

Voith Turbo

VOITH



DIWA®.3

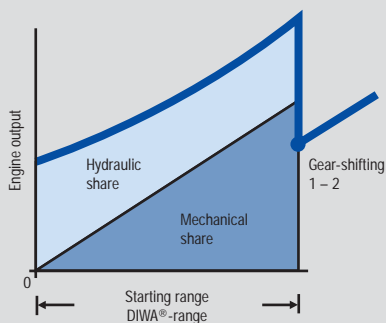
DIWA.3 users know:
Voith sets **the standard** against which the performance of
modern automatic transmissions is measured



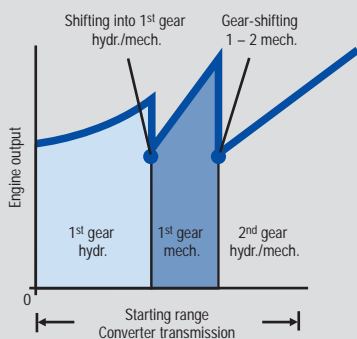
Voith DIWA® Transmissions – Economy and comfort through convincing technology

A good idea is never obsolete. This is why Voith Turbo is consistently pursuing the development of its pioneering DIWA® transmissions. Today, nearly all midi, city and long-distance buses can be fitted with Voith automatics – a technology for the entire range of modern combustion engines. What has remained is the unique principle of the DIWA® transmission: the differential converter.

Starting characteristics
Voith DIWA® transmission



“State-of-the-art”
automatic transmission



This principle allows stepless driving in the DIWA® range even over longer periods – comparable converter transmission need up to 50 % more gear-shifts

- Not having to shift gears during starting is not just more comfortable but also safer
- Less gear-shifting also means less wear on the clutch plates and hence longer service life.

The DIWA® principle has proven itself – and has stayed young. Others have to shift gears in order to achieve what Voith automatics manage easily without gear-shifts.





Superior technology – demonstrated in practical application

DIWA® transmissions are an ideal match for the technological developments in the commercial vehicle sector. The transmissions and their gear-shifting programs are adapted to the environmentally friendly, low-emission EURO-3 combustion engines. Their electronic-hydraulic control systems increase the gear-shifting quality of the transmission in such a way, that gear-shifts are hardly perceptible, even under extreme conditions.

The acceleration-dependent gear-shifting program takes the acceleration and the load conditions of the bus into account and puts the gear-shifting points automatically in the optimum fuel consumption range.

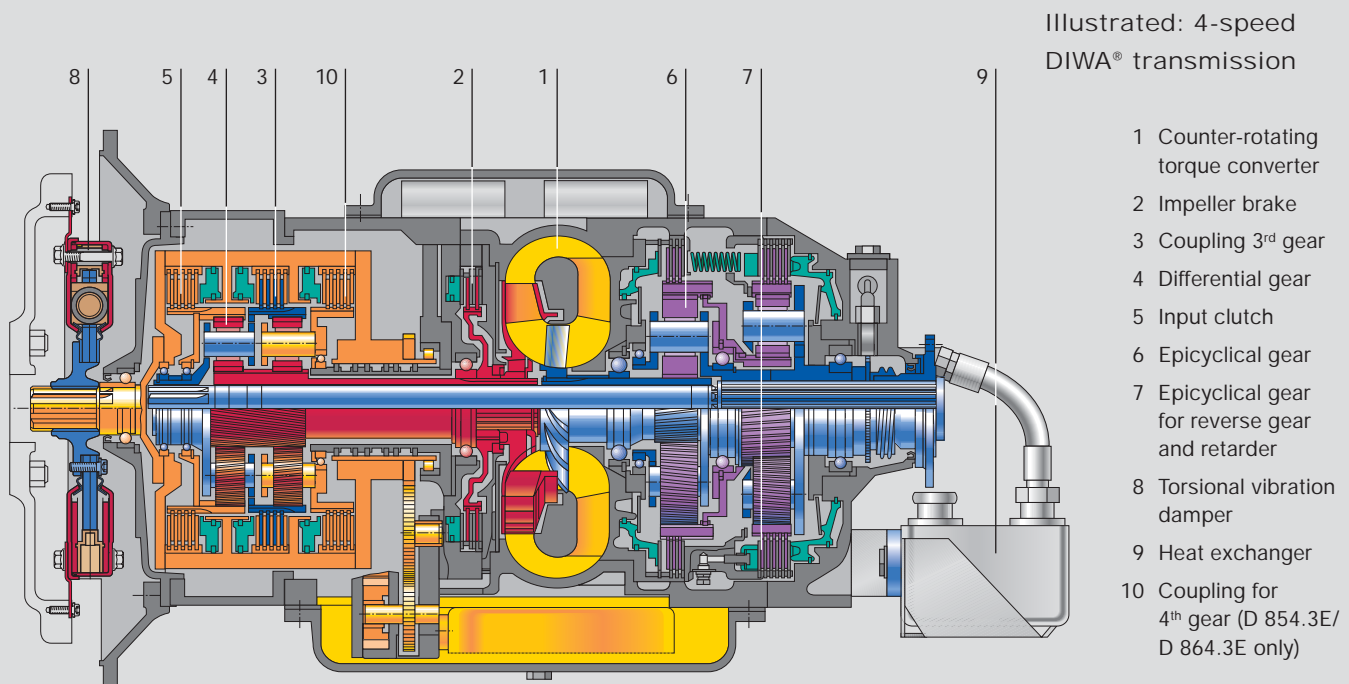
One single gear-shifting program is sufficient for all operating conditions. The unique PC diagnosis system is able to record the transmission functions while the bus is at a halt or on the move. The control system also provides the possibility of operating data storage. The evaluation of the operating data allows detailed analyses of traffic situations and helps with the selection of a driveline that matches the prevailing operating conditions.

Further advantages: the filter which is integrated into the housing, the more compact stainless steel heat exchanger in modular design for longer service life and the advanced torsional vibration damper for low engine speeds and less fuel consumption. This is added by the particularly fine adjustment of the braking behaviour of the retarder: smooth activation, strong braking performance, fast switch-on/switch-off response. This is achieved via a controlled partial draining of the converter.

Performance data DIWA® 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	1 600**	1 600**
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
No. of speeds****		3	3	4	3	4
Transmission mass (dry) inc. 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 put torque Also suitable for long-distance/intercity applications		
<p>* The letter E denotes the consistent further development of the proven DIWA®.3 transmission ** For engines exceeding 1 300 Nm with torque reduction during gear-shifting *** Maximum value, depending on retarder configuration **** 1st gear with hydrodynamic/mechanical power-split (DIWA® range)</p>						

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. Every transport operator is able to maintain and overhaul the transmission at his own premises – with standard equipment and no need for costly special tools.



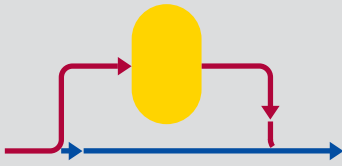
The heart of the DIWA[®] transmission is the hydrodynamic counter-rotating torque converter. Situated in front of it are the impeller, the lock-up clutch, the differential transmission and the input clutch. With the 4-speed transmission, the converter is additionally preceded by the clutch for the 4th gear which is designed as overdrive. Behind the converter, an epicyclical gear combines the hydrodynamic and the 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.

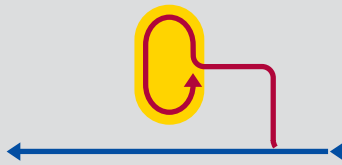
The heat exchanger of the Voith automatic transmission is integrated into the cooling circuit of the vehicle engine; generated heat is immediately dissipated. At the same time, the oil circuit of the transmission is designed in such a way that the temperature stays at a low level and that there is no danger of an impaired performance, if the initial temperature of the cooling agent is higher.

Power flow during gear-shifting and braking

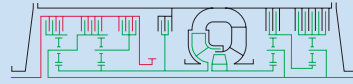
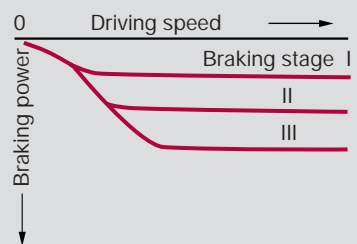
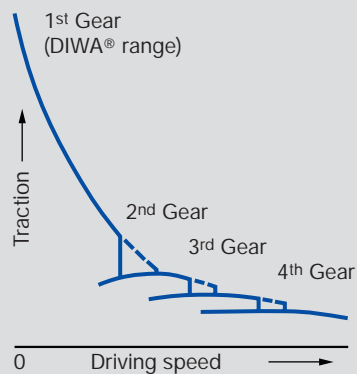
The Voith principle:
Driving and braking with
one hydraulic circuit



Driving:
Power-split with differential
torque converter



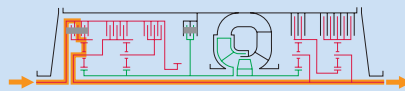
Braking:
Retarder function with
torque converter



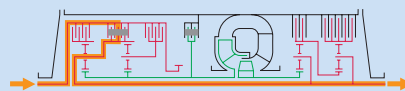
Idling/neutral position
Input clutch open



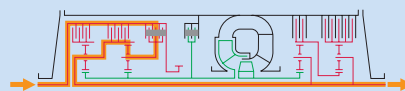
1st Gear
DIWA® range (stepless) Input clutch
and turbine brake are closing: smooth
start with high traction. Rapidly increas-
ing mechanical power transmission
via differential transmission (power-split
principle)



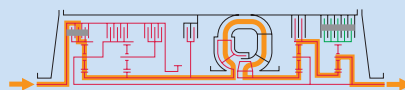
2nd Gear
Automatic gear-shifting is dependent
on acceleration and driving speed.
Impeller closes, turbine brake opens.
Power is now transmitted purely
mechanically



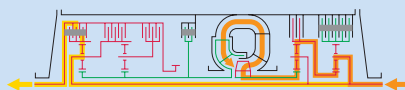
3rd Gear
At approximately 50 % (or 70 % with
D 851.3E/D 863.3E) of the maximum
speed, the input clutch opens automati-
cally and the lock-up clutch is closing



4th Gear (D 854.3E/D 864.3E only)
At approximately 70% of the maximum
speed, conversion occurs automati-
cally: clutch for the 4th gear closes and
lock-up clutch opens



Reversing (R)
Power is transmitted hydrodynamically/
mechanically like in 1st gear (DIWA®
range)



Braking (in 2nd – 4th Gear)
(Retarder function with 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 kine-
tic energy is dissipated via the heat
exchanger

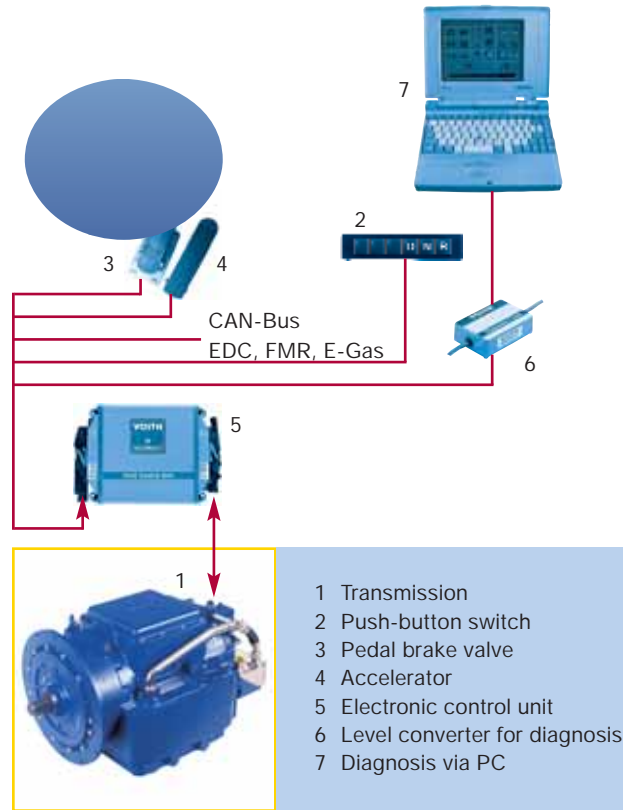
- Active power flow
- Rotating components
- Locked rotating components
- Stationary components
- Clutch plates closed

ANS automatic disengagement of neutral.
In order to save fuel, the power flow
between engine and transmission, in-
cluding the converter, is automati-
cally interrupted when the vehicle is at a halt.

DIWA®.3E, E 200, DIWAGNOSIS – the combination for your economy

Transport companies and bus operators who want to drive economically over long periods, should always fully exploit their resources. It is therefore vital to drive as efficiently as possible and simultaneously minimise wear and maintenance work. Here the unique DIWA®.3 automatic transmission with E 200 control system and DIWAGNOSIS software can help.

The E 200 control system identifies the vehicle acceleration and adjusts itself to the topography and the load conditions. As a result, gear-shifting points can always be put in the optimum range which reduces fuel consumption. The driver keys in the conditions, and the electronic system optimises in line with the pre-selected program. The micro processor control processes the incoming commands from the driver in fractions of a second to ensure that acceleration is always swift while driving is always economical. The PC-based diagnosis system DIWAGNOSIS offers the user optimum support with check-ups and failure detection and elimination, with minimal hardware requirements. It includes peripheral equipment, e. g. push-button switch or load transmitters. With DIWAGNOSIS, all required information can be displayed on a PC at any time. Preventative and routine maintenance are backed up which contributes significantly to the reduction of standstill times.



The control concept:

Micro-processor control

- Digital processing of electronic engine signals such as EDC, E-Gas a. o.
- Adaptive control for independent adaptation to engine and vehicle as a prerequisite for consistent gear-shifting quality throughout the entire service life
- Storage facility allows precise diagnosis of transmission condition
- Easy data exchange allows adaptation to new conditions (vehicle, engine, driving conditions)
- CAN-compatible
- Operating data storage

Hydraulic control

- Patented Voith control valves convert signals into hydraulic pressure
- individually controlled gear-shifts owing to controlled pressure increase
- Reduced wear owing to minimised stress

Systems diagnosis

- Integration into other vehicle diagnosis possible
- Long-term planning of maintenance and overhauls
- Oil change in connection with special oils after every 120000 km

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 Turbo is flexible to these needs and, in addition to its standard product range, also offers components for the adaptation to engine and axle.

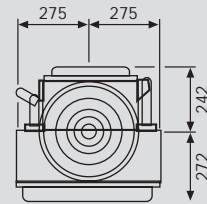
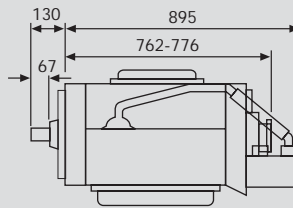
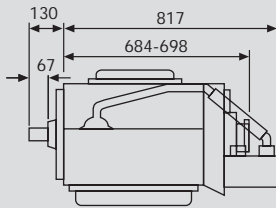
Standard scope of supply

- Voith DIWA® standard transmission
- Anti-corrosive heat exchanger
- Torsional vibration camper
- Electronic control
- Oil temperature pick-up
- Set of cables

Additional range*

- Connecting flanges between engine and transmission
- Suspension flanges
- Input flanges
- Input angle drives
- Output angle drives
- Push-button switch for gear selection
- Braking stage manual switch
- Load transmission

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



Performance data DIWA®.3 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® range)	3	5.9 – 6.2	5.9 – 6.2	5.9 – 6.2	5.9
(Starting point)	4	–	5.1 – 6.4	5.1 – 5.4	5.1 – 5.4
	Transmissions				
2 nd Gear	3	1.43	1.43	1.43	1.43
	4	–	1.36	1.36	1.36
3 rd Gear	3	1.0	1.0	1.0	1.0
	4	–	1.0	1.0	1.0
4 th Gear	3	–	–	0.7	–
	4	–	–	0.73	–
Reverse Gear	3	4.7 – 5.2	4.7 – 5.2	4.7 – 5.2	4.7
	4	–	3.8 – 4.3	3.8 – 4.3	3.8 – 4.3

Voith – The Company

World-wide, Voith is setting standards in paper technology, power transmission, power generation and industrial services.

Quality, reliability, solidity – these are the key words of our corporate philosophy. This is reflected in: Voith – Engineered Reliability.

Voith – Figures, Dates, Facts

Voith is one of Europe's large family-owned companies. The driving forces of our growth are innovative power and reliability.

Holding: Voith AG

Head office: Heidenheim/Brenz, Germany

Turnover: EUR 3.3 billion

Employees: 23 500

Locations: over 180 world-wide

Voith Turbo – Competent Partner for Power Transmission

Voith Turbo is a Group Division of Voith AG.

We develop and produce state-of-the-art drive and braking systems for industry, rail and road applications.

Our products operate economically, efficiently and fast. They save energy, reduce emissions and, at the same time, offer ultimate comfort.

Voith Turbo GmbH & Co. KG
Alexanderstraße 2
D-89522 Heidenheim
Tel.: +49 (0) 73 21 37-82 49
Fax: +49 (0) 73 21 37-75 04
DIWA-Getriebe@voith.com
www.voithturbo.com

VOITH
Engineered reliability.