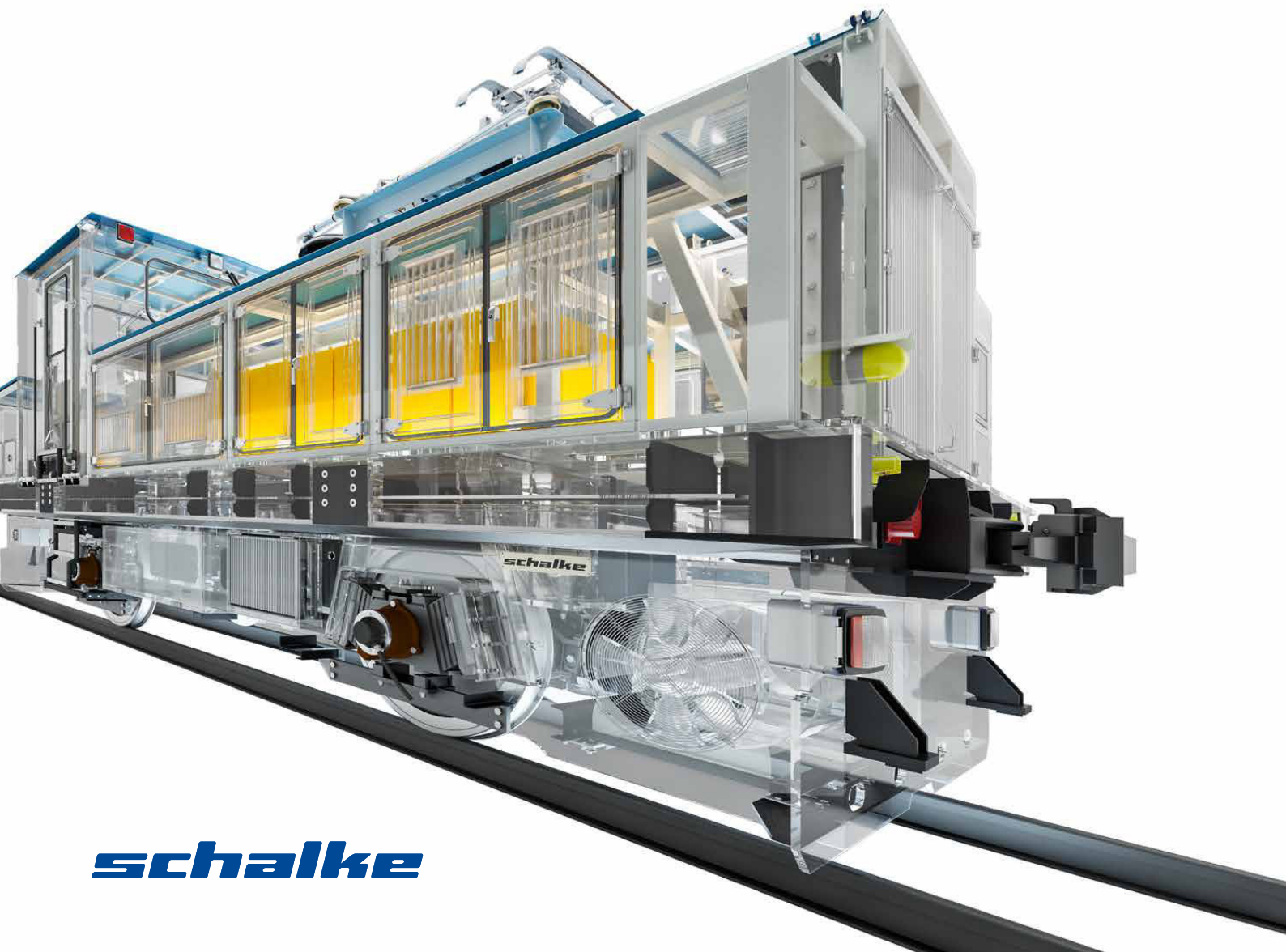


KEEP YOUR BUSINESS ON TRACK





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 wheelset 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.

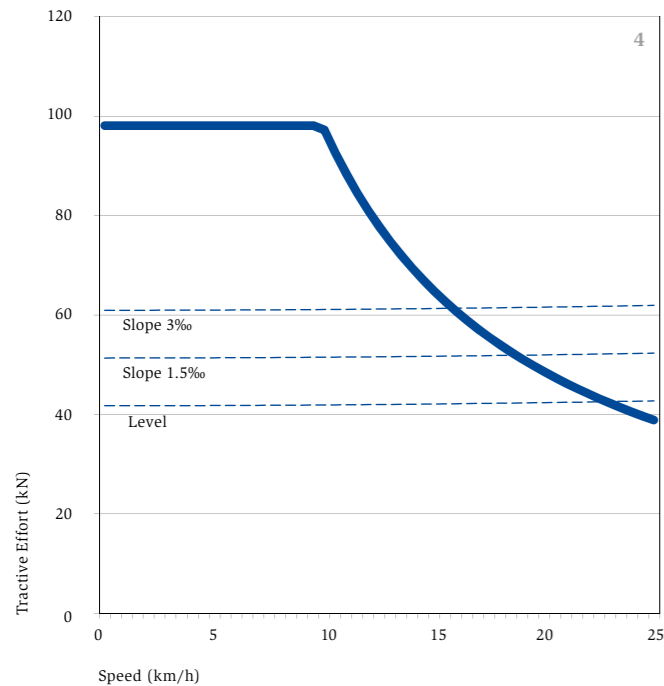
- **Hybrid energy supply: pantograph and Powerpacks (diesel or battery)**
- **Fast switching from Diesel-Powerpack to Battery-Powerpack and vice versa**
- **Central driver's cab for a good view in both directions**
- **Capable of bringing unbraked train capacity of up to 700 tonnes to a standstill**
- **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	Length 8,000 mm
Power Transmission AC	Width 3,000 mm
Weight 40 t	Height 3,650 mm
Axle Arrangement Bo	Maximum Speed 25 km/h
Track Gauge 1,435 mm	Tractive Effort 98 kN (at $\mu = 0.21$)
Power 270 kW	Transport Capacity Fully Loaded Train: 708 t Comprising one locomotive and 11 mining cars a 20 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.

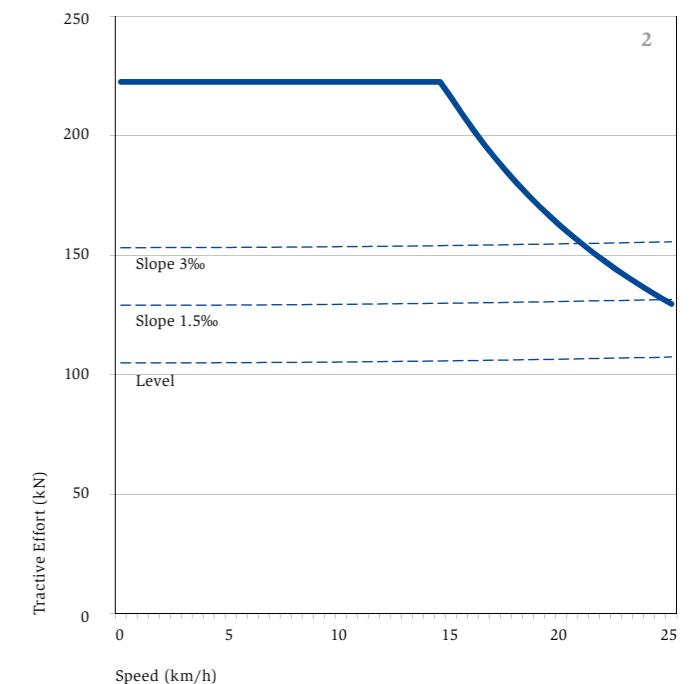
- **Hybrid power supply: overhead pantograph, side pantograph and Battery-Powerpack**
- **Locomotive can be divided into four modules for underground transportation to its final point of assembly**
- **Capable of bringing unbraked train capacity of up to 1,500 tonnes to a standstill**
- **Designed for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

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

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**



Technical data



Power Modules

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



Length

5,830 mm–6,580 mm



Power Transmission

AC



Width

1,150–1,600 mm



Weight

10–25 t



Height

1,600–2,060 mm



Axle Arrangement

Bo or B



Maximum Speed

15 km/h



Track Gauge

600–1,435 mm



Tractive Effort

20,0–49,0 kN (at $\mu = 0.2$)



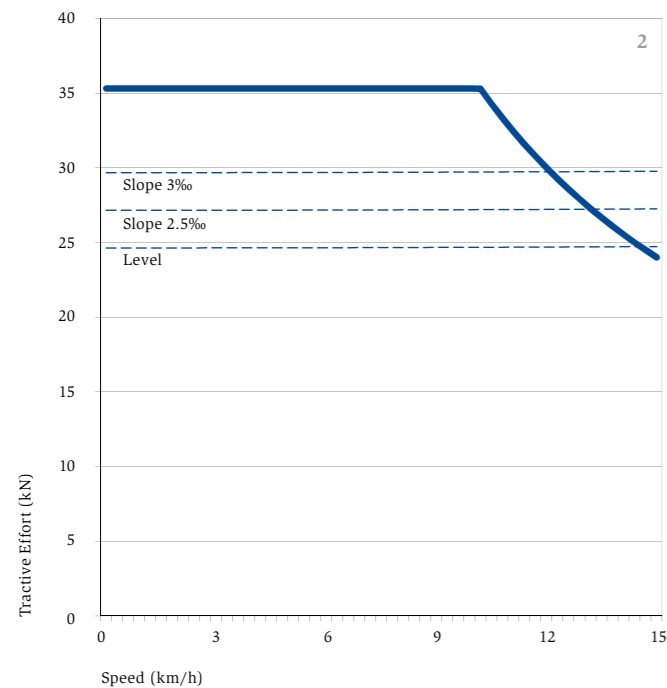
Power

35–100 kW



Transport Capacity

Fully Loaded Train: up to 150 t



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

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