Drive New Ways
Commercial Vehicles
Products and services
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Products for agricultural machinery

Hydrodamp vibration damper
SilentVent

Repairs and services for commercial vehicles

Service portfolio
SmartMaintenance
Service for DIWA automatic transmission
DIWA Service Rental
Service for retarders
Service for air compressors
Voith has already equipped more than 350,000 public transit buses around the world with automatic transmissions. And the number is increasing every day.

Our product spectrum for buses also includes retarders and air compressors. Solutions that help people worldwide to reach their destinations safer and with more comfort.
DIWA automatic transmission

The proven DIWA principle of power splitting allows smooth starting over a range of speeds where other transmissions need to shift two or three times. Up to 50% fewer gear shifts in total reduce wear and increase driving comfort.

When the bus brakes are applied, the unique principle of the DIWA transmission, the differential converter, acts as a retarder. It relieves the load on the service brakes and increases braking power at medium and high speeds by up to 30%.

Advantages and benefits of DIWA automatic transmission

+ Reduced fuel consumption
+ Intelligent start-up management
+ Stop-Start technology
+ Reduced CO$_2$, particulate and noise emissions
+ Lower maintenance and repair costs
+ More comfort and safety for passengers and drivers
+ Maximum availability due to online status monitoring
+ Need-based reduction of the operating pressure
+ Oil-change intervals of up to 180 000 km using approved transmission fluids from the lubricant list
+ Less wear
+ Improved serviceability
+ Extended recording operating data
The SensoTop topography-dependent shifting program optimizes all gear-shifting points in real-time depending on the acceleration, line profile and vehicle load.

A tilt sensor delivers to the transmission control the necessary information for the stepless adjustment of shift points. The driver has the best engine power available for level roads or mountainous terrain with heavy or light loads – achieving fuel savings of up to 7%.

**Best fuel consumption with SensoTop**

Adjustment to topography and vehicle dynamics

<table>
<thead>
<tr>
<th>Uphill / downhill</th>
<th>Power required</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3%</td>
<td></td>
</tr>
<tr>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>5%</td>
<td></td>
</tr>
</tbody>
</table>

-3 % 0 % 0 % 5 % 5 %
Performance data of the DIWA.5 automatic transmission

<table>
<thead>
<tr>
<th>Types</th>
<th>D 824.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input power $P_{\text{1max}}$ [kW]</td>
<td>180</td>
</tr>
<tr>
<td>Input torque $M_{\text{1max}}$ [Nm]</td>
<td>650</td>
</tr>
<tr>
<td>Input speed $n_{\text{1max}}$ [rpm]</td>
<td>2500</td>
</tr>
<tr>
<td>Retarder braking torque $M_{\text{BR}}^*$ [Nm]</td>
<td>2000²</td>
</tr>
<tr>
<td>Transmission mass (dry) including retarder [kg]</td>
<td>approx. 329</td>
</tr>
<tr>
<td>Max. vehicle weight [metric t]</td>
<td>15</td>
</tr>
</tbody>
</table>

**Main areas of application:**
- Midibuses
- Standard public transit buses
- Solo buses

1. 1750 Nm under certain conditions
2. Maximum value depending on retarder configuration
3. Depending on the axle ratio
4. Maximum value depending on retarder configuration
### Performance Data of the DIWA 5 Automatic Transmission

<table>
<thead>
<tr>
<th>Type</th>
<th>D 854.5</th>
<th>D 864.5</th>
<th>D 884.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Power P₁ max [kW]</td>
<td>220</td>
<td>290</td>
<td>320</td>
</tr>
<tr>
<td>Input Torque M₁ max [Nm]</td>
<td>1 100</td>
<td>1 600¹</td>
<td>1 900</td>
</tr>
<tr>
<td>Input Speed n₁ max [rpm]</td>
<td>2 500</td>
<td>2 500</td>
<td>2 200</td>
</tr>
<tr>
<td>Retarder Braking Torque M BR * [Nm]</td>
<td>2 000²</td>
<td>2 000²</td>
<td>2 000²</td>
</tr>
<tr>
<td>Transmission Mass (dry) including retarder [kg]</td>
<td>approx. 334</td>
<td>approx. 339</td>
<td>approx. 344</td>
</tr>
<tr>
<td>Max. Vehicle Weight [metric t]</td>
<td>28</td>
<td>28</td>
<td>34³</td>
</tr>
</tbody>
</table>

**Main Areas of Application:**

1. 1 750 Nm under certain conditions
2. Maximum value depending on retarder configuration
3. Depending on the axle ratio

* Maximum value depending on retarder configuration

**Articulated Buses**

**Public Transit Buses with High Transmission Input Torque Also for Interstate/Intercity Use**
Performance data of the DIWA.6 automatic transmission

<table>
<thead>
<tr>
<th>Types</th>
<th>D 824.6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input power $P_{1\text{max}}$ [kW]</td>
<td>200</td>
</tr>
<tr>
<td>Input torque $M_{1\text{max}}$ [Nm]</td>
<td>800</td>
</tr>
<tr>
<td>Input speed $n_{1\text{max}}$ [min⁻¹]</td>
<td>2 500</td>
</tr>
<tr>
<td>Retarder braking torque $M_{BR}$ * [Nm]</td>
<td>1 800²</td>
</tr>
<tr>
<td>Transmission mass (dry) including retarder [kg]</td>
<td>ca. 329</td>
</tr>
<tr>
<td>Max. vehicle weight [t]</td>
<td>15</td>
</tr>
</tbody>
</table>

¹ 1 750 Nm under certain conditions
² Maximum value depending on retarder configuration
³ Depending on the axle ratio
* Maximum value depending on retarder configuration
<table>
<thead>
<tr>
<th>D 854.6</th>
<th>D 864.6</th>
<th>D 884.6</th>
</tr>
</thead>
<tbody>
<tr>
<td>240</td>
<td>290</td>
<td>320</td>
</tr>
<tr>
<td>1 250</td>
<td>1 700¹</td>
<td>1 900</td>
</tr>
<tr>
<td>2 500</td>
<td>2 500</td>
<td>2 200</td>
</tr>
<tr>
<td>2 000²</td>
<td>2 000²</td>
<td>2 000²</td>
</tr>
<tr>
<td>ca. 334</td>
<td>ca. 339</td>
<td>ca. 344</td>
</tr>
<tr>
<td>28</td>
<td>28</td>
<td>34³</td>
</tr>
</tbody>
</table>
DIWA.6 Stop-Start technology
The new Stop-Start technology for the Voith DIWA.6 transmission provides a significant reduction in fuel consumption. The resulting greater efficiency offers a direct added value. Passengers, drivers and pedestrians benefit from the reduced noise during stop times.

Benefits of the DIWA.6 Stop-Start technology at a glance
- Reduction of fuel consumption by up to 12%
- More comfort for passengers, drivers and pedestrians
- Up to a third less engine operating time
The evolution of efficiency in urban traffic

• Depending on the duty cycle, city buses spend up to 40% of their operating time in idle mode
• A reduction of up to 12% in fuel consumption can be achieved
• No negative influence regarding startup readiness in urban city applications
• DIWA.6 Stop-Start technology enables stop times of up to 180 seconds

Reduced CO$_2$, NO$_x$, particulate and noise emissions

No change to the existing transmission required

Proven in operation in more than 1500 buses
Voith stays on track with the development of its new DIWA NXT transmission for buses. With the new DIWA NXT, the DIWA transmission remains the number one choice for city buses.

The new transmission features an optional mild-hybrid system with a 48V central recuperation unit (CRU) and offers an optimal gear ratio through an additional overdrive gear for inter-city applications.

Test bench and test track results have proven the predicted efficiency and reduction in emissions.
Advantages and benefits DIWA NXT

+ Best-in-class comfort due to proven DIWA-principle
+ Optimal gear ratio through an additional overdrive gear
+ Significant traction and braking performance optimization through the separation of torque converter and retarder
+ Fuel saving potential by up to 7 %
+ No additional installation space and no impact on the weight compared to DIWA.

Advantages and benefits DIWA NXT CRU

+ Optional mild-hybrid system
+ Based on 48V hybrid technology with continuous power of 25 kW and peak power of 35 kW
+ Minimal additional installation space
+ Fuel saving potential by up to 9 %
Retarders for buses

From 7.5 to 250 metric tons – Voith has the right retarder for virtually all your trucks and buses. When retarders from Voith are used, up to 90% of all braking operations can be achieved without any wear.

Voith Retarder – ensuring wear-free continuous braking in trucks and buses. In conjunction with the exhaust valve brake, you always have the optimum braking effect – at low and high speeds. And maximum safety in any driving situation.

Product portfolio

- **Water retarders**
  - Voith Aquatarder ECO-SWR
  - Voith Aquatarder SWR

- **Oil retarders**
  - Voith Retarder 123+
  - Voith Retarder 3250 for Volvo buses
  - Voith Retarder 120 E
In a hydrodynamic retarder, two bladed wheels face each other. The rotor is connected to the propshaft of the vehicle via the retarder input shaft, the stator is rigidly connected to the retarder housing. During braking, oil circulates between the bladed wheels. The oil is accelerated by the rotor and decelerated (retarded) in the stator. As a result, the rotor is also decelerated and the vehicle is slowed down. Braking heat that is generated in this process is fast and effectively dissipated via the vehicle cooling system – without negatively affecting adjacent components.

Advantages

+ More comfort
+ Greater safety
+ Less wear
+ Less time spent in the workshop
+ Higher average speed
+ More transport capacity
+ Reduced emissions
Water retarders

Voith Aquatarder SWR

The secondary water retarder occupies a 50% smaller installation space than its predecessor and is 35 kg lighter. As it uses the engine’s own coolant as its operating medium, it is also maintenance-free: no additional oil or coolant changes and no adjustments. And the environment benefits from up to 80% less brake dust.

Voith Aquatarder SWR – Technical data

<table>
<thead>
<tr>
<th>Step-up ratio</th>
<th>i = 1.83</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. rated braking torque at the universal joint shaft</td>
<td>3 500 Nm</td>
</tr>
<tr>
<td>Standard operation</td>
<td>5-stage multifunction lever + constant velocity function Option: Foot operation</td>
</tr>
<tr>
<td>Operating medium</td>
<td>Engine coolant (see the Mercedes-Benz operating supply specification)</td>
</tr>
<tr>
<td>Control medium</td>
<td>Compressed air</td>
</tr>
<tr>
<td>Unit weight</td>
<td>approx. 46 kg</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>24 V</td>
</tr>
<tr>
<td>CAN-Bus-specific RCM (Retarder Control Module)</td>
<td></td>
</tr>
</tbody>
</table>
Features and benefits

+ Greater safety
+ Lower operating costs
+ Less time spent in the workshop
+ Lower fuel consumption
+ Reduced emissions

Voith Aquatarder SWR
Oil retarders

Voith Retarder 115 E
Jointly with Daimler AG, the GO/VR 115 E transmission retarder system was developed especially for buses.

Retarder VR 115 E – Technical data

<table>
<thead>
<tr>
<th>Step-up ratio</th>
<th>i = 2.03</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. rated braking torque at the universal joint shaft</td>
<td>3 500 Nm</td>
</tr>
<tr>
<td>Standard operation</td>
<td>5-stage handbrake switch</td>
</tr>
<tr>
<td></td>
<td>Stage 1: constant velocity</td>
</tr>
<tr>
<td></td>
<td>(downhill cruise control)</td>
</tr>
<tr>
<td></td>
<td>Option: Foot operation</td>
</tr>
<tr>
<td>Operating medium</td>
<td>Oil (see the operating supply specification)</td>
</tr>
<tr>
<td>Capacity (oil change)</td>
<td>6.7 l</td>
</tr>
<tr>
<td>Control medium</td>
<td>Compressed air</td>
</tr>
<tr>
<td>Unit weight including clutch housing but excluding operating medium</td>
<td>273 kg</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>24 V</td>
</tr>
<tr>
<td>CAN-Bus-specific electronic control system</td>
<td>VERA</td>
</tr>
</tbody>
</table>
Features and benefits

+ Compact design
+ Greater safety
+ Increased driving comfort
+ More cost-effective
+ More environmentally-friendly

Voith Retarder 115 E
Voith Retarder 123+
More safety with the Voith Retarder 123+: The retarder in your buses reduces wear, increases transport capacity, raises average speeds and lowers repair costs.

Retarder 123+ – Technical data

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. rated braking torque at the universal joint shaft</td>
<td>2,000 Nm</td>
</tr>
<tr>
<td>Maximum speed at the universal joint shaft</td>
<td>3,600 rpm</td>
</tr>
<tr>
<td>Standard operation</td>
<td>Handbrake switch</td>
</tr>
<tr>
<td></td>
<td>Option: Foot operation</td>
</tr>
<tr>
<td>Operating medium</td>
<td>Oil (see the operating supply specification)</td>
</tr>
<tr>
<td>Capacity (oil change)</td>
<td>6 l</td>
</tr>
<tr>
<td>Control medium</td>
<td>Compressed air</td>
</tr>
<tr>
<td>Unit weight excluding operating medium</td>
<td>approx. 59.5 kg</td>
</tr>
<tr>
<td>CAN-bus-compatible retarder control</td>
<td>VERA</td>
</tr>
</tbody>
</table>
Features and benefits

+ Greater safety
+ Increased driving comfort
+ More cost-effective
+ More environmentally-friendly

Voith Retarder 123+
Voith Retarder 3250 Volvo
Volvo and Voith worked together in partnership to develop the Volvo Compact Retarder VR 3250.

Retarder 3250 Volvo – Technical data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step-up ratio</td>
<td>$i = 2.03$</td>
</tr>
<tr>
<td>Max. rated braking torque at the universal joint shaft</td>
<td>3 250 Nm</td>
</tr>
<tr>
<td>Maximum speed at the universal joint shaft</td>
<td>2 500 rpm</td>
</tr>
<tr>
<td>Standard operation</td>
<td>5-stage handbrake switch</td>
</tr>
<tr>
<td></td>
<td>Stage 1 = automatic mode A</td>
</tr>
<tr>
<td></td>
<td>(downhill cruise control)</td>
</tr>
<tr>
<td>Operating medium</td>
<td>Oil (see the Volvo operating supply specification)</td>
</tr>
<tr>
<td>Capacity (oil change)</td>
<td>5.4 l</td>
</tr>
<tr>
<td>Control medium</td>
<td>Compressed air</td>
</tr>
<tr>
<td>Unit weight including flange, heat exchanger but excluding operating medium</td>
<td>approx. 59 kg (bus version)</td>
</tr>
<tr>
<td>Nennspannung</td>
<td>24 V</td>
</tr>
</tbody>
</table>
Features and benefits

+ Greater safety
+ Increased driving comfort
+ More cost-effective
+ More environmentally-friendly

Voith Retarder 3250 Volvo
Voith Retarder 120 E
Arrive safer and more economically with the retarder for trucks and buses.

Voith Retarder 120 E – Technical data

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. rated braking torque at the universal joint shaft</td>
<td>2,200 Nm</td>
</tr>
<tr>
<td>Maximum speed at the universal joint shaft</td>
<td>3,000 rpm</td>
</tr>
<tr>
<td>Standard operation</td>
<td>Handbrake switch with constant velocity function (downhill cruise control) Optional: Foot control</td>
</tr>
<tr>
<td>Operating medium</td>
<td>Oil (see the operating supply specification)</td>
</tr>
<tr>
<td>Capacity (oil change)</td>
<td>4.2 l</td>
</tr>
<tr>
<td>Control medium</td>
<td>Compressed air</td>
</tr>
<tr>
<td>Unit weight including flange, heat exchanger but excluding operating medium</td>
<td>approx. 59 kg</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>24 V</td>
</tr>
<tr>
<td>CAN-bus-compatible retarder control</td>
<td>VERA</td>
</tr>
</tbody>
</table>
Features and benefits

+ Greater safety
+ Increased driving comfort
+ More cost-effective
+ More environmentally-friendly

Voith Retarder 120 E
To reduce air and noise emissions in urban areas, operators have started to electrify their fleets. Voith is committed to providing a tailored plug-and-play solution with optimized interfaces that are easy to integrate. The Voith electric drive system is a fully electric powertrain suitable even for articulated buses and challenging topographies.

Best in class for efficiency and reliability. The advanced design of the motor ensures highest efficiency. Due to the high power density the Voith Electrical Drive System Motor has a very compact design.
Features and benefits

+ High reliability
+ Highly efficient, light weight e-bus drive train lowers energy consumption, smaller battery
+ Complete system, single-sourced, perfectly matched components and simple interfaces
+ All components water cooled, high recuperation rate, low noise and compact design
+ Fully need-based control of all auxiliaries
Over one million retarders supplied by Voith reliably take the load off the service brakes of commercial vehicles (buses and trucks). Voith offers additional solutions such as air compressors, Turbo-Compound and turbo retarder clutches for heavy load transportation and construction vehicles.
Retarders

From 16 to 250 metric tons – Voith has the right retarder for virtually all your trucks and buses. When retarders from Voith are used, up to 90% of all braking operations can be achieved without any wear.
Product portfolio

• Water retarders
  – Voith Aquatarder SWR
  – Voith Aquatarder PWR

• Oil retarders
  Inline retarders
  – Voith Retarder 120
  Offline retarders
  – Voith Retarder 115 HV
  – Voith Retarder 3250
  – Voith Retarder 115 E
  – Voith Retarder 120 E
  – Voith Retarder 115 CT
Water retarders

Voith Aquatarder SWR
The secondary water retarder occupies a 50 % smaller installation space than its predecessor and is 35 kg lighter. As it uses the engine’s own coolant as its operating medium, it is also maintenance-free: no additional oil or coolant changes and no adjustments. And the environment benefits from up to 80 % less brake dust.

Voith Aquatarder SWR – Technical data

<table>
<thead>
<tr>
<th>Step-up ratio</th>
<th>i = 1.54 / i = 1.68</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. rated braking torque at the universal joint shaft</td>
<td>3 500 Nm</td>
</tr>
<tr>
<td>Standard operation</td>
<td>5-stage multifunction lever + constant velocity function Option: Foot operation</td>
</tr>
<tr>
<td>Operating medium</td>
<td>Engine coolant (see the Mercedes-Benz operating supply specification)</td>
</tr>
<tr>
<td>Control medium</td>
<td>Compressed air</td>
</tr>
<tr>
<td>Unit weight</td>
<td>approx. 42 kg</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>24 V</td>
</tr>
<tr>
<td>CAN-Bus-specific RCM (Retarder Control Module)</td>
<td></td>
</tr>
</tbody>
</table>
Features and benefits

+ Greater safety
+ Lower operating costs
+ Less time spent in the workshop
+ Lower fuel consumption
+ Reduced emissions

Voith Aquatarder SWR
**Voith Aquatarder PWR**

In place of oil, the Aquatarder uses the available coolant as the primary retarder. It is attached to the engine and connected directly to the crank shaft. As with all Voith retarders, it uses the hydrodynamic principle.

The engine crank shaft drives a rotor. The rotor accelerates the operating medium, in this case coolant. A stator, which is located opposite the rotor, decelerates the medium again. This braking torque is transferred via the rotor and the crank shaft to the driveline of the vehicle. When a retarder is used for braking, kinetic energy is converted into thermal energy. The coolant absorbs the heat directly and transports it to the vehicle cooling system where it is dissipated.

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**Aquatarder PWR for MAN Common Rail Diesel Engines D20/D26 – Technical data**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. rated braking torque at the crank shaft</td>
<td>1 450 Nm</td>
</tr>
<tr>
<td>Standard operation</td>
<td>Either with the operating lever or the brake pedal</td>
</tr>
<tr>
<td>Operating medium</td>
<td>Engine coolant in compliance with MAN operating instructions</td>
</tr>
<tr>
<td>Control medium</td>
<td>Compressed air</td>
</tr>
<tr>
<td>Retarder net weight</td>
<td>approx. 33 kg</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>24 V</td>
</tr>
<tr>
<td>CAN-Bus-specific electronic control system</td>
<td>VERA</td>
</tr>
</tbody>
</table>
Features and benefits

+ Greater safety
+ Lower operating costs
+ Less time spent in the workshop
+ Reduced fuel consumption
+ Reduced emissions

Voith Aquatarder PWR
Oil retarders

Inline retarders
Voith inline retarders are installed directly onto the transmission or freely to the driveline. They are connected to the universal joint shaft of the vehicle.

Position of the Inline retarder in the drive train
Voith Retarder 120 E
For interstate buses, motor coaches and medium-sized trucks such as car transporters, solo vehicles in distribution traffic, beverage vehicles, vehicles for the transportation of large-volume cargo and mobile cranes.
Oil retarders

**Offline retarders**
Voith offline retarders (step-up retarders) work with a conversion ratio. This means that the speed of the retarder is greater than that of the drive shaft. Offline retarders are very compact and exhibit great braking force even at low speeds.

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**Position of the offline retarder in the drive train**
Voith Retarder 3250
The VR 3250 is used in Volvo trucks of the FH and FM series and in Volvo buses using Volvo transmissions. The VR 3250 is used in the Renault T-Range and C&K-Range.
Voith Retarder 115 HV
This retarder was developed for the Mercedes-Benz commercial vehicles Actros and Axor and is attached to the Mercedes-Benz transmission PowerShift.

Voith Retarder 115 HV
Voith Retarder 115 CT

The great cost-effectiveness with high brake quality and very short amortization periods of the Voith Retarder 115 CT are impressive. The modular design and the great accessibility in the vehicle make the retarder extremely easy to maintain.

The Voith 115 CT retarder is manufactured in series production for on-and off-road heavy-haulage applications.

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### Voith Retarder 115 CT

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### Overview of the technical data of all Voith oil retarders

<table>
<thead>
<tr>
<th></th>
<th>SWR</th>
<th>VR 120</th>
<th>VR 123</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. retarder rated braking torque, drive shaft (Nm)</td>
<td>3 750</td>
<td>2 000</td>
<td>2 000</td>
</tr>
<tr>
<td>Max. speed at the drive shaft (rpm)</td>
<td>3 500</td>
<td>3 400</td>
<td>3 600</td>
</tr>
<tr>
<td>Weight excluding operating medium, approx. (kg)</td>
<td>42</td>
<td>65</td>
<td>59,5</td>
</tr>
<tr>
<td>Specific braking torque (Nm/kg)</td>
<td>89</td>
<td>31</td>
<td>29</td>
</tr>
</tbody>
</table>
Overview of the technical data of all Voith oil retarders

<table>
<thead>
<tr>
<th>Model</th>
<th>Max. retarder rated braking torque, drive shaft (Nm)</th>
<th>Max. speed at the drive shaft (rpm)</th>
<th>Weight excluding operating medium, approx. (kg)</th>
<th>Specific braking torque (Nm / kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VR 133-2</td>
<td>4 000</td>
<td>3 500</td>
<td>85</td>
<td>89</td>
</tr>
<tr>
<td>VR 115 HV</td>
<td>2 800</td>
<td>2 480</td>
<td>62</td>
<td>31</td>
</tr>
<tr>
<td>VR 120 E</td>
<td>3 250</td>
<td>2 500</td>
<td>59</td>
<td>29</td>
</tr>
<tr>
<td>VR 115 CT</td>
<td>2 200</td>
<td>3 000</td>
<td>66</td>
<td>47</td>
</tr>
<tr>
<td>VR 3250</td>
<td>3 500</td>
<td>3 000</td>
<td>70</td>
<td>46</td>
</tr>
</tbody>
</table>

Advantages:

- Extremely easy to maintain due to modular design and ideal accessibility in the vehicle
- Greater safety on the road
- Low weight
- Easy vehicle integration
VIAB Turbo retarder clutch

With the wear-free integrated start-up and braking system (VIAB in German), Voith combines the advantages of hydrodynamics with the high efficiency of a mechanical driveline. When transporting heavy loads, at construction sites, with cranes and special vehicles, the VIAB scores highly with sensitive start-up and maneuvering comfort.

In addition, the VIAB offers a high-performance primary retarder. With a fill-regulated, hydrodynamic fluid coupling as the main component, it unites the hydrodynamic start-up and hydrodynamic braking functions into one system.
VIAB Turbo retarder clutch
Principle of operation

When starting up, power is transmitted to the transmission input shaft via the hydrodynamic circuit with a pump wheel and turbine wheel and a downstream free wheel coupling. A conventional friction coupling is configured in parallel to the circuit as a transitional coupler. During braking, the turbine wheel is stopped with the turbine brake. With the friction coupling closed, the system becomes a high-performance primary retarder. The characteristic of the unit is infinitely variable by filling or emptying the hydrodynamic circuit.
Advantages

+ High comfort through sensitive hydrodynamic start-up and maneuvering
+ High availability thanks to a wear-free start-up without friction coupling
+ Integrated high-performance primary retarder
+ Maximum start-up tractive power at low speeds
+ Full conversion of engine torque up to the transaction limit
+ Overload-resistant with high thermal stability
+ Lower fuel consumption in comparison to conventional converter solutions
+ New, efficient automatic transmission concept: Combination of a fluid coupling with an automated manual transmission
Products for commercial vehicle engines

Voith develops and manufactures engine components. With its technical services, Voith reliably supports the processes of customers in the automotive and commercial vehicle industries worldwide.
# Air compressors

Traveling economically and saving the environment at the same time – auxiliary units such as air compressors in trucks and buses contribute significantly to this. Unique applied at Voith: two-stage compression with inter-cooling system. This results in significantly reduced power uptake during delivery operation. The pre-charging of the system with its unique inter-cooling enables a significant reduction in power uptake during delivery operation and therefore allows duty cycles up to 85% and at the same time avoids significantly harmful decomposition products in the air system.

Through intelligent idling systems such as SLS and TwinSave sets standards in relation to power consumption in off-load mode. In addition Voith offers a clutch solution for its air compressors. Through a 100 percent cut off of the clutch optimize values can achieved regarding power consumption in off-load mode.

Furthermore TwinSave and clutch contribute to a quick filling of the air tanks.

## Functionality TwinSave

<table>
<thead>
<tr>
<th>Products for commercial vehicle engines</th>
<th>Air compressors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Balancing piston</strong></td>
<td><strong>Pressure chamber</strong></td>
</tr>
<tr>
<td><strong>Suction chamber</strong></td>
<td><strong>Intermediate chamber with cooler</strong></td>
</tr>
<tr>
<td><strong>Control connection</strong></td>
<td><strong>Suction pressure</strong></td>
</tr>
<tr>
<td><strong>Intermediate pressure</strong></td>
<td><strong>Intermediate pressure</strong></td>
</tr>
<tr>
<td><strong>End pressure</strong></td>
<td><strong>End pressure</strong></td>
</tr>
<tr>
<td><strong>Piston, first stage</strong></td>
<td><strong>Piston, second stage</strong></td>
</tr>
<tr>
<td><strong>Suction</strong></td>
<td><strong>Piston</strong></td>
</tr>
<tr>
<td><strong>Intermediate pressure</strong></td>
<td><strong>Intermediate pressure</strong></td>
</tr>
<tr>
<td><strong>End pressure</strong></td>
<td><strong>End pressure</strong></td>
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</tbody>
</table>

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<td><strong>Balancing piston</strong></td>
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<tr>
<td><strong>Intermediate pressure</strong></td>
</tr>
<tr>
<td><strong>End pressure</strong></td>
</tr>
<tr>
<td><strong>Piston, second stage</strong></td>
</tr>
</tbody>
</table>
Advantages

- Lower fuel consumption (up to 1 L/100 km)
- Energy recovery in braking and coasting mode
- No oil cracking due to lower temperature levels
- Better air quality due to significantly less harmful oil decomposition products, higher availability of the air system as a result
- Lower energy consumption in non-delivery mode thanks to the innovative idling systems
- Longer duty cycles (up to 85%) due to innovative cooling concept
- Higher pressure level: Operation possible in excess of 15 bar
- A significant weight reduction due to die-cast aluminium leads to an increased load capacity
The product family at a glance

The portfolio covers pre-charged two-cylinder and three-cylinder air compressors made from graycast iron or cast aluminum.

<table>
<thead>
<tr>
<th>Customer</th>
<th>Engine</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daimler</td>
<td>OM457</td>
<td>Bus</td>
</tr>
<tr>
<td></td>
<td>OM47x</td>
<td>Truck</td>
</tr>
<tr>
<td></td>
<td>OM936</td>
<td></td>
</tr>
<tr>
<td>Volvo</td>
<td>D5</td>
<td>Bus</td>
</tr>
<tr>
<td></td>
<td>D9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D11</td>
<td></td>
</tr>
<tr>
<td>MAN</td>
<td>D0863LOH</td>
<td>Bus</td>
</tr>
<tr>
<td></td>
<td>D20/D26</td>
<td></td>
</tr>
<tr>
<td>MTU</td>
<td>BR1600</td>
<td>Agriculture machinery</td>
</tr>
<tr>
<td></td>
<td>BR2000</td>
<td>Rail vehicles</td>
</tr>
</tbody>
</table>

LP 490  
2-cylinder air compressor

LP 725  
3-cylinder air compressor
New: LP 560
2-cylinder air compressor

The LP560 air compressor has been further optimized regarding light weight design and operating efficiency still relying on the trusted 2-stage principle. The air compressor can be either equipped with “TwinSave” technology an innovative idling system to further reduce power consumption or with clutch technology to be able to fully disengage the compressor for even higher efficiency in offload mode. Both systems are contributing to save energy on its best. With its new asymmetric design and the new side cooler the internal temperature can be reduced significantly and oil carry over is on lowest level.

Advantages and benefits

+ Oil carry over < 0.3 g/h
+ Increased lifetime of the product
+ Die-cast aluminum for a weight saving of up to 7 kg
+ TwinSave for low power consumption
+ Clutch with low power consumption in non-delivery operation, while integrated in the flange – no additional installation space necessary
+ More air by increasing the displacement and asymmetrical design with the new side cooler
The Voith TurboCompound system supports engine manufacturers in achieving the Euro 6 norm in force since 2013 for commercial vehicles. TurboCompound systems by Voith convert the thermal energy in the exhaust fumes and transfer it to the crank shaft. The efficiency of the engine increases and CO₂ emissions are lowered. Voith supplies hydrodynamic couplings and subsystems for the TurboCompound system.

Another turbine is installed in the exhaust line downstream from the turbocharger. The hot exhaust gases drive the turbine, thus generating mechanical power. This power is transmitted to the engine’s crankshaft via a coupling.

Function and design
Advantages

+ Increased engine power across the entire speed range
+ Lower exhaust gas emissions
+ Lower fuel consumption

TurboCompound – Technical data

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<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Max. power</td>
<td>75 kW</td>
</tr>
<tr>
<td>Turbine speed</td>
<td>50,000 rpm</td>
</tr>
</tbody>
</table>
Products for agricultural machinery

Voith offers vibration dampers for tractors and other agricultural machinery. These dampers reduce torsional vibration in the driveline and increase driving comfort. The TurboCompound systems facilitate fuel savings of up to three percent. They use the energy in the hot exhaust and convert it into input power.
Vibration dampers

The Voith Hydrodamp Vibration Damper hydraulically damps and isolates vibrations – and protects the transmission and engine over the long term. The highly elastic vibration damper with spring-mass system has a separately aligned damping system. It shifts critical resonant frequencies and isolates small vibration amplitudes.

Hydraulic damping can be adjusted to the appropriate application conditions. This allows effective damping of the resonance passages, switching impacts and jerking, without having to give up the isolation effect in drive mode.

Structure of the Hydrodamp vibration damper

Isolation response of the Hydrodamp
Advantages of hydraulic damping

+ No sticking phases followed by breaking free meaning no vibration stimulation as with conventional friction damping
+ The damping effect can be matched to operating ranges by way of the torsion angle, gap geometries and the viscosity of the damping medium
+ Damping is proportional to speed meaning that higher frequencies or amplitudes result in greater damping
+ Damping is wear-free

Damping response of the Hydrodamp

![Damping response graph](chart)

- Magnification factor
- Speed ratio

A: Small damping
B: Hydrodamp
Hydrodamp HTSD 300 / HTSD 300 LS

The Series 300 is intended primarily for use on medium- and high-performance tractors and construction machinery with powershift transmissions and variable-speed drives.

Features:
- Intended for medium to high-performance tractors and construction machinery with powershift transmissions and variable-speed drives
- Engine torques of up to 1,650 Nm
- Hydraulic damping system with damping grease
- Weight-optimized sheet metal forming technology
Hydrodamp HTSD 365
The Series 365 is designed for automatic transmissions in buses and rail vehicles. Also for the high-performance tractors and construction machinery with powershift transmissions and variable-speed drives. The HTSD 365 is available in versions for flange mounting and connection to universal joint shafts.

Features:
- For automatic transmissions in city buses and rail vehicles, for high-performance tractors and construction machinery with powershift transmissions and variable-speed drives
- Engine torques up to 2600 Nm
- Hydraulic damping system with damping oil or damping grease
- Idling stage, several operating stages and terminal operating stage
- Designed in versions for flange mounting and connection to the universal joint shaft
Hydrodamp HTSD 400
The Series 400 is designed for heavy rail vehicle transmissions and large tractors.

Features:
• For heavy rail vehicle transmissions and large tractors
• Engine torques of up to 3 700 Nm
• Hydraulic damping system with damping oil or damping grease
Overview of the Hydrodamp series

HTSD 300, attached directly

HTSD 365, connected to the universal joint shaft

HTSD 400, attached directly
SilentVent

Noise is a high-grade environmental pollutant. This also applies to the application of agricultural machinery. But unlike with cars, it is not the engine that creates the highest sound levels at certain operating conditions, but the cooling units and especially their fans.

Increasingly stricter exhaust regulations and growing output requirements call for higher and higher cooling performances; at the same time, the noise levels of the cooling systems are expected to decrease. Two requirements that fundamentally contradict each other! The SilentVent meets them both: an axial fan with a completely new design combines aerodynamic characteristics with significant noise reduction. Result: the quietest Voith fan of all times.
Advantages and benefits

+ SilentVent contributes significantly towards the adherence of the important TSI-Norm (Technical Specifications for Interoperability)
+ Acoustically optimized with improved aerodynamic features
+ Optimized rotor-stator interaction
+ Additional reserves at the “stalling point”
+ Optimum fan dimensioning regarding type, angle and number of blades
+ Efficient control to lowest possible fan speed at any operating condition
Repairs and services for commercial vehicles

Focus on your core business – we will take care of the rest. With the expertise and experience of our service team, we make sure your vehicles deliver optimum performance at all times. Our global network provides invaluable support in the process to ensure prompt response – the main benefit for our customers.
Our Service – Part of Your Business.

Our custom-tailored service contracts and smart service solutions offer ultimate flexibility and convenience for all challenges. We will guide you all along the way in switching to e-mobility and provide support by concepts, planning and technical solutions.
Service portfolio

To get you back on the road quickly, we have servicing and storage capacity all over the world. Beside managing spare part logistics on a local basis, our offices carry out servicing and repairs. In other words: If necessary, you have access to a tight service network - at any time, from anywhere.

Of course, in addition to spare parts and repairs, we also offer on-site technical consulting. Comprehensive service offers, such as individual product training, supplement our portfolio.

Spare Parts Voith
Voith Original Spare Parts – reliable, durable, efficient and manufactured using state-of-the-art engineering. 1-year warranty for Voith spare parts.

In-House Maintenance/Repair/Overhaul
Fast and safe unit repairs, maintenance and overhaul in Voith service centers in accordance with Voith’s renowned high-quality standards.

Field Service Maintenance/Repair/Overhaul
Fast and safe field repairs, maintenance and condition-based overhaul of the unit at our customers’ premises – with Voith’s renowned high-quality standards.

Retrofit
Does your vehicle no longer represent state-of-the-art? Do you wish to retrofit your existing vehicle with a more recent unit? Voith’s retrofit service makes it possible. Our retrofit professionals will clarify various options with you, assist you in initial installation and provide you with the necessary information regarding installation and modification parts.
REMANS / Exchange Programm
Upgrading the unit to make it literally new again. This involves incorporating technical improvements already used in series production. This increases unit availability to 100%.

A cost-efficient and yet high-quality solution by Voith, it is also quick to implement and beneficial to the environment. Whenever needed, the customer can draw on a replacement pool of REMAN units, allowing them to install an already remanufactured, fully working unit right after the faulty one is removed – REMAN units kept on stock reduce out-of-service times to a minimum.

Service contracts
Service contracts with Voith – predictable costs with ultimate levels of service. With a wide range of options, service contracts are customizable to a great extent. The customer makes the decision – Voith Service takes care of the rest.

Trainings
Voith trainings range from basic product trainings to maintenance and diagnostic trainings to repair trainings and individual trainings tailored to customer requirements.

Technical support
A team of specialists advising customers all over the world with regard to troubleshooting, commissioning and retrofits. They will provide a definite answer to your technical questions and support you in troubleshooting and finding the right service.

Smart Services
With Smart Services, we develop preventive maintenance solutions to guarantee maximum availability while keeping costs to a minimum.
Predictive monitoring of the driveline  
SmartMaintenance

SmartMaintenance enables fleet management to permanently monitor the DIWA transmission. The system identifies critical parameters and thus creates the conditions for predictive and optimal maintenance and repair of the transmission, matched to the relevant conditions.

Advantages and benefits

+ High vehicle availability  
+ No unscheduled service  
+ Minimize time in workshops
At the highest level, SmartMaintenance also uses the traffic light logic with green, yellow and red color-coding in order to combine information on factors such as the condition and the temperature of oil and transmission across the entire fleet. For more in-depth information, the dashboard also provides detailed analyses at all times.

SmartMaintenance provides automated recommendations to support operators in regard to predictive maintenance and repair of their transmissions. Costs due to downtimes, towing, providing replacement vehicles, and contractual penalties can easily add up to several thousand euros per incident. Not to mention the loss of image.
Service for DIWA automatic transmissions

Increase the availability of your fleet with our service for DIWA. With our comprehensive service portfolio, you will profit twice: with lower costs and greater vehicle availability.

Our service portfolio
• Spare parts
• Spare units
• In-house MRO (Maintenance, Repair, Overhaul)
• REMAN
• Field Service
• Retrofit
• Service contract
• Trainings
• Technical support

DIWA Reman
Our REMAN service for the DIWA gearbox ensures your gearbox is ready to use and back on the road right away – 100 % uptime, 0 % downtime.

+ Available at short notice from the warehouse in Munich, which minimizes downtime
+ Always state-of-the-art
+ Comes with the Voith warranty – 2 years/200 000 km
+ Acceptance of the used part, with its value reimbursed
+ Resource-conserving and economical
+ Special conditions possible for a preventive transmission overhaul

Technical support
DIWA
Tel. +49 7321 37-4152
Fax +49 7321 37-7618
diwa@voith.com

Ordering spare parts
Voith CV products
Tel. +49 7951/32-1644
Fax +49 7951/32-756
VTSparepartsCV@voith.com
DIWA Service Rental

Is the remaining service life of your bus too short to have your DIWA gearbox repaired?

DIWA Rental – the solution you need, brought to you by Voith!

The rental service for your DIWA gearbox offers tested, used DIWA gearboxes for rent. By this, we enable our customers to manage the remaining service life of their buses in an optimal manner.

Your benefits

+ Predictable costs with no hidden risks
+ A wide range of various mileage fees to choose from
+ DIWA gearboxes are available for rent up to a mileage of 180,000 km
Service for retarders

No matter what needs to be done, our service professionals will make sure that everything is running. It starts with installation and is far from over when service and repairs are finished. At the Voith retarder service center in Crailsheim and everywhere else in the world.

Our service portfolio
• Spare parts
• Spare units
• In-house MRO (Maintenance, Repair, Overhaul)
• REMAN
• Field Service
• Retrofit
• Service contract
• Trainings
• Technical support

Voith replacement retarders – remanufactured by Voith
+ Completely overhauled and 100 % tested
+ Always state-of-the-art
+ Retarder retrofit
+ Diagnostics possible both in-vehicle and with unit removed
+ Repair of customer-supplied retarders (all model series)
+ Diagnostics and function test of individual components
+ Worldwide delivery of Voith original spare parts as well as replacement and basic retarders
+ Resource-sparing and economical

Technical support
Retarders
Tel. +49 7951/32-1555
Fax +49 7951/32-1506
Retarder@voith.com

Ordering spare parts
Voith CV products
Tel. +49 7951/32-1644
Fax +49 7951/32-756
VTSparepartsCV@voith.com
Service for air compressors

Make use of our service for air compressors and benefit from our many years of experience in the development and manufacture of key components for commercial vehicles.

Our service portfolio

- Spare parts
- Spare units
- In-house MRO (Maintenance, Repair, Overhaul)
- REMAN
- Field Service
- Retrofit
- Service contract
- Trainings
- Technical support

Retrofit

Voith’s retrofit service also allows you to retrofit your vehicle with a Voith air compressor.

+ Lower fuel consumption (up to 1 L/100 km)
+ No oil cracking due to lower temperature levels
+ Better air quality due to significantly less harmful oil decomposition products, greater reliability of the air system as a result
+ Lower power consumption in non-delivery operation thanks to an innovative idling system, eliminating the need for external control signals

Technical support
Air compressors
Tel. +49 7951/32-1555
Fax +49 7951/32-1506
compressor@voith.com

Ordering spare parts
Voith CV products
Tel. +49 7951/32-1644
Fax +49 7951/32-756
VTSparepartsCV@voith.com