

Traveling Comfortably
and Economically.
DIWA.3E



DIWA-Transmissions – Economy and Comfort Through Convincing Technology.

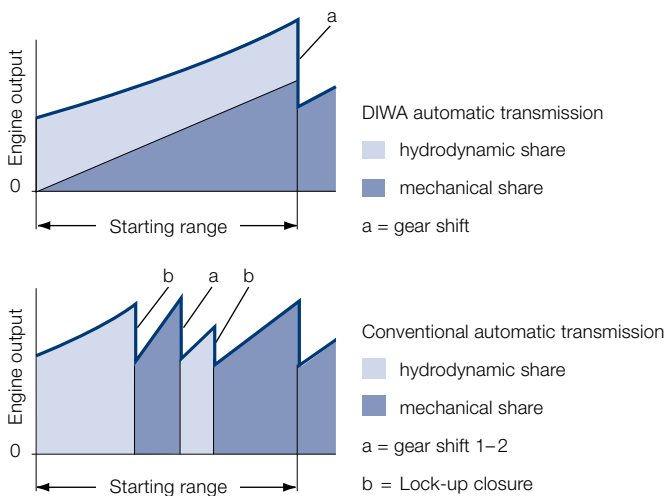
Today, virtually all midi, city and long-distance buses can be fitted with Voith automatic transmissions. The unique principle of the DIWA transmission, the differential converter, is a technology suitable for the entire catalogue of modern combustion engines.

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.

Wear reduction and comfort become visible

One gear replaces two conventional gears



DIWA.3E





Superior Technology Demonstrates in Practical Application.

DIWA transmissions are ideally adapted to the technology developments on the commercial vehicle sector. The transmissions and their gear-shifting programs comply with the environmentally friendly low-emission combustion engines and the latest emission standards. Their electronic-hydraulic control increases the gear-shifting quality in such a way that the gearshifts are hardly percep-

tible even under extreme conditions. The acceleration-dependent gear-shifting program takes the acceleration and load condition of the bus into consideration and places the gear-shifting points automatically into the optimum consumption range. The unique PC diagnosis is capable of recording the functions of the transmission both during driving and at standstill of the bus. The control system also features an operating data evaluation mode. The evaluation of operating data allows a detailed analysis of traffic situations and helps when it comes to selecting a driveline that is tailor-made to its actual operating conditions.

Further advantages: a filter that is integrated into the housing, a compact stainless-steel heat exchanger in modular design for a long service life and a torsional vibration damper for low engine speeds and minimum consumption. This is added by a particularly sensitive adaptation of the braking behavior of the retarder: smooth activation, strong braking performance, fast switch-on/switch-off response. This is achieved by the controlled part-drainage of the converter.

Performance data DIWA.3E transmission

Types		D 823.3E	D 851.3E	D 854.3E	D 863.3E	D 864.3E
Input power P_{1max}	[kW]	180	220	220	290	290
Input torque M_{1max}	[Nm]	650	1 100	1 100	1600*	1600*
Input speed n_{1max}	[rpm]	2 800	2 800	2 500	2 800	2 500
Retarder braking torque M_{BR}^{**}	[Nm]	2 000	2 000	2 000	2 000	2 000
Number of gears***		3	3	4	3	4
Transmission mass (dry) incl. retarder	[kg]	270	275	310	280	315
Max. vehicle weight	[t]	15	28	28	28	28
Major areas of application:	Midibuses	Standard single deckers and articulated buses		Buses with high transmission input torque also suitable for long- distance/intercity applications		
						

* For engines exceeding 1 300 Nm with torque reduction during gear-shifting

** Maximum value, depending on retarder configuration

*** 1st gear with hydrodyn. / mechan. power splitting (DIWA driving range)

Design and Operation of DIWA Transmissions.

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 3rd gear clutch, the differential gear and the input clutch. With the 4-speed transmission, the converter is additionally preceded by the clutch for the 4th gear which is designed as overdrive. Behind the converter, an epicyclic gear combines the hydrodynamic and mechanical forces.

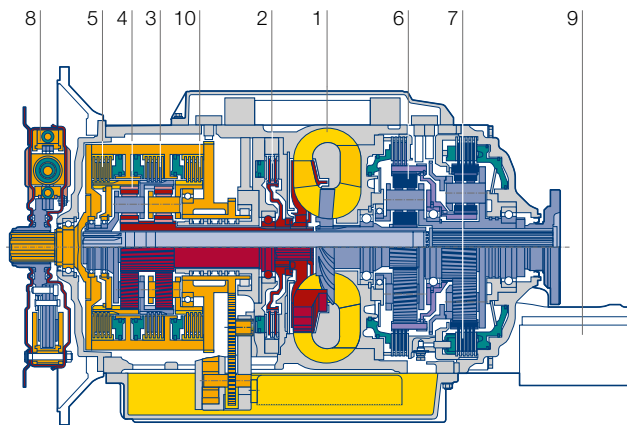
The final set of epicyclic gears activates the reverse gear and, during braking, also the retarder.

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.

At the same time, the oil circuit of the transmission is designed in such a way that the temperature stays at a low level and that there is no danger of an impaired performance, if the initial temperature of the cooling agent is higher.

4-speed DIWA transmission



- 1 Counter-rotating torque converter
- 2 Impeller brake
- 3 3rd gear clutch
- 4 Differential gear
- 5 Input clutch
- 6 Epicyclic gear
- 7 Planetary gear unit for reverse gear and converter brake
- 8 Torsional vibration damper
- 9 Heat exchanger
- 10 4th gear clutch (D 854.3E/D 864.3E)

Power flow during gear-shifting and braking



Idling / neutral position
input clutch open



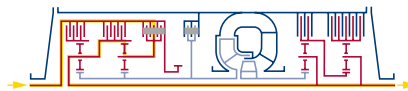
1st Gear
DIWA range (stepless), input clutch and turbine brake are closing: smooth start with high traction. Rapidly increasing mechanical power transmission via differential transmission (power-split principle).



2nd Gear
Automatic gear shifting is dependent on acceleration and driving speed: Impeller closes, turbine brake opens. Power is now transmitted purely mechanically.



3rd Gear
At approximately 50 % (or 70 % with D 851.3E/D 863.3E) of the maximum speed, the input clutch opens automatically and the 3rd gear clutch is closing.



4th Gear (D 854.3E / D 864.3E only)
At approximately 70 % of the maximum speed, conversion occurs automatically: clutch for the 4th gear closes and 3rd gear clutch opens.



Reversing (R)
Power is transmitted hydrodynamically/ mechanically as in 1st gear (DIWA driving range).

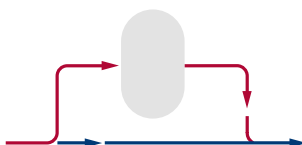


Braking (in 2nd – 4th gear)
(Retarder function with the converter)
The turbine wheel acts as axial pump which delivers oil against the stalled impeller and the guide wheel. Heat resulting from the conversion of kinetic energy is dissipated via the heat exchanger.

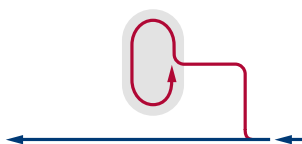
ANS – Automatic Neutral Switch
In order to save fuel, the power flow between the engine and transmission, including the converter, is automatically interrupted when the vehicle is at a halt.

- Active power flow
- Rotating components
- Locked rotating components
- Stationary components
- Clutch plates closed

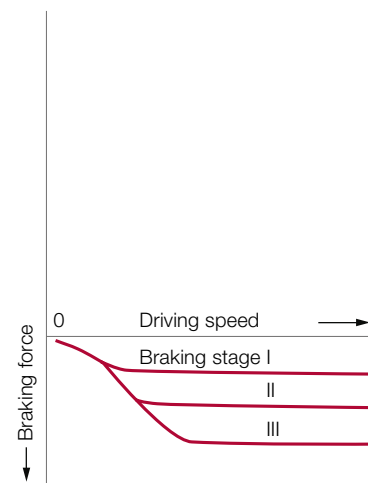
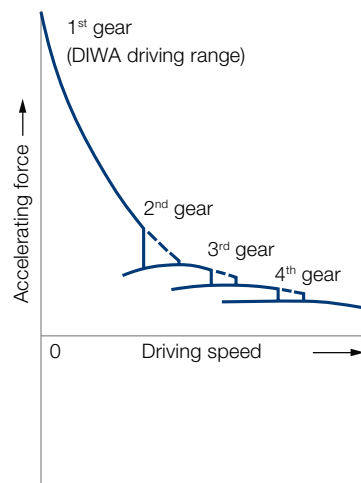
The DIWA principle: driving and braking with one hydraulic circuit



Driving: power split with differential torque converter



Braking: retarder function with torque converter



DIWA.3E, E 310, ALADIN – An Ideal Combination for Your Economy.

Transport companies and operators who want to drive economically in the long run should utilize their resources to the full. This means driving as efficiently as possible and simultaneously reducing wear and maintenance work. The DIWA.3E automatic transmission supports these efforts with its E 310 control and the software program ALADIN.

DIWA operating data recording of the second generation

The Voith DIWA transmission is the first automatic transmission for buses with an operating data recording facility. Operators and vehicle manufacturers have long learnt to appreciate this feature – for example when analyzing and optimizing their fleet application, or when selecting a driveline that is adapted to route requirements. The E 310 control unit features operating data recording of the second generation and therefore offers a far more detailed analysis of the operating conditions of vehicle and transmission.



Intelligent E 310 control unit

Event storage

The control unit not only reports failures, but all recognizable events that indicate wear, operating errors or maintenance work to be carried out. The in-depth diagnosis of the E 310 allows precise, detailed and therefore rapid localization of the actual cause of the event.

CAN push button

The CAN push button excels by high operating comfort, as well as trouble-free installation and low susceptibility to failure.

Analysis and diagnosis software

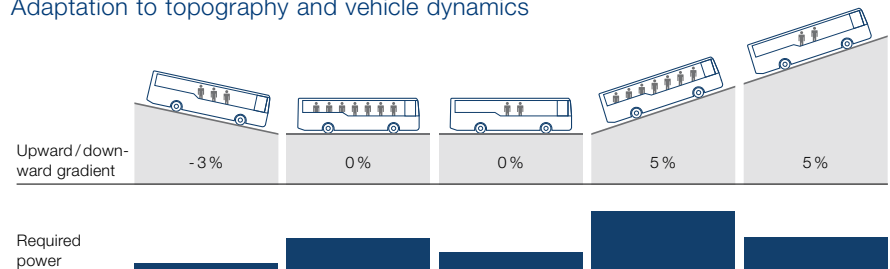
The user-friendly software ALADIN presents information regarding service and operating data in clear, compact and printable reports. Everything that needs to be known from the control unit is taken into consideration: event storage, identification data, key data, operating data, standstill times, adaptation values and many other criteria.

Optional: topography-dependent gear-shifting program SensoTop

Today's conventional acceleration dependent gear-shifting programs consider axle ratios, vehicle acceleration and load conditions, yet road grades can only be estimated fairly roughly. Using a simple sensor, the E 310 transmission control quickly and accurately recognizes the prevailing topography. Only then can gear-shifting points be adapted optimally to the ambient conditions at all times. The topography-dependent gear-shifting program SensoTop reduces fuel consumption by up to 7 % and simultaneously increases driving comfort by reliably avoiding gear hunting – our contribution to the environment.

Optimum fuel consumption with SensoTop

Adaptation to topography and vehicle dynamics



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.

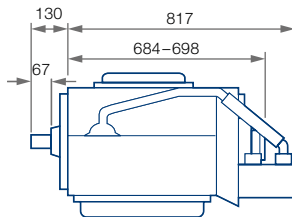
Standard scope of supply

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

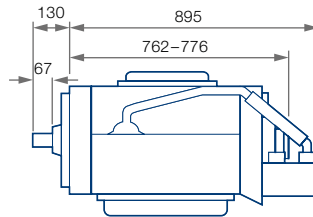
Additional program*

- Connecting flanges between engine and transmission
- Suspension flanges
- Input angle drives
- Output angle drives
- Pushbutton switch for gear selection
- Braking stage manual switch
- Load transmission
- Topography-dependent gear-shifting program SensoTop

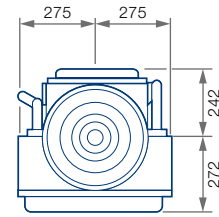
3-speed**



4-speed**



Front view**



Performance data DIWA.3E transmission

Types		D 823.3E	D 851.3E	D 854.3E	D 863.3E	D 864.3E
	Differential					
		Torque ratio – output / input				
1 st gear (DIWA driving range) (drive point)	3	5.3 – 6.1	5.3 – 6.1	5.3 – 6.1	5.3 – 6.1	5.3 – 6.1
	4	–	4.9 – 5.3	4.9 – 5.3	4.9 – 5.3	4.9 – 5.3
		Transmission ratio				
2 nd gear	3	1.43	1.43	1.43	1.43	1.43
	4	–	1.36	1.36	1.36	1.36
3 rd gear	3	1.0	1.0	1.0	1.0	1.0
	4	–	1.0	1.0	1.0	1.0
4 th gear	3	–	–	0.7	–	0.7
	4	–	–	0.73	–	0.73
Reverse gear	3	4.2 – 5.5	4.2 – 5.5	4.2 – 5.5	4.2 – 5.5	4.2 – 5.5
	4	–	4.1 – 4.7	4.1 – 4.7	4.1 – 4.7	4.1 – 4.7

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

** Typical installation dimensions of Voith DIWA.3E

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Engineered Reliability