



# SOLUTIONS IN TRANSPORT ENGINEERING

Electric Drives and Systems





## A vision in motion

We have been developing and manufacturing railway vehicle drives for more than a century at VEM. Our experience, highly qualified professionals and advanced production equipment place us in an excellent position to provide the transport industry with innovative transport engineering services from an expert partner. We work hand-in-hand with scientific institutes, universities and research laboratories as we constantly develop our technologies for motors that will always be state-of-the-art. Our VEM traction motors also excel in long lifetimes and low life-cycle costs.

We live the vision of supplying our customers with a competitive market solution with our VEM machines – and an ideal solution for any conceivable application.

## Renaissance on rails

Increasing traffic density in heavily built-up areas and the ensuing traffic issues have given trams and street cars a new lease of life. Today's railway vehicle industry supplies modern high and low-floor vehicles to satisfy the most exacting expectations on transport capacity, acceleration capability and, most importantly, passenger comfort.





## VEM – at home on the railways of the world

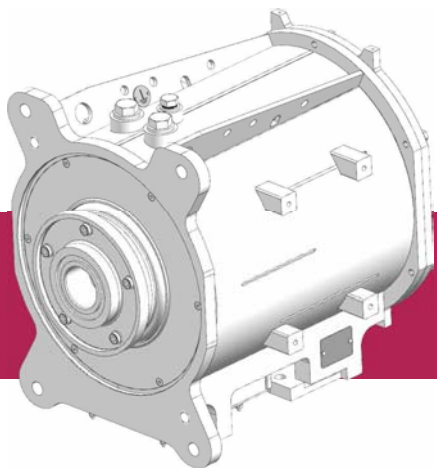
Our experience places us in an excellent position to address the international railway industry's demanding requirements for powerful traction motors. These include highly efficient asynchronous traction motors for electric and diesel-electric locomotives, trains, trams and maintenance vehicles. Main and auxiliary equipment generators and control systems round off our range. Our product range at VEM includes traction motors for hybrid and trolley buses for environmentally-friendly public transport.





## State-of-the-art drives for the Berlin tram service

We began on the development and production of DKWBZ water jacket-cooled AC drive motors for trams in 1994, and we have developed a number of other motors of this type since. These include very small motors for single-wheel drives as used in modern Berlin trams alongside more powerful locomotive motors with high-level protection to withstand extreme climatic conditions.







## VEM traction motors for any low-floor design

We launched the DKCBZ air-cooled motor series at a design height of only 350 mm and an output range of 85–125 kW on to the market for ultra-modern low-floor vehicles. These encapsulated motors feature noise-optimised, speed-controlled surface cooling.

As with all VEM traction motors, the stator winding comes in a two-layer coil-form design at insulation class 200. We designed the motors for both transverse and longitudinal drive operation with minor modifications, making the DKCBZ series ideal for low-floor designs and application scenarios for any common gauge.





## A motor series for fast trams and metro systems

We developed the DKOBZ motor series to deliver the power needed by larger and faster trams and metro systems. At 120–155 kW of continuous output, DKOBZ motors are more powerful than our DKCBZ units. Our DKOBZ series motors are available at design heights of 370 and 430 mm.

We have installed an internal cooling circuit to give the power-to-weight ratio another substantial boost. These motors have found their way into services such as London's Docklands Light Railway.







## Retrofitting is the key

We also have ideal solutions for revamping ageing trams for modern AC technology. We freshen up DC motors that are still in good condition with a slot-in three-phase stator after reworking existing housing parts.

This resulted in our DKABZ cross-ventilated three-phase traction motor family with an output range of 42–85 kW, a design that is especially beneficial in that the “new” motor can be easily installed back into the bogie without requiring alterations to the mounting fixtures or connections.





## Complete solutions for any type of locomotive or railcar

We at VEM work closely with major railway gearbox manufacturers on complete drive systems consisting of motors, couplings and gearboxes for light railway vehicles, railcars and locomotives.

As an example, Berlin-based Stadler Pankow GmbH commissioned us to develop and supply motor-gearbox units for Stuttgarter Straßenbahn AG's DT 8.12 trams.







## Three-phase asynchronous traction motors for electric trains

We also equip electric trains with modern three-phase asynchronous traction motors for rapid and local transport services at speeds of up to 160 kph. These include ÖBB Rh 4023/4024 E-Talent railcars alongside state-of-the-art railcars for PESA and other services.

These train motors are available in different design sizes as single and dual-bearing design with continuous output ranging from 280 to 650 kW; usually designed for forced ventilation, the motors are also available with self-ventilation for railbuses. Very high-quality, durable winding insulation supports a direct 3 kV DC power supply.

The equipment includes a speed-sensing system, temperature sensor in the stator winding, and an insulated bearing on the N side. Torque is transmitted to the gearbox using a diaphragm or gear coupling.





## VEM motors powering specialised vehicles

We supply force-ventilated traction motors from locomotives as well as water jacket-cooled motors from trams and regional trains or custom designs for specialised applications such as maintenance-of-way, rail milling and grinding vehicles.

Examples: You will find our motors in Germany's Deutsche Bahn high-speed rail grinders or the new Swiss SBB maintenance-of-way vehicles as used in the Gotthard Tunnel.







## High availability with VEM generators

Almost every diesel-powered railway vehicle needs an additional power source alongside the starter battery for a constant traction and on-board power supply. This is usually a synchronous or asynchronous generator or powerpack directly coupled to the diesel engine, which provides the entire power supply for the vehicle in addition to the traction motors. Diesel-hydraulic transport vehicles use hydrostatically powered auxiliary generators to supply the vehicle's electrical system with power.

Our broad range of VEM railway generators cover output ranges from 30 to 5000 kVA – enough for virtually any conceivable application scenario. Our standard system is a self-cooled, electrically magnetised, brushless synchronous generator with electronic excitation and control systems.

Our frameless design with an integrated exciter is an outstanding feature – the unit operates either suspended under floor or upright in the locomotive's engine room. Our portfolio includes single and dual-bearing generators; the type required will depend on the diesel engine's design.

In addition to electrically magnetised synchronous generators, we also supply asynchronous generators and permanent-magnet synchronous generators. You will find our VEM railway generators in many hundreds of vehicles around the world delivering a steady stream of power in the most hostile climatic environments. Traction generators for mining trucks delivering an output in excess of 2,500 kVA are the latest member of the family; these machines are very robust and perfectly adapted to the harsh conditions prevalent in ore, coal and tar-sand mining.

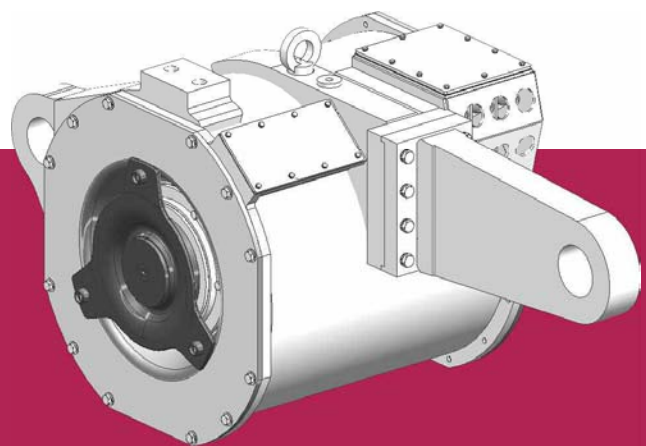




## Mainline and industrial locomotive motor development – a long history at VEM

We have a long track record of developing and manufacturing locomotive traction motors at VEM with more than 7000 DC traction motors for heavy industrial locomotives and nearly 5000 single-phase AC traction motors for the DB series 112, 143, 155 and 156 up to the mid-nineties.

Our engineering potential and modern production and testing facilities at VEM have placed us in an excellent position to construct and test three-phase traction motors in compliance with the exacting quality standards of Europe's railway services. We draw on the know-how that we have acquired from thousands of low-floor trams, commuter trains and electric trains using AC traction motors.







We developed the VEMoDUR VPI-200® insulating system specifically for mainline use, a system developed for the extreme thermal, mechanical and electrical challenges. This allows us to design traction motors at up to 1,800 kW output and voltages of up to 3,000 V while ensuring long motor lifetimes.

This insulation system's durability against voltage spikes makes it ideal for IGBT and GTO converters for use as axle-hung or integrated bogie-mounted drives with full suspension. One specific example is the use of 600 kW water jacket-cooled locomotive motors as used by CODELCO in Chilean copper sulphate mines under extremely difficult conditions.

You will also find auxiliary drives for cooling and fan units in marshalling and light maintenance vehicles.





## A safe and pleasant ride – with VEM technology

We focus on energy-efficient drive solutions that ensure passenger comfort combined with economical operation on the railway, and our advanced manufacturing technologies allow for economical and efficient use of resources in manufacturing drives. Our high-efficiency low-voltage motors and compact solutions ensure extraordinary operating reliability, durability, efficiency, and environmental soundness.







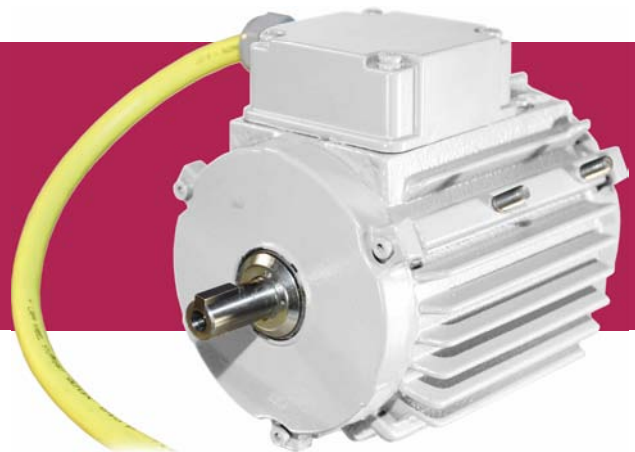
## More than just standard

Our expertise in railway technology and decades of experience in the field give us an excellent position to address the international railway industry's demanding requirements for powerful auxiliary drives. Our motors find a wide variety of applications – our IE2 and IE3 versions are perfect for pumps, fans and compressors, and our VEMoDRIVE M21R AST BAH compact drives certified for operation on railway vehicles are ideal for pumps and ventilation systems.

VEM motors for machine and traction motor fans operate in extremely difficult climatic conditions. Either as single-speed or pole-changing motors, our auxiliary drives can easily withstand wide temperature fluctuations. Temperatures up to 70°C are possible depending on project requirements, and our motors are also ideal for challenging track beds and extreme route lengths; you will find them operating smoothly and reliably as fan drives for electric locomotives in Russia as well as regional trains in Germany and Austria.

Designed as brake motors, our auxiliary motors are also installed in electric lifting and lowering equipment as used in Deutsche Bahn's car-carrying trains.

VEM motors are also used as drive motor fans in trams. These bogie-mounted units work smoothly and reliably despite heavy mechanical stress from moisture, dirt, snow, ice, and mechanical shocks.

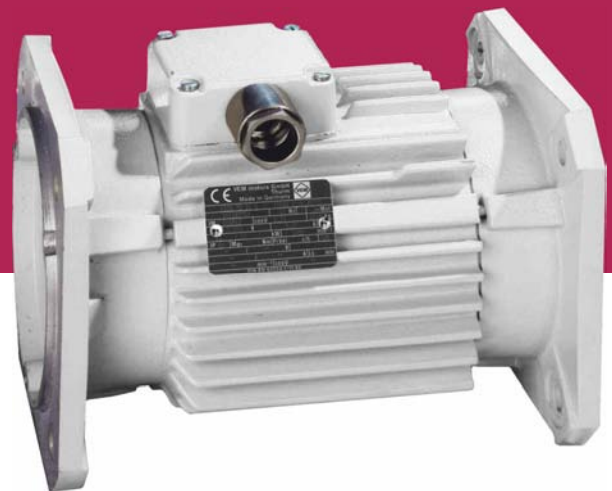




## Fan motors to keep it cool

Reliable operation and comfort are the hallmarks of today's passenger trains; comfort includes quiet, draught-free air conditioning. These systems have to be resistant to dust and chemical influences, and also have to keep temperatures inside the vehicle to an ideal level whatever the weather outside.

Control via inverter requires increased withstand voltage from motors, a feature of VEM drives with sophisticated designs, reinforced insulation systems, customised bearings and increased lubrication intervals to meet the highest standards.





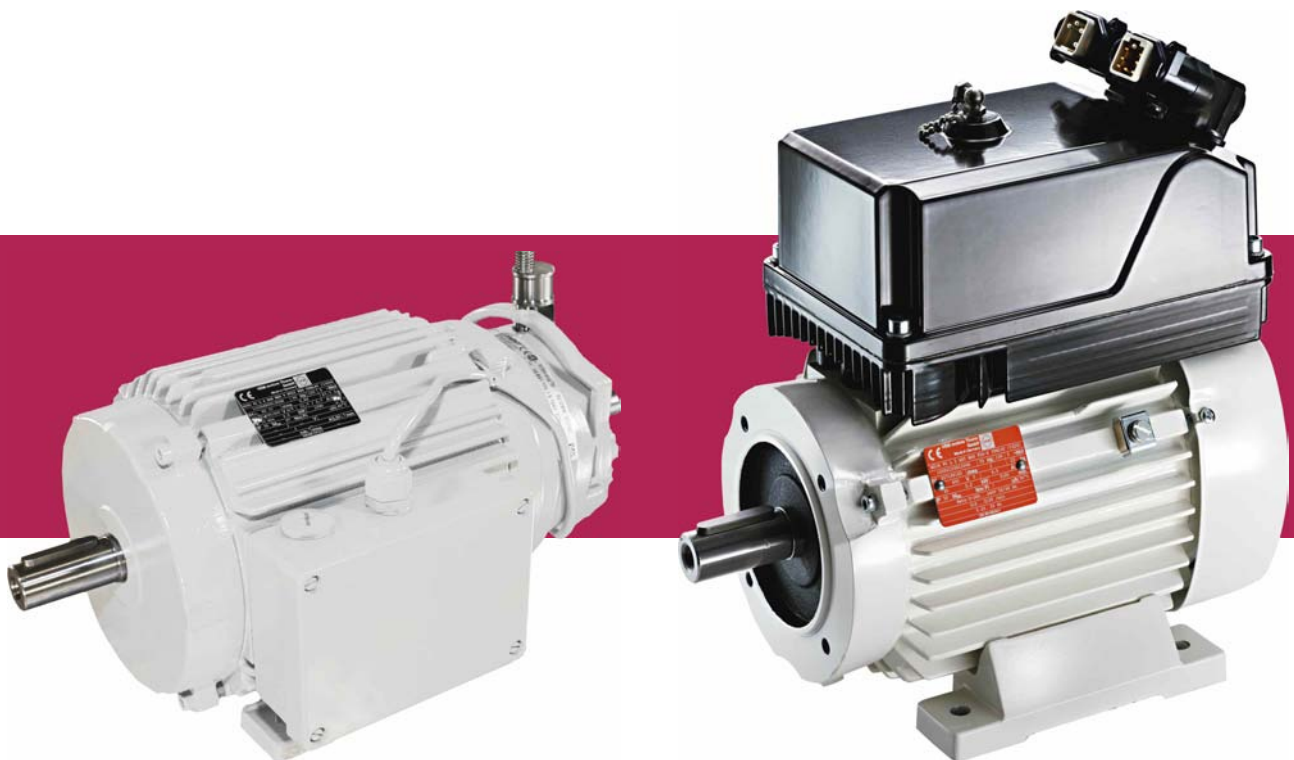


© dreamstime.com

## VEMoDRIVE Compact cooling Frecciarossa traction motors

Railway applications pose specific requirements on the electrical assemblies used. On customer request, we developed a new compact drive – M21R 90 L2 AST BAH – designed to withstand vibration and shock loads as well as varied climatic conditions, a new compact drive to replace conventional pole-changing motors in traction motor ventilation systems.

Trenitalia opted for this technology in all of its Frecciarossa high-speed trains, which will be able to reach a top speed of 400 kph. The new drive has to be able to run at top output for ten minutes when ambient temperatures reach 70°C. Apart from that, entering into and emerging from tunnels causes thermal shocks of up to 3 K/s on motors and control electronics mounted underneath the train; our new drive system cools the motors for them to withstand these massive loads at full performance.



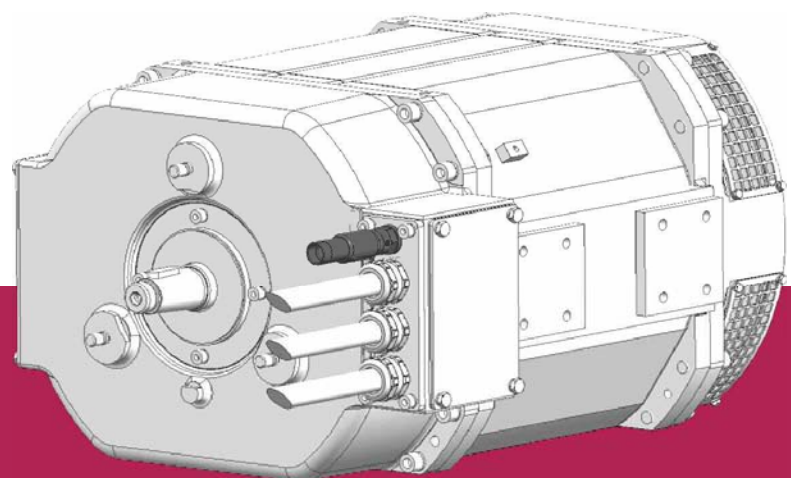




## Innovative drive technology and power supply systems from VEM

We have developed permanent-magnet traction machines for railcars and buses in public transport; these motors allow far more compact and lightweight gearless wheel drive designs compared to drives with gearboxes.

We follow the same high-energy magnet approach in designing generators for diesel-electric and hybrid vehicles.









Detailed information  
on the homepage.

SENSE EXPERIENCE  
EXPERIENCE VISION

[www.vem-group.com](http://www.vem-group.com)