Transmashholding
MAGAZINE FOR PARTNERS
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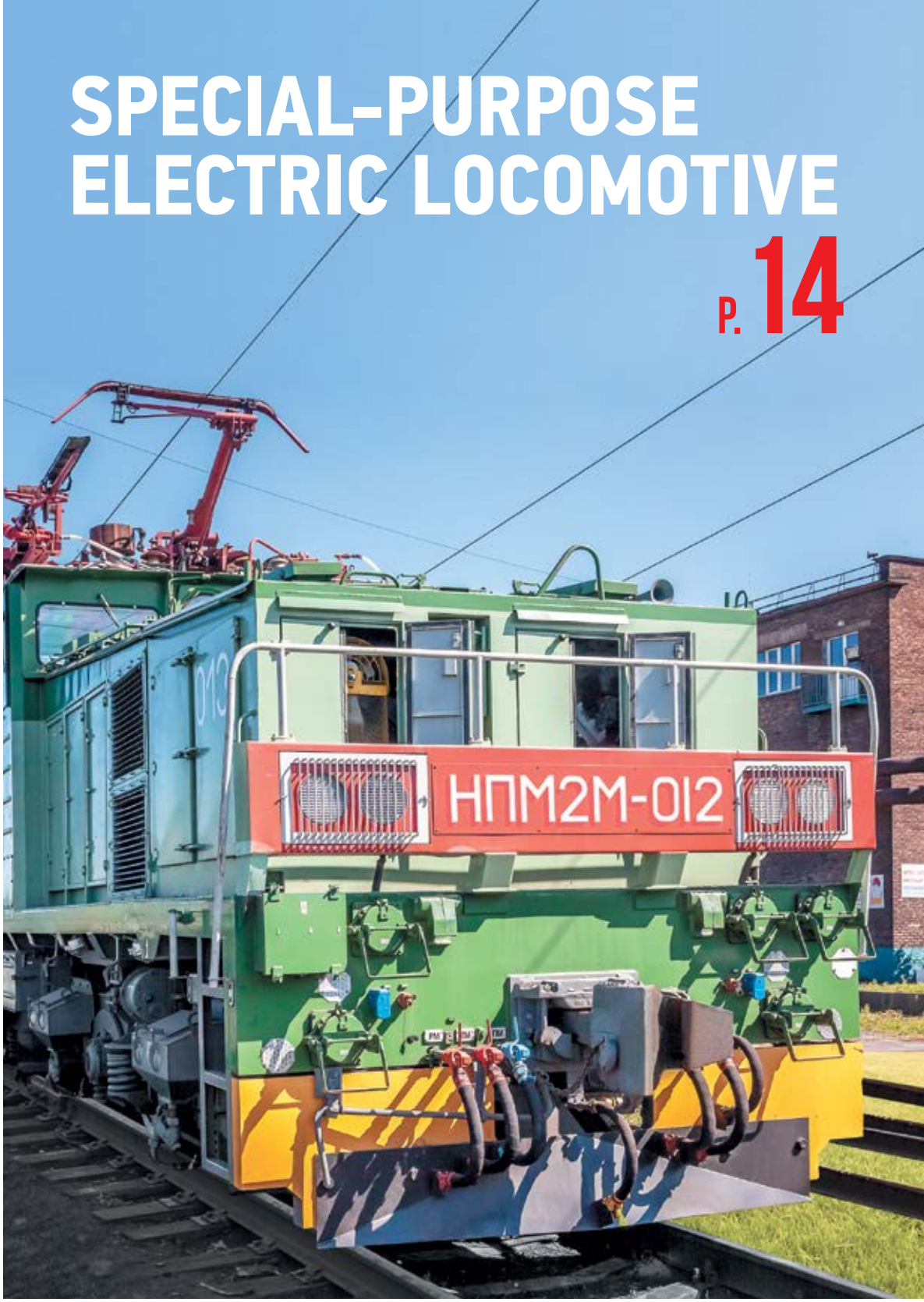
SPECIAL-PURPOSE ELECTRIC LOCOMOTIVE

P. 14



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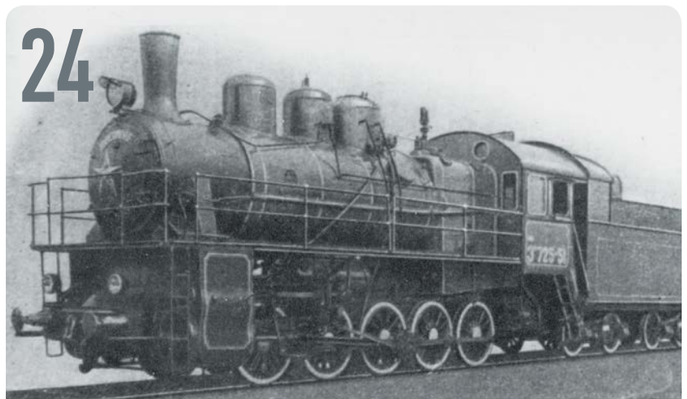

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of ZAO Transmassholding

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300 TRAMS FOR FIFA WORLD CUP

Transmashholding is going to build 300 three-section trams for the city of Moscow. All the vehicles will come with a 30-year warranty

"Transmashholding is going to offer an original tram car design to the Government of Moscow, making the trams a new city sightseeing attraction," says Kirill Lipa, General Director of Transmashholding. "It is especially important in view of the 2018 FIFA World Cup and the expected influx of foreign tourists."

The trams to be built specifically for Moscow are in full compliance with the proposed technical specifications. The design of the trams will comprise cutting-edge international technical solutions and will be based on the experience of the tram system operation both in Moscow and major foreign metropolises. The tram design will utilize original swiveling low-floor bogies. Thanks to the modern technologies, the introduction of new trams will result in the reduction of power consumption by the Moscow transport system. The trams will feature up-to-date diagnostic systems for real-time evaluation of the correctness of all basic systems' operation. The design provides for an efficient security system recording everything that happens in tram cars and around them.

The designers of the new trams focused on passenger comfort and improved working conditions for drivers. The trams will have more doors, which will significantly accelerate the boarding and exiting by passengers and ensure comfortable conditions for passengers with baby strollers.

The trams are to be delivered from 2017 to 2019 (100 trams a year). The manufacturing is organized at the facilities of Tver Carriage Works.

It is worth noting that our company will assume responsibility for the warranty maintenance of the trams within their whole expected service life, that is 30 years. Transmashholding has a proven track record of establishing a premium service network for the rolling stock of its manufacture. Currently, the metro cars of the Moscow Metro and EP20 electric locomotives of Russian Railways are serviced in the same manner.

FROM CHINA TO POLAND IN 5 DAYS

Transmash entered into the first agreement on delivery of high-speed flatcars.

The agreement was executed at InnoTrans 2016 in Berlin. Komplexnye Skorostnye Tekhnologii (Integrated Speed Technologies) purchased Russia's first flatcars for transportation of high-capacity containers at an operating speed of 160 km/h. The agreement provides for the delivery of two experimental flatcars to be built in 2016 with a subsequent certification testing cycle. In addition, a letter of intent was executed for the delivery of 2,800 high-speed flatcars from 2017 to 2019.

Utilization of new flatcars will accelerate transportation of cargos, which is vital for domestic economy, and make the transit connection between China and Europe faster and more efficient. There are plans to use such flatcars for marshalling high-speed container trains and operate them in transit traffic between China and EU via the Trans-Siberian Railway on Zabaykalsk — Brest (5.5 days) and Naushki — Brest (4.5 days) routes.

INFORMATION

The 13-6954 high-speed flatcar is designed to carry one 40/45 foot container (including refrigerating containers with autonomous diesel generators). The design features the running gear and parts of passenger rolling stock, including the high-speed four-wheel bogie with swing bolster suspension (model 18-6960). The car has an electro-pneumatic braking system.

Photo: Igor Litvyak / Lori Photobank

NEW TRAINS FOR SAINT PETERSBURG METRO

Oktyabrsky Electric Railway Car Repair Plant (OEVRZ) is to deliver 27 trains to the Saint Petersburg Metro.

The trains will be delivered to the customer in 2017-2018. OEVRZ will build 54 cars in each of the three different configurations: head-end, middle motor, and middle motorless cars.

The train will consist of cars with a asynchronous tractional unit saving up to 30% of power. The design of air intakes and ventilation grids will evenly distribute air flow around the passenger compartment.

The design provides for an electronic destination indicator on head-end cars and a comfortable driver's cabin with an air conditioning system and vibration-absorbing chair. All cabins will be furnished with state-of-the-art control panels.

"We pay special attention to our cooperation with the Saint Petersburg Metro," says Boris Bogatyrev, General Director of OEVRZ. "We hope that both local residents and numerous visitors of our Northern Capital will appreciate the new cars."

Photo: Ivan Vasiliev / Lori Photobank

OUR ELECTRIC LOCOMOTIVE IS THE BEST!

The EP20 electric locomotive wins the contest of Russian Railways for the best-quality rolling stock.

The dual-mode passenger electric locomotive is manufactured by Novocherkassk Electric Locomotive Plant (NEVZ), which presented its machines for the contest held by Russian Railways. The EP20 won first place in the nomination The Best Quality of Rolling Stock and Complex Engineering Systems.

The contest awarding ceremony was hosted by InnoTrans 2016, International Trade Fair for Transport Technology and Logistics, held in Berlin. Valentin Gapanovich, Senior Vice-President, Russian Railways, presented the prize to Alexander Sapunkov, General Director of NEVZ.

WITH GOOD INTENT

Transmashholding enters into two cooperation agreements with Helios and Agiplan at InnoTrans 2016 in Berlin.

We executed a memorandum of understanding on technical cooperation with Helios, a Slovenian company specializing in manufacturing of lacquers and paints.

One of the objectives of such interaction is to provide the holding with modern materials manufactured in Russia (with subsequent localized manufacturing) and meeting the requirements of railway equipment consumers.

Additionally, Transmashholding and Agiplan entered into an agreement of understanding with respect to implementing an efficiency improvement project for the Bezhitsa Steelworks. It calls for upgrade of the manufacturing facilities, optimization of their occupancy, and establishment of a number of new manufacturing sites at the enterprise.

AUSTRALIANS TO RIDE "JAPANESE"

MITSUBISHI ELECTRIC

Mitsubishi Electric (Japan) entered into an agreement on the delivery and maintenance of modern cars for new intercity trains of New Intercity Fleet, an Australian railway project.

The largest project in the history of Australian engineering is estimated at $1.8 bn. The Japanese company is going to supply rolling stock for passenger service between Sidney and the Central Coast, Newcastle, the Blue Mountains area, and Southern Australia.

Furthermore, the company assumed an obligation to manage and maintain its products for 15 years, starting from the date of the first delivery in 2019. A total of 512 passenger cars are to be designed and manufactured as part of the project.

MONORAIL TO BE RENOVATED IN WUPPERTAL

The world's oldest functional overhead monorail — the Wuppertal Suspension Railway — is to be renovated.

Specifically, the whole rolling stock operated on the line since 1972 will be replaced. Four cars have already been built and are now used for the training of 200 operators. The new rolling stock will be more comfortable.

Aluminum and fiberglass are used in the manufacturing process.

The weight of cars will be reduced considerably.

The Wuppertal suspension railway in Wuppertal, Germany, has been operated since March 1, 1901. The double-track suspension system on overhead roads spans 13.3 kilometers, with 10 km over the Wupper river at a height of ca 12 meters and the remaining 3.3 km over the city streets at a height of ca 8 meters. The railway trains have the maximum speed of 60 km/h. Each train is 24 meters long and is designed to carry 178 passengers.

Photo: Sergey Fadeichev / TASS

IVOLGA TAKES WING

According to Vladimir Kozlov, COO of Central Suburban Passenger Company (CPPK), new Russian EG2Tv Ivolga express trains (meaning "oriole" in Russian) are to carry their first passengers before the end of 2016.

The Ivolgas are to carry passengers along the route Moscow (Kiev railway terminal) — Novoperedelkino.

Ivolga is the first representative of the advanced family of electric trains for urban, timed, suburban and local passenger transportation. The base was developed in view of the possibility to manufacture versions for maximum traveling speeds of 120 and 160 km/h or up to 250 km/h in the future. It is also possible to create versions operated in DC and AC systems as well as double–current systems. The trains are basically formed by 5 cars with the possibility to make up trains of 3 to 12 cars, as well as paired trains of up to 14 cars controlled by a multiple-unit system.

RUSSIAN RAILWAYS TO GO DIGITAL

Russian Railways starts the development of intelligent control systems.

Valentin Gapanovich, Senior Vice-President, Russian Railways, stated that the company is focused on 13 innovative growth options. Its key project will be associated with a precise gridding of infrastructure facilities.

"Russian Railways is going to abandon infrastructure facilities' dimensioning based on the milestone system of coordinates. All the data are to be digitized, thus improving the efficiency of railway design and construction. Additionally, this has to be done for the purpose of improving the satellite systems of automatic train operation, including the possibility to operate locomotives without a driver," said Mr. Gapanovich.

Upon development and testing, the new intelligent systems are to be implemented at the Moscow Central Circle with subsequent replication throughout the whole network of Russian Railways.

On the Moscow City Day, Transmashholding together with the Russian capital's Transport Department and Metro presented new subway cars "Moskva" at the Exhibition of Economic Achievements. Our correspondent, who was among the first passengers of the car of the future, has contributed to this issue with his photo coverage.

MUSCOVITES SEE METRO OF TOMORROW

The presentation of the Moskva train at the Exhibition of Economic Achievements saw over 40 thousand attendees.

MAXIM LIKSUTOV,
Vice Mayor of Moscow:

— The new "Moskva" 765 series cars will be among the safest and most reliable cars in the world. In addition, their capacity will be 20% greater than that of the previous series of cars. The main systems responsible for safe operation and passenger comfort were developed by Russian manufacturers. These cars have no comparable counterparts in the world. Due to the lower weight of a car, the railway load and the wear are reduced. The new trains will be 22 tonnes lighter than their predecessors and, accordingly, have 40% less impact on the rails, thus minimizing their wear and tear.

From 2017 to 2020, the Moscow subway will receive as many as 768 new cars. The "Moskva" will be supplied to the metro system under life-cycle contracts. Within their entire service life, the new trains will be the responsibility of the company's maintenance system, which will secure their failure-free operation for at least the next 30 years.

1. The presentation of "Moskva" cars was attended by the Moscow government's officials and the Transmashholding management.

2, 3. Touch-screen data display units with interactive metro map are installed in passenger compartments. If necessary, video or even TV footage may be displayed on the display units. There are USB ports for charging mobile devices.

4. There are 30% more handholds with special, so-called "warm" coating.

5. From the point of view of design, the "Moskva" subway cars are something completely new for Russian-made vehicles. Nothing similar has ever been manufactured before.

6. The driver's cabin is functional and comfortable. The control system features a new information display interface with speed indication on the train control screen. The modern video surveillance system records everything happening on the train and around it. The driver can always see on his display what is going on in passenger compartments throughout the train.

7. Inter-car walkways make it possible to walk from one end of the train to the other.

8. The new trains have modern climate control systems.

9. The driver's call button has improved characteristics. Video cameras in passenger compartments register both the face of the person pushing the emergency button and his/her surroundings.

10. Passenger seats are comfortable and safe. Compartments are lit with LED lamps with adjustable color temperature of luminescence. There is cold light in the morning with the color temperature turning warm by the evening.

11. The doors are furnished with LED elements for better passenger notification. The green light is on when the doors are open for boarding and the red one comes on when the status of the doors changes to opening or closing. There is an extra acoustic signal when the status of the doors changes. The compartment doorways have become 12% larger as compared with the previous train series.

ALEXANDER NIKITENKO: “CAR MAINTENANCE IS A SPECIAL WORK”

During the past several years, Metrovagonmash has been focusing on a new area — premium maintenance of subway trains.
Since 2013, the plant has been delivering up-to-date rolling stock to the Moscow Metro under life-cycle contracts. Such contracts provide for the supplier’s responsibility for the technical condition of the operated cars, timely scheduled maintenance, and commissioning of rolling stock. **Alexander NIKITENKO**, Deputy General Director of Metrovagonmash, speaks about the peculiarities of cooperation with the Moscow subway and prospects of the new focus area.

▶ Alexander Pavlovich, Metrovagonmash is gradually expanding its presence in the Moscow Metro and intends to service its whole rolling stock. What is the project’s current status?

◀ Today, we are working with the Novogireyevo and Vladykino electric engine houses. Under effective agreements, we are to replace the rolling stock at the Vykhino engine house by the end of this year. There are 19 trains there as of now, while we intend to deliver a total of 192 cars, that is 24 trains. The new rolling stock will be serviced under life-cycle contracts. Starting next year, we intend to include 400 cars belonging to the Varshavskoye and Izmaylovo engine houses in the premium service system. If we are lucky, we can become responsible for servicing the whole 81-760/761 car series.

A total of 26 million rubles has already been invested in the premium service system. According to the plans for this year and in the years to come, the plant is to invest another 67 million rubles in its expansion.

However, our greatest achievement is the change in the employees’ approach to the process, the main idea of which is as follows: each engine house worker should be interested in the technical availability and operating readiness of as many trains as possible.

▶ What are the ways of interaction with the metro? What qualitative and quantitative indicators does the customer use to assess the quality of your work?

◀ There are key indicators specified in the agreement. For instance, the degree and rate of rolling stock readiness. If we currently have 31 trains at the Novogireyevo engine house, we must make 29 of them ready for operation. The second indicator is the number of trains cancelled because of failure of our machinery. If we exceed the threshold set by the Moscow Metro, we are liable to a fine. Note that we have not been imposed fines this year. It means that everything has been done on time.

▶ What surprises did you encounter in the process of integration into the existing infrastructure facilities of the Moscow Metro?

◀ There were no surprises, as most of our employees had been previously employed by the Moscow Metro. They are experienced and skilled workers. We have been doing our job for decades, and it is not a novelty to us. Sometimes, the Moscow Metro for some reason fails to immediately get acquainted with the new technologies implemented by Metrovagonmash, which leads to differences and misunderstandings in the maintenance of cars. Luckily, they are eliminated through open discussions and clarification of each party’s viewpoints.

Ultrasonic Inspection

THIS YEAR, WE HAVE ALREADY CARRIED OUT THE REHABILITATION OF

120 CARS

To ensure comfortable working conditions for our employees, we have procured a large vacuum cleaner, which immediately draws in dirt during traction engine cleaning, thus helping to prevent it from spreading around the premises. After the research conducted jointly with the Demikhovo Machinebuilding Plant, we decided to carry out ordinary wheelset examination at our premises instead of complete examination at the plant, this way significantly reducing the cost of parts and equipment transportation. We have also purchased a test-bench for checking shock absorber efficiency. Furthermore, it was resolved to train the personnel in vibration damper repairs so that they could immediately eliminate emerging problems. Therefore, we see a trend towards reducing the cost of rolling stock rehabilitation with no loss in quality. A unique bogie assembly test-bench has been created for inspecting the working capacity of main units, parts and assemblies without running tests of cars after repairs. Specialists of the maintenance service selected new detergents for trains; new cleaning devices have been purchased and car cleaning regulations have been revised: each train is now subject to comprehensive cleaning twice as frequently as before.

▶ ***The transition to servicing multiple models and versions of subway cars, both new ones and those whose service life is nearing expiration, means an increased burden on the maintenance specialists who have to master new competences. How does this affect the maintenance infrastructure development?***

◀ We have not yet replaced old cars, but we are not going to have difficulties even when this happens. To put it another way, we have many employees who used to work for the Moscow Metro with cars of the previous series, that is they dealt with the maintenance and repairs of the rolling stock operated currently. Due to our hands-on experience with older cars, we know well enough how to build new ones.

As for major repairs, we have mastered a big rehabilitation project — RRS-1. We began the work last fall, procured test-benches, wheel pairs, traction motors and other spare parts, prepared a site at the Vladykino engine house, and trained personnel. This year, we have already carried out the rehabilitation of 120 cars. No one has ever worked on that rolling stock before. It is our competency. We have mastered technologies required for the performance of all necessary maintenance specified in the operating manual on a relatively small site.

OUR SPECIALISTS CHANGED CAR CLEANING REGULATIONS: EACH TRAIN IS NOW SUBJECT TO COMPREHENSIVE CLEANING TWICE AS FREQUENTLY AS BEFORE

▶ ***Which assemblies and units of subway cars demonstrate the best reliability indicators?***

◀ Brake equipment. There were some design errors, but all flaws were eliminated in the process of equipment modernization by Transmash. Today, the equipment demonstrates good performance. In addition, expensive and reliable German equipment has been purchased from KNORR-BREMSE. Based on the results of our engine house repairs and research conducted jointly with the manufacturer, we concluded that the tested equipment would require no intervention. Therefore, the repairs were postponed until the next phase, thus again reducing our costs. We follow the well-known principle, “I am not rich enough to buy cheap things.”

I would also like to draw your attention to the Vityaz-M system designed for safe subway train operation, real-time control and diagnostics of the train car equipment. The system operates in a stable manner. In the same way as with the Moscow Metro, we entered into a life-cycle contract with Tikhomirov Scientific Research Institute of Instrument Design. This means that the institute will service its products. This is the first organization to enter into an agreement with us. We intend to rely on this experience in our cooperation with other companies. This approach has many advantages. In addition, it motivates our partners to manufacture reliable, high-quality products.

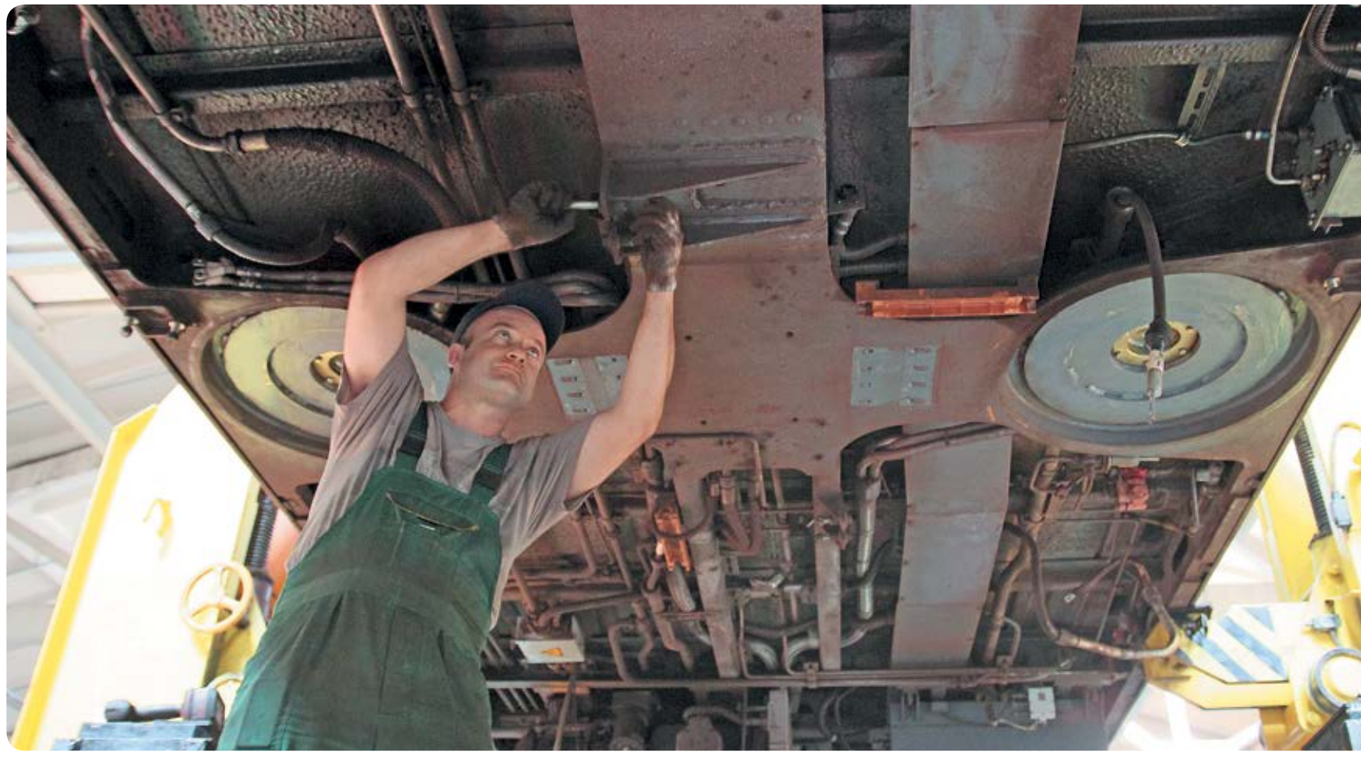
▶ ***Maintenance representatives work in the situation room of the Moscow Metro on permanent basis. What is your view of the efficiency of such work? What impact does it have on the activities of the maintenance service in general?***

◀ We have had our representatives in the situation room since the commencement of our work at the Moscow Metro. They give online answers to various questions asked by our drivers. There are engineers familiar both the car structure and the work of a driver. They can offer clear and expert advice on how to eliminate any problem or they can promptly remove a train from the line, keeping our key indicator, which must not exceed eight cancelled trains a month. Employees of that service constantly improve their skills. We continually “feed” them with the knowledge of new processes. They are always aware of all updates.

Rehabilitation and roundhouse servicing (RRS-1)

▶ ***What are the peculiarities of rolling stock operation in hot weather? How do air conditioners work? How efficient are they?***

◀ In the summer time, hard times come for both the passengers and the service center, as our climate control units are to be prepared appropriately. Air conditioners have to be switched from the winter mode to the summer one. This means working with a rather large rolling stock. As the saying goes, repair your cart in December, in July your sledge remember. We have entered into an air conditioning service agreement with the Car Transport Service Centre (CTSC). Our maintenance service also performs cleaning and replaces filters in air conditioners. Furthermore, we establish an inventory of spare parts, which may break down in the summer time. As for the efficiency of air conditioners, I can say that it is a subjective opinion on



MOST OF OUR EMPLOYEES HAVE BEEN PREVIOUSLY EMPLOYED BY THE MOSCOW METRO; THEY ARE EXPERIENCED AND SKILLED WORKERS

the part of the passengers, as the Metro Emergency Response Center receives an equal number of complaints about low and high temperatures in cars. Pursuant to its specifications, the climate control unit functioning depends on the number of people in a car.

▶ ***Metrovagonmash is known to use both French Faiveley and Russian Transcon air conditioners in the manufacturing of its subway cars. What are the peculiarities of working in the Moscow conditions?***

◀ There are no peculiarities at all. The manufacturers differ in their component base, but the principle remains the same. Speaking about reliability, Faiveley is a bit better than Transcon, but we cannot say that Transcon ceased to improve its quality. Both of them are committed to constant improvement. There are price differences. Transcon is a Russian company, and Faiveley is French; Russian products are certainly more affordable.

▶ ***What outside equipment and services does the maintenance service require? How are contractors selected? Whom should interested organizations contact?***

◀ The car structure features some equipment from outside suppliers. Traditionally, the contractors supplying parts for cars participate in their maintenance. If there are any companies that can offer such services at lower rates than the suppliers we work with, we are always willing to discuss the matter, if the product quality is not affected. For the selection of contractors, please contact Metrovagonmash, our service center or design bureau. Potential contractors must be prepared for tests of the products they offer. We have to be confident in the equipment we install on our trains.

▶ ***What specialists are you looking for? How can a potential employee join you? What are your requirements to candidates? What conditions do you offer to your employees? What are your training programs?***

◀ Subway car maintenance is a rather particular specialty. It does not suit everyone, even though a person may have higher or professional educational background. At the same time, our requirements are quite simple: desire to develop professionally and, of course, some basic knowledge in the fundamentals of mechanics, electric engineering, etc. If a candidate meets these requirements, we employ him or her and offer on-the-job training. We have a proprietary personnel training system. Each foreman devises his own program and gives lectures to workers. As they say, every work must be paid. This applies to personnel training. We intend to implement a new training system jointly with service centers. Our service centers are scattered all over Moscow, and it is sometimes inconvenient for people to travel from one part of the city to another, say, the town of Mytishchi. We have decided to organize classrooms with video communication for the purpose of interactive training. We must expand that system and encourage feedback. In order to assess how the employees undergoing training understand the material, we plan to distribute tablet computers with questions related to the lectures. The foreman will follow up on the knowledge of employees and assign grades, which will eventually affect bonuses to be paid to each respective trainee.

WE HAVE A PROPRIETARY PERSONNEL TRAINING SYSTEM. EACH FOREMAN DEVISES HIS OWN PROGRAM AND GIVES LECTURES TO WORKERS

67 MILLION RUBLES

WILL BE INVESTED IN THE PREMIUM SERVICE SYSTEM THIS YEAR AND IN THE YEARS TO COME

SPECIAL-PURPOSE ELECTRIC LOCOMOTIVE

The Novocherkassk Electric Locomotive Plant (NEVZ) launched production of an upgraded version of the NPM2M, a four-axle DC electric locomotive. Representatives of the customer ordering the electric locomotive — engineers of the Magnitogorsk Iron and Steel Works — took an active part in this initiative.

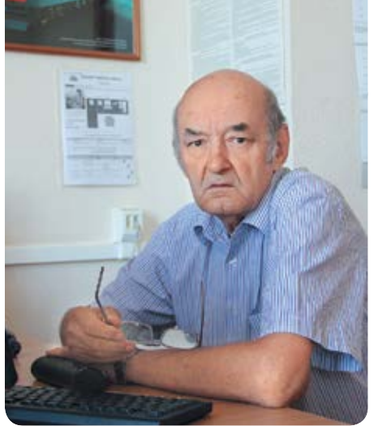
The history of the NPM2 goes back to 2004, when the Novocherkassk Electric Locomotive Plant entered the market with the first Russian industrial four-axle direct-current electric locomotive. The locomotive was designed for operation on railway tracks of metallurgical enterprises with direct current and rated voltage of 1,500 V in the overhead contact system. The main feature of the NPM2 is its asynchronous drive designed jointly by specialists of NEVZ and All-Russian Design and Research Institute of Electric Locomotive Building based on Russian-made parts with some components from the Japanese manufacturer Hitachi. It has a drive that is more advanced, cost-efficient, and fuel-efficient during repairs. The new machine demonstrated excellent characteristics; the NPM2 won the prize of All-Russian Contest 100 Best Products of Russia in 2013.

Jointly with the Operator

NEVZ decided to go an extra mile and upgraded the electric locomotive, presenting its new version — the NPM2M — in 2014. In upgrading the electric train, special attention was paid to the comments from the locomotive operator. The new product was developed by NEVZ, All-Russian Design and Research Institute of Electric Locomotive Building (VelNII), and Magnitogorsk Iron and Steel Works (MMK), where electric locomotives account for 70% of cargo carriage and 100% of haulage of finished products. Alexander Tarasov, Chief Engineer at Railway Transport Office, MMK, says the following about the results of such cooperation between metallurgists and machine builders, "In the early 2000s, we experienced the need for the renewal of our locomotive fleet operated over 50 years. However, the specific character of electric locomotive operation at the iron and steel works — overhead contact system voltage within the limits of 1.2-1.8 kV; low speeds not exceeding 40 km/h and aggregate traction motor capacity within 1,000-2,100 kW — became a challenge for MMK.

Russia was not manufacturing any locomotives capable to work in such conditions. Therefore, it was decided to place an order for designing a locomotive with VElNII, which had a vast experience in designing electric locomotives for different purposes, with their manufacturing organized at NEVZ, which is the leading electric locomotive manufacturer in this country. We certainly had our colleagues in mind. However, we could not find a partner for building a new industrial electric locomotive among metallurgical enterprises using electric traction; the financial component was the main issue. MMK became the only customer ordering the new industrial electric locomotive. This is reflected in its name, the NPM2M, where N stands for Novocherkassk, P for "Promyshlenny" (Industrial), M for Magnitogorsk Iron and Steel Works, 2 for the new-generation direct current electric locomotive, and M for Modernized.

Today, the Magnitogorsk Iron and Steel Works operates eleven NPM2 industrial electric locomotives and three NPM2Ms. They earned a good reputation in the process of operation. Their main advantage is the asynchronous towline drive with axle support suspension on rolling bearings re-



GENNADY MARCHENKO, NPM2M Project Supervisor:

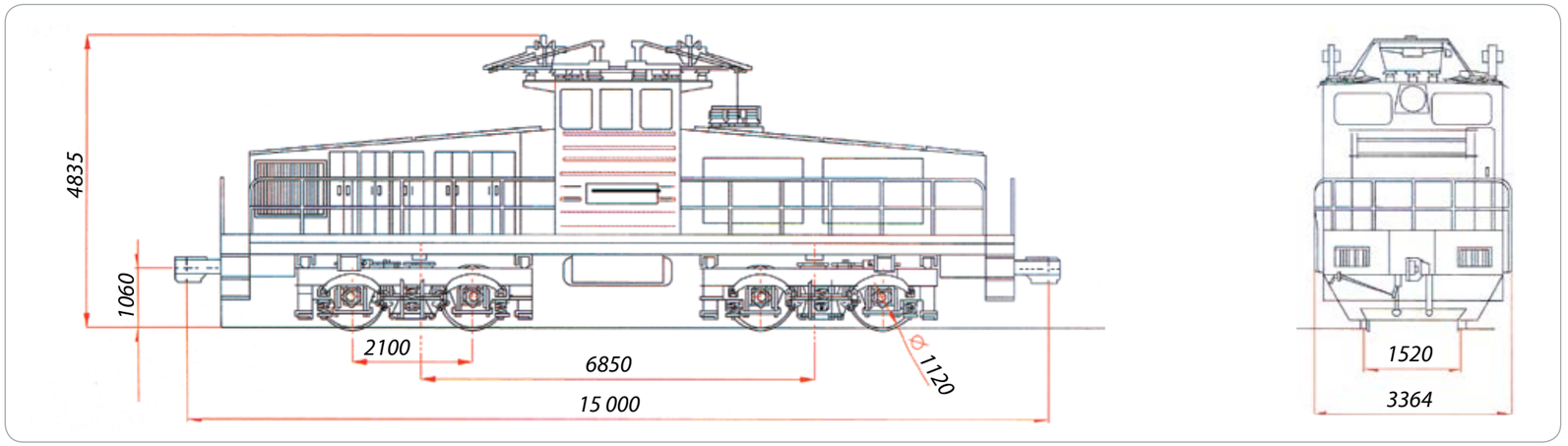
— The main modifications of the upgraded industrial electric locomotive affected electronic assemblies based on new components. Due to the innovations, the electric locomotive became even more comfortable and reliable with practically zero chance of failure of power electronic instruments. It features a backup locomotive control unit. The upgrade of the towline drive and control system significantly improved the operating reliability and made the operation of the electric locomotive more convenient. The time between repairs increased from 30 to 45 days. The new machine was unified with the previous one in terms of installation dimensions.

Furthermore, as was requested by the customer, Magnitogorsk Iron and Steel Works, the electric locomotive design was modified to make both hoods on its body removable, thus facilitating maintenance and repairs.

The exterior of the NPM2 and NPM2M electric locomotives looks very similar

THE LOCOMOTIVES WERE DESIGNED FOR WORKING IN THE SYSTEM OF TWO LOCOMOTIVES OPERATED BY ONE LOCOMOTIVE CREW

Driver consoles



quiring practically no maintenance during operation. The stepless control of draw and brake pulls is ensured by modifying the frequency and magnitude of voltage output. The workplace ergonomics, ease of control and range of visibility meet all modern requirements. The NPM2 involves lower costs of on-site service and repairs at the engine house.

Special capabilities

The design of the NPM2 and NPM2M series of locomotives has a number of special features. For example, the industrial electric locomotives have two central and two side current collectors. The locomotives were designed for working in the system with multiple units (two locomotives) operated by one locomotive crew from the control room of any locomotive. All the machines have dynamic, pneumatic, automatic load-carrying, pneumatic direct and hand brakes. The electric locomotive cabins have two driver consoles, each having control gears for the electric locomotive and trailing section with a diesel generator unit, relevant control instruments and signaling devices. The locomotives have separate air duct outputs for unloading dump cars at a rated operating pressure of 0.7 MPa (7.0 kgf/cm^2). They also have separate voltage leads for electric supply of a snow-removal device for rail track cleaning. The locomotive design ensures its maintenance by a single specialist.

The performance characteristics of the NPM2 and NPM2M will provide the customers with electric locomotives with reliable operation, economic efficiency, and long service life.

SPECIFICATIONS OF THE NPM2M ELECTRIC LOCOMOTIVE

Bogie formula	2_0–2_0
Gauge of railway, mm	1,520
Maximum adhesive weight with 0.7 of sand reserve, t	92±2
Rated voltage across collector shoe, V	1,500
Design speed, km/h	60
Minimum radius of curves run through at a speed below 0 km/h, m	60
Maximum traction effort in standing start, kN (tf), at least	212,2 (21,5)
Traction effort in hourly mode, kN (t), at least	164,6 (16,5)
Power in hourly mode, kW, at least	1,400
Movement speed in hourly mode, km/h, at least	30
Electric locomotive efficiency in hourly mode, in traction, at least	0,85
Traction effort in power supply from trailer-type diesel generator, kN (tf), at least	98,7 (10,0)
Movement speed in power supply from trailer-type diesel generator, km/h, at least	3,0

By: **Anna Semenyuk**
Photo by **Press Service of NEVZ and Press Center of MMK**

ADVANTAGES OF THE NPM2M

- Use of power devices with expanded (by approximately 30%) safe operating area and permissible collector emitter voltage increased by almost 40%.
- Use of intelligent drives with built-in short-circuit and switching overvoltage protection with power-failure control.
- Continuous monitoring of coolant temperature with display representation and simultaneous impact on the control system.
- Use of more efficient controllers with a built-in "dead time" generation feature and a number of other "library" features improving software reliability of the control system.
- To improve jamming resistance, control units with a traction converter were placed inside traction converters.
- To avoid dust penetration into traction converters, the body of converters has sealing covers. The cover design ensures prompt removal thereof.
- The electric locomotive features a PUBZ unit for external fault protection. These measures prevent failures of power electronic devices of the electric locomotive in the event of external faults.
- Instead of pointer indicators for the control of operating parameters of traction electric motors, the GERSYS BC3741 display is used with the feature of displaying current information on the operating modes, data recording in emergency and preliminary modes (recorder) and diagnostics.
- Diagnostics of main assemblies in the instrument scheme when preparing a trip (starting) and during locomotive operation with data display for the driver:
  - — diagnostics data display;
  - — presentation of faulty equipment list;
  - — organization of diagnostics data transfer via main power networks in operation under SME.
- Implementation of a backup locomotive control unit (LCU). In the event of working unit failure, the driver can switch control to the backup unit.

Electric locomotive in shunting operations at a station

D500: STATE-OF-THE-ART TECHNOLOGIES AND UNIQUE TRADITIONS

The 12LDG500 locomotive diesel generator at EXPO1520 International Railway Exhibition

MOST ADVANCED TECHNICAL SOLUTIONS IMPLEMENTED IN THE ENGINE DESIGN:

- electronic fuel feed system;
- register turbocharging system with electronic air and gas bypass control system;
- high pressure exhaust gas recirculation;
- Miller's working cycle and compression degree of 17.5;
- maximum combustion pressure: 220 bar;
- non-symmetric oval-barrel-shaped pistons with increased gas tightness;
- piston rings with predetermined radial pressure and non-symmetric shape of longitudinal section working profile;
- TIAN and SPUTTER heavy-duty connecting rod and crankshaft bearing liners;
- flange-mounted tractional unit with inverter start without auxiliary electric machines;
- fast-response turbo compressors with 67% efficiency;
- automatic self-cleaning oil filter, etc.

Medium-speed engines are in steady demand in both domestic and international markets, and this trend is expected to continue in the future. Among the main advantages of the diesel engine are its good torque properties, cost efficiency, ability to work within a wide range of rotation rates and loads, multi-fuel capacity, long service life, and relative ease of maintenance. According to the International CIMAC Congress, diesel engines for transport will have no competitors for several decades to come.

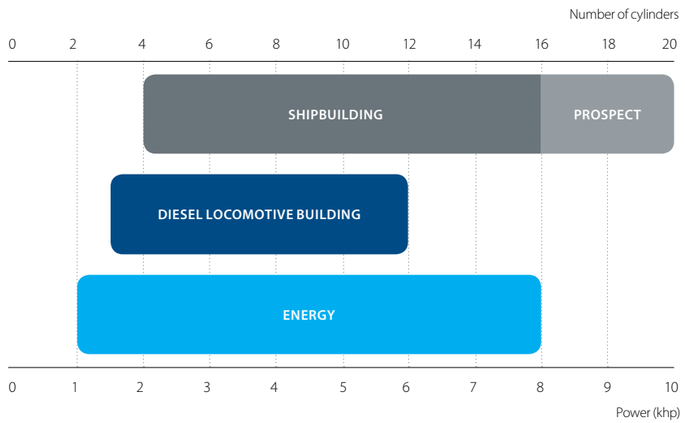
VALERY RYZHOV,
Professor, Full Member (Academician) of Saint Petersburg Academy of Sciences, Honored Designer of the Russian Federation, Winner of Russian Federation Government Award, Chief Designer for Diesel Engineering and Special Products of Kolomensky Zavod

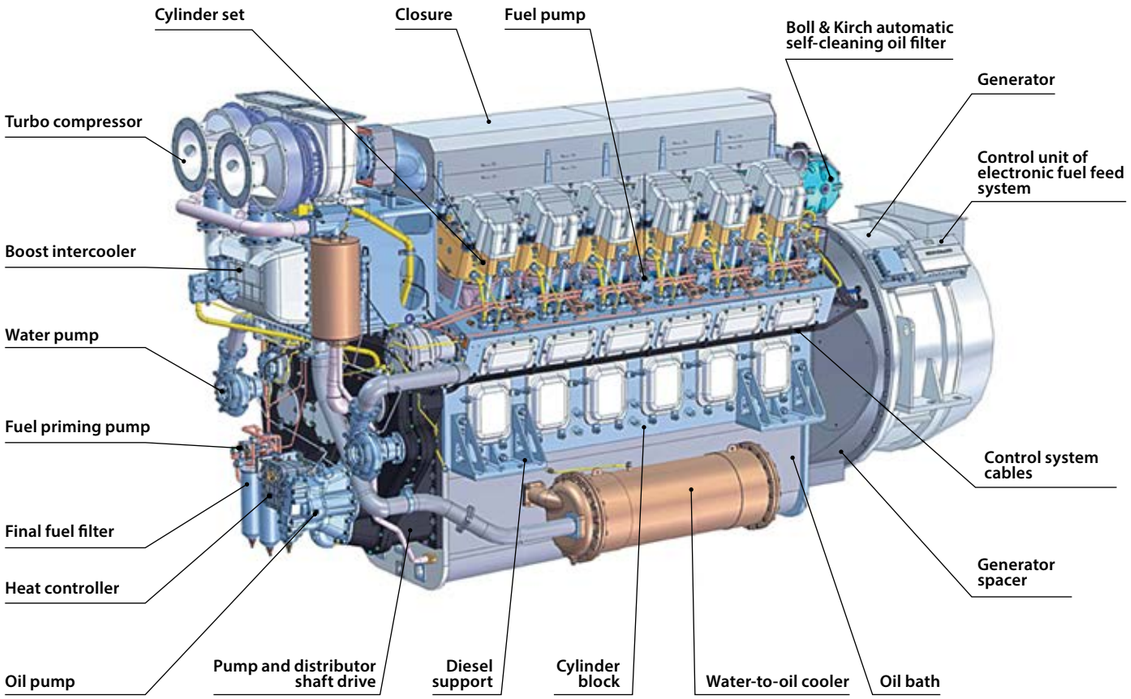
The Engine the Country Needs

Medium-speed engines are in demand in the railway transport sector (main-line locomotives of up to 3,500 kW with a high probability of using engines with a power of 4,450 kW and shunting engines of up to 1,100 kW), merchant navy (river-sea vessels and low capacity sea vessels with a main propulsion power of up to 6,000 kW), and the Navy (frigates, corvettes and submarines with diesel engines of 24,000 kW or more). There is also demand for diesel generator units of up to 6,300 kW for emergency power supply to nuclear power plants both in Russia and abroad. Kolomensky Zavod is the only manufacturer of such diesel generator units in Russia and one of the few in the world. The number of orders for such units is likely to increase significantly due to the approval of the program of development of 24 nuclear power plants in this country in the years to come. The unique nature of such units determines their high price and ensures favorable conditions for the manufacturer.

At the same time, the customer requirements to the improvement of technical and environmental performance of diesel engines tend to become more stringent each year. The existing situation in the Russian diesel engine manufacturing, where there have been no new designs for the past few decades, is typical for most Russian processing sectors. The problem with Russia's technological inferiority in the area of manufacturing of industrial and ship diesel engines is very serious. Thus, 2011 saw the adoption of the Federal Target Program, including a five-year subprogram of diesel engine manufacturing. The program's objective is to transfer the domestic diesel

CAPACITY RANGE FOR THE NEW CHN26.5/31 ENGINE FAMILY FOR MAIN FIELDS OF APPLICATION





D500 engine scheme

MAIN TECHNICAL AND ECONOMIC CHARACTERISTICS OF THE D500 ENGINE

INDICATOR	ADVANCED WESTERN DESIGNS*	CHN26.5/31 DESIGN
Aggregate capacity, kW (hp)		
Locomotive	4,412 (6,000)	≤ 4,412 (6,000)
Marine (Navy)	7,200 (9,792)	≤ 7,352 (10,000)
Nuclear power plant	6,200 (8,432)	< 6,200 (8,432)
Rotation rate, rpm	900–1000	900–1000
Augmentation ratio in working process, MPa	2.08–2.65	2.58
Specific fuel consumption under ISO 3046-1, g/kWh	185-191	184–185
	195-198[1]	—
	200-203[2]	199-202[2]
Specific oil burning consumption, g/kWh	0.45–0.6	0.35–0.4
Specific weight, kg/kW	5.2–5.95	5.0–5.5
Service before overhaul, k h	24-50	60

* Average indicators of leading global manufacturers

[1] Environmental indicators under UIC 624 II

[2] Environmental indicators under the EC 2004/26/EG directive

engine manufacturing to a new level. As part of the Federal Target Program, Kolomensky Zavod developed a radically new platform of D500 diesel engines. The process simulation of the options of most preferable dimensions, which were selected on the basis of engine development trend analysis in given areas, shows that the best way to meet the prospective requirements is through the standard series of 26.5/31 dimensions. This allows creating a multipurpose range of the same dimensions with a unification degree of up to 85% covering the range of required capabilities within the range of 3,000 to 7,500 kW. The new diesel engine family has a cylinder output of 500 hp. This value gave the name to the new range — the D500.

What is the modern diesel engine?

The D500 four-stroke compound combustion engine with a dimension of 26.5/31 (crank shaft rotation rate: 1,000 rpm, mean effective pressure: 25.8 bars) with V-type cylinder arrangement, gas turbine charging and charged air cooling is intended for a wide range of new-generation industrial products: diesel locomotives, ships, and nuclear power plants. Depending on the number of cylinders (12, 16 or 20), the engines cover a capacity range from 2,000 kW (2,720 hp) to 7,360 kW (10,000 hp) forming standard series of versions with a unified design differing in the number of cylinders, boosting level, completing units, etc.

Practical experience shows that it is expedient to start the creation of a new standard series with the version that is subject to the strictest requirements in terms of weight and dimensional indicators. Therefore, the basic version incorporates the design of the twelve-cylinder engine 12CHN26.5/31 for a heavy-haul long-distance freight locomotive for the Siberian and East Siberian Railways.

The D500 engine was designed using the parallel-serial design method in the integrated CAD system utilizing 138 specialized programs and following all ISO quality management requirements. The engine was designed with due account for future pollutant emission standards.

In the development and manufacture of the D500 diesel engine, Kolomensky Zavod used parts and components from such renowned companies as AVL (Austria), ABB (Switzerland), Federal Mogul (Germany), Bosch (Austria), Federal Mogul (Germany), Bosch (Austria and Germany), Heinzmann (Germany), Zollern BHW (Germany), and utilized methods of the leading Russian scientists.

The diesel generator is automated within the range of the second automation degree under GOST 14228.

In 2015, a sample new-generation 12LDG500 diesel built and tested by the enterprise was exhibited at the EXPO1520 International Railway Engineering and Technology Exhibition, where it took the first place in the nomination Locomotives and Multiple Units in the contest held by Russian Railways for recognizing the best innovations. The design solutions used in the new engine represent up-to-date global standards and ensure operating and economic efficiency of the engine that meets customer requirements.

The purpose of implementation of the Federal Target Program is to establish industrial and technology conditions for manufacturing a new generation of competitive high-tech products meeting global standards in the field of the most important engineering systems (aviation and marine engineering, machine-building and energy equipment, and information management systems), special materials and other high-tech products supporting the technical aspects of national security and economic development.

ELECTRONIC FUEL FEED CONTROL SYSTEM ENSURES:

- automatic control of rotation rate and capacity in accordance with precision class B2 under GOST 10511;
- individual adjustment of the amount and fuel feed phase in cylinders;
- disconnection of fuel feed from a part of cylinders under a preset algorithm;
- comprehensive protection against emergencies with displaying the necessary information on the screen;
- online control of current parameters with the information transfer via the CAN bus to the upper-level control system.

Assembly of the 20EDG500 diesel generator for nuclear power plants

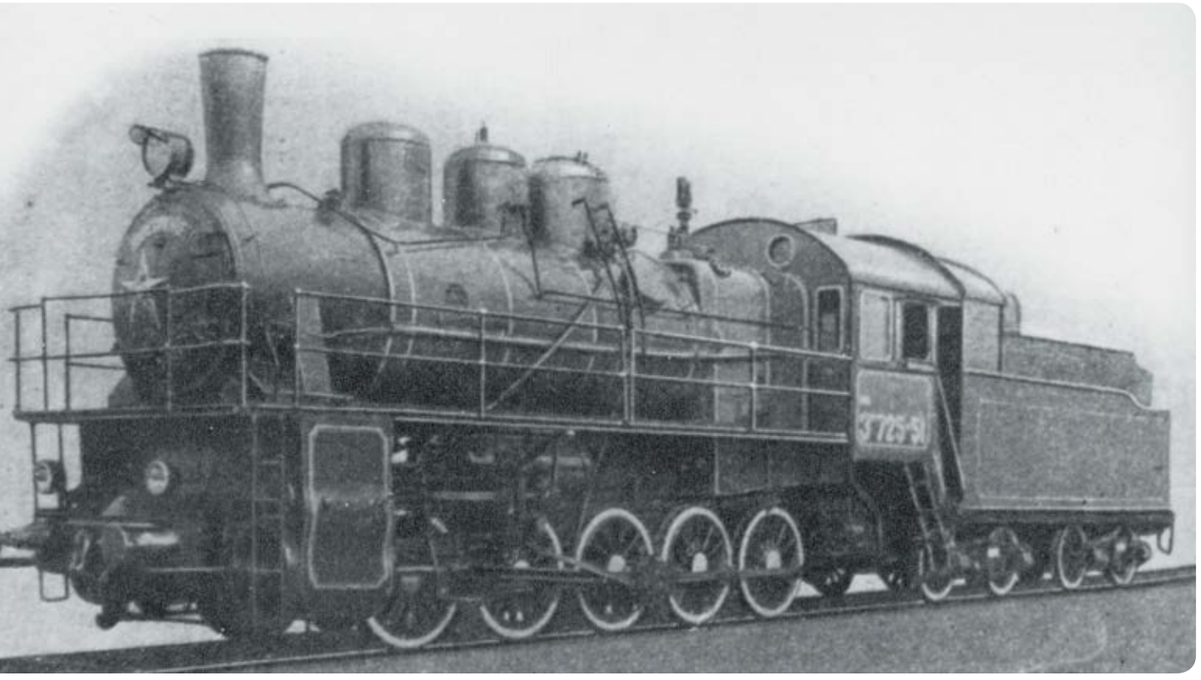
TRANSMASHHOLDING AT INNOTRANS 2016

We took an active part in the International Transport Technology and Logistics Exhibition InnoTrans 2016 held in Berlin from September 20 to 23, 2016. It is rightfully considered the world's largest sectoral exhibition, as practically all manufacturers of rolling stock for rail transport showcase their new designs and products there. Transmashholding has been an exhibitor at the Berlin forum for more than 10 years. This year, we have built a large exposition booth dedicated to the technical innovations and achievements of the past two years. Kirill Lipa, General Director, led the holding's delegation at InnoTrans 2016.

For information on the documents executed during the exhibition, please see Company News on p. 2

11,000 E

September 2016 marked the 100th anniversary of the commencement of construction of the most famous freight steam locomotive of the E series at the Bryansk Plant. This series of steam locomotives has been manufactured for 40 years with different indices, E, Eg, Esh, Eu, Em and Er, and has been the pivotal product of the enterprise. The plant was called the Bryansk Steam Locomotive Building Plant from 1943 to 1956.



The Eu steam locomotive

The history of the steam locomotive dates back to 1905, when the discussion on using the 0-5-0-type locomotives was continued in the preliminary design of the E-series steam locomotive. The design was developed by Mikhail Pravosudovich, Head of Motive-Power Department of the Vladikavkaz Railway, and Engineer Waclaw Lopuszynski, Head of Technical Bureau of the Department. They submitted the design with an explanatory note to the Ministry of Transportation for a critical decision on the permissibility of the 0-5-0 type. The preparation of the preliminary design and explanatory note was preceded by the analysis of the operation of the steam locomotives on the railways of Western Europe. Almost 300 steam locomotives of the type were operated on the Austrian railways. Therefore, the authors of the design stated in their note, "A steam locomotive with five coupled axles cannot be considered as some untested novelty."

According to the preliminary design, the 0-5-0 type steam locomotive designed for freight transportation was supposed to have a simple two-cylinder engine and Schmidt's two-revolution superheated element.

The rational design was performed by the Lugansk Steam Locomotive Building Plant that was part of Hartmann's Russian Society of Machine Building Plants. The enterprise showed a strong interest in the new type of steam locomotives; the first E-series steam locomotive was built for the Vladikavkaz Railway in Lugansk in 1912.

The Bryansk Plant also began manufacturing the 0-5-0 type E-series steam locomotives with a superheater and two-cylinder single-expansion engine in 1916. The locomotive had an adhesion weight of 81.2 t, wheel diameter of 1,320 mm, grate surface of 4.46 m2, steam pressure in the boiler of 12 kg/cm2 and design speed of 65 km/hour. Wheels on the third (driving) axle of the steam locomotive had no flanges, while the second and fifth axles had 22-mm plays.

A total of 1,528 E-series steam locomotives were built, including 119 locomotives built by the Bryansk Plant. They were operated at the Vladikavkaz, Ryazan-Urals, Northern Donetsk, Samara-Zlatoust and Southern Railways.

In 1925, the NKPS scientific research institute studied the operation of E-series steam locomotives and noted insufficient steam superheating. In the course of conversion performed at the Bryansk Plant, the four-tube two-revolution superheater was replaced with Sergey Chusov's six-tube single-revolution superheater. The number of boiler tubes was also increased from 25 to 32, while the number of flue tubes was reduced from 188 to 157. Surface type or mixing heating boiler for feed water, feeding cap and mud collector were installed. The production of the new-design E-series freight locomotives started in 1926 under the series name Eu (enforced). The average superheated steam temperature of the Eu series was 350 degrees as compared to 300 degrees on the E series.

A TOTAL OF 11,000 E-SERIES STEAM ENGINES WERE BUILT WITH DIFFERENT INDICES. THIS IS THE ONLY EXAMPLE IN THE INTERNATIONAL STEAM LOCOMOTIVE BUILDING PRACTICE

Changes in assemblies (superheated element and feed-water heater) introduced in Bryansk improved the cost efficiency of the steam locomotive.

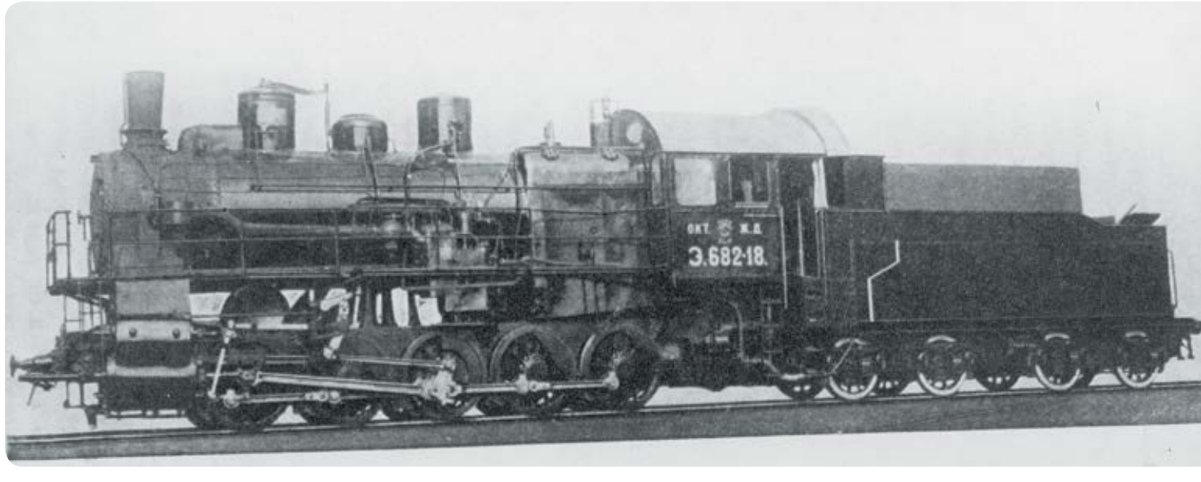
The plant manufactured the Em steam locomotive (modernized) in 1931-1935. Those locomotives had welded structures instead of cast or riveted ones, which made their production simpler and cheaper and their structures much lighter.

In the summer of 1933, the Scientific Research Institute for Reconstruction and Traction developed a detailed design of an elongated combustor for the Em series based on the proposal of engineer Ivan Pirin. The proposal had an objective to use simple and cheap means for increasing the locomotive capacity and obtain equal load distribution over bearing axles, as the lighter weight of the locomotive rear part frequently caused slipping. The new freight locomotive was assigned the Er series (reconstructed).

A total of 11,000 E-series steam engines were built with different indices. This is the only example in the international steam locomotive building practice.

Many years of operation proved that those were the best steam locomotives created before the revolution. Their manufacture was discontinued only in 1957.

Engineer Ivan Pirin



The 0-5-0 type, E-series freight steam locomotive manufactured in 1925-1927

- Transmashholding – No. 1 IN CIS COUNTRIES in rolling stock output and sales
- Transmashholding is ranked among THE WORLD'S TOP TEN MANUFACTURERS of railroad machinery
- Transmashholding – RUSSIA'S ONLY COMPANY, with experience in developing and manufacturing technical equipment for arctic conditions
- The technical equipment of Transmashholding is operated IN ALL CLIMATIC ZONES ON EARTH

TRANSMASHHOLDING

HOLDING'S PRODUCTS AND SERVICES:

- mainline and industrial electric locomotives;
- mainline and shunting diesel locomotives;
- freight and passenger cars;
- electric train and metro cars;
- road-rail buses and diesel trains;
- car casting;
- diesel locomotive and marine diesel engines;
- diesel generators and turbine-driven compressors;
- components for transport;
- spare parts;
- repairs and maintenance.

IN THE PAST FIVE YEARS, THE COMPANY HAS MANUFACTURED

over **3000** locomotives

more than **4000** passenger cars

more than **3000** electric train cars

over **230** cars of road-rail buses

more than **1500** metro cars

over **2700** diesels

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