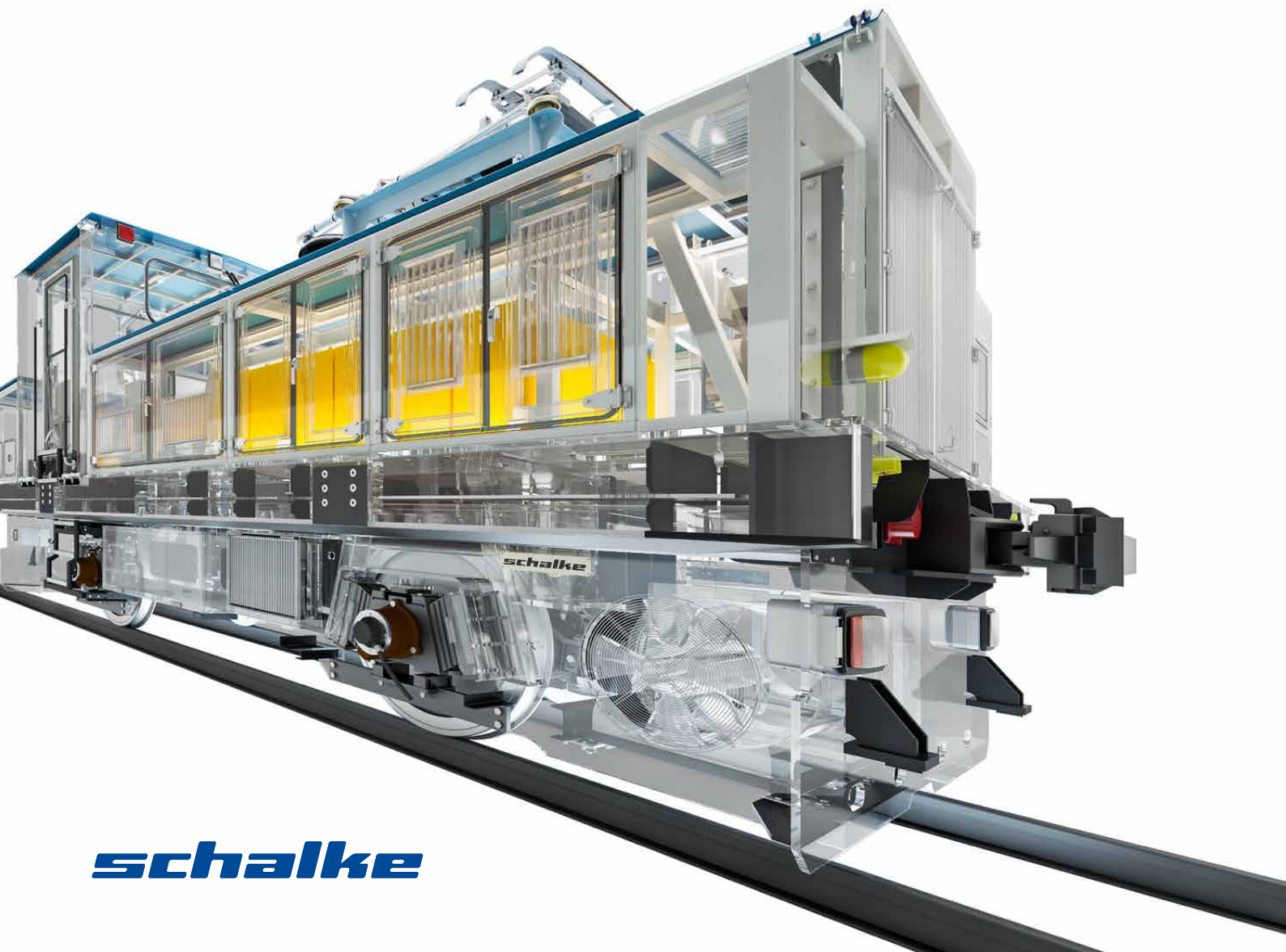


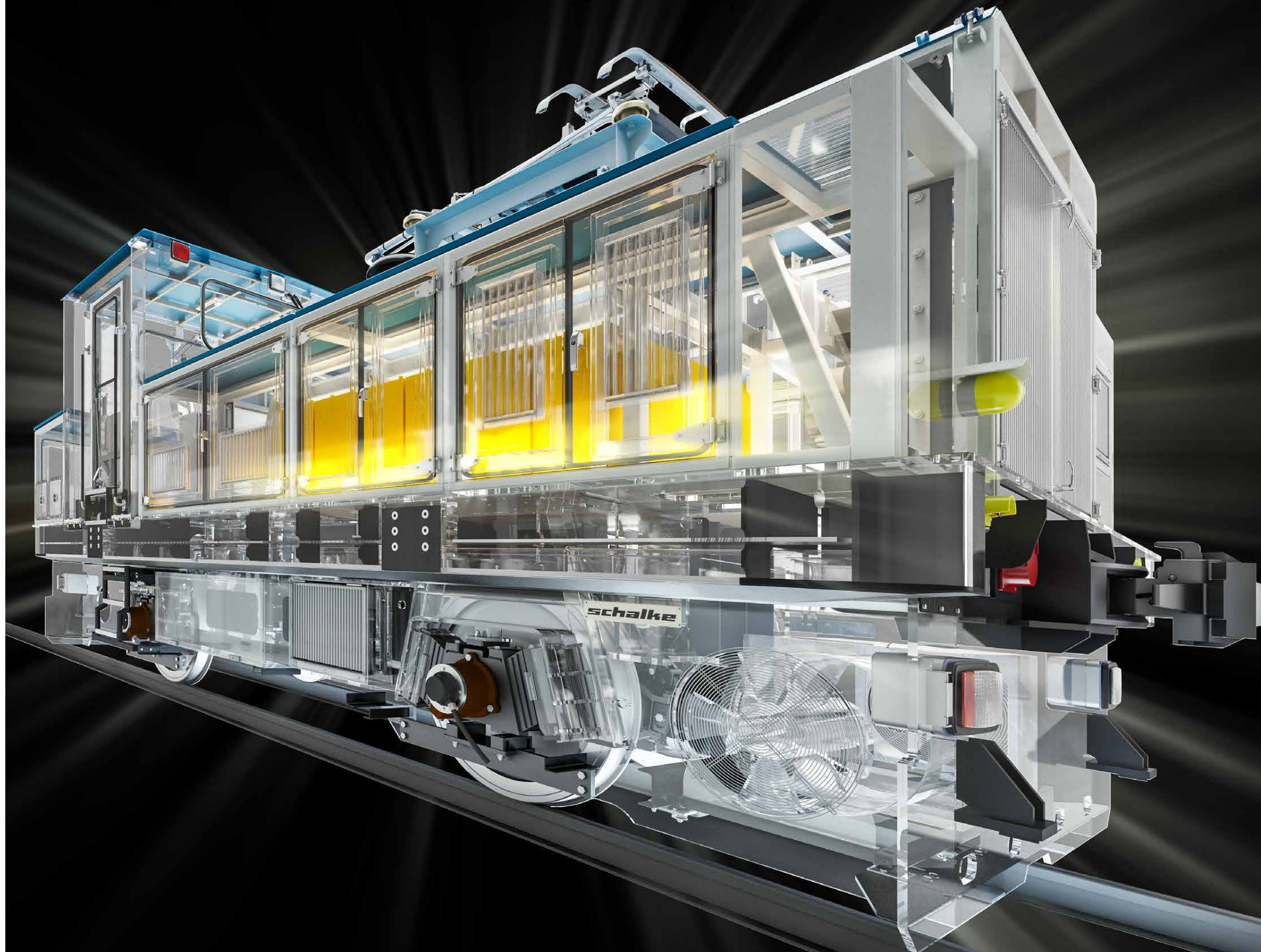
KEEP YOUR BUSINESS ON TRACK



schalke
modutrak

SWITCH FROM DIESEL TO BATTERY IN LESS THAN ONE HOUR

Schalke develops, manufactures and supplies its locomotives to locations throughout the world. They are tailor-made to handle widely varying customer requirements and equipped with highly practical innovations – such as exchangeable Powerpacks. If the need arises, any Modu-Trac locomotive can be simply converted from diesel to battery operation in less than one hour and also to other traction technologies in future as well, due to its modular design. Already today, equipped with an additional pantograph, the locomotive can also be operated as a multi-mode unit.



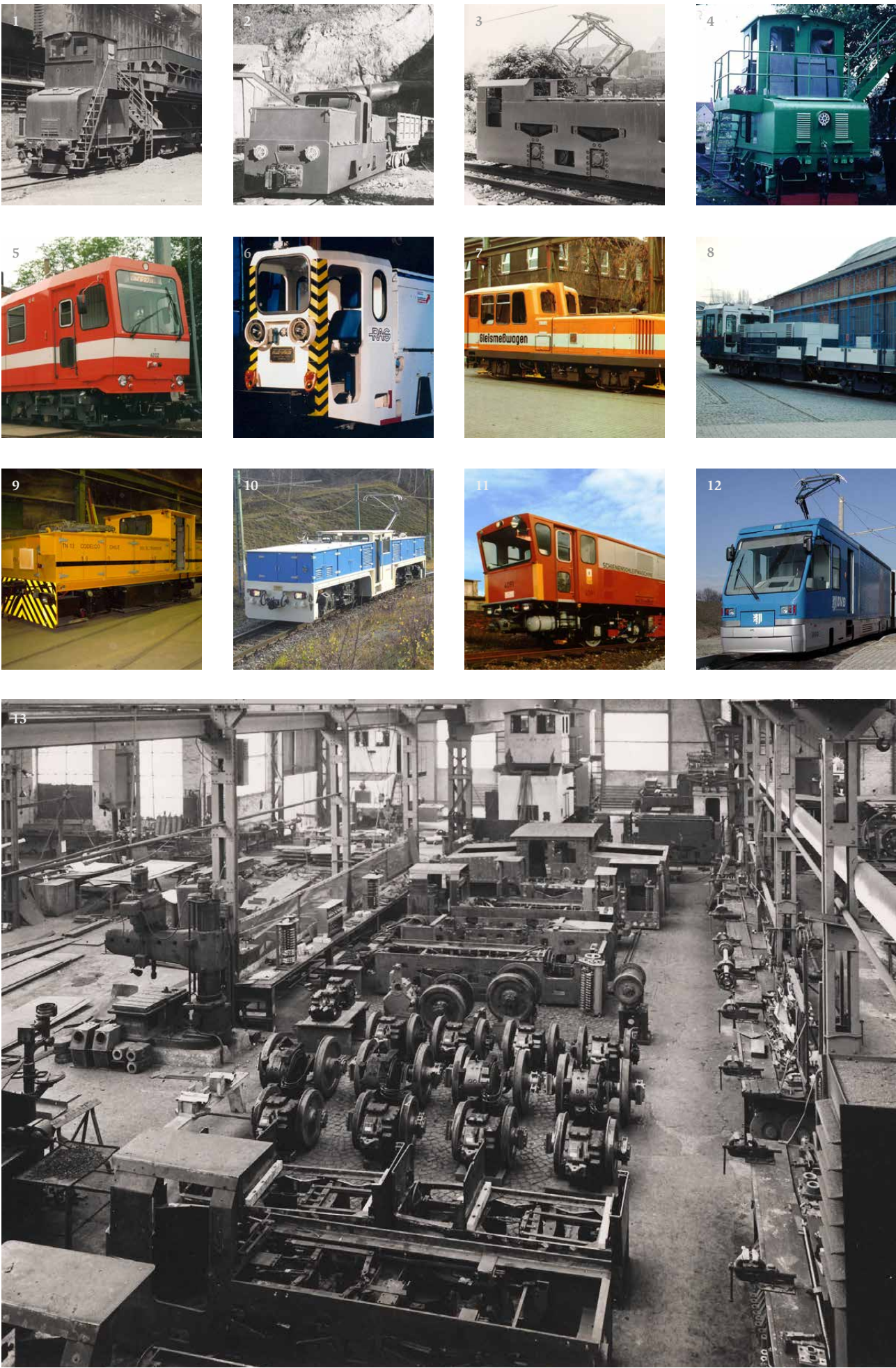
KNOW-HOW
SPANNING THREE
CENTURIES

The Schalke locomotive success story had its origins in Gelsenkirchen and – like nearly all stories from the Ruhr district – it all began with mining. On 21 August 1872, Friedrich Grillo founded Schalker Eisenhütte Maschinenfabrik GmbH, a company that manufactured machinery and spare parts for use in underground mining. These included brakes, trucks, winding drums and tempered cast steel for the wheels of mine cars and trucks. The enterprise also produced coke oven equipment and castings in clay and sand as well as hard iron castings. Right from the beginning, Schalke products were known for their robustness, enduring strength and reliability – ideal for daily use in extremely rugged conditions.

Ten years later, Schalke built the first coke pusher machines. These gigantic steam-driven “monstrosities” were the forerunners of a series of coke oven machinery that also included transfer cars, guide machines and quenching cars. At that time, locomotives were used to pull the coke oven machinery – and therefore Schalke took the next logical step and began building locomotives in its own right. The company’s portfolio was soon enlarged to include coke quenching cars and transport locomotives, all with the reliability that had become typical for Schalke. The powerful working machinery became popular – and opened up a promising market for the future. In 1937 Schalke began producing 70-tonne catenary wire locomotives for mining brown coal in the Rhine district. By 1954 the company had built a total of 34 locomotives, cooperating with renowned electric companies such as Siemens, AEG and BBC to manufacture the first dual-mode catenary wire and battery-powered mining locomotives. Schalke’s expertise in the field of locomotives therefore grew continually, particularly when it came to innovative and alternative drive systems.

Joining forces
In 1968 Schalke joined forces with the Bochum-based Gebr. Eickhoff Maschinenfabrik u. Eisengießerei GmbH, which also specialised in building strong, sturdy machinery and had its origins in the mining sector. In the years that followed, Schalke concentrated not only on coke oven technology, but also increasingly on locomotives, beginning with units specially designed for use in coal mining. That was how the Ruhrkohle AG standard locomotive came into being. It was first manufactured in 1993, developed and purpose-built for Germany’s underground ignite coal mining and delivered more than 120 times, making the name Schalke a synonym for dependable rail vehicles in the mining sector. The company gained a worldwide reputation and since the 1980s, among other customers, Schalke has supplied more than 20 locomotives for two different mines operated by CODELCO in Chile.

This hard-won knowledge and the experience gained in manufacturing rail vehicles specially designed for tough working conditions were also ideal for transferring to other fields, which led to Schalker Eisenhütte consistently expanding its range of products to include multi-purpose service locomotives for urban rail transport systems, welding vehicles, rail grinding machines and platform vehicles, such as those produced for the Berlin public transport system (BVG). In record time, Schalke also built the “CargoTram” rail freight vehicle for the environmentally friendly and economical transportation of car parts to VW’s so-called “Gläserne Manufaktur” car plant in Dresden. Whether above ground or in the underground tunnels of major cities, customers benefit from Schalke’s main advantages: incredible flexibility in finding custom-made solutions and experience that spans three centuries.



1-12 Cross section of
Schalke locomotives,
from early production to
the present day

13 The Gelsenkirchen
Schalke plant in 1953



MOBILITY FOR TOMORROW

If we had one word to describe the future of the world in the coming years and decades – it would be growth! The spiralling expansion of the world's population is creating ever-growing, increasingly closely connected mega-cities. Our need for energy and raw materials, both for industry and private consumption, will also continue to grow, along with our awareness of the need for sustainability and greater environmental compatibility. This knowledge has led Schalke to pinpoint three key mega-trends, for which it is capable of providing suitable solutions: urbanisation, the extraction of raw materials, and efficiency.

Getting cities on the move

According to the United Nations, up to five billion people will be living in cities by the year 2030. New mega-cities with millions of inhabitants will develop, with new needs in terms of infrastructure and mobility, particularly in Asia and Africa. This urbanisation will lead to a growing demand for public transportation. New metros and underground rail systems will be needed to cope quickly and smoothly with the growing numbers of people. This is where the reduced loading gauge locomotives made by Schalke come in. They can be used for a wide range of service tasks that help keep the lifelines of the new mega-cities flowing.

Extracting mineral resources economically

At the same time, mankind needs increasing volumes of raw materials. Alongside conventional sources of energy, ores are in demand, which

are again being increasingly searched for and mined below ground. In order to work both safely and economically in this environment, semi- and fully automatic systems are called for with transport solutions capable of working around the clock – even under the most difficult conditions. The current and future mining locomotives made by Schalke are utilised wherever the tunnels are lower, the gradients steeper and the curves tighter. Schalke is in continual collaboration with the global players of the sector, busy developing complete systems for rail transportation that are custom-built with amazing precision to suit the situation at each mining site.

Intelligently preserving resources

The mega-trend towards greatest possible efficiency has always driven the company's development. Schalke has a long, proud tradition of creating innovation and has always looked for intelligent ways of using resources sparingly as well as new drive technology and energy supply options – like Schalke ModuTrac locomotives, for example. Systems such as the in-house developed power pack, a highly efficient energy module that can be replaced within a very short time, help to utilise energy intelligently and precisely adapt it to suit each individual situation. This ability will also continue to be one of Schalke's inherent strengths going in the future: the ability to devise individually tailored solutions, with a passion for performance and the strength gained from experience.

1 Growing mobility:
urbanisation requires suitable
transportation

2 Growing efficiency:
raw materials need to be
transported intelligently

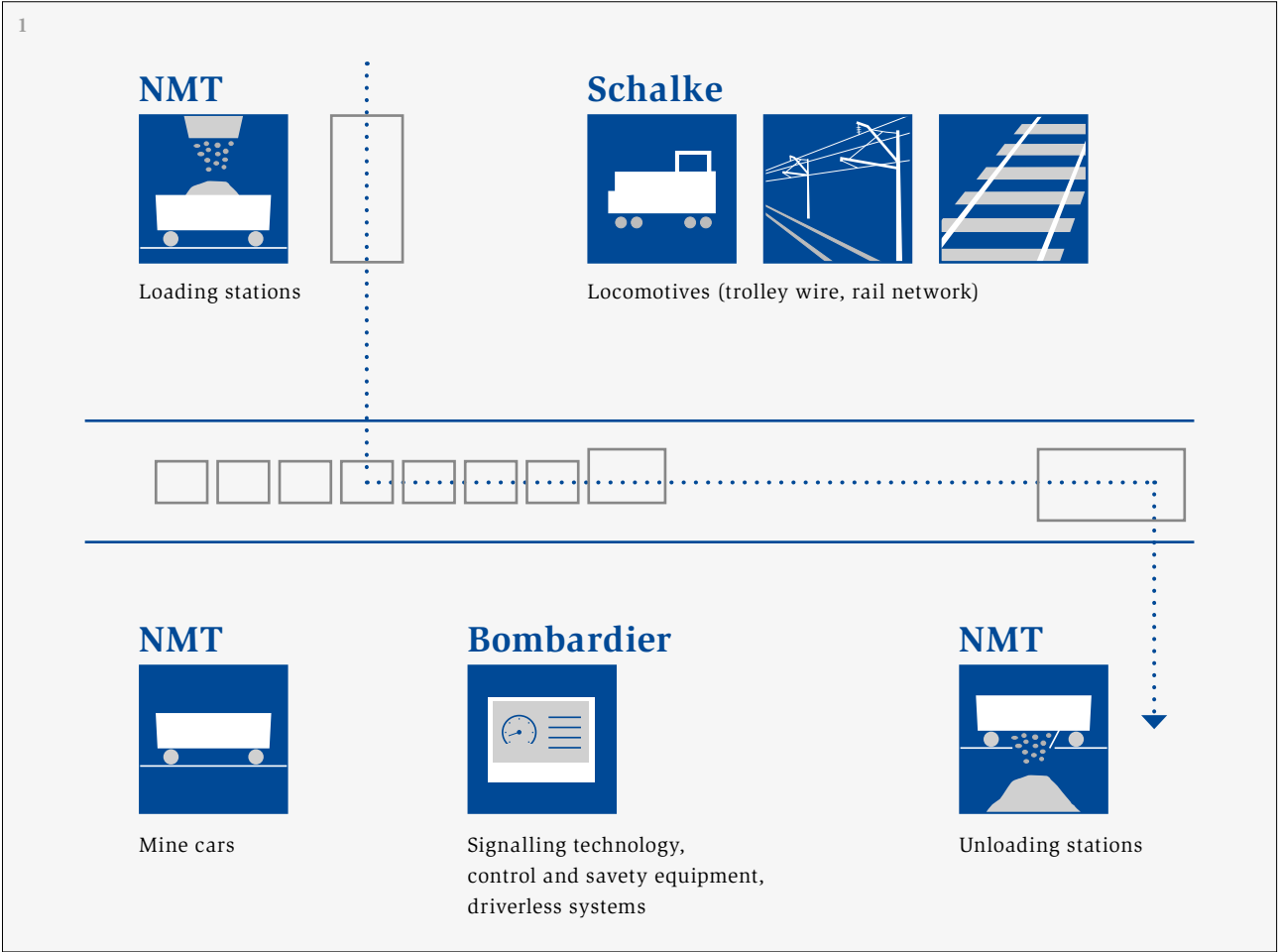
SUCCESS IS
A MATTER OF
TEAMWORK

Accomplishing more together – as a renowned specialist for mining locomotives, Schalke also cooperates with other partners on joint major projects in order to concentrate expertise and benefit from synergies. One particularly fine example is a complete system for underground rail transport, which Schalke has developed in collaboration with Bombardier Transportation and Nordic Minesteel Technologies (NMT). Each of the three partners has decades of experience in developing and producing mining equipment. They have now combined their knowledge and ability to form a system supplied from one single source.

Schalke provides the locomotives, Bombardier contributes a special train automation system and the rail network, while NMT supplies the mining cars as well as the loading and unloading stations. The collaboration has resulted in a complete system unique worldwide that features a high degree of automation and incredible robustness. All of the system’s components are designed to withstand 25 to 30 years of continual operation. The system enables constant round-the-clock operation at high speed and maximum capacity. The automatic operation guarantees maximum effectiveness, cuts costs and increases safety underground.

The all-round proven robustness of the system means reliability is high, downtimes are minimal and operating and maintenance costs are extremely low in comparison.

The operators of several of the largest mines in the world already put their trust in this complete system, including Freeport’s Grasberg mine in Indonesia, the LKAB Kiruna mine in Sweden and the CODELCO El Teniente mine in Chile. The fact that these global players rely on the performance and quality of this system is an affirmation of Schalke’s strategy of success through teamwork. For this reason, the company is always open for advantageous cooperation with other specialists.



Bombardier Transportation
As a leading manufacturer of rail transportation technology, Bombardier delivers the INTERFLO 150 signalling and train automation system – an intelligent automatic train control solution.

Schalke Eisenhütte
As a specialist for safe, reliable high-performance traction units, Schalke provides a range of mining locomotives from 10 to 130 tonnes as well as service and/or shunting locomotives.

Nordic Minesteel Technologies
Based in Ontario, Canada, NMT specialises in the loading and unloading of rail transportation vehicles. NMT supplies mine cars and freight vehicles as well as loading and unloading stations for the system.



1 Providing complete systems: breakdown of the scope of supply



SCHALKE MINING LOCO- MOTIVES

Extremely tough conditions prevail wherever the mining locomotives from Schalke are in use – mostly in round-the-clock operation. In some cases they are operating in depths of more than one thousand metres below ground level and in mines of all types of climatic zones, from northern Sweden to the Indonesian tropics, in their daily work as highly robust work-horses.

In the Kiruna mine in Sweden, the 108-tonne production locomotive operates in depths of 1,365 metres below ground level.

MMT-M-270-BDE

MODULAR MULTI SYSTEM
PRODUCTION LOCOMOTIVE

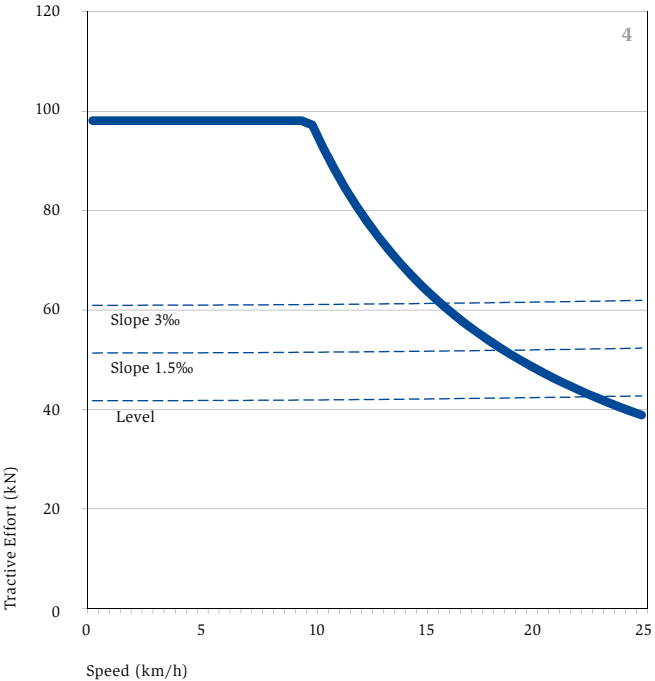
With a total weight of 40 tonnes, this ModuTrac locomotive is designed with a central cab and is currently the heaviest twin-axle locomotive Schalke manufactures. Each wheel-set is driven by a 135-kW AC electric traction motor. Two state-of-the-art, amongst others liquid-cooled IGBT-controlled traction converters make it possible to control each wheelset individually. The locomotive is designed with a hybrid power supply system, featuring a pantograph for overhead catenary and Powerpacks for diesel or battery operation. The Powerpacks can be quickly and smoothly replaced in approximately one hour as required. This ModuTrac locomotive is therefore equipped with several state-of-the-art traction technology systems simultaneously.

Furthermore, the locomotive features numerous characteristics typical for Schalke products that keep operating and maintenance costs low. These include the electro-dynamic main brake, which is powered by the traction converter and strong enough to bring the entire train to a standstill if required. In cases of emergency or for prolonged parking, the locomotive is equipped with a pneumatic service brake, which includes a spring-loaded function. Moreover, a highly efficient slip-and-slide protection system is used, ensuring the optimal use of available tractive forces, depending, of course, on the wheel-rail friction coefficient.

State-of-the-art AC traction technology ensures reduced maintenance costs and standstill period compared with DC systems. A train protection system for outstanding operating safety and an train automation system for driverless operation are also optionally available.

In use at the Grasberg and Esmeralda mines
These ModuTrac locomotives are in use in PT Freeport's Grasberg underground mine in Indonesia. In one of the world's largest copper mines and simultaneously the world's currently largest gold mine, they transport all of the extracted material in a driverless, round-the-clock, fully automated system. The predecessors of these locomotives still operate in the Andes mountains of Chile. They also work underground in the Esmeralda mine, which is part of the El Teniente mining complex operated by CODELCO.

- Hybrid energy supply: pantograph and Powerpacks (diesel or battery)
- Fast switching from Diesel-Powerpack to Battery-Powerpack and vice versa
- Central driver's cab for a good view in both directions
- Capable of bringing unbraked train capacity of up to 700 tonnes to a standstill
- Designed for fully automatic, driverless, round-the-clock use



1 Robust and versatile: the production locomotive was developed for use in the Grasberg mine in Indonesia.

2 Battery-Powerpack

3 Diesel-Powerpack

4 Tractive Effort Diagram and
- - - - Resistance Curve for
Hauling capacity: 708 t
Curve radius: 120 m
Example:
Locomotive with diesel generator



Technical data



Power Modules
Diesel-Powerpack, Battery-Powerpack, Pantograph



Power Transmission
AC



Weight
40 t



Axle Arrangement
Bo



Track Gauge
1,435 mm



Power
270 kW



Length
8,000 mm



Width
3,000 mm



Height
3,650 mm



Maximum Speed
25 km/h















Tractive Effort
98 kN (at $\mu = 0.21$)



Transport Capacity
Fully Loaded Train: 708 t
Comprising one locomotive and 11 mining cars a 20 m²



Technical data	
 Power Modules Battery-Powerpack, Pantograph (overhead), Pantograph (side)	 Length 11,300 mm
 Power Transmission AC	 Width 3,050 mm
 Weight 108 t	 Height 3,400 mm
 Axle Arrangement Bo'Bo'	 Maximum Speed 25 km/h
 Track Gauge 1,435 mm	 Tractive Effort 223 kN (at $\mu = 0.21$)
 Power 900 kW	 Transport Capacity Fully Loaded Train: 1,608 t Comprising one locomotive and 21 mining cars a 17 m ²

MT-M-900-EEB

MULTI SYSTEM PRODUCTION LOCOMOTIVE

This locomotive is designed with an end cab and has a total weight of 108 tonnes, distributed over four axles. Each wheelset is driven by a 225-kW AC traction motor and can be individually controlled, thanks to state-of-the-art, amongst others liquid-cooled, IGBT-controlled traction converter technology. The power can be supplied by various hybrid options, including a vertical pantograph for overhead catenary operation and also a horizontal pantograph for side catenary operation. The locomotive is additionally equipped with Battery-Powerpacks, enabling it to operate without an external power supply. This locomotive is equipped with an impressive range of the latest modular traction technology.

In typical Schalke style, the engineering and the carefully selected components keep running and maintenance costs to an absolute minimum. The wear-free, electro-dynamic main brake is capable of bringing the entire train to a standstill, for example 1,500 tonnes of unbraked train capacity can be brought from 25 km/h to a complete halt. The electro-dynamic traction technology enables the locomotive to halt briefly or stop and start on ascending slopes without a problem. The pneumatic service brake is equipped with a spring-loaded function and only designed for use in emergencies or for prolonged parking.

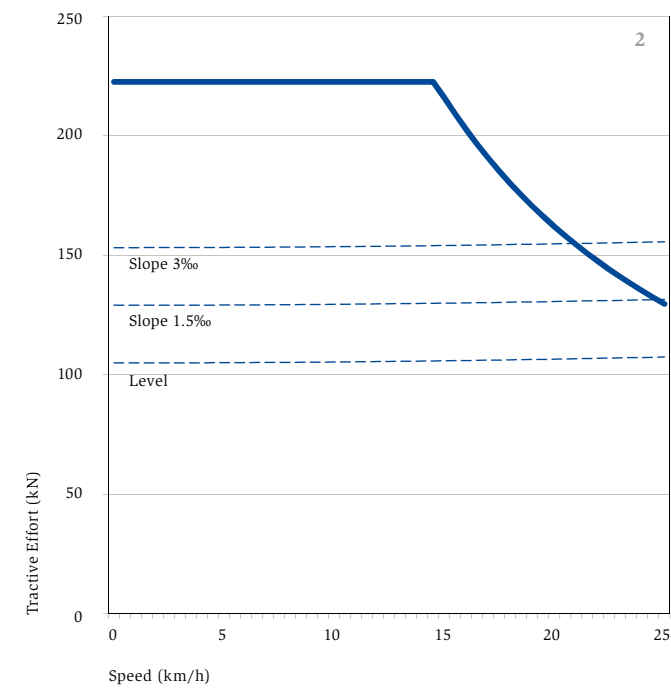
Further features of this locomotive are its highly efficient slip-and-slide protection system and its state-of-the-art AC traction technology, which also ensures reduced maintenance and downtime costs. The locomotive can be divided into four separate modules to facilitate transportation and assembly underground. A train protection system for outstanding operating safety and a train automation system for driverless operation are also optionally available.

In use in Kiruna
The Kiruna mine is the largest underground iron ore mine in the world and operated by the Swedish state-owned company LKAB. Schalke locomotives operate on a new main level at a depth of 1,365 metres – fully automatically, driverless and around the clock. 365 days a year, day and night.

- **Hybrid power supply: overhead pantograph, side pantograph and Battery-Powerpack**
- **Locomotive can be divided into four modules for underground transportation to its final point of assembly**
- **Capable of bringing unbraked train capacity of up to 1,500 tonnes to a standstill**
- **Designed for fully automatic, driverless, round-the-clock use**

1 Powerful and reliable: production locomotive for iron ore mining in Kiruna, Sweden.

2 Tractive Effort Diagram and Resistance Curve for Hauling capacity: 1,500 t Curve radius: 120 m



SMT-M-100-BDE

MODULAR PRODUCTION AND SERVICE LOCOMOTIVE

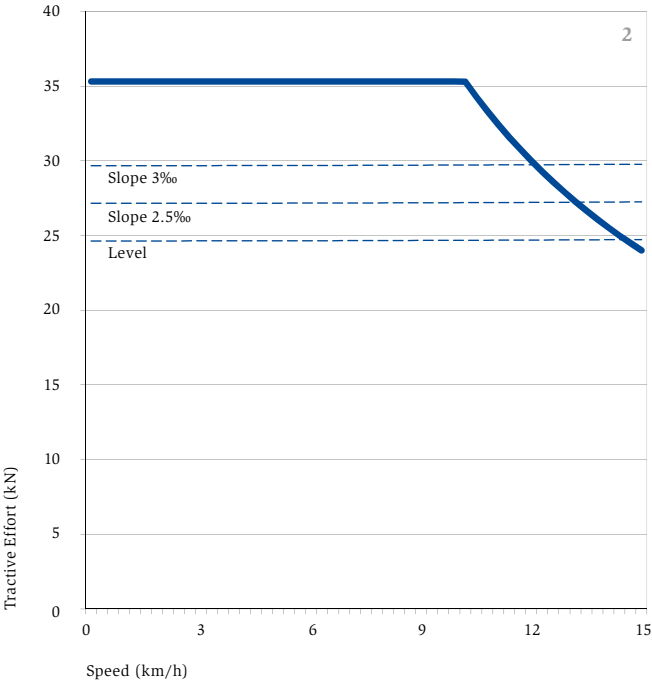
Using a modular system, this small ModuTrac locomotive was developed by Schalke as a new standard vehicle and enlarges the company's portfolio for mining vehicles to include a model that features a comparatively low total weight. It is ideal for use as a production locomotive in smaller mines with lower capacities, but can also be practical for use in larger-scale mines, for example as a service vehicle. Although its design is fundamentally simple, the technology used in it is still of excellent quality and the locomotive itself is extremely robust and long-lasting.

This ModuTrac locomotive is highly flexible and modularly designed to make it suitable for as many locations and applications as possible. For example, various distances between axles can be selected. Customers can choose from gauge widths between 600 and 1,435 mm. Weights vary between 10 and 25 tonnes. The types and heights of the couplings are just as variably selectable and can be precisely ordered to suit on-site requirements. The power system of the ModuTrac is also extremely variable and offers a choice of traction batteries with up to 465 Ah capacity that provide sufficient power for an entire shift, but also a diesel generator unit with up to 150 kW of power output and a pantograph for straightforward electrical operation via overhead catenary.

In addition to the typical Schalke qualities, such as long-lasting robustness, a great feature of this locomotive is its nimble ability to negotiate even the tightest of curves with radii as small as 17 metres. Furthermore, this ModuTrac locomotive can also be manufactured in a special ATEX-approved version for coal mines.

This new type of ModuTrac locomotive has a number of predecessors on which the new design is based. Due to their durability, many of these are still in operation today and their references include mines in countries such as Germany, Slovenia and Japan.

- **Wide range of applications:** designed for use as both production and service locomotives
- **Simple but robust with technically outstanding design**
- **Modular design with various track gauges, weights, couplings, etc.**
- **Various power units available:** Battery-Powerpack, Diesel-Powerpack or electrically powered via overhead catenary



1 Extremely flexible: can be used as a small-scale production locomotive or as a service vehicle in larger mines.

2 Tractive Effort Diagram and
- - - - Resistance Curve for
Hauling capacity: 150 t
Curve radius: 40 m
Example:
18t Locomotive with Diesel-Powerpack



Technical data



Power Modules
Diesel-Powerpack (150 kW),
Battery-Powerpack (465 Ah), Pantograph



Power Transmission
AC



Weight
10–25 t



Axle Arrangement
Bo or B



Track Gauge
600–1,435 mm



Power
35–100 kW



Length
5,830 mm–6,580 mm



Width
1,150–1,600 mm



Height
1,600–2,060 mm



Maximum Speed
15 km/h



Tractive Effort
20,0–49,0 kN (at $\mu = 0.2$)



Transport Capacity
Fully Loaded Train: up to 150 t

SCHALKE MULTI-PURPOSE LOCOMOTIVES FOR URBAN RAIL TRANSPORT OPERATORS

Schalke locomotives provide maximum versatility and can be used to perform a variety of tasks in suburban and regional passenger rail transport systems. They are in daily use to perform service or maintenance work in the underground and tram rail networks of cities such as Vienna, Bangkok and São Paulo.



Two-system locomotive in use on lines
in Vienna.

MMT-S-800-BDE

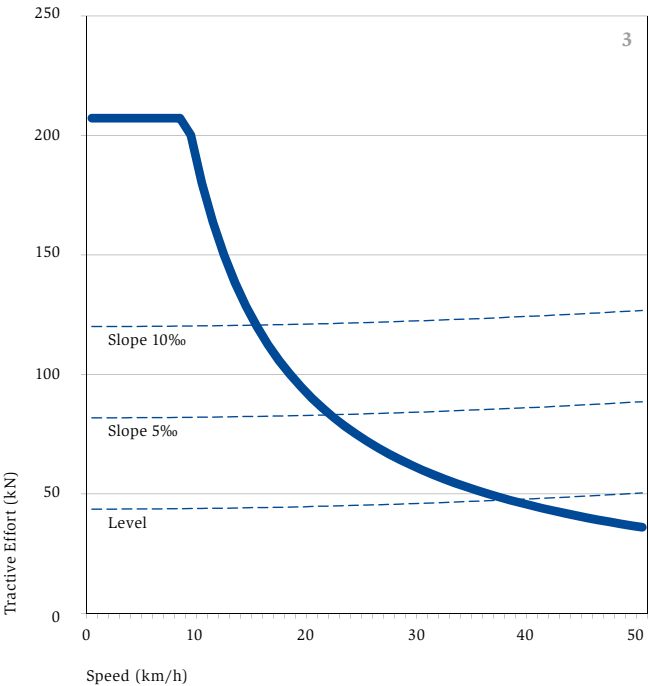
MODULAR MULTI SYSTEM SERVICE
AND SHUNTING LOCOMOTIVE

This four-axle locomotive with reduced loading gauge has an unladen weight of between 48 and 64 tonnes and is an extremely versatile, reliable working vehicle. Developed for the operators and service companies of underground and urban rail services, this traction vehicle is very useful for duties such as constructing or maintaining infrastructure.

Due to its modular design, its traction technology and modules can be combined in a variety of ways to suit the requirements of the customer. The locomotive can be supplied with the required power via a number of different modules: a Diesel-Powerpack, Battery-Powerpack, a pantograph for catenary operation or a third rail are all available and can be either combined with one another or simply used alternately. Thus the locomotive can be easily optimised to suit the intended purpose, for example by switching to environmentally friendly battery operation when working in or near residential areas. The ModuTrac design makes Schalke locomotives particularly economical and well equipped for the future, since any new power-source technologies that emerge can also be simply integrated as new modules

in the existing set-up. Other features also make this ModuTrac Locomotive highly versatile: such as the specially developed bogies, which can cover all known track gauges from 1,000 to 1,676 mm. The extremely narrow loading gauge and the low axle load between 12 and 16 tonnes makes the vehicle suitable for use in practically all tram and underground subway networks throughout the world. This narrow-gauge locomotive reaches a maximum speed of 60 km/h and is a highly efficient workhorse that is suitable for a wide range of service tasks.

- Locomotive with narrow loading gauge, reduced axle loads and various track gauges
- Modular platform concept with regard to power supply and modular locomotive lay-outs
- AC traction technology for use with a wide variety of power supply modules (electricity, battery and diesel traction)



1 Versatile and modularly designed for narrow structure gauges: this service locomotive is suitable for use in underground, city and narrow-gauge networks.

2 For different purposes: examples with different configurations.

3 Tractive Effort Diagram and
- - - - Resistance Curve for
Hauling capacity: 700 t
Curve radius: 150 m
Example:
64 t Locomotive with
e-traction



Technical data



Power Modules
Diesel-Powerpack, Battery-Powerpack
Pantograph (Third Rail or Overhead)



Power Transmission
AC



Weight
48–64 t



Axle Arrangement
Bo'Bo'



Track Gauge
1,000 mm–1,676 mm



Power
800 kW (e-traction)



Length over coupler
15,840 mm



Width
2,540 mm–2,758 mm



Height
3,550 mm














Maximum Speed
60 km/h



Tractive Effort
up to 210 kN (at $\mu = 0.33$)



Technical data	
 Power Modules Battery-Powerpack, Pantograph (Third Rail)	 Length 15,120 mm
 Power Transmission AC	 Width 2,358 mm
 Weight 36 t	 Height 3,487 mm
 Axle Arrangement Bo'Bo'	 Maximum Speed 50 km/h
 Track Gauge 1,435 mm	 Tractive Effort 115 kN (at $\mu = 0.33$)
 Power 520 kW	

MT-S-600-BE

MULTI SYSTEM SERVICE LOCOMOTIVE

Optimised for use in underground and urban rail networks, the 36-tonne locomotive has been designed as a lightweight that achieves an axle load of only 9 tonnes. At the same time it has a high power density and can be operated throughout an entire shift without catenary input, thanks to its battery capacity of 540 Ah.

Each of its four wheelsets is driven by a 130-kW AC traction motor that is separately being controlled via IGBT converter technology. Moreover, the locomotive is equipped with a highly efficient slip-and-slide protection system that improves traction and minimises wear on both infrastructure and wheels. Designed for dual-mode operation, the locomotive is powered either by a traction battery or by a third rail current collector, which means it can be used flexibly on any route. The locomotive is also fitted with a four-quadrant controller, enabling it to brake electro-dynamically and effectively bring the entire train to a standstill as well as stop and start on ascending slopes.

Its components are easily accessible from the outside, making it particularly simple to maintain. Moreover, its central cab is ergonomically designed and provides the driver with a good all-round view as well as the ability to drive in both directions.

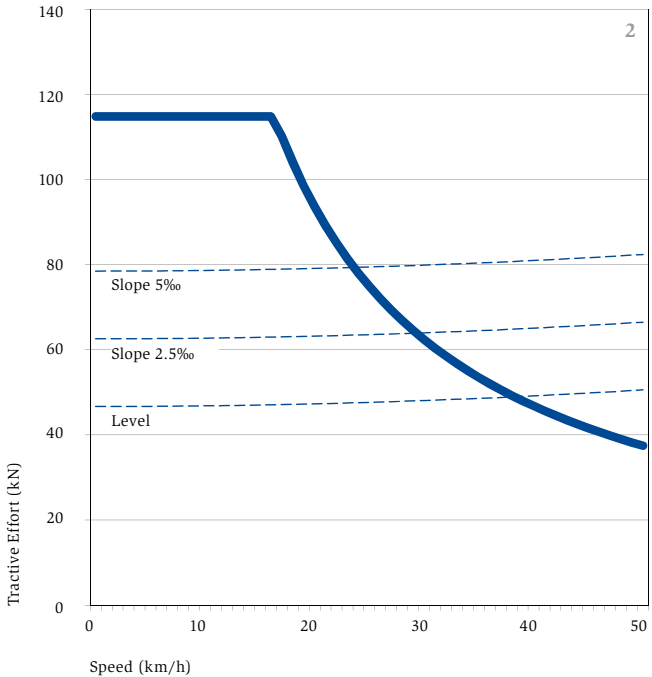
A built-in camera additionally facilitates coupling. With tractive effort of 115 kN (at $\mu = 0.33$) and maximum speed of 50 km/h, this service locomotive is an ideal working vehicle and combines emission-free operation with outstanding reliability.

In use at Wiener Linien and Berliner Verkehrsbetriebe
The five city routes of the “Wiener Linien” in Vienna convey well over 400 million people through the Austrian capital each year. The number of passengers is growing and the network is being continually enlarged. Together with Vossloh Kiepe, Schalke developed and supplied the public transport company with five electrically powered service locomotives for performing maintenance and repair work. The Schalke locomotives are also used by the Berlin public transport system.

- Specially designed for tram and suburban light rail networks
- Lightweight construction
- Powered either by battery or third rail current collector
- Electro-dynamic brake for wear-free stopping and starting on ascending slopes

1 Emission-free traction vehicle: this service locomotive was specially developed for use on Vienna's public transport system.

2 Tractive Effort Diagram and Resistance Curve for
Hauling capacity: 1,000 t
Curve radius: 100 m



SCHALKE LOCOMOTIVES FOR SPECIAL PURPOSES

The ultimate specialists and uniquely developed to suit exacting customer requirements, these locomotives offer a high power density under extreme conditions and can be custom-built for demanding traction tasks in industry or ports. Here too, the Modu-Trac design concept featuring exchangeable traction modules plays a key role.



One of the most modern in Europe:
the ThyssenKrupp Schwelgern
steel plant in Duisburg

MMT-S-400-BDE

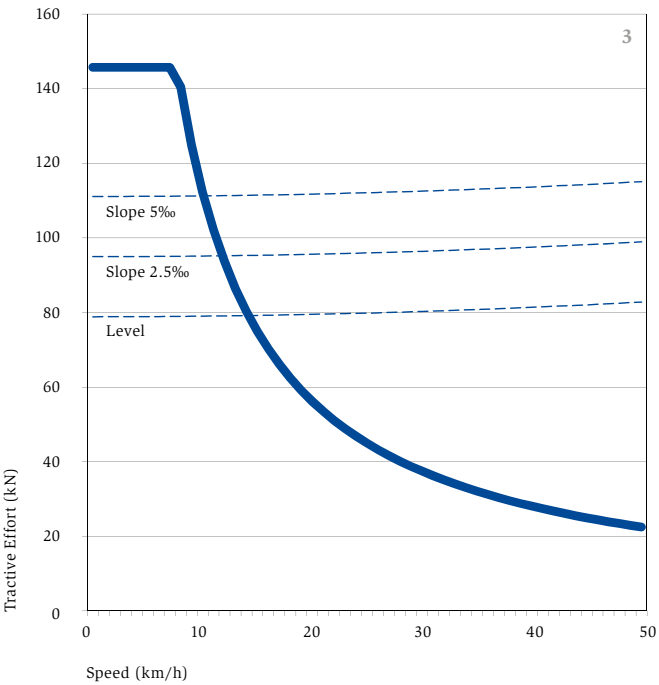
MODULAR SHUNTING LOCOMOTIVE
FOR INDUSTRIAL AND PORT USE

Efficient logistical processes and the smooth distribution of goods in industry, freight depots and ports as well as compliance with the latest environmental standards are fundamental requirements for today's rolling stock fleet operators. Robust, reliable locomotives are called for, capable of continuous operation on a wide range of assignments. At the same time they need to be flexible and designed to meet the needs of the future, which means firstly being able to comply with increasingly restrictive requirements and secondly being equipped to handle new technological developments.

With these points in mind, Schalke has developed a specially adapted locomotive concept. The ModuTrac locomotive is modularly designed and equipped with quickly exchangeable power modules, enabling it to switch from one mode of traction to another, from diesel to battery operation for example. This ability makes the locomotive extremely flexible to use and means it can also be operated with the technologies of the future. The modular design is made possible by state-of-the-art inverter technology. The ModuTrac locomotive can be manufactured either as a

compact two-axle unit approximately 8 metres long or as a 17-metre, high-performance, four-axle version with correspondingly greater traction capability. With tractive effort between 150 and 390 kN and a maximum speed of 60 km/h, this locomotive provides the right solution for every purpose. Its ergonomically designed cab provides a good all-round view and can be optionally fitted with a camera to ease coupling procedures.

- Robust, modular design
- Various traction concepts available
- Future proven through exchangeable modules
- Designed for maximum efficiency and reliability
- Optional accessories such as radio remote control, train radio communication or air conditioning



1 Short and compact: this locomotive is ideal for intensive shunting work.

2 Four axle version.

3 Tractive Effort Diagram and
- - - - Resistance Curve for
Hauling capacity: 600 t
Curve radius: 50 m
Example:
two-axle locomotive with
390 kW and a weight of 45 t



Technical data



Power Modules
Diesel-Powerpack, Battery-Powerpack



Power Transmission
AC



Weight
40-45 t / 80-90 t



Axle Arrangement
Bo / Bo'Bo'



Track Gauge
1,000-1,600 mm



Power
390 / 1,800 kW



Length
8,000 / 17,000 mm



Width
3,000 mm



Height
4,250 mm



Maximum Speed
50 / 60 km/h














Tractive Effort
150 / 390 kN (at $\mu = 0.33$)



28

Technical data

 Power Module Diesel Engine	 Length 16,690 mm
 Power Transmission AC	 Width 2,650 mm
 Weight 64 t	 Height 3,885 mm
 Axle Arrangement Bo'Bo'	 Maximum Speed 100 km/h
 Track Gauge 1,000 mm	 Tractive Effort 210 kN (at $\mu = 0.33$)
 Power 1,800 kW	

GMF 4/4 287

DIESEL-ELECTRIC LOCOMOTIVE

Schalke developed the four-axle GMF 4/4 287 diesel-electric locomotive especially for the needs of the “Infrastructure” department of Switzerland’s Rhaetian Railway. Its design fulfils a broad range of basic requirements for special circumstances, as the railway has a narrow loading gauge (tunnel gauge) and a low axle load of 16 tonnes. The narrow, metre-gauge track gauge includes small curve radii as tight as 40 metres. The locomotive is particularly suitable for high-altitude areas with steep slopes of 70‰ as an adhesion railway. Moreover, it is reliable under extreme climatic conditions: its application range stretches from temperatures of -35 °C to +40 °C and it even runs on fine, crystalline snow.

The implementation of these technical challenges has been combined with the integration of numerous specific components. For example, the locomotive is fitted with four different types of brake system, possesses the ability to run in multiple unit operation of up to three locomotives and is capable of a maximum speed of 100 km/h.


The official operating authorisation granted by the Swiss Federal Office of Transport (Schweizer Bundesamt für Verkehr - BAV) also makes this diesel locomotive unique on the market.

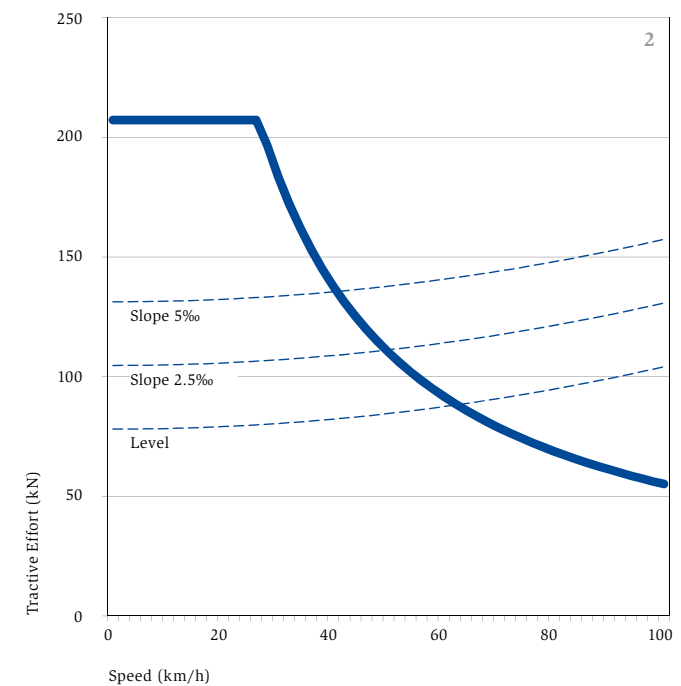
Its main duties comprise the transportation of heavy construction trains or special-purpose trains, even if the catenary wire is switched off, the operation of snow blowers in the winter, the rescue of trains that have broken down and shunting in various districts.

In use by Rhaetian Railway
Rhaetian Railway operates locomotives on spectacular routes, some of which are under UNESCO World Heritage protection. The routes feature very tight curve radii and extremely steep ascents and descents.

- **High power density with 1,800 kW, low axle load and small loading gauge**
- **Designed to withstand extreme conditions such as cold and steep gradients**
- **Newly developed bogie for maximum speed of 100 km/h and small curve radii as tight as 40 metres**
- **Integration of four different brake systems**

1 Versatile for the mountains: universal locomotive in use by Rhaetian Railway in Switzerland

2 Tractive Effort Diagram and Resistance Curve for  Hauling capacity: 1,000 t
Curve radius: 100 m



AFTER-SALES SERVICE

Just the beginning of a long-term relationship – when a locomotive leaves the Schalke manufacturing plant, it signifies the beginning of its working life with the customer. However, the engineers and technicians at Schalke accompany the locomotive throughout its entire life cycle. Servicing, maintenance and useful updates are integral parts of the comprehensive after-sales service Schalke provides.

Working to capacity: various types of locomotive are built simultaneously in the Schalke assembly building.



LONG-TERM PARTNERSHIP

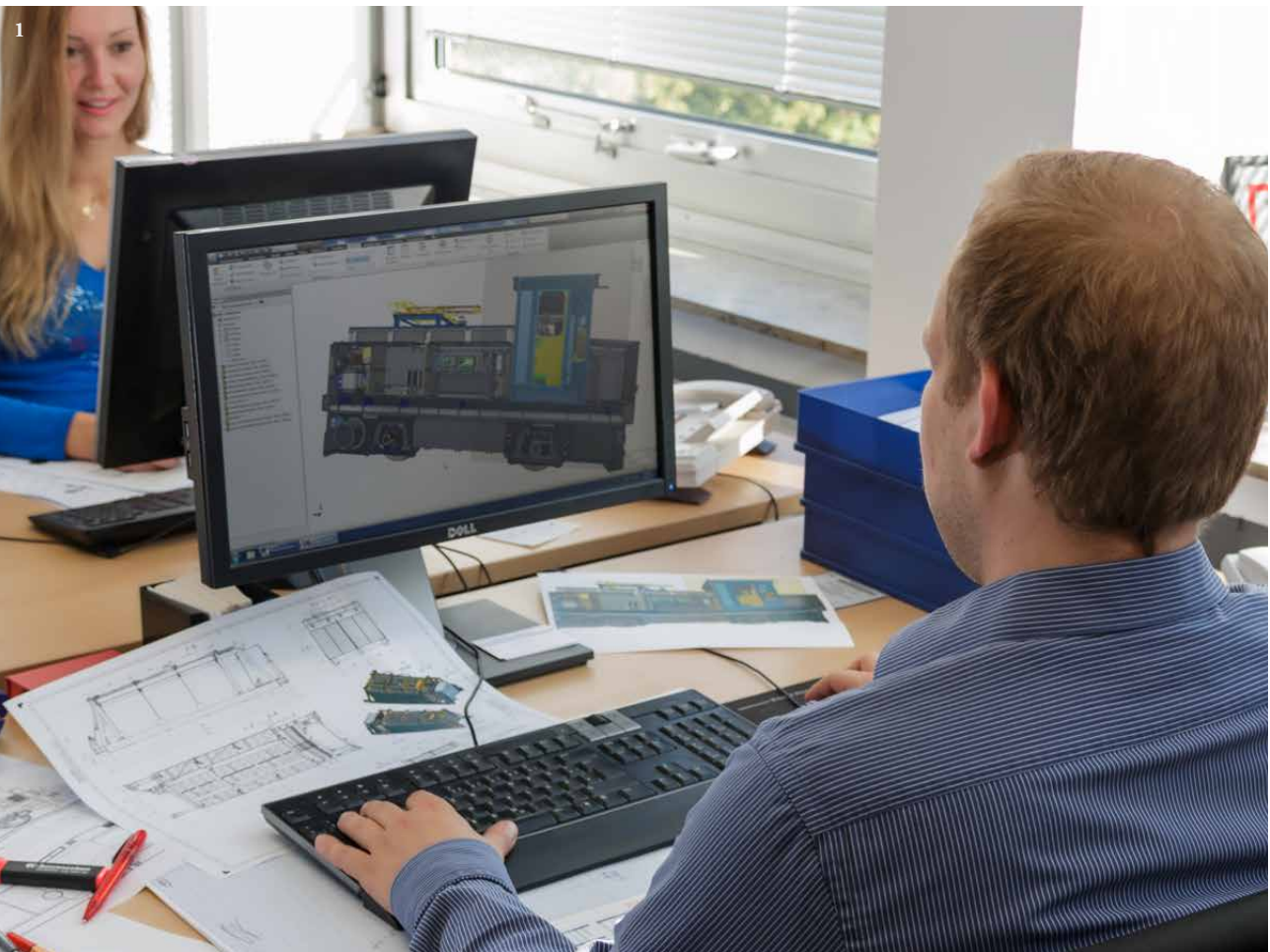
Schalke locomotives are not only high-performance workhorses – they are also robust investment goods. Their service lives are calculated at 25 to 30 years, guaranteeing continual yields and low downtimes. In other words, they stand for long-term reliability.

Under these circumstances, professional after-sales service takes on an entirely new level of significance. When a locomotive leaves the Schalke plant, it is not the end of a technical relationship, but merely the first step. Schalke continues to offer after-sales support throughout the product's entire life cycle – with a complete service concept.

It begins with the commissioning of the locomotive by experienced technicians at the site and continues with regular service inspections. Whenever there are new technical developments, the technicians provide updates and thus ensure continual product improvement. The supply of spare parts is also guaranteed throughout the locomotive's entire life cycle. Any repairs are carried out within the shortest possible time

and in accordance with the highest quality standards. Furthermore, Schalke is always ready to provide technical support and advise its customers on-site.

The Schalke service teams form the core of this long-term partnership for quality. The teams consist of specialists who have a wealth of experience and expertise gained in serving customers throughout the world. They too embody the fundamental virtues incorporated in locomotives made by Schalke right from the development and production stages: every project is individually supported with great flexibility and commitment – with the ultimate aim of providing the customer with the best possible solution. Thus the purchase of a Schalke locomotive becomes a long-term partnership.



1 Sustainably developed:
designed using state-of-the-art
CAD software

2 Expert support: electrical
engineers at work

REFERENCES:
MINING LOCOMOTIVES



Production Locomotive
Vale Canada Limited, Canada
Thompson Manitoba

Length	7,815 mm
Width	2,000 mm
Height	2,485 mm
Weight	30 t
Track Gauge	914,4 mm (36inch)
Power	200 kW
Maximum Speed	20 km/h
Quantity	3
Delivery Period	2017



Production Locomotive
Freeport, Indonesia
Mine Grasberg

Length	8,000 mm
Width	3,000 mm
Height	3,650 mm
Weight	40 t
Track Gauge	1,435 mm
Power	270 kW
Maximum Speed	25 km/h
Quantity	10
Delivery Period	2014–2018



Production Locomotive
LKAB, Sweden
Mine Kiruna (1.365 m Level)

Length	11,300 mm
Width	3,050 mm
Height	3,400 mm
Weight	108 t
Track Gauge	1,435 mm
Power	900 kW
Maximum Speed	25 km/h
Quantity	9
Delivery Period	2012–2015



Production Locomotive
CODELCO, Chile
Mine El Teniente 8

Length	16,000 mm
Width	2,900 mm
Height	4,000 mm
Weight	130 t
Track Gauge	1,435 mm
Power	1,600 kW
Maximum Speed	60 km/h
Quantity	10
Delivery Period	2001–2015



Service Locomotive
CODELCO, Chile
Mine El Teniente 8

Length	18,695 mm
Width	3,000 mm
Height	3,975 mm
Weight	105 t
Track Gauge	1,435 mm
Power	1,380 kW
Maximum Speed	60 km/h
Quantity	3
Delivery Period	2012



Service Locomotive
CODELCO, Chile
Mine Esmeralda

Length	8,000 mm
Width	3,000 mm
Height	3,100 mm
Weight	36 t
Track Gauge	1,435 mm
Power	270 kW
Maximum Speed	20 km/h
Quantity	3
Delivery Period	1998–2005



Production Locomotive
CODELCO, Chile
Mine Esmeralda

Length	11,548 mm
Width	3,000 mm
Height	3,700 mm
Weight	72 t
Track Gauge	1,435 mm
Power	560 kW
Maximum Speed	25 km/h
Quantity	6
Delivery Period	1997–2004



ATEX-Locomotive
Ruhrkohle AG, Germany
Mine: several

Length	5,500 mm
Width	1,000 mm
Height	1,800 mm
Weight	15 - 18 t
Track Gauge	540–750 mm
Power	38 kW
Maximum Speed	14 – 36 km/h
Quantity	> 120
Delivery Period	1990–1997



ATEX-Locomotive
Matsushima, Japan
Mine Ikeshima

Length	5,520 mm
Width	1,050 mm
Height	1,700 mm
Weight	18 t
Track Gauge	610 mm
Power	50 kW
Maximum Speed	50 km/h
Quantity (personal cars)	2 + 5
Delivery Period	1995



Production Locomotive
LKAB, Sweden
Mine Kiruna (540 m Level)

Length	8,700 mm
Width	2,100 mm
Height	2,200 mm
Weight	40 t
Track Gauge	900 mm
Power	270 kW
Maximum Speed	13 km/h
Quantity	6
Delivery Period	1972–1974

REFERENCES:
LOCOMOTIVES FOR
URBAN RAIL TRANSPORT



Service Locomotive
SWM, Germany
Metro Munich

Length	15.840 mm
Width	2,724 mm
Height	3,550 mm
Weight	53 t
Track Gauge	1,435 mm
Power	720 kW
Maximum Speed	40 km/h
Quantity	2
Delivery Period	2017



Service Locomotive
Wiener Linien, Austria
Tram Vienna

Length	15,120 mm
Width	2,358 mm
Height	3,487 mm
Weight	36 t
Track Gauge	1,435 mm
Power	520 kW
Maximum Speed	50 km/h
Quantity	5
Delivery Period	2011–2016



Rail Grinding Machine
CMSP, Brazil
Metro São Paulo

Length	21,442 mm
Width	2,764 mm
Height	3,442 mm
Weight	80 t
Track Gauge	1,600 mm
Power	1,800 kW
Maximum Speed	80 km/h
Quantity	2
Delivery Period	2010



Diesel Electric
Service Locomotive
MRTA, Thailand
Metro Bangkok

Length	14,530 mm
Width	3,080 mm
Height	3,680 mm
Weight	52 t
Track Gauge	1,435 mm
Power	500 kW
Maximum Speed	35 km/h
Quantity	2
Delivery Period	2000–2005



Diesel Electric
Service Locomotive
KLIA Ekspres, Malaysia
Airport Ekspres line,
Kuala Lumpur

Length	13,000 m
Width	3,000 mm
Height	4,520 mm
Weight	52 t
Track Gauge	1,435 mm
Power	880 KW
Maximum Speed	70 km/h
Quantity	1
Delivery Period	2002



Diesel Electric
Mulipurpose Locomotive
RET Rotterdam, Netherlands
Tram Rotterdam

Length	17,800 mm
Width	2,700 mm
Height	3,540 mm
Weight	43 t
Track Gauge	1,435 mm
Power	300 kW
Maximum Speed	50 km/h
Quantity	1
Delivery Period	2000



Dual System Service Locomotive
Berliner Verkehrsbetriebe,
Germany
Metro Berlin

Length	13,800 mm
Width	2,280 mm
Height	3,170 mm
Weight	36 t
Track Gauge	1,435 mm
Power	440 kW
Maximum Speed	40 km/h
Quantity	2
Delivery Period	1997



Diesel Electric Service Vehicle
Wiener Linien, Austria
Tram Vienna

Length	17,200 mm
Width	2,500 mm
Height	3,640 mm
Weight	40 t
Track Gauge	1,435 mm
Power	460 kW
Maximum Speed	60 km/h
Quantity	1
Delivery Period	1997



Rail Grinding Machine
Berliner Verkehrsbetriebe,
Germany
Metro Berlin

Length	20,400 mm
Width	2,274 mm
Height	3,170 mm
Weight	54 t
Track Gauge	1,435 mm
Power	360 kW
Maximum Speed	40 km/h
Quantity	2
Delivery Period	1994–1995



Shunting Locomotive
Berliner Verkehrsbetriebe,
Germany
Metro Berlin

Length	5,900 mm
Width	2,300 mm
Height	3,180 mm
Weight	15 t
Track Gauge	1,435 mm
Power	66 kW
Maximum Speed	15 km/h
Quantity	2
Delivery Period	1987

REFERENCES:
SPECIAL PROJECTS



Diesel Electric Locomotive
Gmf 4/4 287
Rhaetian Railway, Switzerland
Narrow-Gauge rail operator

Length	16,690 mm
Width	2,650 mm
Height	3,885 mm
Weight	64 t
Track Gauge	1,000 mm
Power	1,800 kW
Maximum Speed	100
Quantity	4
Delivery Period	2014–2015



Electrical Locomotive for Industry
Solvay Chemicals,
Bernburg, Germany
Plant rail network

Length	13,000 mm
Width	2,370 mm
Height	2,600 mm
Weight	75 t
Track Gauge	900 mm
Power	760 kW
Maximum Speed	30 km/h
Quantity	2
Delivery Period	2007



Freight Tram
Dresdner Verkehrsbetriebe,
Germany
Tram Dresden

Length	59,400 mm
Width	2,200 mm
Height	3,450 mm
Weight	158 t
Track Gauge	1,450 mm
Power	840 kW
Maximum Speed	50 km/h
Quantity (freight cars)	5 + 7
Delivery Period	2007

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