



# Diesel-Electric Locomotives

Reference List

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# Introduction

## Competence in diesel locomotives

For over 100 years, Siemens has been making substantial contributions to the development of efficient and modern long-distance transportation systems. This kind of experience and competence further enables Siemens Transportation Systems to come up with innovative designs in the field of diesel-electric locomotives that meet the worldwide railroading needs of today and tomorrow.

As a total systems supplier, Siemens Transportation Systems is in a position to offer a broad product spectrum – from standard units to tailor-made locomotives, from small switchers to high-performance universal locomotives.

By working with competent partners, Siemens is able to offer customer-oriented solutions on an international scale, too. For example, our productive cooperation with EMD in the USA made us the first supplier to successfully introduce AC traction in the North American locomotive market.



# ME 05

## Diesel-Electric Locomotive Class ME 05

The ME 05 standard locomotive with three-phase power transmission is used by industrial railroad operators on an international scale. The ME 05 is part of a modular range with ratings from about 500 to 1700 kW. The range is characterized by the consistent use of standardized components and modules. The concept conforms to the VDV class recommendation for standard locomotives.

### Scope of application

The ME 05 is especially suited for medium to heavy switching duty in works and transfer operations. Axle loads of 20 to 25 metric tons have been realized.

### Technical features

For the first time, diesel locomotives were implemented with a consistent modular design: The engine-alternator unit, cooler, cab, and converter are each designed as a fully exchangeable module. Customers can choose from a module kit to implement locomotives with two end cabs or a central cab. The modules are supported by the slab frame with its unsurpassed robustness. Built of sturdy solid sections, it provides increased robustness even in the most demanding switching operations.

### Benefits

The excellent degree of efficiency of the AC technology with both full and partial loads over the entire speed range makes for optimum utilization of engine power and fuel. The result: higher tractive effort at the same diesel engine rating than with other power transmission systems. In addition, the modular design of the entire ME class provides substantial cost advantages through reduced repair downtimes and limited spare part stocking.

Type	ME 05	
Year	1982–1987	
Wheel arrangement	C	
Weight	[t]	60/67.5
Length over buffers	[mm]	10 000
Diesel engine rating	[kW]	560
Track gauge	[mm]	1 435
Starting tractive effort	[kN]	194/218
Maximum speed	[kph]	65
Numbers built	23	



# ME 07

## Diesel-Electric Locomotive ME 07 for Turkish State Railways (TCDD)

The standard ME 07 locomotive with three-phase power transmission for Turkish State Railways (TCDD) is part of a modular range. Its mechanical section largely corresponds to its "sister" model DE 1000. The operational advantages over the DE 1000 were critical for the purchase of the three-phase series.

### Scope of application

As a multi-purpose locomotive, the ME 07 is designed both for heavy switching duty and for light line service. With an axle load of 17 to 18 metric tons, it is also permitted to run on lines with light track superstructures.

### Technical features

The ME 07 is a standard locomotive with a modular design and three-phase power transmission. It has a bogie construction with a light welded underframe. The modular construction also permits the implementation of an AC/DC power transmission version based on the same mechanical section, the DE 1000.

### Benefits

Compact bogies with an open H-frame and long spring travel provide optimum running characteristics even on poorly maintained tracks. The modular design provides advantages for operation and maintenance. The modular design also proved to be an efficient way to enable a technology transfer. Five units were fully built in Germany. Another 35 locomotives of this type were later built by Tülomsas in Turkey.

Type	ME 07	
Year	1984–1989	
Wheel arrangement	Bo'Bo'	
Weight	[t]	68/88
Length over buffers	[mm]	13 250
Diesel engine rating	[kW]	745
Track gauge	[mm]	1 435
Starting tractive effort	[kN]	220/285
Maximum speed	[kph]	100
Numbers built	40	



# DE 1000

## Diesel-Electric Locomotive Class DE 1000 for Turkish State Railways (TCDD)

The DE 1000 for Turkish State Railways (TCDD) is a standard locomotive with AC/DC power transmission and a member of the modular range. Its mechanical section is largely identical with its “sister” model ME 07 with three-phase power transmission. TCDD ordered DC and three-phase versions for the purpose of comparison.

### Scope of application

As a multi-purpose locomotive, the DE 1000 is designed both for heavy switching duty and for light line service. With an axle load of 17 to 18 metric tons, it is also permitted to run on lines with light track superstructures.

### Technical features

The DE 1000 is a standard locomotive with a modular design and conventional AC/DC technology. It has a bogie construction with a light welded underframe. The modular construction also permits the implementation of three-phase power transmission version based on the same mechanical section, the ME 07.

### Benefits

Compact bogies with an open H-frame and long spring travel provide optimum running characteristics even on poorly maintained tracks. The modular design provides advantages for operation and maintenance. The modular design also proved to be an efficient way to enable a step-by-step technology transfer. Ten units were completely built in Germany. Five units were built as PKD locomotives with a partial local content and 30 units were built as CKD locomotives with a large local content by under license by Tülomsas in Turkey.

Type	DE 1000	
Year	1984–1985	
Wheel arrangement	Bo'Bo'	
Weight	[t]	68
Length over buffers	[mm]	13 250
Diesel engine rating	[kW]	745
Track gauge	[mm]	1 435
Starting tractive effort	[kN]	220
Maximum speed	[kph]	100
Numbers built	45	



# ME 10

## Diesel-Electric Locomotive ME 10 for MSC Iran

Over the period of 1990–1994, Siemens supplied a total of 15 class ME 10 locomotives from the modular range to the works railway of MSC in Iran. This locomotive class is a further development of the ME 07 with proven three-phase AC propulsion system and an increased power rating.

### Scope of application

The locomotives are used in works traffic at the Mobarakeh Steel Complex and in traffic with the state railway's transfer station.

### Technical features

The ME 10 is a standard locomotive with a modular design and three-phase power transmission. It has a bogie construction with a welded underframe. The modular construction also enables the unit to be adapted with minimum effort to the demanding climatic conditions with outside temperatures of 45 °C at 1,800 m above sea level. The locomotives were equipped with automatic UIC center couplers for heavy-duty ore transportation. Swiveling coupler heads with auxiliary coupling hook and fold-down side buffers also permit combined coupling operations with vehicles that are equipped with screw couplers and side buffers.

### Benefits

The commutatorless three-phase traction motors are characterized by a high degree of robustness and reliability for the operating conditions in steel works and ore loading stations where a high amount of electrically conducting dust is present. The mechanical and thermal stability of commutatorless three-phase motors is a significant advantage, especially in view of the high shock loads and heavy-duty switching runs with brakeless cars which are typical for ore loading stations. In addition to its known benefits, the modular design also permitted the successful production by WPCO in Iran.

Type	ME 10	
Year	1990–1994	
Wheel arrangement	Bo'Bo'	
Weight	[t]	76–88
Length over buffers	[mm]	14 450
Diesel engine rating	[kW]	1 120
Track gauge	[mm]	1 435
Starting tractive effort	[kN]	246/285
Maximum speed	[kph]	120
Numbers built	15	



# 311.1

## Diesel-Electric Locomotive 311.1 for Spanish National Railways (RENFE)

In 1986, the Spanish National Railways (RENFE) purchased its first locomotive with AC propulsion technology. This 311.0 prototype (MABI) was a multi-purpose diesel-electric locomotive. An extensive program of trials verified the performance of this locomotive and prompted RENFE to order 60 more locomotives with the class designation 311.1.

### Scope of application

As a multi-purpose locomotive, the 311.1 is designed both for heavy switching duty and for light line service.

### Technical features

Siemens provided substantial technical support for the development of the three-phase drive and also supplied the complete three-phase traction equipment and microprocessor control for the production locomotives.

### Benefits

The locomotives were the first Spanish diesel-electric locomotives in AC technology. Based on the positive experience with this drive system, the Spanish National Railways continued to rely on the three-phase technology during its further acquisition of high-performance electric locomotives.

Type		311.0	311.1
Year		1986	1989–1990
Wheel arrangement		Bo'Bo'	Bo'Bo'
Weight	[t]	80	80
Length	[mm]	14 200	14 200
Diesel engine rating	[kW]	785	785
Track gauge	[mm]	1 668	1 668
Starting tractive effort	[kN]	260	260
Maximum speed	[kph]	90	90
Numbers built		1	60





# Di 8

## Diesel-Electric Locomotive Di 8 for Norwegian State Railways (NSB)

The Di 8 is a further variant of the DE 1000 from the existing DE locomotive range.

### Scope of application

The locomotives are designed for heavy-duty switching and as a mainline locomotive for freight operations.

### Technical features

This locomotive is equipped with state-of-the-art AC traction technology. It incorporates water-cooled, GTO-based PWM inverters, AC traction motors with nose-suspended drive, and a SIBAS® 32 control system. All auxiliary devices are powered via IGBT-based auxiliary inverters. The locomotives are built to operate in the extreme climate of Norway.

### Benefits

The Di 8 has been specifically designed for the extreme climatic and geographic conditions encountered in Norway. Additional cost savings are achieved through the consistent modular design. The modern central cab provides a high degree of comfort for long service runs.

Typ	Di 8	
Year	1995–1996	
Wheel arrangement	Bo'Bo'	
Diesel engine rating	[kW]	1 570
Weight	[t]	82
Length	[mm]	17 380
Starting tractive effort	[kN]	270
Maximum speed	[kph]	120
Numbers built	20	



# Rh 2016

## Diesel-Electric Locomotive Rh 2016 for Austrian Federal Railways (ÖBB)

In 1998, ÖBB ordered 70 diesel-electric locomotives with a rating of 1600 kW at the wheel rim from Siemens AG Austria. There is an option for another 80 locomotives.

### Scope of application

The multi-purpose locomotives are designed for universal use in both freight and passenger services. The AC power transmission supplies the onboard power supply system with minimum extra effort and provides excellent efficiency over the entire range of speeds and tractive efforts; given the expected development of energy costs, this is a decisive factor in the selection of a power transmission technology.

### Technical features

As the launching customer, ÖBB planned the replacement of its existing diesel-electric mainline locomotives and presented a list of requirements that is representative for European diesel-electric mainline locomotives and exemplary in its environmental standards. For this reason, Siemens developed the Rh 2016 as the base vehicle for the versatile EuroRunner® product platform. It corresponds to the class ER 20. Fuel-saving, low-emission diesel engines offer customers a perfect alternative in view of the expected emission limits for rail-bound vehicles.

### Benefits

Ecofriendliness, high efficiency, low track wear, and a high degree of passive safety are significant advantages for the customers. Adhering to the strict Austrian legislation for noise emission, the Rh 2016 is the world's quietest diesel-electric locomotive in the 2 MW class.

Type		Rh 2016
Year		2000
Wheel arrangement		Bo'Bo'
Weight	[t]	80
Length over buffers	[mm]	19 275
Diesel engine rating	[kW]	2 000
Starting tractive effort	[kN]	235
Maximum speed	[kph]	140
Numbers built		70



# ME 26

## Diesel-Electric Locomotive Multi-Purpose Locomotive Class ME 26

Siemens Transportation Systems has built 12 class ME 26 locomotives since 1996.

### Scope of application

The ME 26 locomotive is designed both for fast passenger and heavy freight traffic. All locomotives are offered in the locomotive pool of Siemens Dispolok GmbH and are leased out to rail operators with a full service package.

### Technical features

The locomotives are equipped with a medium-speed diesel engine. The advanced three-phase power transmission system is implemented with GTO PWM inverters with evaporation bath cooling that power traction motors with resilient drive. The locomotives use SIBAS® 32 microcomputer traction control. The three-axle bogies have a two-stage suspension. Power is also provided to the electrical train systems.

### Benefits

This locomotive provides very high starting and continuous tractive efforts. The two-stage suspension and the very comfortable cabs provide optimum working conditions for the train personnel even on long runs. Equipped with WC and a galley, these locomotives are currently the most comfortable six-axle diesel-electric locomotives in the German market for leased locomotives. The train power supply also permits the traction of passenger trains, making this product a multi-purpose locomotive and an especially cost-effective solution.

Type		ME 26
Year		1996
Wheel arrangement		Co'Co'
Weight	[t]	122
Length over buffers	[mm]	20 960
Diesel engine rating	[kW]	2 650
Starting/continuous tractive effort	[kN]	400/283
Maximum speed	[kph]	140
Numbers built		12



# AC-DF 4

## Diesel-Electric Locomotive AC-DF 4 for Chinese Railways (CR)

The AC-DF 4 locomotive is based on the Chinese DF4 that is built in the locomotive works "Dalian Locomotive Rolling Works" in Dalian, China with DC traction technology. In April 1999, after many years of preparatory work, an agreement was signed to build two prototypes with the latest AC propulsion technology.

### Scope of application

The locomotive prototypes are used in the network of Chinese Railways and are universally suited for passenger and freight service.

### Technical features

The AC-DF 4 is equipped with state-of-the-art AC traction. The Siemens scope of supply includes an IGBT traction converter and the three-phase traction motors.

### Benefits

Successful trial operations of the two prototype locomotives will provide the basis for an expansion of the Siemens scope of supply as well as for the future use of advanced diesel-electric locomotives with AC traction technology in China.

Type	AC-DF 4	
Year	1999	
Wheel arrangement	Co'Co'	
Weight	[t]	138
Length over buffers	[mm]	21 100
Diesel engine rating	[kW]	2 940
Starting tractive effort	[kN]	555
Maximum speed	[kph]	145
Numbers built	2	



# SD 70 MAC

## Diesel-Electric Locomotive SD 70 MAC for freight traffic in North America

Together with its American partner EMD (Electro Motive Division of General Motors), Siemens supplied the first production diesel-electric freight locomotives with AC propulsion technology. The initial order for a total of 350 locomotives for the U.S. railroad company Burlington Northern (BN) was the largest single order in U.S. railroad history.

### Scope of application

The SD 70 MAC is a freight locomotive for heavy freight service.

### Technical features

The locomotives are equipped with state-of-the-art three-phase technology, PWM traction converters with evaporation bath cooling, and SIBAS 16 microprocessor control.

### Benefits

The customer benefits in particular from the comparatively high starting and continuous tractive efforts of these locomotives. As a result, it has been possible to replace five conventional DC locomotives with three SD 70 MAC locomotives.

The advent of this locomotive established AC traction technology for diesel-electric locomotives in the U.S. market.

Type	SD 70 MAC	
Year	1993–2000	
Wheel arrangement	Co'Co'	
Weight	[t]	188
Length over buffers	[mm]	22 555
Diesel engine rating	[kW]	2 835/4 000
Track gauge	[mm]	1 435
Starting/continuous tractive effort	[kN]	780/640
Maximum speed	[kph]	113
Numbers built	962	



# SD 80 MAC

## Diesel-Electric Locomotive SD 80 MAC for Conrail, USA

In May 1994, the American rail freight company Conrail ordered 28 class SD 80 MAC diesel-electric locomotives from EMD and Siemens. Although this order called for a completely new design, reliable elements of the SD 70 MAC were adopted and refined.

### Scope of application

The SD 80 MAC is used for heavy freight duty in the Northeastern United States.

### Technical features

The traction system can use 4,300, 5,000, and 6,000 metric HP diesel engines. The SD 80 MAC for Conrail is powered by a 20-cylinder, 5,000 metric HP diesel engine. The proven AC traction features two PWM inverters with evaporation bath cooling, three-phase traction motors, and SIBAS 16 traction control units.

### Benefits

At the time of their delivery, the SD 80 MAC locomotives were the most powerful single-engine diesel locomotives in the world. They provide high starting and continuous tractive efforts plus high speeds.

Type	SD 80 MAC	
Year	1996	
Wheel arrangement	Co'Co'	
Weight	[t]	190
Length	[mm]	24 400
Diesel engine rating	[kW/PS]	3 730/5 000
Track gauge	[mm]	1 435
Starting/continuous tractive effort	[kN]	820/654
Maximum speed	[kph]	128
Numbers built	30	



# SD 90 MAC

## Diesel-Electric Locomotive SD 90 MAC for freight traffic in North America

In early 1994, Union Pacific, the USA's largest railroad company, decided to buy diesel-electric locomotives from EMD and Siemens. The locomotives supplied to UP are similar to the design of the SD 80 MAC.

### Scope of application

The SD 90 MAC is a multi-purpose locomotive.

### Technical features

The SD 80 MAC supplied to UP was driven by a 4,300 metric HP, 16-cylinder diesel engine. It is possible to refit them with a 6,000 metric HP engine. The power electronics is already designed for the higher power. The proven AC propulsion technology consists of two GTO PWN converters with evaporation bath cooling, three-phase traction motors, and SIBAS 16 traction control units.

### Benefits

The SD 90 MAC provides high starting and continuous tractive efforts plus high speeds to cover all fields of application.

Type		4300 HP	6000 HP
Year		1996–2000	1997–1998
Wheel arrangement		Co'Co'	Co'Co'
Weight	[t]	190	190
Length	[mm]	24 400	24 400
Diesel engine rating	[kW/PS]	3 210/4 300	4 475/6 000
Track gauge	[mm]	1 435	1 435
Starting tractive effort	[kN]	820/654	890/734
Maximum speed	[kph]	128	128
Numbers built		410	21



# SD 90 MAC Phase 2

## Diesel-Electric Locomotive SD 90 MAC Phase 2 for freight traffic in North America

The SD 90 MAC Phase 2 was built by EMD and Siemens for the customers Canadian Pacific and Union Pacific. It is a further development of the 6,000 metric HP variant of the SD 90 MAC.

### Scope of application

This locomotive is used in heavy freight service in North America.

### Technical features

The SD 90 MAC Phase 2 locomotives are powered by a 20-cylinder, 6,000 metric HP diesel engine. They also feature the proven AC propulsion technology consisting of two GTO PWN converters with evaporation bath cooling, three-phase traction motors, and SIBAS 16 traction control units.

### Benefits

The SD 90 MAC Phase 2 provides high starting and continuous tractive efforts plus high speeds. One SD 90 MAC Phase 2 can replace two existing SD 40-2s. This provides substantial fuel savings in addition to reduced emissions.

Type	SD 90 MAC Phase 2	
Year	1993–2000	
Wheel arrangement	Co'Co'	
Weight	[t]	190
Length	[mm]	24 400
Diesel engine rating	[kW]	4 475/6 000
Track gauge	[mm]	1 435
Starting/continuous tractive effort	[kN]	890/734
Maximum speed	[kph]	128
Numbers built	46	





# DE 30 AC DM 30 AC

## Diesel-Electric Locomotive DE 30 AC and Dual-Mode Locomotive DM 30 AC for Long Island Rail Road (LIRR), New York, USA

Given the ever increasing energy costs and traffic problems, the North American commuter railways are gaining in importance. Rising passenger numbers call for attractive, high-performance traction solutions. In cooperation with its American partner EMD, Siemens is supplying the American market with the DE and hybrid (dual mode) variant of an advanced passenger rail locomotive. The customer is Long Island Rail Road (LIRR), the largest commuter rail company in the USA.

### Scope of application

The locomotives are used in commuter service in the New York metropolitan area.

### Technical features

The locomotives are equipped with PWM converters with proven evaporation bath technology and the SIBAS 32 microcomputer control system. The hybrid or dual mode locomotive DM 30 AC features additional equipment that allows it to operate as an electric locomotive on the third rail (650 V DC). Both locomotives feature a head-end power supply.

### Benefits

A marked decrease in noise and a substantial improvement in fuel economy compared to the previously used locomotives set standards for ecofriendliness. The dual-mode DM 30 AC is capable of operating alternatively on the third rail (650 V) as an electric locomotive. This operating mode allows the unit to operate in the tunnels leading into New York. Dual-mode locomotives from Siemens can therefore offer the passengers a "one-seat ride" – a direct connection into the heart of the city without the need to change trains – and provide the rail operators with a perfect solution for gradual electrification.

Type		DE 30 AC	DM 30 AC
Year		1997–1998	1997–1998
Wheel arrangement		Bo'Bo'	Bo'Bo'
Weight	[t]	128	128
Length	[mm]	22 900	22 900
Diesel engine rating	[kW/PS]	2 237/3 000	2 237/3 000
Continuous rating in 650 V DC operation	[kW]	–	2150
Track gauge	[mm]	1 435	1 435
Starting tractive effort	[kN]	360	360
Maximum speed	[kph]	161	161
Numbers built		23	23



# GT 46 MAC GT 46 PAC

## Diesel-Electric Locomotive GT 46 MAC and GT 46 PAC for Indian Railways (IR)

In cooperation with EMD, Siemens developed the six-axle GT 46 MAC and GT 46 PAC locomotives. With these modular locomotives, Indian Railways enters into a new dimension of power, cost-effectiveness, and reliability.

### Scope of application

The GT 46 MAC is used in freight traffic while the GT 46 PAC is designed for passenger service.

### Technical features

The locomotives are equipped with the GTO converter technology with evaporation bath cooling, SIBAS 16 traction control, and robust three-phase traction motors – a configuration that has proven its value a thousand times over in the USA.

### Benefits

As compared to the previous fleet, the GT 46 MA provides 45% higher starting and 33% higher continuous tractive effort, considerable fuel savings, and the extension of service intervals from 7 to 90 days.

The GT 46 PAC achieves a higher speed and is almost 7 metric tons lighter than the GT 46 MAC because it has two traction motors less. The lower tractive effort meets the requirements of passenger traffic. Using different bogie variants, this locomotive which is designed to be a standard platform covers the requirements of a large number of rail companies in the competitive export market.

Type		GT 46 MAC	GT 46 PAC
Year		1998	2000
Wheel arrangement		Co'Co'	(Bo1)(1Bo)
Diesel engine rating	[kW/PS]	3 000/4 000	3 000/4 000
Weight	[t]	126	119.4
Length	[mm]	21 300	21 300
Track gauge	[mm]	1 676	1 676
Starting/continuous tractive effort	[kN]	540/400	270/200
Maximum speed	[kph]	120	160
Numbers built		21	10



# GT 42 CUAC

## Diesel-Electric Locomotive GT 42 CUAC for Queensland Rail

The Australian rail company Queensland Rail (QR) ordered 38 diesel-electric locomotives with three-phase traction of type GT 42 CUAC in order to handle their transport tasks more economically.

### Scope of application

The locomotives are used to transport coal from the open-cast mining areas in the Northeast of the country through the coastal region to the Pacific seaports. The commonly used lines in narrow Cape gauge (1067 mm) place specific requirements on the design of high-performance freight locomotives.

### Technical features

The diesel engines supplied by EMD output 3,000 metric HP. The AC traction technology supplied by Siemens is largely the same as in the SD 70 MAC.

### Benefits

The GT 42 CUAC is one of the most powerful narrow-gauge locomotives in the world and the first with three-phase traction in Australia. Only the use of commutatorless three-phase motors enables these narrow-gauge locomotives to provide the necessary starting and continuous tractive efforts while ensuring maximum utilization of adhesion coefficients for advanced heavy-haul operations.

AC traction systems from Siemens enables competitive heavy-haul freight operations also on narrow-gauge tracks!

Type	GT 42 CUAC	
Year	1999–2001	
Wheel arrangement	Co'Co'	
Diesel engine rating	[kW/PS]	2 424/3 000
Weight	[t]	120
Length	[mm]	22 000
Track gauge	[mm]	1 067
Starting/continuous tractive effort	[kN]	600/460
Maximum speed	[kph]	100
Numbers built	38	



# TALGO BT

## High-Speed Diesel Power Car TALGO BT for TALGO

The cooperation in the field of traction for lightweight permanently coupled trains dates back several decades. After three generations of fast, high-performance diesel locomotives, an innovative diesel power car was developed as a technology platform and demonstration vehicle and two units were built.

### Scope of application

Traction of TALGO tilting trains with automatic gauge changing capability.

### Technical features

The diesel power car is a lightweight construction and is designed as an integral part of the train. Depending on requirements, fixed-gauge or variable-gauge bogies can be used. The vehicles have been designed for free lateral acceleration up to  $1.5 \text{ m/s}^2$  using the tilting system. An especially innovative feature is the brake control system that is integrated with the electronic train control system.

### Benefits

The integrated design allows the formation of very lightweight tilting trains for 300 to 400 passengers with a total train weight of only 230 to 290 metric tons.

The innovative variable-gauge bogie permits, for the first time, continuous operation between the standard gauge of 1435 mm and the broad gauge of 1668 mm without changing the power car.

The TALGO BT power car represents the world's first implementation of a high-performance power car with automatic gauge-changing capability. Following a successful test program, both power cars were sold to the Spanish infrastructure authority GIF for monitoring operations on standard and broad gauge tracks. With 254 kph, they hold the speed record for diesel locomotives.

Type	TALGO BT	
Year	1999	
Wheel arrangement	B'	
Diesel engine rating	[kW]	1500
Weight	[t]	44
Length	[mm]	15 000
Track gauge	[mm]	1 435/1 668
Starting tractive effort	[kN]	90
Maximum speed	[kph]	220
Numbers built	2	



## Class 38

### Dual-Mode Locomotive Class 38 for South African Railways Spoornet

In mid-1990, South African Railway (Spoornet) awarded a Siemens-led consortium the largest order ever placed by a railway company for dual-mode locomotives.

#### Scope of application

As dual-mode or hybrid locomotives, the class 38 units are especially suited for combined yard and freight service within the same roundtrip.

#### Technical features

The locomotives are designed to operate on 3 kV DC systems as well as in diesel mode. The three-phase power transmission using commutatorless traction motors permits the generation of high continuous tractive efforts while keeping the motor weight low on the very narrow gauge of only 1067 mm, the so-called Cape gauge, that is common in South Africa.

#### Benefits

The design as dual-mode locomotive eliminates the otherwise necessary switching of locomotives when changing from electrified to non-electrified line sections. This makes railway operations faster, more economical, and more efficient. The combination of electrified line sections and service on mostly non-electrified connecting sections can eliminate the need for extra switching locomotives and saves investment and operating costs, as well as personnel. The capability as a fall-back level in case of damaged catenary systems has proved to be an especially advantageous feature of the dual-mode traction.

Hybrid locomotives with Siemens three-phase technology – cost-effective freight traffic on the rail!

Type	Class 38	
Year	1992–1994	
Wheel arrangement	Bo'Bo'	
Weight	[t]	74
Length	[mm]	16 314
Diesel engine rating	[kW]	780
Continuous rating in 3 kV V DC mode	[kW]	1 500
Track gauge	[mm]	1 067
Starting tractive effort	[kN]	260/181
Maximum speed	[kph]	100
Numbers built	50	



# ED 1600

## Dual-Mode Locomotive ED 1600 for RAG Bahn- und Hafenbetriebe, Germany

In cooperation with the Bahn- und Hafenbetriebe of Ruhrkohle AG (RAG) two older dual system locomotives built to operate on line voltage and battery voltage were converted into dual-mode locomotives (overhead line/diesel engine).

### Scope of application

The locomotives are assigned to heavy-duty line and transfer operations.

### Technical features

The purpose of this conversion was to increase the tractive power in electric mode from 720 kW to 1600 kW within the same weight and volume restrictions, as well as to install an additional, powerful diesel-alternator set.

The locomotives are worked primarily in two and even three shifts, hauling loads that weigh as much as 2900 metric tons. In addition, performance studies have shown that these units are capable of traveling at a speed of 60 kph with a trailing load of 2,000 metric tons, as well as at 80 kph with a trailing load of 1,000 metric tons.

### Benefits

As with the class 38, this locomotive demonstrates the advantages of hybrid traction which can only be implemented in three-phase technology in a cost-effective manner. Continuous operation without the need to switch locomotives in line and switching service provides economy in terms of locomotives and personnel, accelerates operations, and improves the utilization of the traction unit.

Type	ED 1600	
Year	1992	
Wheel arrangement	Bo'Bo'	
Weight	[t]	88
Length	[mm]	15 000
Diesel engine rating	[kW]	560
Continuous rating in 15 kV, 16.7 Hz mode	[kW]	1 600
Continuous rating in diesel mode	[kW]	425
Starting tractive effort	[kN]	360
Maximum speed	[kph]	50
Numbers built	2	

# Literature

If you would like to know more about our diesel-electric locomotives, please write to the following address and request the corresponding order number:

Siemens AG  
Transportation Systems  
Infoservice VT 6/Z 042  
P.O. Box 2348  
90713 Fürth  
Germany

## **Product brochures**

Wildenrath Test Center – for Comprehensive Testing of Rail-based Transportation Systems  
Order No.: A19100-V900-B532-V4-7600

## **Offprints**

“Three-Phase AC Drives for Diesel Locomotives in North America”, reprint from “ZEV + DET Glasers Annalen”  
Vol. 118 (1994) No. 2/3  
Order No.: A19100-V500-B483-X-7600

## **Technical information**

Diesel-Electric Locomotive  
Rh 2016 for Austrian Federal Railways (ÖBB)  
Order No.: A19100-V600-B421-X-7600

Diesel-Electric Locomotive  
GT 42 CUAC with Three-Phase Drive  
Order No.: A19100-V600-B433-X-7600

Three-Phase AC Traction Technology for Diesel-Electric Locomotive WDG4 of Indian Railways  
Order No.: A19100-V600-B434-X-7600

Diesel-Electric Locomotive  
SD 90 MAC with Three-Phase Drive  
Order No.: A19100-V600-B632-X-7600

Diesel-Electric Locomotive  
SD 80 MAC with Three-Phase Drive  
Order No.: A19100-V600-B629-X-7600

Diesel-Electric Locomotive  
SD 70 MAC with Three-Phase Drive  
Order No.: A19100-V600-B152-X-7600

Diesel-Electric Di 8 Locomotive for the Norwegian State Railways  
Order No.: A19100-V600-B180-X-7600



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The information in this document contains general descriptions of the technical options available, which do not always have to be present in individual cases. The required features should therefore be specified in each individual case at the time of closing the contract.