



Diesel-Electric Locomotives

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efficient rail solutions

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Introduction

Global player on every track – Diesel-electric locomotives from Siemens

Operating all over the world, locomotives from Siemens Transportation Systems underscore their quality and reliability every day. This is made possible by our experience that comes from a long tradition in railroading, assuring the customer of maximum profitability through optimum and sustained availability from the very beginning.

Our expertise in diesel-electric locomotives is evidenced by an extensive product portfolio for all track gauges. From small switchers to high-performance universal locomotives to efficient three-phase AC traction, we offer units for high-speed passenger service and heavy-haul freight traffic.

That our products are convincing across national borders is demonstrated by the retrofit of 1,900 American locomotives with our three-phase AC propulsion technology.

To ensure flexibility for our customers, Siemens Dispolok GmbH offers attractive solutions for purchase or rent.

We develop future-oriented products such as the Eurorunner® for the railway applications of tomorrow. It is the most ecologically friendly diesel locomotive to date and testifies to our commitment and the continuity of our innovative technology.

The name Siemens guarantees the sustained optimization of this quality standard, which is the safeguard for our customers' success.

Diesel-Electric Locomotives





ER20

Universal Locomotive ER20

for Eisenbahn- Bau- und Betriebsgesellschaft Pressnitztalbahn mbH PRESS

Local German operator Pressnitztalbahn ordered a Eurorunner type ER20 locomotive from Siemens Transportation Systems in January 2004. Owing to the successful operation of that vehicle, PRESS promptly ordered a second in December 2004.

Scope of application

Both of these units are now being used in heavy-haul freight traffic all over Germany.

Technical features

Like all vehicles of the Eurorunner family, the ER20 is especially quiet and low on exhaust emissions. The transmission of three-phase AC power gives the locomotive a high degree of efficiency over the entire speed and tractive effort range.

Benefits

Instrumental for the award of this order were reliability, environmental friendliness and quick delivery but, above all, the axle load of 20 metric tons that enables these vehicles also to be used on secondary lines.

Type	ER20	
Year	2004	
Wheel arrangement	Bo'Bo'	
Diesel engine rating	[kW]	2000
Starting tractive effort	[kN]	235
Maximum speed	[kph]	90
Weight	[t]	80.5
Track gauge	[mm]	1435
Numbers built	2	



ER20

Universal Locomotive ER20

for Eisenbahnen und Verkehrsbetriebe Elbe-Weser GmbH EVB

The private rail operator EVB ordered a Eurorunner type ER20 universal locomotive from Siemens in November 2004 and again in August 2005.

Scope of application

Both ER20s are to haul container trains on the Hamburg – Bremen – Bremerhaven route.

Technical features

Ultramodern diesel engine technology ensures high performance and low noise and exhaust emissions. The modular design of the Eurorunner platform enables the vehicle to be readily adapted to meet individual customer demands.

Benefits

All members of the Eurorunner family – and that includes the ER20 – are noted for their a high degree of availability and environmental friendliness. With an axle load of 20 metric tons, it is suitable for service on secondary lines and on EVB's own rail infrastructure.

Type	ER20	
Year	2004/2006	
Wheel arrangement	Bo'Bo'	
Diesel engine rating	[kW]	2000
Starting tractive effort	[kN]	235
Maximum speed	[kph]	90
Weight	[t]	80.5
Track gauge	[mm]	1435
Numbers built	2	



ER20

Universal-Lokomotive ER20 for Connex Verkehr GmbH

In July 2005, Connex Verkehr placed an order with Siemens for two Class ER20 locomotives. The first unit will be delivered in December 2005, with the second following in January 2006.

Scope of application

Both ER20s are intended for Connex's own pool of vehicles and will probably be used in passenger service on the Hamburg – Sylt line.

Technical features

The ER20 is based on the platform of modular Eurorunner locomotives and therefore built to enable easy adaptation to customers' specific operating requirements.

Benefits

The short delivery time was a major reason behind the order award.

Like all Eurorunner models, the two units for Connex Verkehr offer good fuel economy and low noise and emission values, making it an especially environment-friendly locomotive.

Type	ER20	
Year	2005	
Wheel arrangement	Bo'Bo'	
Diesel engine rating	[kW]	2000
Starting tractive effort	[kN]	235
Maximum speed	[kph]	90
Weight	[t]	80.5
Track gauge	[mm]	1435
Numbers built	2	



ER20

Universal Locomotive ER20 for Siemens Dispolok GmbH

This vehicle type represents the latest generation of diesel-electric locomotives. It is available for rent in the vehicle pool of Siemens Dispolok GmbH.

Scope of application

Designed as a universal locomotive, the ER20 can be used in passenger service as well as in freight traffic. Siemens developed the Eurorunner as a modular vehicle platform especially for the medium performance range up to 3000 kW, for axle loads of about 20 metric tons and for speeds up to 160 kph.

Technical features

The vehicle is a member of the Eurorunner family and is currently certified for Germany, Austria and Hong Kong. The three-phase power transmission enables the train power supply to be implemented with minimum extra effort and excellent efficiency to be achieved over the entire range of speeds and tractive efforts.

Benefits

State-of-the-art diesel engine technology and innovative soundproofing make the ER20 one of the quietest and lowest-emission diesel locomotives in Europe.

Type	ER20	
Year	2003 – 2004	
Wheel arrangement	Bo'Bo'	
Diesel engine rating	[kW]	2000
Starting tractive effort	[kN]	235
Maximum speed	[kph]	140
Weight	[t]	80
Track gauge	[mm]	1435
Numbers built	10	



ME 26

Multi-Purpose Locomotive ME 26 for Siemens Dispolok GmbH

Siemens Transportation Systems has built 12 Class ME 26 locomotives since 1996. Having made successful use of the pool of vehicles offered by Siemens Dispolok, Vossloh AG signed a purchase contract in 2004 for a total of 12 of these locomotives.

Scope of application

The ME 26 locomotive is designed both for fast passenger and heavy freight traffic. All locomotives have been offered in the locomotive pool of Siemens Dispolok GmbH and have been 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. 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'	
Diesel engine rating	[kW]	2650
Starting tractive effort	[kN]	400
Maximum speed	[kph]	140
Weight	[t]	122
Track gauge	[mm]	1435
Numbers built	12	



BB 475000

Freight Locomotive BB 475000 for French National Railways SNCF

In February 2004, state-owned French National Railways SNCF placed an order for the supply of 400 diesel locomotives of the type BB 475000 with a consortium consisting of Alstom Transport SA (consortium leader) and Siemens Transportation System. The order includes an option for an additional 100 locomotives.

Siemens TS is supplying the traction equipment and control systems and building 130 bodies of the fixed batch in its Munich plant. Alstom is responsible for the mechanical equipment and final assembly in its plant in Belfort, France.

This project is the largest single order placed by a European railway company in 30 years for the procurement of diesel locomotives.

Scope of application

The locomotives will primarily be used as freight locomotives in France.

150 of these locomotives will be equipped for cross-border traffic in the French and German railway networks.

Technical characteristics

The design of the new BB 475000 diesel locomotive for SNCF reflects especially the expertise of the two consortium partners that has been demonstrated with the following locomotives:

- the Rh 2016 diesel-electric locomotive built by Siemens AG for Austrian Federal Railways (ÖBB)
- the BB 427000 electric locomotive built by Alstom Transport SA for SNCF

Mechanical parts and bogies are taken from the electric locomotive of the type BB 427000 and combined with components of the Rh 2016 diesel locomotive, including the electrical block, the diesel engine (MTU 16V 4000 R41), the cooling system, the braking resistor, the control system and the cab displays from Siemens.

Benefits

The use of advanced and proven traction components based on the Rh 2016 for ÖBB, combined with the structural part of the BB 427000 from Alstom, was instrumental in SNCF's purchasing decision.

This combination is a perfect match for the specific requirements of the customer SNCF (optimized maintenance and spare part management, ease of operation for the driver, etc.).

The BB 475000 will replace diesel locomotive series from the years 1960 to 1970 of SNCF and ensure freight traffic within the regional zones.

Type		BB 475000
Year		2005 – 2015
Wheel arrangement		Bo'Bo'
Weight	[t]	84
Length over buffers	[mm]	20280
Diesel engine rating	[kW]	2000
Track gauge	[mm]	1435
Starting tractive effort	[kN]	250
Maximum speed	[kph]	120
Numbers built		400



Rh 2016

Universal Locomotive Rh 2016 for Austrian Federal Railways ÖBB

Since 1998, ÖBB ordered a total of 100 diesel-electric locomotives in several batches with a rating of 1600 kW at the wheel rim from Siemens AG Austria. There is an option for another 50 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 ER20. 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		2004
Wheel arrangement		Bo'Bo'
Diesel engine rating	[kW]	2000
Starting tractive effort	[kN]	235
Maximum speed	[kph]	140
Weight	[t]	80
Track gauge	[mm]	1435
Numbers built		100



ER20

Universal Locomotive ER20 for Logistik und Transport GmbH LTE

In December 2003, Graz-based Logistik und Transport GmbH LTE placed an order with Siemens Transportation Systems for a type Rh 2016 locomotive for its cross-border freight service.

Scope of application

The Eurorunner model operates on lines that run from the OMV refinery in Burghausen (Germany) via Braunau, Linz and Vienna (Austria) to the aluminum plant in Ziar nad Hronom (Slovakia).

Technical features

The ER20 is based on the platform of modular Eurorunner locomotives and therefore built to enable easy adaptation to customers' specific operating requirements.

Benefits

Decisive for placement of this order were the short delivery period of 4 months, quick adaptation to the customer's operating requirements and good maintenance possibilities in Austria. This locomotive type – as do all units in the Eurorunner family – is characterized by its low noise and exhaust emissions.

Type	ER20	
Year	2004	
Wheel arrangement	Bo'Bo'	
Diesel engine rating	[kW]	2000
Starting tractive effort	[kN]	235
Maximum speed	[kph]	90
Weight	[t]	80.5
Track gauge	[mm]	1435
Numbers built	1	



ER20

Universal Locomotive ER20 for Steiermärkische Landesbahn STLB

In 2004, local Austrian operator Steiermärkische Landesbahn STLB, based in Graz, ordered two Class ER20 locomotives to work new routes.

Scope of application

The Eurorunner type ER20 is being used in long-distance freight traffic.

Technical features

The ER20 is based on the platform of modular Eurorunner locomotives and therefore built to enable easy adaptation to customers' specific operating requirements.

Benefits

The deciding factors for placement of this order were the short delivery time, the ease of maintenance due to the same design as the Rh 2016 locomotives operated by ÖBB, and the existing certification in Austria. Like all Eurorunner vehicles, the ER20 combines high economic efficiency and reliability with low noise and exhaust emission levels.

Type		ER20
Year		2004/2005
Wheel arrangement		Bo'Bo'
Diesel engine rating	[kW]	2000
Starting tractive effort	[kN]	235
Maximum speed	[kph]	90
Weight	[t]	80.5
Track gauge	[mm]	1435
Numbers built		2



AC-DF 4

Universal 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

These two prototype locomotives have demonstrated the performance capability and reliability of modern Siemens IGBT technology under Chinese operating conditions.

Type	AC-DF 4	
Year	1999	
Wheel arrangement	Co'Co'	
Diesel engine rating	[kW]	2940
Starting tractive effort	[kN]	555
Maximum speed	[kph]	145
Weight	[t]	138
Track gauge	[mm]	1435
Numbers built	2	



Series 8000

Universal Locomotive Series 8000 for Kowloon-Canton Railway Corporation KCRC

In 2001, Kowloon-Canton Railway Corporation KCRC ordered 5 diesel-electric locomotives of the Eurorunner family, which are based on the Rh 2016 locomotives of Austrian Federal Railways.

Scope of application

As multi-purpose locomotives, the Eurorunners are used in freight traffic in Hong Kong and on the mainland as well as for maintenance and recovery operations in the rail transit network.

Technical characteristics

The modular design of the Eurorunner made customization easy: The locomotive features an AAR center coupler with crash element and coupler status sensors, three independent train protection systems, a customer-specific train radio system, a customized brake system as well as work and warning lights.

Benefits

As all members of the Eurorunner family, the Hong Kong variant is also particularly environment-friendly – with low noise and low emissions.

Type		Series 8000
Year		2001 – 2003
Wheel arrangement		Bo'Bo'
Diesel engine rating	[kW]	2000
Starting tractive effort	[kN]	235
Maximum speed	[kph]	140*
Weight	[t]	80
Track gauge	[mm]	1435
Numbers built		5

*throttled to KCRC's max. operation speed



ER20

Freight Locomotive ER20 for Lithuanian Railways LG

In July 2005, Siemens received an order from Lithuanian Railways LG for the supply of 34 diesel-electric locomotives. It also contained an option for 10 more vehicles. Delivery is to take place between summer 2007 and spring 2009.

Scope of supply

These six-axle Class ER20 units are built to haul trains weighing up to 6,000 metric tons in multiple running on the main lines of Lithuanian Railways. As many as 3 locomotives can run in multiple.

Technical features

The ER20s are based on the Eurorunner platform for diesel locomotives. The diesel engines develop a rating of up to 2000 kW and a maximum speed of 120 kph.

Benefits

The high starting tractive effort and passive safety of this locomotive are outstanding. Other important criteria for the operator were the vehicle's low fuel consumption, low emissions and reduced life cycle costs.

Type	ER20	
Year	2007 – 2009	
Wheel arrangement	Co'Co'	
Diesel engine rating	[kW]	2000
Starting tractive effort	[kN]	450
Maximum speed	[kph]	120
Weight	[t]	135.7
Track gauge	[mm]	1520
Numbers built	34	



AR 15

Universal Locomotive AR 15 for Vietnam Railway VNR

Vietnam Railways VNR ordered 16 diesel-electric locomotives from Siemens and Vossloh in October 2004.

Scope of application

Vietnam Railways wants to deploy these units in freight and passenger service on the more than 17,000 kilometers of meter-gauge track of the north-south trunk line that runs between Hanoi and Ho Chi Minh City.

Technical features

With the wheels arranged Co'Co' and weighing 81 metric tons, this three-phase AC locomotive is capable of running at a top speed of 120 kph. The motor of the AR 15 has a rating of 1500 kW and develops approx. 1220 kW at the wheel rim. Up to three locomotives can run in multiple.

Benefits

Called Asiarunner, the AR 15 is based on a modular design that makes use of service-proven systems and components. It can be adapted flexibly to the customer's specific requirements in terms of power, capacity and intended purpose. In order to meet the weight limitation to a maximum axle load of 13.5 metric tons, the locomotive was equipped with a 12-cylinder diesel engine motor instead of the usual 16-cylinder model.

Type	AR 15	
Year	2006	
Wheel arrangement	Co'Co'	
Diesel engine rating	[kW]	1500
Starting tractive effort	[kN]	260
Maximum speed	[kph]	120
Weight	[t]	81
Track gauge	[mm]	1000
Numbers built	16	

Cooperations with Electro Motive Division (EMD)





SD 70 MAC

Freight Locomotive SD 70 MAC for Burlington Northern Santa Fé (BNS)

Together with its American partner EMD (Electro Motive Division), Siemens supplied the first production diesel-electric freight locomotives with AC propulsion technology. The initial order placed by the U.S. railroad company Burlington Northern (BN) in 1993 for a total of 350 locomotives marked the largest single order in U.S. railroad history. Successful operation has since led to followup orders, bringing today's total number of locomotives equipped with Siemens three-phase technology to 786.

Scope of application

The SD 70 MAC is a freight locomotive for heavy-duty 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 designed for heavy-duty freight service in the U.S. market.

Type	SD 70 MAC	
Year	1993 – 2000	
Wheel arrangement	Co'Co'	
Diesel engine rating	[kW]	2835
Starting tractive effort	[kN]	780
Maximum speed	[kph]	113
Weight	[t]	188
Track gauge	[mm]	1435
Numbers built	786	



SD 80 MAC

Freight Locomotive SD 80 MAC for Conrail (now CSXT and NS)

In May 1994, the American rail freight company Conrail ordered 30 diesel-electric locomotives of the type SD 80 MAC with 5,000 metric HP 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 two-stroke 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'
Diesel engine rating	[kW]	3750
Starting tractive effort	[kN]	820
Maximum speed	[kph]	128
Weight	[t]	190
Track gauge	[mm]	1435
Numbers built		30



SD 90 MAC

Freight Locomotive SD 90 MAC for Union Pacific UP

In the spring of 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. The design of this locomotive already allows the use of several diesel engine variants. Union Pacific chose the variants with 4,300 PS and 6,000 PS. Several follow-up orders increased the customer's fleet of the SD 90 MAC with 4,300 metric HP to a total of 309 vehicles. UP also has 22 locomotives of the type SD 90 MAC Phase 1 with 6,000 metric HP.

Scope of application

The SD 90 MAC is a multi-purpose locomotive that is primarily used in freight service.

Technical characteristics

The SD 90 MAC locomotives supplied to UP are driven either by 4,300 metric HP, 16-cylinder two-stroke diesel engines or by 6,000 metric HP, 16-cylinder four-stroke power plants. The three-phase traction system is already designed for this higher rating. The proven AC propulsion technology consists of two GTO PWM inverters 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		SD 90 MAC 4300 HP	SD 90 MAC 6000 HP
Year		1996 – 1999	1998 – 1999
Wheel arrangement		Co'Co'	Co'Co'
Diesel engine rating	[kW]	3210/4300	4475/6000
Starting tractive effort	[kN]	820	890
Maximum speed	[kph]	128	128
Weight	[t]	190	190
Track gauge	[mm]	1435	1435
Numbers built		309	22



SD 70 MAC

Freight Locomotive SD 70 MAC for CSX Transportation CSXT

Since 1997, Siemens and its partner EMD have been supplying SD 70 MAC freight locomotives to the U.S. railroad company CSX Transportation, which operates the largest rail network in the eastern United States with more than 23,000 miles of track. A total of 220 locomotives were built for this customer.

Scope of application

The rail network of CSXT spans 23 U.S. states and two neighboring Canadian provinces, where the SD 70 MAC locomotives are used for freight traffic.

Technical characteristics

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

Benefits

The benefits of the three-phase technology include low maintenance and a compact design of the three-phase traction motors as well as high starting and continuous tractive efforts. This enables CSXT to run trains with two SD 70 MAC locomotives instead of three conventional DC locomotives.

Type	SD 70 MAC	
Year	1997 – 2000/2004	
Wheel arrangement	Co'Co'	
Diesel engine rating	[kW]	3150
Starting tractive effort	[kN]	780
Maximum speed	[kph]	113
Weight	[t]	188/210
Track gauge	[mm]	1435
Numbers built	90 + 130	



SD 70 MAC

Freight Locomotive SD 70 MAC for Transportación Ferroviaria Mexicana TFM

In 1999, TFM ordered a total of 75 locomotives of the proven SD 70 MAC family from Siemens and EMD.

Scope of application

TFM also uses the SD 70 MAC in heavy freight service, partly for cross-border traffic in the network of Kansas City Southern.

Technical characteristics

The locomotives are equipped with state-of-the-art three-phase technology, PWM converters with evaporation bath cooling and Sibas 16 microprocessor control. The SD 70 MACs for TFM provide the same technical equipment as the vehicles that are operated by other customers in the United States (e. g. Burlington Northern Santa Fé).

Benefits

Other reasons prompting the customer to purchase this locomotive type were the impressive starting and continuous tractive efforts of the three-phase AC propulsion system.

Type		SD 70 MAC
Year		1999 – 2000
Wheel arrangement		Co'Co'
Diesel engine rating	[kW]	3150
Starting tractive effort	[kN]	780
Maximum speed	[kph]	113
Weight	[t]	188
Track gauge	[mm]	1435
Numbers built		75



SD 70 MAC

Freight Locomotive SD 70 MAC and Freight and Passenger Locomotive SD 70 MAC HEP for Alaska Railroad ARR

Together with its North American partner Electro Motive Division (EMD), Siemens supplied 16 freight locomotives of the type SD 70 MAC to Alaska Railroad. Since Alaska Railroad is the only railroad company in the United States that offers freight as well as passenger service, the customer ordered an additional 8 locomotives of this type in 2004. This time, however, with the requirement that these vehicles should be suitable for passenger service.

Scope of application

The SD 70 MAC locomotive is used for heavy freight duty. Alaska Railroad will use the SD 70 MAC HEP locomotive, however, to haul the prestigious passenger trains taking passengers from cruise ships on day trips, such as to Mount McKinley.

Technical characteristics

The SD 70 MAC locomotives operated by ARR provide the same technical equipment as the vehicles that are operated by other customers in the United States. Several minor adjustments were made to enable operations at ambient temperatures up to 50 °C. The SD 70 MAC HEP is also able to provide power for the on-board power supply of passenger trains. This is achieved by using a converter either for traction or the on-board power supply. Other required electrical components are identical with those that have been used for years on the locomotives DE/DE30 for Long Island Rail Road (LIRR), eliminating the need to develop new components and minimizing the risks.

Benefits

In addition to providing the performance range of the SD 70 MAC, the variant SD 70 MAC HEP also provides the on-board power supply for passenger trains without the need for a separate diesel-generator set.

Type		SD 70 MAC	SD 70 MAC HEP
Year		1999 – 2000	2004
Wheel arrangement		Co'Co'	Co'Co'
Diesel engine rating	[kW]	2835	3150
Starting tractive effort	[kN]	780	780
Maximum speed	[kph]	113	113
Weight	[t]	188	188
Track gauge	[mm]	1435	1435
Numbers built		16	8



SD 90 MAC

Freight Locomotive SD 90 MAC for Commercial Investment Trust CIT

In 1999, the leasing company CIT ordered 40 locomotives of the type SD 90 MAC with a 4,300 metric HP rating. These units have been leased to Union Pacific and Canadian Pacific to cover peak demands.

Scope of application

The SD 90 MAC is a multi-purpose locomotive that is primarily used for freight traffic.

Technical characteristics

The locomotives are equipped with state-of-the-art three-phase AC technology, PWM converters with evaporation bath cooling and Sibas 16 microprocessor control. They provide the same technical equipment as the vehicles that are operated by other customers in the United States, such as Union Pacific.

Benefits

Here again, low maintenance requirements, the compact design of the three-phase traction motors and the high starting and continuous tractive efforts were the key criteria.

Type	SD 90 MAC	
Year	1999 – 2000	
Wheel arrangement	Co'Co'	
Diesel engine rating	[kW]	3210/4300
Starting tractive effort	[kN]	820
Maximum speed	[kph]	128
Weight	[t]	190
Track gauge	[mm]	1435
Numbers built	40	



SD 90 MAC

Freight Locomotive SD 90 MAC for Canadian Pacific CP

In 1998, Canadian Pacific ordered a total of 61 vehicles with 4,300 metric HP from Siemens and EMD.

Scope of application

As a multi-purpose locomotive, the SD 90 NAC is operated by Canadian Pacific for freight duty in the entire network from Vancouver to Montreal.

Technical characteristics

The locomotives are equipped with state-of-the-art three-phase technology, PWM converters with evaporation bath cooling and Sibas 16 microprocessor control. They provide the same technical equipment as the vehicles that are operated by other customers in the United States (e. g. Union Pacific).

Benefits

High starting and continuous tractive efforts permit operation for all applications.

Type	SD 90 MAC	
Year	1998 – 1999	
Wheel arrangement	Co'Co'	
Diesel engine rating	[kW/HP]	3210/4300
Starting tractive effort	[kN]	820
Maximum speed	[kph]	128
Weight	[t]	190
Track gauge	[mm]	1435
Numbers built	61	



SD 90 MAC

Freight Locomotive SD 90 MAC Phase 2 for Canadian Pacific and Union Pacific

The SD 90 MAC Phase 2 is a further development of the 6,000 metric HP variant of the SD 90 MAC and aims at cutting cost at the vehicle level. After building two prototypes for EMD, EMD and Siemens produced 4 locomotives for Canadian Pacific and 40 units for Union Pacific.

Scope of application

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

Technical characteristics

The SD 90 MAC Phase 2 locomotives are powered by a 16-cylinder, 6,000 metric HP four-stroke diesel engine. Like the other series, they also feature the proven AC propulsion technology consisting of two GTO PWM converters with evaporation bath cooling, three-phase traction motors, and Sibus 16 traction control units.

Benefits

This further development also 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		2000
Wheel arrangement		Co'Co'
Diesel engine rating	[kW/HP]	4475/6000
Starting tractive effort	[kN]	890
Maximum speed	[kph]	128
Weight	[t]	190
Track gauge	[mm]	1435
Numbers built		44



GT 46 MAC GT 46 PAC

Freight Locomotive GT 46 MAC and Passenger Locomotive 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 locomotives are used on the main lines in Central India as well as in the southern and southwestern parts of the country.

Technical characteristics

The electrical equipment of the vehicles is essentially based on the technology used on the SD 70 MAC. The diesel engines supplied by EMD have a rating of 4,000 metric HP. The three-phase traction system supplied by Siemens is largely identical to that of the SD 70 MAC.

Benefits

The use of technology from the SD 70 MAC allows to leverage the totality of operating experience from the large locomotive fleets in the USA.

Type		GT 46 MAC	GT 46 PAC
Year		1998 – 2000	2000 – 2001
Wheel arrangement		Co'Co'	(Bo1) (1Bo)
Diesel engine rating	[kW]	2985	2985
Starting tractive effort	[kN]	540	270
Maximum speed	[kph]	120	160
Weight	[t]	126	119.4
Track gauge	[mm]	1676	1676
Numbers built		21	10



WDG4
WDP4

Freight Locomotive WDG4 and Passenger Locomotive WDP4

for Indian Railways IR

In 1999, the Indian railway operator presented its diesel-electric freight locomotive WDG4 with three-phase traction. This locomotive type is the variant GT 64 that was built locally under license.

Scope of applications

The locomotives are used on the main lines in Central India as well as in the southern and southwestern parts of the country.

Technical characteristics

The electrical equipment of the vehicles is essentially based on the technology used on the SD 70 MAC. The diesel engines supplied by EMD have a rating of 4,000 metric HP. Except for a few mechanical details, Siemens supplied three-phase AC propulsion technology that is largely identical to the equipment used in the SD 70 MAC. The three-phase traction motors were also supplied by Siemens.

Benefits

The use of proven technology from the SD 70 MAC makes it possible to leverage the totality of operating experience from the large locomotive fleets in the USA also for operation in India.

Type		WDG4	WDP4
Year		2000 – 2008	2004 – 2008
Wheel arrangement		Co'Co'	B1'1B
Diesel engine rating	[kW]	2985	2985
Starting tractive effort	[kN]	540	270
Maximum speed	[kph]	120	160
Weight	[t]	126	119
Track gauge	[mm]	1676	1676
Numbers built		81	47



GT 42 CUAC

Freight Locomotive GT 42 CUAC for Queensland Rail QR

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. 11 more locomotives were ordered in 2003.

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 3000 metric HP. The three-phase traction technology supplied by Siemens is largely the same as in the SD 70 MAC, except for minor mechanical differences. Siemens also supplied the three-phase traction motors.

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 heavyhaul operations. For these vehicles, too, it was possible to leverage the operating experience gained with the large SD 70 MAC fleets in the USA.

Type		GT 42 CUAC
Year		1999 – 2001/2004
Wheel arrangement		Co'Co'
Diesel engine rating	[kW]	2424
Starting tractive effort	[kN]	600
Maximum speed	[kph]	100
Weight	[t]	120
Track gauge	[mm]	1067
Numbers built		38/11



GT 42 CUAC

Freight Locomotive GT 42 CUAC for Pacific National PN

The broad application of this proven locomotive type at Queensland Rail convinced the private operator Pacific National also to purchase 13 locomotives of this type in 2004.

Scope of application

Pacific National plans to haul unit trains in the network of Queensland Rail.

Technical characteristics

The diesel engines supplied by EMD output 3,000 metric HP. Siemens supplied the three-phase traction motors as well as the three-phase traction equipment that is largely identical with the equipment used on the SD 70 MAC except for minor mechanical differences.

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.

Type		GT 42 CUAC
Year		2004
Wheel arrangement		Co'Co'
Diesel engine rating	[kW]	2424
Starting tractive effort	[kN]	600
Maximum speed	[kph]	100
Weight	[t]	120
Track gauge	[mm]	1067
Numbers built		13

Power Cars for High Speed Trains





TALGO BT

High Speed Diesel Power Car Talgo BT for Patentes Talgo SA

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 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]	1435/1668
Starting tractive effort	[kN]	90
Maximum speed	[kph]	220
Numbers built		2

Dual-Mode Locomotives





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]	1600
Continuous rating in diesel mode [kW]	425
Starting tractive effort [kN]	360
Maximum speed [kph]	80
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 nonelectrified 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-DC mode [kW]	1500
Track gauge [mm]	1067
Starting/continuous tractive effort [kN]	260/ 181
Maximum speed [kph]	100
Numbers built	50



DE 30 AC/ DM 30 AC

Dual Mode Locomotive DE 30 AC/DM 30 AC for Long Island Rail Road LIRR

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]	2237/3000	2237/3000
Continuous rating in 650-V-DC-Betrieb	[kW]	–	2150
Track gauge	[mm]	1435	1435
Starting tractive effort	[kN]	360	360
Maximum speed	[kph]	161	161
Numbers built		23	23

Switching Locomotives





ME 05

Standard 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	
Diesel engine rating	[kW]	560
Starting tractive effort	[kN]	194/218
Maximum speed	[kph]	65
Weight	[t]	60/67.5
Track gauge	[mm]	1435
Numbers built	23	



DE500

Switching Locomotive Class DE500

In the early 1990s, Siemens developed a three-axle diesel-electric switching locomotive with three-phase traction together with Kaelble-Gmeinder GmbH, Mosbach. The remote control system enables the locomotive to be operated in a very flexible manner and with minimum personnel.

Scope of application

The locomotives are used in heavy switching applications. The axle loads have been designed accordingly for 20 or 22 metric tons.

Technical features

Advanced three-phase traction produces very high starting tractive efforts as well as high continuous tractive efforts at low speeds. The use of three-phase technology in conjunction with advanced diesel engines has resulted in excellent efficiency.

Benefits

The combination of very high starting tractive efforts, high continuous tractive efforts and high efficiency ensures optimum utilization of the available engine power.

Type		DE500
Year		1980 – 1990
Wheel arrangement		Co
Diesel engine rating	[kW]	510
Starting tractive effort	[kN]	250/200
Maximum speed	[kph]	40/50
Weight	[t]	66/60
Track gauge	[mm]	1435
Numbers built		8/1



Di 8

Switching and Main-Line 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.

Type		Di 8
Year		1995 – 1996
Wheel arrangement		Bo'Bo'
Diesel engine rating	[kW]	1570
Starting tractive effort	[kN]	270
Maximum speed	[kph]	120
Weight	[t]	82
Track gauge	[mm]	1435
Numbers built		20



311.1

Switching and Main-Line 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'
Diesel engine rating	[kW]	785	785
Starting tractive effort	[kN]	260	260
Maximum speed	[kph]	90	90
Weight	[t]	80	80
Track gauge	[mm]	1668	1668
Numbers built		1	60



ME 07

Switching and Main-Line 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 Tlomsas in Turkey.

Type		ME 07
Year		1984 – 1989
Wheel arrangement		Bo'Bo'
Diesel engine rating	[kW]	745
Starting tractive effort	[kN]	220/285
Maximum speed	[kph]	100
Weight	[t]	68/88
Track gauge	[mm]	1435
Numbers built		40



DE 1000

Switching and Main-Line Locomotive 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 Tlomsas in Turkey.

Type	DE 1000	
Year	1984 – 1989	
Wheel arrangement	Bo'Bo'	
Diesel engine rating	[kW]	745
Starting tractive effort	[kN]	220
Maximum speed	[kph]	100
Weight	[t]	68
Track gauge	[mm]	1435
Numbers built	45	



ME 10

Works 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 are 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 are 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'
Diesel engine rating	[kW]	1120
Starting tractive effort	[kN]	246/258
Maximum speed	[kph]	120
Weight	[t]	76 – 88
Track gauge	[mm]	1435
Numbers built		15



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