



**ELECTRIC
LOCOMOTIVES**

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ELECTRIC LOCOMOTIVES

dragon

A modern six-axle locomotive, specially designed for heavy freight transport

E6ACT DRAGON is a traction vehicle from the six-axle locomotive platform specially designed for the heavy freight transport. Dragon locomotives are powerful, safe, attractively-priced, economical, fully-equipped locos utilizing reliable, latest technological solutions and offering high comfort of the driver's work. DRAGON's main advantage is a very high tractive force of the value from 410 kN to 450 kN. In connection with a high locomotive weight, a performant antiskid system and an individual drive per each axle, this allows to pull heavy duty freight trains.

Our commitment: Safety, reliability and ease of maintenance

Our utmost goal is to provide our Customers with safe and reliable locomotives. Dragon locomotives are manufactured using subassemblies designed and delivered by world-class suppliers offering the highest quality standards and the highest competence level. Therefore, Dragon locomotives are not only reliable but they also have an optimized maintenance schedule. This, in turn, allows us to guarantee a very high technical availability rate which each carrier will find satisfying. The loco's drive is made up of asynchronous traction motors driven by IGBT-based traction inverters. The locomotive has a modular construction which allows for tailoring technical parameters to individual clients' needs e.g., increasing available tractive effort or implementing an additional Diesel engine to allow the loco to be run on non-electrified

lines. Our designers also ensured driver's safety and enhanced working conditions by providing an ergonomically designed cab and driver's desk, a double function air-conditioning unit, as well as a system of cameras, a safety cage and anti-climbing structure protecting the operators in case of collision. Dragon is equipped with microprocessor control systems adapting the operating mode to the changing conditions and to the customer's requirements, an on-board diagnostics system with full visual information and a data registration module which facilitates locating or predicting possible damages.

Our company's high quality standards confirmed by such certificates as International Railway Industry Standard IRIS guarantee the highest level of quality.









Available options: Dual Power and Max Load

According to customers' needs, Dragon locomotives can be equipped with an additional combustion module called "Dual Power". This additional Diesel engine greatly increases the locomotive flexibility, allowing it to drive a complete train on non-electrified track sections. For customers who need a locomotive able to haul even higher loads, Dragon locomotive can be equipped with "Max Load" option, which allows to increase the maximum tractive effort up to 450 kN.







Dragon electric locomotives offer

- Optimized use of available tractive effort
- Guaranteed high quality
- High availability rates
- Optimum maintenance costs
- Ergonomic, safe and comfortable working conditions
- Competitive price
- Additional amenities

Wheelsets

- monoblock wheels with a nominal diameter of 1250 mm
- braking discs fixed on both sides of the wheel
- asynchronous traction motors with power of 842 kW each
- axle bearing with conical roller bearings, temperature and speed sensors







Suspension

- primary level: two sets of coil springs mounted directly on both sides of the wheelset axle box
- secondary level: a set of large-scale, flexicoil spiral springs
- hydraulic shock absorbers for muffling vibrations







Locomotive body

- integral welded design
- safety cage in driver's cab
- modular structure
- ergonomic, two-persons loco cab
- modern fire detection and extinguishing system





High voltage electrical circuits

- two or four single-arm pantographs with independent ADD system
- two traction converters, each equipped with 3 traction inverters and auxiliary converter module
- individual water cooling system for each of the supply blocks







Locomotive diagnostic and control

- microprocessor-based control system
- two independent panels to display drive parameters and diagnostics in each cab
- event recorder synchronized with the electronic speedometer





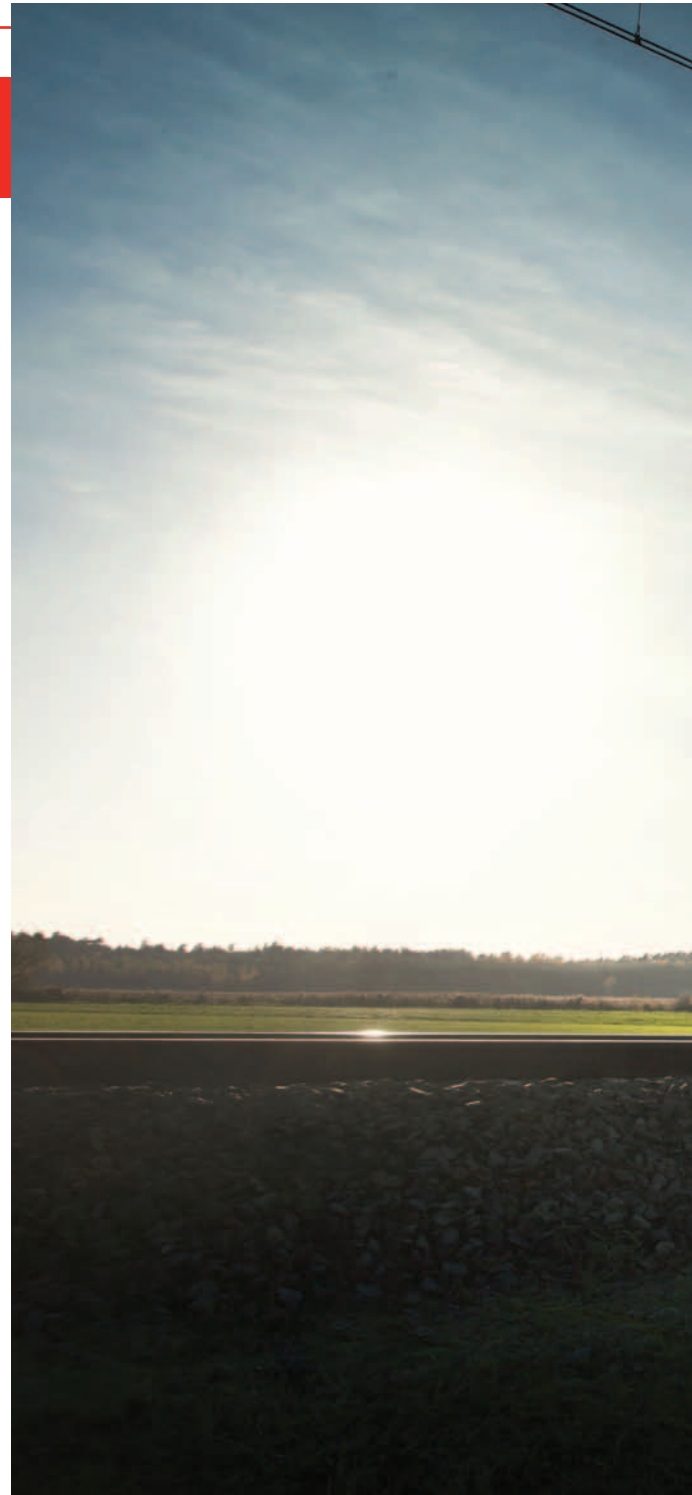
Low-voltage electrical circuits

- 3 × 400 V output voltage powering the auxiliary circuits
- 110V DC battery voltage
- top-class 100 Ah FNC battery system



Functions

- overall control of locomotive operation
- fully automatic drive control with speed set by loco driver
- verification of loco driver's orders entered by man-machine interface panel
- full locomotive diagnostics with the event recording





DRAGON ELECTRIC LOCOMOTIVES

Technical data	DC	AC	MS	DIESEL
Axle configuration	Co' Co'			
Supply voltage	DC 3 kV	AC 15 kV 16 2/3 Hz AC 25 kV 50 Hz	DC 3 kV AC 15 kV 16 2/3 Hz AC 25 kV 50 Hz	-
Continuous power	7,2 MW AC and MS version			2,3 MW
Maximum speed	120 km/h			
Starting tractive effort	410 kN or 450 kN (max Load)			410 kN or 450 kN
Track width	1435 mm			
Service weight	119 t			
Maximum axle load	20 t/06			
Nominal wheel tread diameter	1250 mm			
Loco length with buffers	20330 mm			
Clearance gauge	UIC 505-1			





griffin

Cutting-edge, universal four-axle locomotive designed for pulling freight and passenger trains

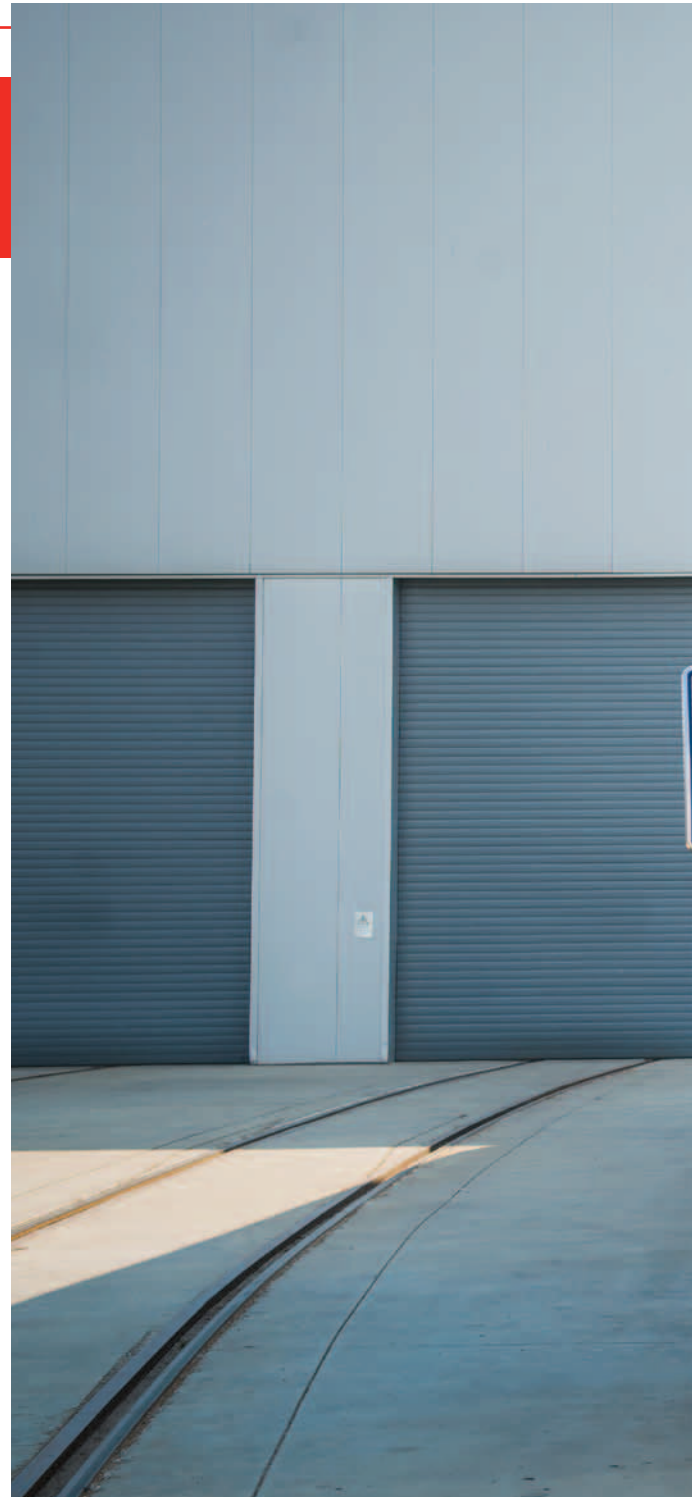
Griffin is a universal family of four-axle locomotives designed for pulling freight and passenger trains. It is the first Polish multisystem locomotive adapter to be used both with the 3 kV direct current power supply system and 15 kV or 25 kV alternating current power supply systems.

Thanks to its modular construction, the E4MSU Griffin locomotive can be tailored to suit specific needs of particular carriers and its interoperability (compliance with the TSI requirements) and the multi-system character facilitate obtaining homologation in most countries. NEWAG S.A. cooperates with subcontractors who are European leaders in their sectors. Owing to this, locomotives from the Griffin family are characterised by high reliability and extended servicing intervals, resulting in a high availability rate. Locomotives from the Griffin family stand out among other locomotives offered on the European market due to their very competitive purchase terms and their simple, fault-free design guarantees low rolling stock maintenance costs.



Interoperational and universal locomotive

Griffin locomotives may be used for pulling freight trains of a maximum weight up to 3 200 t with the speed of up to 160 km/h, as well as passenger trains with the speed of up to 200 km/h. They are available in several versions. Additionally, the “Dual Power” option available in locomotives with the AC and the DC power supply makes it possible for locomotives to be operated on non-electrified lines.







Reliability, optimal maintenance programme, high availability rates

- Modern on-board diagnostic system with full visual information enabling both diagnosing and predicting potential problems
- Optimised maintenance system with extended servicing intervals
- Decreased failure rate owing to cooperation with strategic suppliers, selected from among leading European manufacturers
- High quality of manufacturing, the choice of the best suppliers and optimised servicing cycles guarantee high availability rates





Basic features of E4MSU Griffin locomotive

- Multi-system – ready to operate in many power supply systems
- Universal – used for passenger and freight trains
- Interoperational- suitable for homologation in most European countries
- Comfortable – ensures enhanced driver's working conditions
- Reliable – characterised by optimal maintenance costs and high availability rates
- Favourable and flexible terms of purchase



The highest safety level

- Integral welded structure with crumple zones and a safety cage with the anti-climbing system protecting drivers of both trains involved in a collision
- Modern fire detection and extinguishing system in the driver's cab and in the machinery room
- Fire barrier with 15 minutes integrity
- Modern data-recording module





Griffin locomotives

- Fitted with one, two or three power supply systems (3 kV DC, 15 kV AC and 25 kV AC) depending on clients' needs
- With high continuous power (5.6 MW) capable of pulling passenger trains with the speed of up to 200 km/h and freight trains of 3 200 t gross weight in all weather conditions
- Interoperational – comply with TSI requirements
- Enable to install safety systems required in particular countries
- Adapted for ERTMS and GSM-R installation







Enhanced driver's working conditions

- Well sound-insulated and spacious driver's cab
- Clear, intuitive control panel
- Camera system facilitating driver's work
- Cruise-control system enabling smooth and comfortable ride
- Driver's cab amenities including a microwave oven, a fridge and a kettle







GRIFFIN ELECTRIC LOCOMOTIVES

Technical data	E4DCU	E4DCP	E4ACU
Axle configuration	Bo' Bo'	Bo' Bo'	Bo' Bo'
Supply voltage	DC 3 kV	DC 3 kV	AC 15 kV 16,7Hz; AC 25 kV 50 Hz
Continuous power	5,6 MW	5,6 MW	5,6 MW
Maximum train weight	3 200 t	3 200 t	3 200 t
Maximum speed	160 km/h	200 km/h	160 km/h
Starting tractive effort	310 kN	310 kN	310 kN
Train speed at gross weight: – 500t train at 0‰ profile – 2400t train at 0‰ profile – 2400t train at 7‰ elevation – 3200t train at 0‰ profile	160 km/h 135 km/h 80 km/h 120 km/h	200 km/h 135 km/h 80 km/h 120 km/h	160 km/h 135 km/h 80 km/h 120 km/h
Track width	1435 mm	1435 mm	1435 mm
Service weight	79 t	79 t	84 t
Maximum axle load	196 kN	196 kN	208 kN
Nominal wheel tread diameter	1250 mm	1250 mm	1250 mm
Loco length with buffers	19900 mm	19900 mm	19900 mm
Clearance gauge	UIC 505-1	UIC 505-1	UIC 505-1

E4ACP	E4MSU	E4MSP	D4MSU
Bo' Bo'	Bo' Bo'	Bo' Bo'	Bo' Bo'
AC 15 kV 16,7Hz; AC 25 kV 50 Hz	DC 3 kV; AC 15 kV 16,7Hz; AC 25 kV 50Hz	DC 3 kV; AC 15 kV 16,7Hz; AC 25 kV 50Hz	DIESEL
5,6 MW	5,6 MW	5,6 MW	2,3 MW
3 200 t	3 200 t	3 200 t	3 200 t
200 km/h	160 km/h	200 km/h	160 km/h
310 kN	310 kN	310 kN	248 kN
200 km/h 135 km/h 80 km/h 120 km/h	160 km/h 135 km/h 80 km/h 120 km/h	200 km/h 135 km/h 80 km/h 120 km/h	160 km/h 80 km/h 35 km/h 70 km/h
1435 mm	1435 mm	1435 mm	1435 mm
84 t	88 t	88 t	79 t
208 kN	220 kN	220 kN	196 kN
1 250 mm	1 250 mm	1 250 mm	1 250 mm
19900 mm	19900 mm	19900 mm	19900 mm
UIC 505-1	UIC 505-1	UIC 505-1	UIC 505-1

About Newag

Polish manufacturer Newag S.A.

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Registry data:	KRS0000066315 NIP PL 734 00 09 400 District Court for Kraków-Śródmieście in Kraków, XII Economic Department Paid-up share capital of PLN 11,250,000,25

NEWAG S.A. has existed since 1876. It is one of the biggest and oldest railway companies in Poland, a leader in the production, modernisation and repairing rolling stock. The company has extensive experience in production of modern and fast rolling stock for passenger transport, diesel and electric locomotives, trams and underground trains.

Focusing on customer satisfaction, **NEWAG S.A.** pays particular attention to the quality of its products and services it provides, which is confirmed by the recognition the company has received. The company has been awarded the title "The company that transforms Polish industry" for its spectacular market success in competing with European rail industry giants. In 2017, **NEWAG S.A.** was granted a title of "The Promoter of the Polish Economy" by the "Teraz Polska [Poland Now]" Promotional Emblem Foundation in recognition of the company's achievements in building the Polish brand in Poland and abroad.

NEWAG S.A. holds PN-EN ISO 9001:2009 certification which confirms that the company introduced and has implemented the modern quality control system, PN-EN ISO 14001:2005 referring to the implementation of the requirements concerning the environmental management system and PN-EN ISO 50001:2012 confirming effective energy management in every form. **NEWAG S.A.** also holds IRIS Certification Rev. 02.1 that attests to the implementation of the international railway industry standards.





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