

Combining Ride Comfort with Economy. DIWA.5



DIWA.5 – the Evolution of Modern Bus Transmissions.

Starting, gear shifting, accelerating, gear shifting, braking, gear shifting:
 Bus transmissions have a lot to endure. Especially with the start-stop conditions in inner-city traffic, but also on country roads and motorways.
 Therefore, over 200 000 buses worldwide have one thing in common:
 A DIWA automatic transmission from Voith.

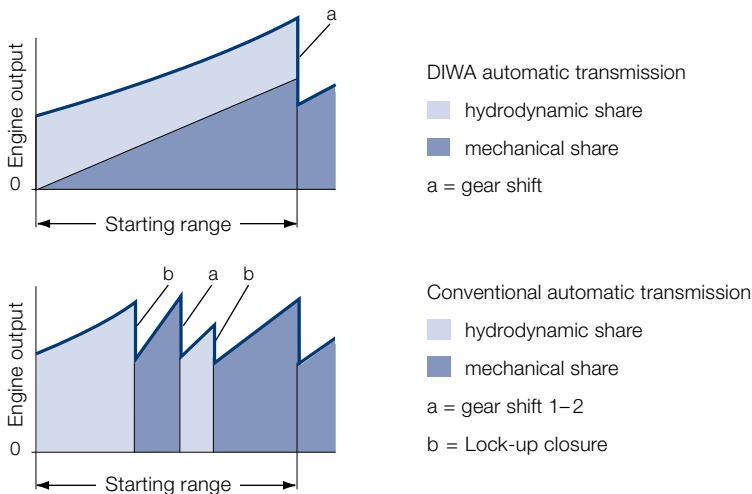
With the DIWA.5 transmission, its E 300.1 and its ALADIN diagnostic software, Voith offers the ideal solution for automatic transmissions in buses. The proven DIWA power-split principle allows smooth acceleration across a speed range where other transmissions need to shift gears two to three times. This makes DIWA the epitome of economical bus transmissions, up to 50% fewer gearshifts means less wear and higher driving comfort.

The elimination of external piping or hoses for the oil circulation and the heat exchanger built into the output cover are just a few features of the DIWA.5 transmission. This makes it easy for vehicle manufacturers to build the transmission into the vehicle, even where space is at a premium. Operators benefit from high availability as well as low maintenance and operating costs.

The DIWA D 884.5 is a valuable addition to the product line: When faced with meeting increased demands, for instance, in Bus Rapid Transit (BRT), the new DIWA D 884.5 represents the ideal solution for engine torques up to 1900 Nm. It is capable of handling almost 20% more engine torque and 10% higher engine power – and that within almost identical dimensions and only a slight increase in weight.

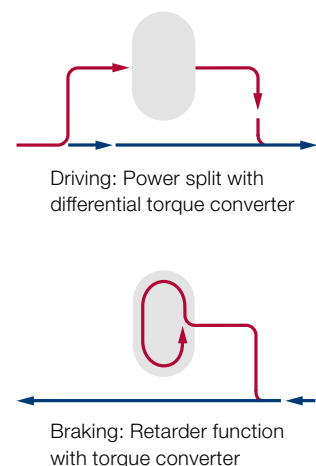
Wear reduction and comfort become visible

thanks to the flexible DIWA starting range



The DIWA principle: Driving

and braking with one hydraulic circuit



Voith DIWA – economy and comfort made to measure

On the basis of individual criteria such as wear, weight distribution, noise levels, passenger compartment design, etc., bus manufacturers and operators often select highly different drive solutions and overall concepts for their vehicles. Voith is flexible to these needs and, in addition to its standard product range, also offers components for the adaptation to different engines and axles.

Standard scope of supply

- Voith DIWA standard transmission
- Corrosion-resistant heat exchanger
- Torsional vibration damper
- Electronic control
- Set of cables

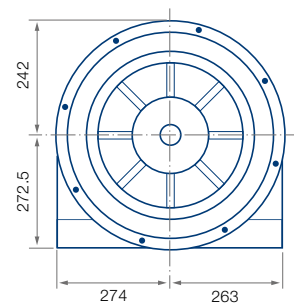
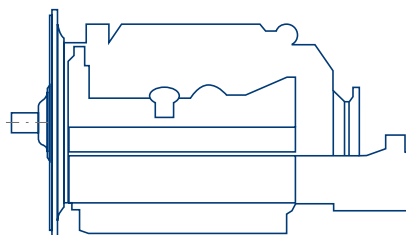
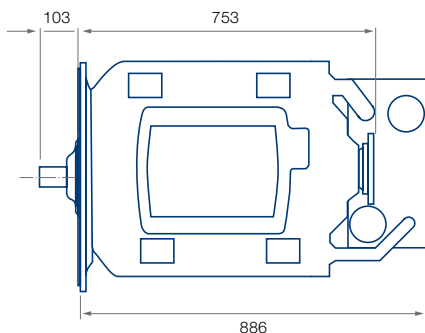
Additional program*

- Connecting flanges between engine and transmission
- Suspension flanges
- Output flanges/yokes
- Output angle drives
- Pushbutton switch for gear selection
- Permanent brake operating lever

*These parts are not included in the standard delivery package, but can be supplied upon request.

Typical assembly dimensions of the Voith DIWA.5 transmission

(864.5 including connection flange, in mm)



Design and Operation of the DIWA Transmission.

The mature design of Voith automatic transmissions is up-to-date with the latest technological developments. It is simple, logical and clear.

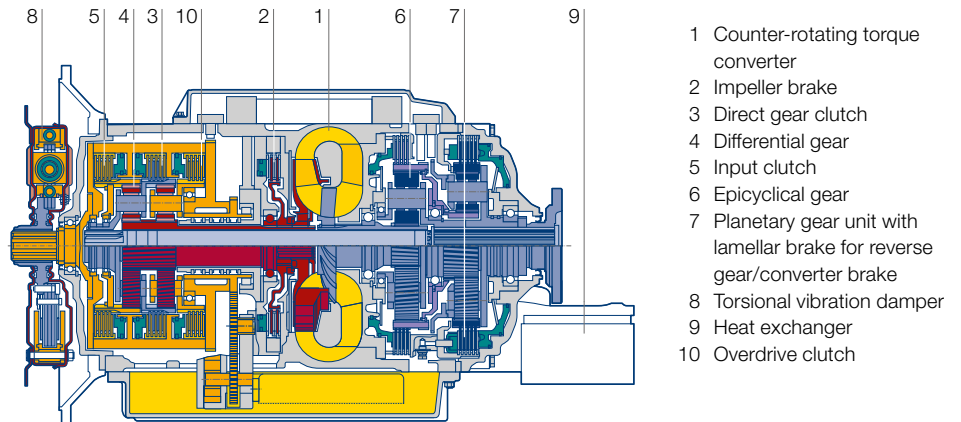
The heart of the DIWA transmission is the hydrodynamic counter-rotating torque converter. Situated in front of it are the impeller, the direct gear clutch, the differential gear, the input clutch and the overdrive clutch.

Behind the converter, an epicyclical gear combines the hydrodynamic and mechanical forces. The final set of epicyclical gears activates the reverse gear and, during braking, also the retarder.

A hydraulic torsional vibration damper at the transmission input reduces engine vibrations effectively. Gear shifting occurs electro-hydraulically, with patented solenoid valves; the gear-shifting commands are placed by the control system.

The heat exchanger of the Voith automatic transmission is integrated into the cooling circuit of the vehicle engine; generated heat is immediately dissipated. The transmission oil circuit is designed as a full flow system ensuring that the oil temperature and transmission components run and operate as cool as possible. Even when the vehicle's cooling system is running hot, the temperature of the transmission remains relatively stable with no danger of overheating.

DIWA D 864.5



Performance data DIWA.5 transmission

Types		D 824.5	D 854.5	D 864.5	D 884.5
Input power P_{1max}	[kW]	180	220	290	320
Input torque M_{1max}	[Nm]	650	1 100	1 600 ¹	1 900
Input speed n_{1max}	[min ⁻¹]	2 500	2 500	2 500	2 200
Retarder braking torque M_{BR}	[Nm]	2 000 ²	2 000 ²	2 000 ²	2 000 ²
Transmission mass (dry)		approx.	approx.	approx.	approx.
incl. retarder	[kg]	329	334	339	344
Max. vehicle weight	[t]	15	28	28	34 ³

¹ 1 700 Nm under certain conditions

² Maximum value, depending on retarder configuration

³ depending on the axle ratio

In operating terms, fuel consumption plays a major role. The overdrive ensures that fuel-friendly engine speeds are achieved both in city and in long-distance traffic. This is also aided by the torsional vibration damper which protects the transmission from low speed engine vibrations.

The oil circulates solely inside the transmission. The Voith DIWA.5 is designed without external oil hoses or pipes. This simplifies transmission installation and improves the overall reliability of the oil circuit saving service and maintenance costs.

Filter replacement without having to change the oil? Oil change intervals up to 180 000 km? Even that is possible with the DIWA.5, again helping to reduce maintenance costs.

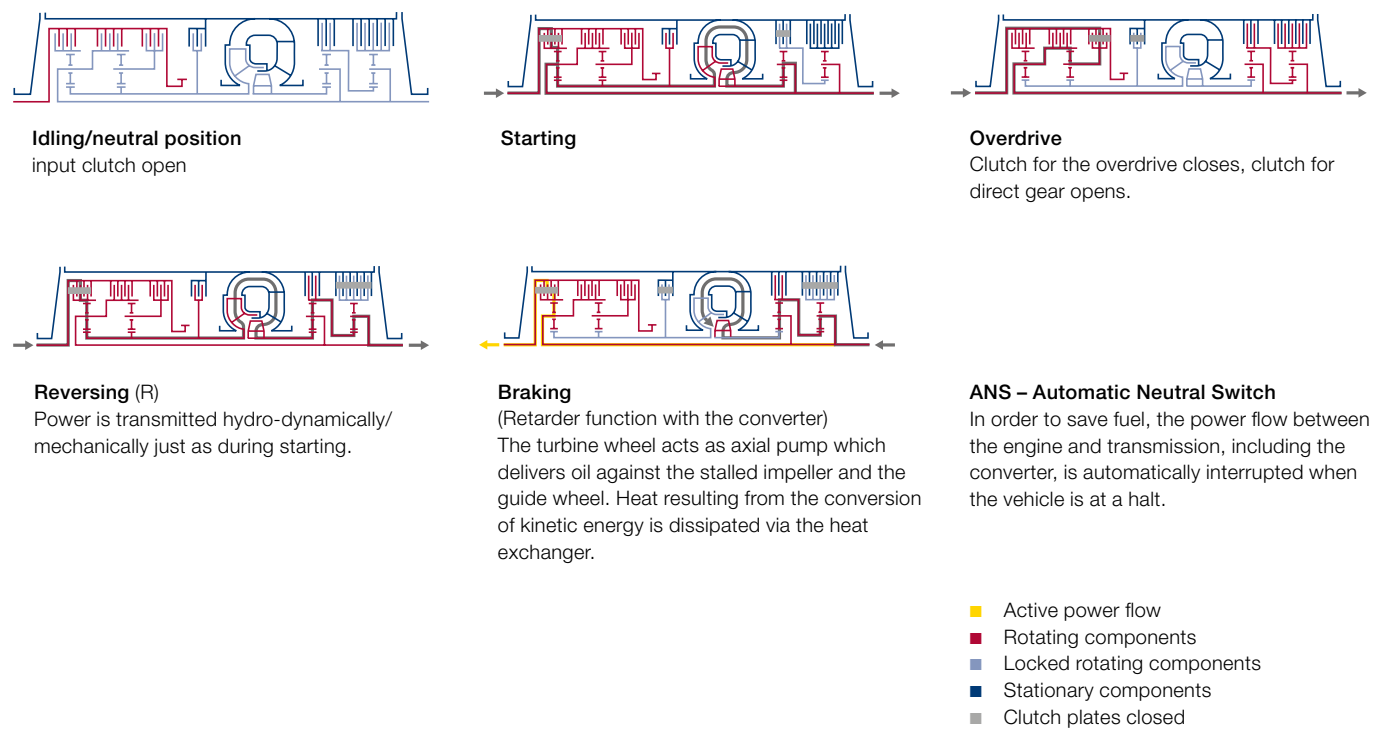
Reliability starts in the detail

Specially developed sensors ensure that the transmission is extremely reliable. However, on those occasions when a sensor needs to be replaced they are all accessible from the top of the transmission reducing maintenance times. Installation space is scarce in buses. The compact outer dimensions (e. g. by omitting pipes and tubes) facilitate the

installation of the transmission even in the most confined of spaces. Last but not least, transmission installation and removal times from the vehicle chassis are also significantly reduced – owing to the straightforward connection of the torsional vibration damper.

Hydrodynamics are one of the core competences at Voith: that is why over 100 years of experience have been put into our converter, the key component of the DIWA transmission.

Power flow during gear shifting and braking



- 1 Analysis and diagnosis software
- 2 Event storage
- 3 Key data and operating data

E 300.1 – a New-Generation Transmission Control.

The E300.1 transmission control adjusts itself optimally to its environment: whether it is the topography and the axle ratio, or the electronic architecture of a modern commercial vehicle.

SensoTop: topography-dependent shifting program

The acceleration-dependent shifting programs common today take into consideration the axle ratio, the vehicle's acceleration and the load; However, the grade or slope that the vehicle is operating on can only be estimated.

The DIWA.5 Electronic Control Unit (E300.1) has been equipped with a maintenance-free inclination sensor that identifies the topography quickly and precisely. Only this feature allows the optimum adaptation of gear speeds to the prevailing condition at all times.

The SensoTop topography-dependent shifting program reduces fuel consumption by up to 7% while providing even greater driving comfort by avoiding gear hunting – our contribution to the environment.

Second-generation DIWA operating data recording

The Voith DIWA transmission is the first automatic transmission for buses that has an operating data recording system. Operators and vehicle manufacturers have learned to appreciate this not just since yesterday – e.g. in the analysis and optimization of the vehicle operation or in the selection of a driveline that meets all requirements. The E300.1 control includes the second-generation operating data recording system and thus the ability to obtain a more detailed analysis of the service conditions under which the vehicle and transmission are being used.

Event storage

The control unit not only reports failures, but also all detectable events which indicate wear, incorrect operation or the need for maintenance work. The thoroughness of the diagnostics offered by the E 300.1 enables a precise, detailed and therefore fast localization of the cause.

CAN pushbutton switch and electronic type plate

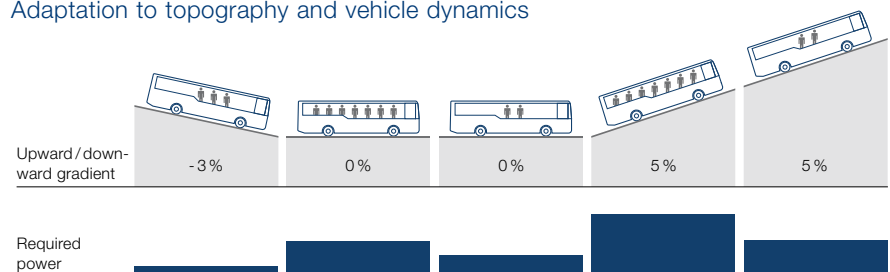
The CAN pushbutton switch is convenient to use, simple to install and extremely reliable. The Transmission Identification Module (TIM) offers optimum and automatic configuring of the E 300.1 control to the transmission.



Intelligent E 310 control unit

Optimum fuel consumption with SensoTop

Adaptation to topography and vehicle dynamics





1



2



3

ALADIN – the User-Friendly Diagnostic Software for the DIWA.5 Transmission.

The Aladin diagnosis and analysis software presents service and operating data in clear, compact and ready-to-print reports. All important information from the control unit is taken into account: Event storage, identification data, key data, operating data, standstill times, adaptation values and much more.

The event storage can accommodate up to ten independent events. An event may be either a fault message, e.g. about a short circuit in the lead to a solenoid valve, or a low oil level alert, for instance.

The operating data serve as a source of information about the vehicle and contribute significantly to optimizing the driveline design, reducing operating costs and increasing availability. The data are recorded, classified and accumulated by the electronic control unit during the entire time that the transmission is in operation. In addition, vehicle-specific key data are derived from the operating data.

Your benefits

- Less time required for diagnostics
- Minimization of standstill times
- Reduction in fuel consumption
- Ability to plan maintenance and servicing
- Increased vehicle availability
- Lower operating costs
- Simple, intuitive operation
- Fast, detailed and precise diagnostics
- Direct incorporation of repair instructions into OEM diagnostic systems possible

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