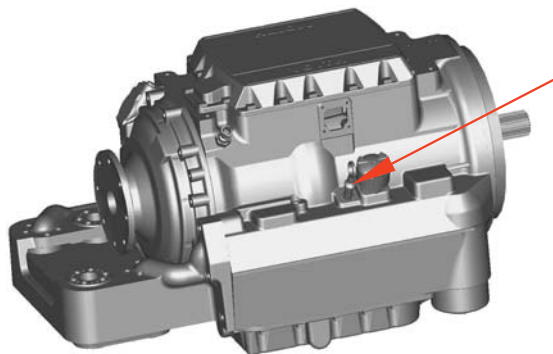


Fig. 1 Oil dipstick on the side

3.2 Oil dipstick on top the transmission

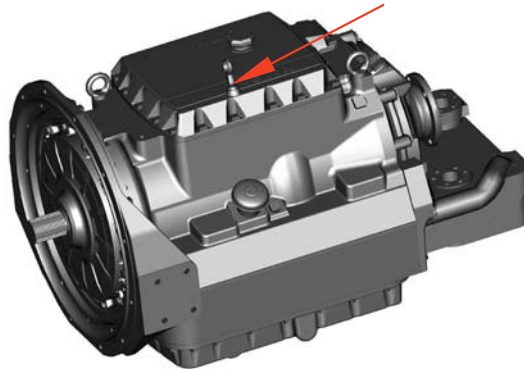


Fig. 2 Oil dipstick on top

4 Checking the oil level

- Position vehicle horizontally.
- Apply parking brake.
- Press N key.



CAUTION

Transmission damages due to missing oil

If the engine is started and the transmission has not yet been filled with oil, e.g. after transmission repair, the transmission may take considerable damage as a result.

- After the transmission has been repaired, check the oil level with the engine dead.
- If there is no or insufficient oil in the transmission: Fill in oil.



NOTE

Measurement conditions

In order to obtain the correct value under operating conditions, the oil level must be checked while the engine is running and at operating temperature (at least 60°C).

To determine the transmission oil temperature, you can use the cooling water temperature indicator inside the vehicle since the temperatures of transmission oil and cooling water are almost identical.

- Start engine
- Let the engine coast.
- ☐ If the transmission oil temperature is below 60°C:
- warm up the engine to operating temperature



Fig. 3 Oil dipstick

- ➔ Pull out the oil dipstick.
- ➔ Clean the oil dipstick.
- ❑ The oil dipstick can be located to the side of [⇒ Page 9] or on top [⇒ Page 9] the transmission.
- ➔ Insert the oil dipstick briefly and pull it out again.
- ➔ Read the oil level.
- ❑ The oil level must lie between the markings "min" and "max" at the oil dipstick.
- ❑ The difference in quantity between the two marks is approximately 2.5 l.
- ➔ If there is no or insufficient oil in the transmission, replenish oil [⇒ Page 16] .

5 Draining the transmission oil

- Shut off engine.
- Check the transmission oil temperature.



NOTE

Conditions

Drain the oil at operating temperature only (at least 60°C). Otherwise, too much oil will remain in the transmission.

The cooling water temperature indicator in the vehicle can be used to determine the transmission oil temperature since transmission oil and cooling water temperature are almost identical.

- If the transmission oil temperature is below 60°C, warm up the engine to operating temperature.

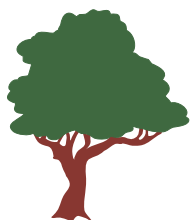


WARNING

Risk of scalding through hot oil

Direct contact of the hot transmission oil with the skin can cause severe scalding injuries.

- Take appropriate safety precautions for handling hot oil.



ENVIRONMENT

Environmental hazard due to oil

The used oil must not enter the environment.

- Collect the oil in an appropriate container.
- Any oil must be disposed of in accordance with the local regulations.

Draining oil from the oil sump



Fig. 4 Oil pan drain plug

- ➔ Loosen and remove the drain plug at the oil sump (1).
- ❑ Use an hexagon socket wrench size 12.
- ➔ Drain the oil.

Draining oil from the converter

- ❑ The drain plug at the converter (2) is accessible through the oil drain hole of the oil sump (1)..



Fig. 5 Converter drain plug

- ➔ Loosen and remove the drain plug for the oil in the converter (2).
- ➔ Use an hexagon socket wrench size 12.
- ➔ Drain the oil.

Closing the oil drain plugs

- ➔ Screw in the converter drain plug (2) with a new copper sealing ring 14x20.
- ➔ Pull tight the drain plug.
- ❑ Tightening torque 50 Nm.
- ➔ Screw in the drain plug of the oil sump (1) with a new copper sealing ring 26x34.
- ➔ Pull tight the drain plug.
- ❑ Tightening torque 100 Nm.

6 Position of the oil filling orifice

6.1 Oil filling orifice on the side

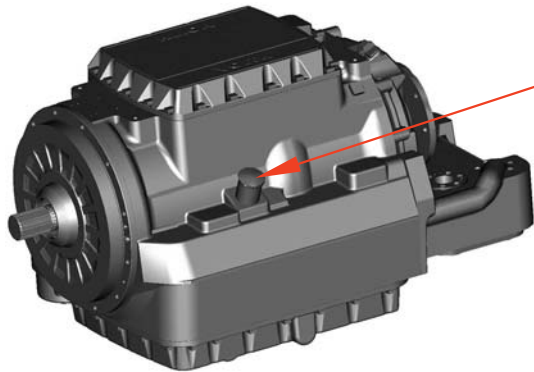


Fig. 6 Oil filling orifice on the side

6.2 Oil filling orifice on top

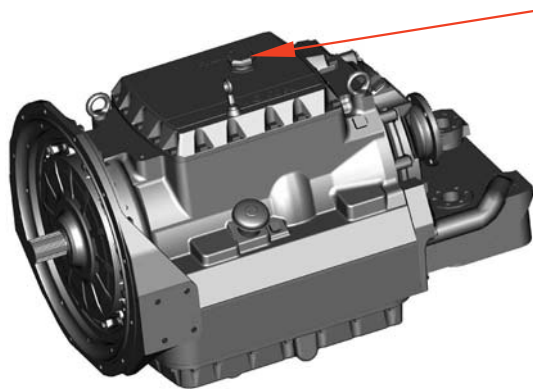


Fig. 7 Oil filling orifice on top

7 Fill the transmission with oil.

	 CAUTION
	Transmission damages due to incorrect oil level Too little oil can lead to transmission malfunctioning and damages (disk damage). Too much oil can cause the fuel consumption to increase and oil to escape at the breather. ➔ It is imperative to check the transmission oil level before first starting the engine after the transmission has been installed.

- ➔ Fill ATF oil into transmission
- ❑ The oil filling orifice can be located to the side of [⇒ Page 15] or on top [⇒ Page 15] the transmission.

Oil quantity

- For an oil change: ca. 22 l
- For complete refill, e.g. after transmission repair: ca. 24-25 l
- No additional oil filling required for ex-works oil filling
- If the oil level reaches below the min. mark of the oil dipstick, proceed as follows:
The oil level must reach between the marks "min." and "max." of the oil dipstick.

Oil quality

Fill only such oil types into the transmission that are approved in the most recent version of the Voith lubricants lists H55.6335.. and H55.6336..

- ➔ Check the oil level [⇒ Page 10] after filling in the oil and examine the transmission for leaks.

8 Replace the oil filter.



NOTE

For changing the oil filter for DIWA .5 the transmission oil does not have to be drained.

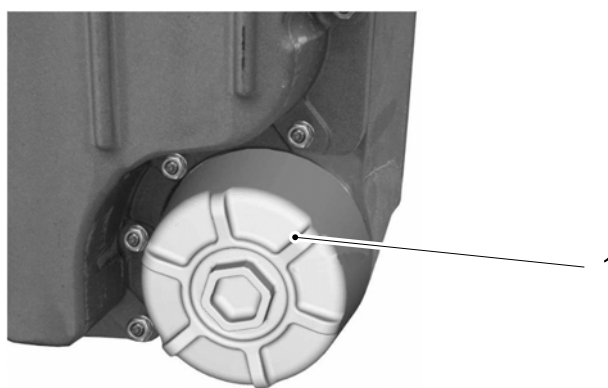


Fig. 8 Oil filter cover

1 Oil filter cover

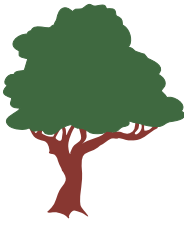


WARNING

Risk of scalding through hot oil

When unscrewing the oil filter cap, a small quantity of transmission oil leaks out, which can be very hot. If the hot oil comes into direct contact with the skin, there is a risk of severe scalding injuries.

→ Take appropriate safety precautions for handling hot oil.

	ENVIRONMENT
	Environmental hazard due to oil The oil must not enter the environment. ➔ Collect the oil in an appropriate container. ➔ Any oil must be disposed of in accordance with the local regulations.

➔ Unscrew in the oil filter cover (1).

□ Width across flats 36.

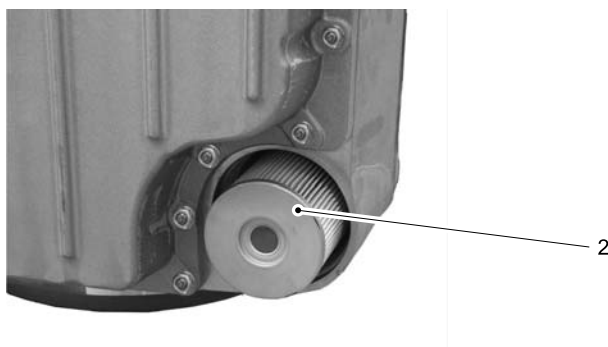
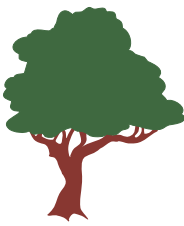


Fig. 9 Oil filter

2 Oil filter

	ENVIRONMENT
	Environmental hazard due to oil The oil must not enter the environment. ➔ The oil filter (2) must be disposed of in accordance with the local and national regulations.

➔ Remove the used oil filter (2).



NOTE

Soiling of the filter

If the used oil filter is extremely dirty, this indicates excessive wear of transmission components.

→ In this case, the transmission should be examined by a Voith employee.



CAUTION

Wrong oil filter

It is possible to install an oil filter of a DIWA.3E transmission into a DIWA.5 transmission. Both housings have the same fitting for accommodating the oil filter. The DIWA.3E filter is shorter than the DIWA.5 filter (see Fig. below).

If a DIWA.3E filter is installed in a DIWA.5 transmission:

- no filter effect exists
- pressure decrease in the transmission may be the result.

→ It must be ensured that the oil filter for the DIWA. 5 is installed.

The material number for the oil filter assembly is 151.000887XX

The material number for the oil filter is H91.4732XX.

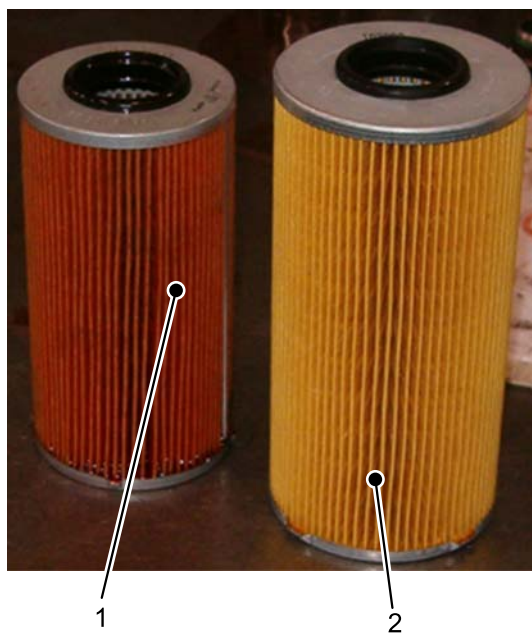


Fig. 10 Differences between the oil filters for DIWA.3E and DIWA.5

1 Oil filter DIWA.3E 2 Oil filter DIWA.5

- ➔ Installing a new the oil filter.
- ➔ Screw in the oil filter cover with a new sealing ring.
- ➔ Tighten the oil filter cover.
- ❑ Tightening torque 25 Nm.

9 Oil hoses

- Oil hose lines are only installed in DIWA.5 if special attachments are used (e.g. angle drive).

General instructions

- ➔ Check regularly once every three months.
- ➔ Use only original Voith parts for replacement.

Dirt accumulation due to road dust and moisture or road salt and grit during winter months can impair the lifetime.

Voith recommends a usage of not longer than 6 years (counting from production). Storage time should not exceed 2 years (according to DIN 20066).

Cleaning

	 CAUTION
	Possible damage caused by inappropriate cleaning methods Oil hose lines can be damaged. ➔ Do not hose down oil hose lines using high-pressure cleaners. ➔ Do not use chemical additives.

Criteria for replacement

- Damage of the outer layer
- Brittleness of the outer layer
- Leakage
- Damage / deformation of the fitting
- Loosening of the hose from the fitting
- Corrosion at fitting that impairs function and firmness
- Exceeding the maximum storage and usage time

10 Cooling water quality

	 CAUTION
	Damage of the heat exchanger due to inappropriate antifreezer and corrosion inhibitors The heat exchanger can corrode and become leaky as a consequence.

Water quality requirements

- No floating particles (especially with CU content) in the water
 - Pure, entirely demineralized water
 - pH-value 6.5 to 8 at 20 °C
 - Chloride content max. 75 mg/l
 - Sulphate content max. 50 mg/l
 - Water hardness 3 to 10 °dH
 - Nitrate content max. 50 mg/l
 - Nitrite content max. 0 mg/l
- ☐ Drinking water is suitable in most cases.

Mixing ratio

- Water ≤ 64 %
 - Antifreezer ≥ 35 %
 - Corrosion preventive 1%
- ➔ Use ethylene-glycol based antifreezer.

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