

ontrack

by Voith Turbo — N° 03

p.03

Drive into the future:
smart electrification

p.08

Urban bus benefits:
moving Latin America

p.12

Improving mobility:
city buses, trains
and ferries

Empowering public transport

Enhanced technology for better performance,
availability and security

Editorial



For a modern society and a thriving business world, fitting and future-oriented mobility concepts are a key success factor. Voith has a strong commitment to deliver the smart technology that helps our customers master challenges such as growing transport volumes, better eco-friendliness and top performance. We are offering the

technologies that can drive the public transport businesses into the future: with the state-of-the-art DIWA automatic transmission for city and inter-city buses, with the RailPack drive systems for diesel-electric multiple units (DEMU), or with the Voith Inline Propulsor using rim-drive technology for most-precise ship maneuvers. In order to provide optimal solutions combining smart innovation, improved performance, reliability and security, we always stay close to our customers. We listen. We understand. We advance. Since we know the local markets and the pressing challenges, we can deliver the technologies, components and services our customers need to keep their businesses up and running – smart, connected and reliable, with minimum Total Cost of Ownership.

Now enjoy the read and discover how to drive new ways.

Yours sincerely,

Cornelius Weitzmann
CEO, Voith Turbo Mobility

Content

03 Driving electrification

The Voith Electrical Drive System moves city buses forward into the future of public transport

04 Perfect bus driver

DIWA NXT, the mild-hybrid transmission system, offers top performance

06 Advancing with e-power

Less emissions but more power for DEMUs with RailPacks

08 Urban bus benefits

How Voith's DIWA automatic transmissions empower public transport in Latin America

11 Smooth sourcing

The new Voith Turbo webshop provides customers with all relevant information 24/7

12 Success stories

Learn how Voith delivers the technologies that drive buses, trains and ferries

14 Flagship to Fishbourne

Precise maneuverability for the MV Victoria of Wight with Voith Schneider Propellers

IMPRINT ontrack N°03 – 2019

Publisher: Voith GmbH & Co. KGaA, St. Pöltener Str. 43, 89522 Heidenheim, Germany **Responsible for the content:** Kristine Adams **Editor-in-chief:** Susanne Speiser **Editorial Board:** Sebastian Busch, Deborah Fischer **In cooperation with:** C3 Creative Code and Content GmbH, Heiligegeistkirchplatz 1, 10178 Berlin, Germany www.c3.co **Printer:** EBERL PRINT GmbH, Kirchplatz 6, 87509 Immenstadt **Copyright:** No part of this publication may be copied, reproduced or otherwise disseminated, nor may any of the content in it be used in part or in whole in other works in any form whatsoever, without express written permission of the editor. **Photos:** Cover: Prisma/Syda Productions p.3: Getty Images (1); p.8–10: Getty Images; p.11: Getty Images (1); all other photos are from Voith

Your feedback: if you have any comments or questions on this issue of ontrack, please contact us: ontrack@voith.com

www.linkedin.com/company/voith-turbo
[www.twitter.com/voith_turbo](https://twitter.com/voith_turbo)
www.youtube.com/user/VoithTurboOfficial



voith.com

Driving electrification

As of today, many innovative cities embrace new technology in order to use low- and zero-emission vehicles for public transport. In fact, urban e-buses are strong leaders in electric-vehicle growth, especially in Europe, where the transition to an all-electric urban bus fleet is expected to be finalized by 2030. Voith Turbo presses ahead with its innovative Voith Electrical Drive System. “Electric motors, traction inverters, high-voltage distribution and software components for energy management and drive control are fully integrated and perfectly matched,” says Tobias Weber, Senior Vice President R&D Mobility, Voith Turbo. So customers can easily upgrade their various bus types in operation and integrate the Voith Electrical Drive System into their existing fleet.

“Switching to e-mobility has never been easier or more efficient,” adds Alexander Denk, Voith Turbo’s Vice President E-Mobility. The permanent magnet motor with a highly efficient inverter enables reduced energy consumption and results in an increased range. “The intelligent energy management system we use,” Alexander Denk concretizes, “allows higher operating ranges for e-buses, to cover the requirements of the daily operation of an urban bus line.” Low noise levels are achieved by direct drive and water-cooling, while more than 300 kW deliver enough power to keep even heavy articulated and double-decker buses on the move toward an electrified future. —

Driver Console

Access data of the Vehicle Communication Platform (VCP) through customizable apps



Drive Inverter System (DIS)

Built-in Brake Chopper & Safety Controller



Drive Management Unit (DMU)

Integrated Advanced Energy Management



Auxiliary Inverter (EACU)

On-demand control of auxiliary components



Plug & Play Roof Rack

Assembled complete system, easy installation



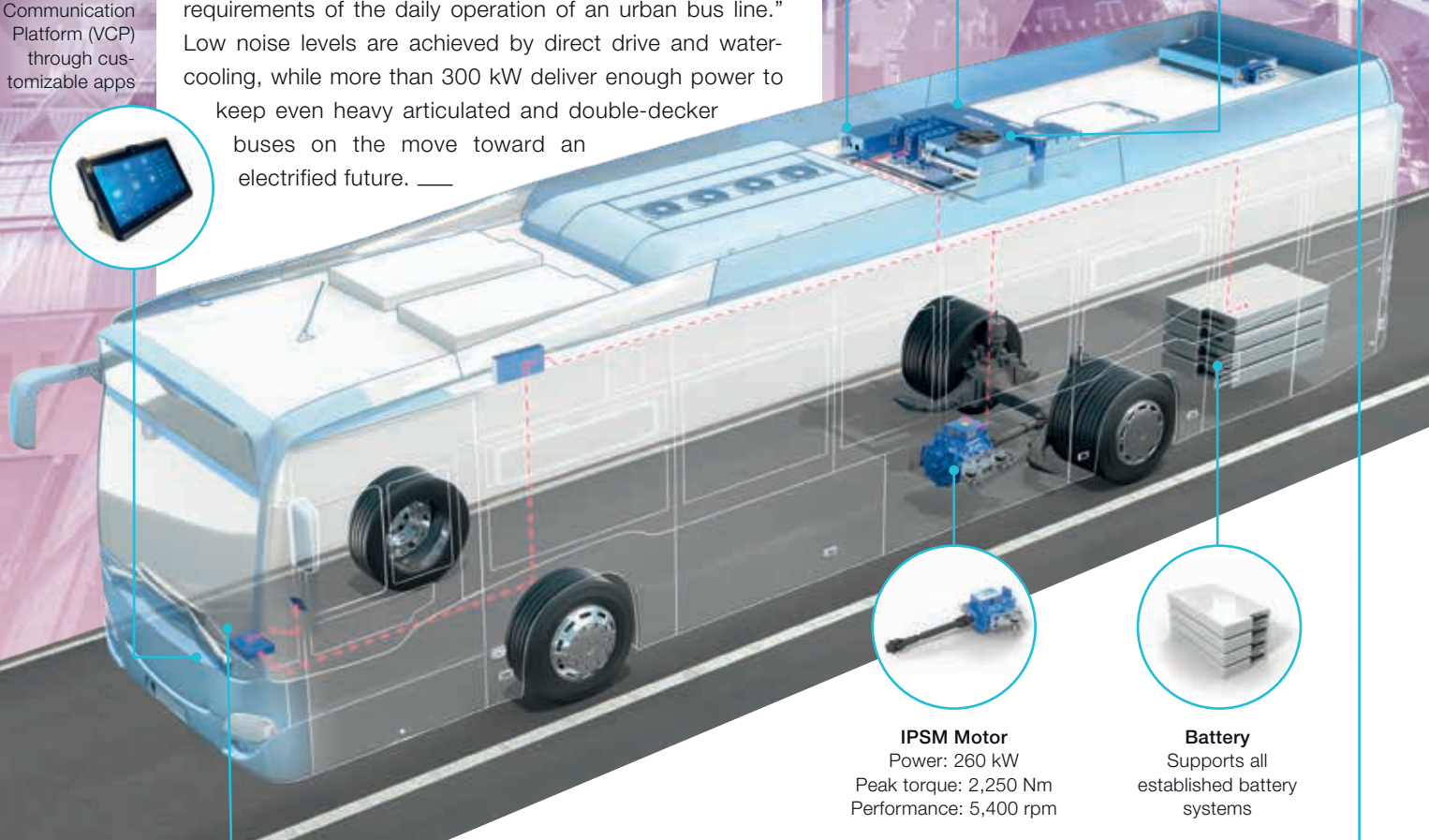
IPSM Motor

Power: 260 kW
Peak torque: 2,250 Nm
Performance: 5,400 rpm



Battery

Supports all established battery systems





More power, almost no additional space!

With its continuous performance of 25 kW and a peak performance up to 35 kW, the CRU strongly supports the vehicle electrical system. It is integrated into the flywheel housing and requires almost no extra space in axial length. Even its integrated inverter hides behind the transmission housing and does not jut out.



Perfect bus driver: DIWA NXT

With its more than 40 years of experience in bus transmissions, Voith understands the challenges of bus operators and comes up with a solution for city and inner-city buses – the DIWA NXT.

The DIWA NXT is a completely new developed 5-gear transmission with an additional overdrive to combine the well-known smooth start-up with high speeds. Although it has a separated secondary retarder and a bigger cooler, it has the same dimensions as the DIWA.6. To further increase fuel efficiency, the DIWA NXT is designed as a mild-hybrid system and optionally equipped with a 48 V recuperation unit (CRU) to recover braking energy for a higher efficiency.



1 Manufacturing

At the production halls in Heidenheim, engineers assemble the most advanced drivelines of their class: the Voith RailPacks.

2 Testing

Before delivery, every RailPack is checked in detail on the test bench.

RailPacks: advancing with e-power

Diesel-electric drive systems are best suited to build hybrid trains and hybrid systems in combination with energy storage. Voith RailPacks deliver the power.

locomotives. And 40% of Germany's rail networks are still diesel-operated. That's why hybrid trains such as diesel-electric multiple units (DEMU) equipped with the Voith RailPack 800 DE are a huge asset for operators, who can deploy them on electrified and non-electrified routes.

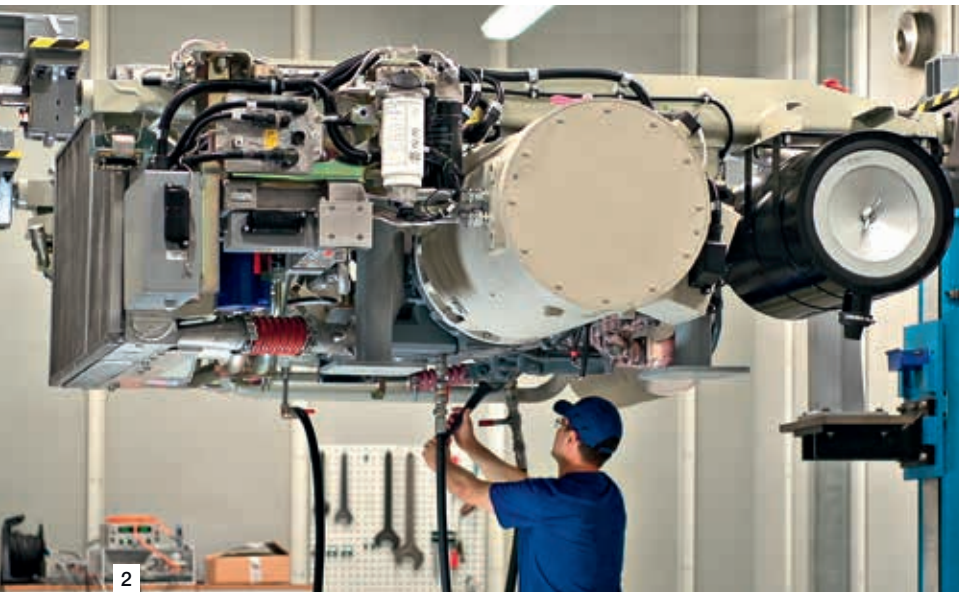
Voith RailPacks have been designed to serve the needs for city, regional, inter-city and national rail services. They have gained popularity because of their high reliability, low operating costs and easy management. Customers benefit from a single source of the complete driveline with engine,

traction generator, turbo transmission, gear unit, cooling system, electronic control and auxiliary systems.

Before delivering a RailPack ready for installation, Voith engineers always test the technical design, adaption and the functions of all components. A series of test runs after the assembly makes sure that everything works flawlessly – from basic functions to communications, hydrostatics adjustment and tightness. No RailPack ever leaves production unless it has been quality approved in testing.

Frame constructions were designed individually for each power

On many routes in many countries diesel engines still play a major part. The European Commission, for example, states that 20% of the European rail traffic is hauled by diesel



2

class resulting in improved driving comfort due to minimum vibration and low noise levels. Voith RailPacks also meet the most strict emission standards for rail vehicles. They can help reduce fuel consumption up to 8% while delivering 23% more power than comparable drive systems using the same installation space.

“The exhaust aftertreatment system we developed to meet the European Emission Standard Stage V gives the engine the lowest emissions of its performance class. In combination

with the highly developed basic unit from Liebherr, this created the most advanced engine for the rail vehicle market at this time,” says

Dr. Andreas Wegmann, manager of engine development at Voith Turbo.

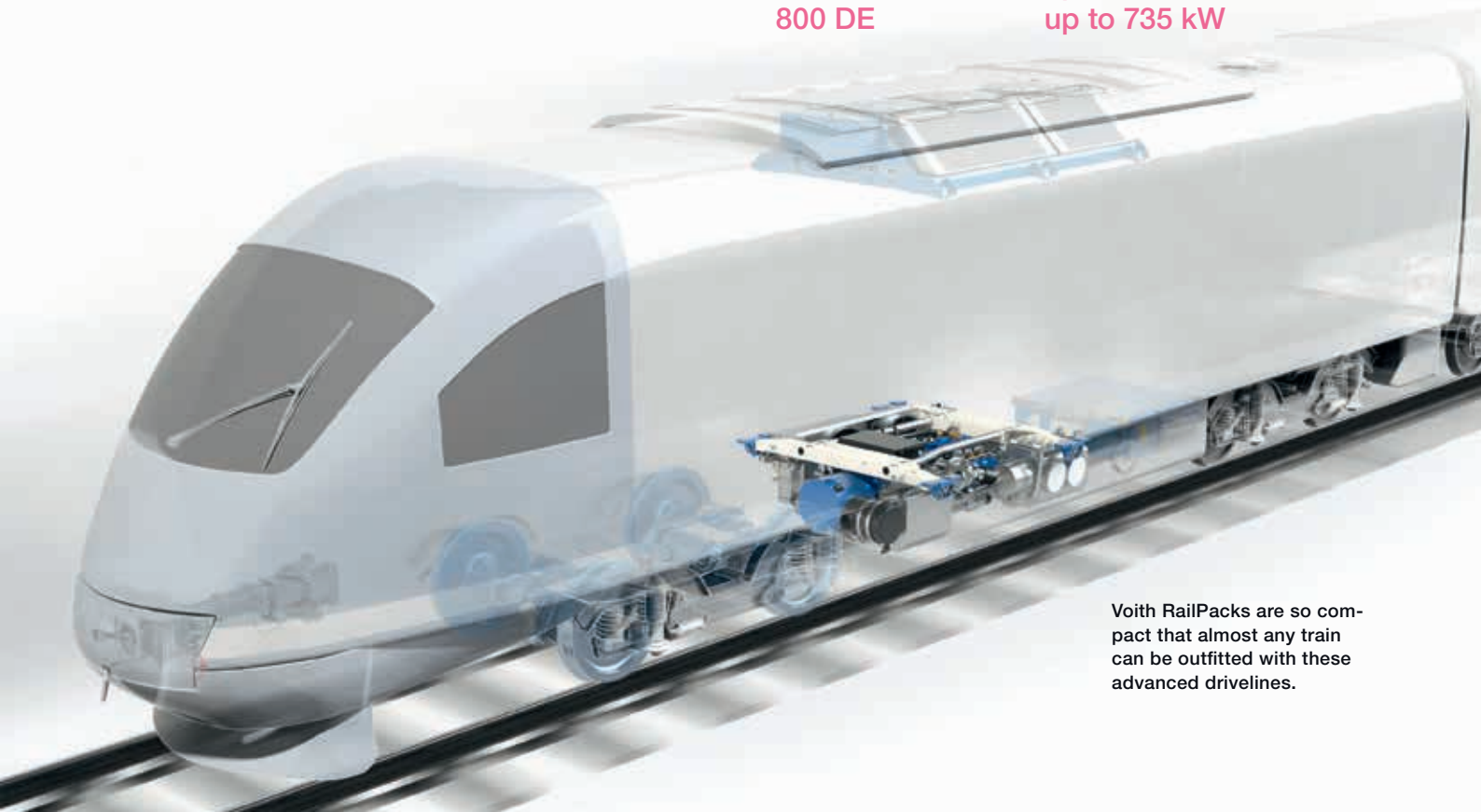
Their compact design makes Voith RailPacks suitable for almost any train.

Approximately 1,200 RailPacks are currently in operation around the world, including diesel-mechanical, diesel-hydraulic and diesel-electric configurations. Voith’s efficient rail solutions satisfy the needs of public transport operators worldwide – and they will drive new ways into the future. ____

Power classes

Voith RailPacks for diesel-electric traction

RailPack	engine-power
400 DE	up to 400 kW
500 DE	up to 480 kW
600 DE	up to 588 kW
800 DE	up to 735 kW



Voith RailPacks are so compact that almost any train can be outfitted with these advanced drivelines.

Urban bus benefits in Latin America: driven by DIWA automatic transmission

For over 25 years Voith has teamed up with local players to deliver the most efficient and reliable technology in public transport. As a market leader in many segments, Voith has empowered business and private life to thrive and prosper.

————— Rapid urbanization has drawn a vast majority of Latin America's 640 million inhabitants to the prospering big cities. But increasing mobility has often caused congestion and air pollution. All 20 countries of Latin America are very much tied to traditional public transportation such as buses, trains or metro systems. Large cities must transport huge numbers of commuters to and from work. In order to achieve this they have established integrated public transportation systems such as Bus Rapid Transit (BRT) or similar. Buses have a significant role in urban mobility solutions due to the implementation

Mexico

DIWA units in operation: 1,000

Voith Turbo center: Mexico City

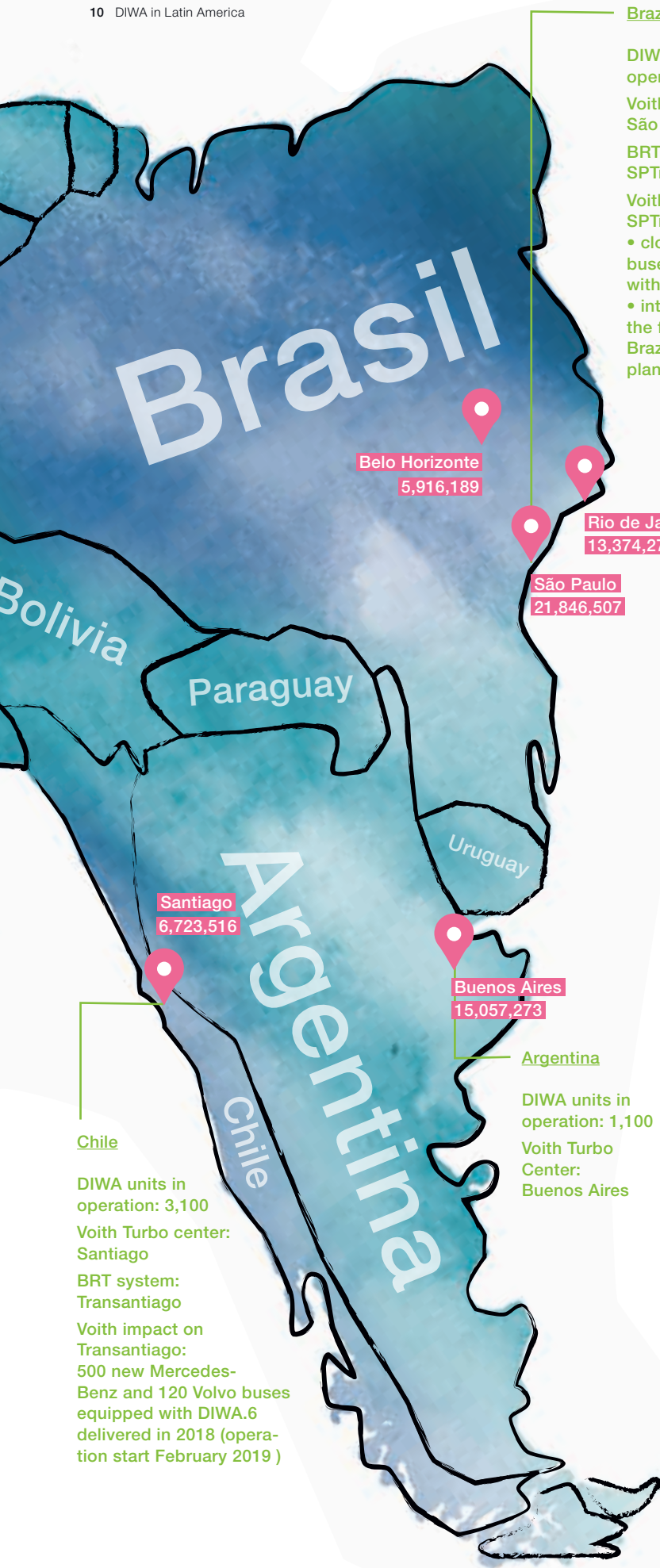


speed and costs. BRT systems deliver, with advanced operational strategy and technology, increased capacities, better performance and comfort. Today some megacities, such as Mexico City, Bogotá, Santiago, São Paulo or Panama City, have become role models for highly developed public transport. Voith has contributed to the significant improvements with technology and equipment such as automatic transmissions, retarders, air compressors and services. Because of early investigations in local applications and a deep knowledge of original equipment manufacturers' (OEM) and bus operators' demands, Voith has achieved a strong presence in Latin America and has become market leader in automatic transmissions for high-performance bus applications.

In 1993 the first DIWA automatic transmission started operation in Latin America. Today there are more than 15,000 in operation in the region, with 9,000 of them used in BRT systems. Since 1998 operational data has been used for continuous improvements of the product and services. Today, embedded technology has been offered as a result of the most-accurate data analytics, so that Voith DIWA →

Key benefits DIWA automatic transmission

- ✓ Lower fuel consumption
- ✓ Reduced air and noise pollution
- ✓ Maximum comfort for passengers
- ✓ Low maintenance costs
- ✓ High reliability for high-performance applications



automatic transmissions are reaching outstanding levels of performance and efficiency during the vehicle's life cycle, which can last for over 18 years or more than 1.4 million kilometers.

Voith's strategy to deliver global technology with local competence and a deep understanding of the local needs has proven successful in many projects in Latin America (see map). For the years to come, public transport by bus will continue to be the backbone of mobility in Latin America's large cities. In the long term, different electrification strategies will increase the quality of urban high-performance bus travel with more efficiency, less noise and lower emission levels. _____

“The well-proven DIWA principle, combining a continuous variable transmission with power-shift gears, is the perfect solution for all urban applications. The single overdrive and integrated secondary retarder offers the most reliable package for inner city, BRTs and suburban systems.”

Rogério Pires
Vice President Key Account
Management Americas & Sales
Mobility Brazil, Voith Turbo



Smooth sourcing and pleasant procurement

Sourcing for Voith customers now becomes much more convenient and flexible: Our new webshop provides all the information you need at your fingertips 24/7 and allows for shorter processing times. The personalized, easy-to-use service also features product configurators, availability checks and customer-specific real-time pricing.

_____ For a quick and easy online shopping experience, the largest online retailers in the world – Amazon, Alibaba and eBay – have led the way so far. But the B2B sector is following suit. Since business customers have increasingly adopted digital technologies and become more tech-savvy, leading manufacturers such as Voith are now offering an e-commerce platform that makes procurement processes smooth and simple, so business customers can save time and money.

The new Voith Turbo webshop offers all the information you need, when you need it. You may use the catalog feature to browse through



Webshop benefits at a glance

- product catalogs
- spare parts
- configurations
- available 24/7
- personalized area
- automated handling process
- availability check
- real-time pricing
- order tracking
- integration with ERP software
- secure data exchange



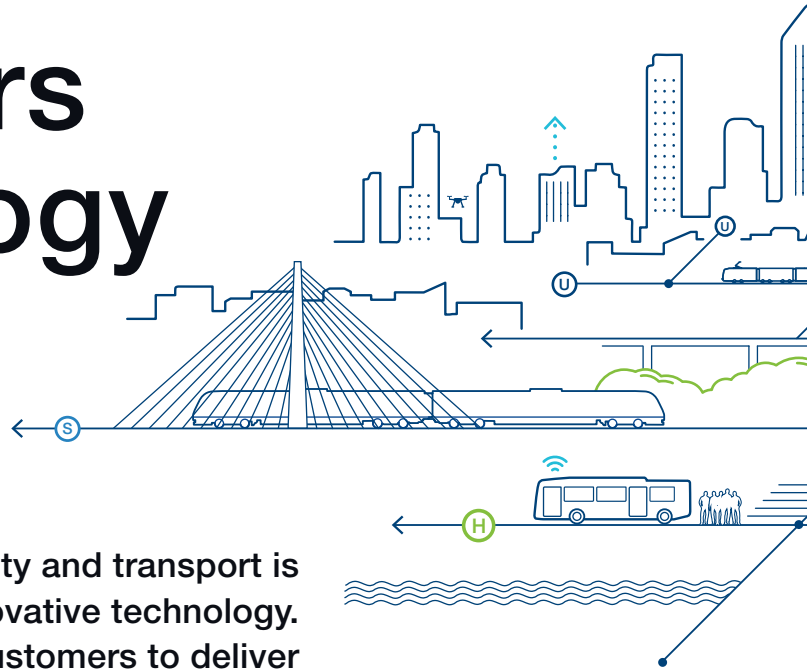
products, features, technical data and specifications. Or you may use the search function to look up product instructions and spare parts. Once you have identified the product of your choice, you can configure it to your individual needs and instantly check for availability, pricing and terms of delivery.

Your personalized area MyVoith for Turbo lets you keep track of orders and all the relevant information. For even more convenience the webshop can be integrated with your enterprise resource planning system. Order handling can be fully automated. Yet, all transactions are strongly encrypted for the best possible data security.

The advancements of sourcing and procurement through highly available e-commerce solutions such as the Voith Turbo webshop are a valuable time saver and make business life much easier. But making contact personally and keeping in contact closely is still at the core of business success. At Voith we see the customer and his needs at the heart of everything – now and in the future. _____

Voith delivers the technology that drives new ways

The best experience in mobility and transport is made possible by using innovative technology. Voith is working closely with customers to deliver the best in performance, efficiency and reliability for buses, trains and ferries.



Automatic transmission

The biggest single DIWA.6 order to date

In order to maintain the high level of service quality, the German public-transport company Berliner Verkehrsbetriebe (BVG) is investing in the expansion of their fleet, ordering 950 Mercedes-Benz Citaro city buses from bus manufacturer EvoBus. All these new buses will be equipped with Voith's DIWA.6 automatic transmission, which makes this the biggest single DIWA order to date for Voith. The 600 articulated and 350 solo buses will also feature air compressors from Voith, adding to the reduction of CO₂ and NO_x emissions within the city limits. DIWA.6 automatic transmission is a key component for highly efficient and low-pollution bus operation. Its intelligent start-up management system reduces operating pressure, and an optimized converter reduces fuel consumption by up to 5%. So using Voith DIWA.6 was a reasonable decision for BVG and EvoBus, a company dedicated to efficient, innovative and sustainable technology. And as Helmut Zimmermann, Regional Sales Director for Germany, Austria and Switzerland at Voith Turbo, points out: "The key to confidence in our products is the long-standing partnership between Voith and BVG."

Electric drives

Swiss trains to be energized by EmCon traction inverters

For the first time ever Voith EmCon traction inverters will be deployed in Switzerland. To ensure train operability until 2037, Swiss rail company Forchbahn AG has decided to modernize 13 of their narrow-gauge trains. The modernization project, executed by train manufacturer Stadler Rail, includes the replacement of the existing traction inverters with Voith EmCon. In the Zurich public transport network the Voith EmCon traction inverters will be operated at 600 V DC, and 1,200 V DC outside Zurich. Through the use of state-of-the-art power electronics Voith traction inverters ensure the most efficient conversion of supplied energy and make it available to the drive motors. In combination with dynamic motor control techniques these power electronics achieve optimal traction effort. Alfred Gmeiner-Ghali, responsible for Sales & Marketing of the Voith Electric Traction Systems, Voith Turbo, says: "We are proud of Forchbahn AG's decision to use Voith traction inverters. Voith supplies Stadler Rail with traction inverters for the first time and we are convinced that the confidence in our technology is more than justified."



Engine transmission unit

RailPacks empower new Ukrainian DEMUs

Ukrainian Railways serve a transportation network with more than 22,000 kilometers in total length. In order to manage the increasing workload better Ukrainian Railways announced a tender offer for six diesel-electric multiple unit (DEMU) trains, all of which will be powered by Voith RailPacks.

Participating in the tender was transnational train manufacturer Kryukov Railway Car Building Works (KRCBW). With the conviction that new technologies and materials add to product quality, KRCBW purchase and install the best European components. So in 2011 they turned to Voith and started to use Voith products for DEMUs and electrical multiple units (EMUs). In 2017 negotiations began about using Voith RailPacks, cooling systems and gear units leading to a contract on the delivery of RailPacks for six DEMUs. Beside the previous collaboration successes the decision takes into account some key benefits: extensive testing has proven that RailPack suits KRCBW's specific needs. Voith RailPack complies with all the technical specifications and works reliably at 588 kW even under snowy conditions in -40°C cold. In Voith KRCBW has found a strong strategic partner.

Propulsion system

VIP maneuvers MY Elandess precisely

The German yard Abeking & Rasmussen has equipped one of their custom-design luxury yachts, the MY Elandess, for the first time with a Voith Inline Propulsor (VIP). The improved VIP for yachts makes maneuverability precise, smooth and easy with fast responding to steering commands. At all times crew and guests will enjoy maximum comfort on board with minimal noise and vibration levels during maneuvers. Based on Voith's Rim-Drive technology this compact swing-out system can pivot 360 degrees and requires neither a drive shaft nor a transmission. So the 200 kW input power is directly transferred for increased efficiency. The VIP can be used as a maneuvering aid or as an auxiliary propulsion system. Thus the yacht can be kept smoothly in GPS-defined position without anchoring or it runs silently at low speeds without using the main engines. Due to its compact design and simple installation, it is also easy to retrofit existing yachts with the VIP. Among the top benefits for customers are engine smoothness, excellent response characteristics, innovative design, and the global availability of specialized Voith assemblers and service engineers.

Flagship to Fishbourne

Voith control system



Serving the route from Portsmouth to Fishbourne Wightlink's new flagship MV Victoria of Wight has been customized to perfectly meet the needs of challenging harbor situations. Cycloidal Voith Schneider Propellers (VSP) provide both safety and economy due to high reliability and precise maneuverability.

Welcome to Portsmouth, England. Located about 110 kilometers southwest of London, Portsmouth is the only island city in the United Kingdom and is inhabited by more than 1,500,000 residents in the metro area. An important mode of transport is the ferries operated by Wightlink serving routes to the Isle of Wight. Since entering service on August 26, 2018, the harbor of Portsmouth is home to a new flagship: The MV Victoria of Wight.

Being the largest ship in Wightlink's fleet of ferries, the Victoria of Wight is in many ways a unique vessel. Built at Cemre Shipyard in Yalova, Turkey, this innovative ferry runs on a hybrid diesel-battery propulsion system, which minimizes fuel consumption, emissions and noise levels. This is particularly important due to its operation close to residential properties and Wightlink's green agenda.

To ensure Victoria of Wight's excellent maneuverability needed to maintain a tight schedule in shallow draft and narrow harbor conditions, four VSPs have been installed. These 5-bladed cycloidal propellers combine propulsion and steering in one unit. Fitted within the hull the propeller

Interactive VSP: virtual training for real gaining

Experience the VSP in action on your digital device and make yourself familiar with the fast maneuvers that are only possible with this innovative propulsion system.

The new version of the interactive VSP desktop app (iVSP 2.1) allows you to control virtual marine vessels such as the featured double-ended ferry MV Victoria of Wight with four VSPs. A new training mode lets you try its excellent maneuvering capabilities. As the captain of a VSP tug you can still use the free-driving mode and see how your tug responds to the commands of your virtual joysticks.

When mastering the course during simulation training you can follow the 3-D model of your ship or switch to visualization modes that show propeller motions and hydrodynamic forces. The simulations are based on real physics and kinematics, so you get a true feeling for the VSP's uniquely fast dynamic responses.

iVSP 2.1 is freely available in the desktop version at www.voith.com/ontack3-iVSP2.1 and will soon also be available in Apple AppStore and Google Play where you can already find the tug version of the app (iVSP 2.0).

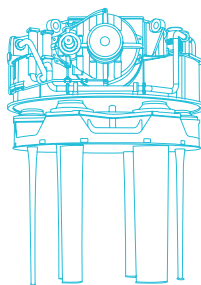


Double-ended ferry Victoria of Wight

Powered with

4x

VSPs, 950 kW
power per VSP



blades protrude from the rotor casing and rotate around a vertical axis. Each blade performs an oscillatory motion around its own axis, which is superimposed on the uniform rotary motion. Along its cycloidal path through the water the blades generate hydrodynamic lift, which effectively results in propeller thrust. The magnitude of the thrust is determined by a combination of these blade motions, with the ability to vector the resultant thrust 360 degrees in a few seconds. This ingenious propulsion system design therefore greatly increases maneuverability compared with conventional thrusters and offers precise, effective and reliable propulsion.

Operating on a tight schedule the Victoria of Wight must navigate confined harbor areas quickly and safely. Thanks to the VSPs the captain and helmsman can do this smoothly and reliably. Thus a full 15 to 20 minutes turnaround time is available for the loading and unloading of 1,208 passengers and 178 cars. Time savings due to swift berthing and unberthing with VSPs allow ferry operators to minimize their crossing speed, saving significant amounts of energy.

The Victoria of Wight is equipped with a customized control system delivered by Voith. The control system features a combinatory mode, which automatically and continuously optimizes the propeller speed and pitch setting to provide the best efficiency. This feature, as well as the other benefits of Voith Schneider Propulsion, significantly minimizes the vessel's energy consumption and leverages the overall reduction of fuel costs and emissions complementary to the hybrid system.



Bring Internet of Things into public transport

Connect all your vehicle systems

One standardized solution connects all your vehicle systems to each other and to the cloud, with eco-driving, lower IT investment costs, maintenance savings and no vendor lock-in as a result. In cooperation with Pilotfish, Europe's leading provider of IT for public transport,

Voith offers a wide range of tools, with Android apps, connectivity, integration consulting and fuel economy – all connected around the gateway solution.

For further information please visit www.pilotfish.se

voith.com

VOITH
Inspiring Technology
for Generations