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  The SU-76: from Mytishchi to Berlin
Penzadieselmash launches production of 1-PD4D diesels equipped with electronic fuel injection system (EFI).
The employment of the EFI system in the diesel design allows significant improvement of operating performance and reduction of fuel consumption by up to 7-8%. The new injection system’s efficiency has been monitored for two years.

The EFI-equipped diesel was installed in the TEM18DM diesel locomotive owned by Joint Stock Company Russian Railways. The operation of the diesel locomotive with the upgraded diesel was monitored by the design engineers of Penzadieselmash and JSC VNIIZhT. The 1-PD4D diesel is installed in TEM18DM shunting diesel locomotives, which are widely used both in rail transport and the production sector and are marketed both in Russia and abroad.

Smart Diesel

Production

Outlook

Special Cars by TVZ

TVZ has been licensed to manufacture new cars to transport inmates.
Tver Carriage Works (TVZ, a member of CJSC Transmashholding) has completed certification of passenger rail cars designed for transportation of individuals in legal custody, i.e. individuals with restrictions imposed by court in the form of imprisonment or punishment, entailing deprivation of liberty (remand detainees, convicted or sentenced felons). The new cars (the 61-4495 model) meet all the requirements set forth in the Customs Union Technical Regulations for Rolling Stock Safety. The 61-4495 model rolling stock for transportation of special escort squads is an innovation of TVZ designers based on the state-of-the-art 44th series of passenger cars. Its key distinct features as compared with earlier versions of this car type include a longer body made of antirust steel. This allowed changing the car interior layout and improving its ergonomics and environment, taking into account the requirements to special transportation organization. The car’s service life is 40+ years. For the first time ever, water and air decontamination systems and double-circuit air conditioning system are installed in a rail car.
Certification enables Tver Carriage Works to start series production.

New Director General

The Board of Directors of CJSC Transmashholding elects Kirill Lipa Director General of the company.
Andrey Andreyev is resigning as Director General of the company, which he has headed since 2008. Andrey Andreyev has received a letter of gratitude signed by Vladimir Yakunin, President of Joint Stock Company Russian Railways, emphasizing the important role of the holding’s leader in Russia’s rail transport development. "Under your guidance, cooperation between Russian Railways and Transmashholding was elevated to a totally new level. To a great extent, this was achieved due to your energy, lateral thinking, friendliness and ability to establish rapport with people”, reads the message from the President of RZD.

biography

Kirill Lipa was born in Moscow in 1971 and graduated from Moscow State Law University. He worked as Managing Director of the Department for Investment Banking Service of UniCredit Aton. Since December 2007, Kirill Lipa has been member of the Board of Directors of Transmashholding. In the past few years, he has also chaired boards of directors of TMH-Service, LLC and JSC Zheldorremmash, which are members of the locomotive maintenance holding managed by Locomotive Technologies.

Appointment

Smart Diesel

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On Thursday, President of RZD Vladimir Yakunin and Director General of Transmashholding Kirill Lipa signed an agreement on production and delivery (for RZD needs) of escort cars for special rolling stock – trains consisting of hopper-batchers and trains used to carry switch assemblies of heavy track machines.

The document was signed within the framework of the Tenth International Rail Business Forum 1520 Strategic Partnership held in Sochi. The agreement provides for cooperation between the two companies until 2020. The cars accompanying freight and service trains are manufactured by Tver Carriage Works. The first rolling stock of this type (the 61-4483 and 61-4484 models) was presented to the general public in 2011 at the EXPO 1520 international exhibition. The Russian rail industry ordered 47 cars that are to be manufactured in 2015 (a total of 133 in 2011–2015).

In a specialized escort car, railroad personnel are offered comfortable conditions for travel. The car features passenger compartments, shower with water heating system, bathroom, storage, clothes dryer, and workshop. Power is supplied from an on-board diesel generator unit, which allows the car to remain autonomous for 30 days.

Double-deck Seater Car

Tver Carriage Works launches new double-deck cars.

The innovative double-deck car with seats is a newcomer in the Russian rail industry. It has been manufactured under a contract with Federal Passenger Company signed in 2013. The 61-4492 car model is a new addition to the lineup of domestic double-deck rolling stock developed by TVZ and designated for operation at speeds up to 160 km/h. It is designed with employment of state-of-the-art technologies, equipment and materials, with domestic components used in car production accounting for more than 90%. A key feature of the new rolling stock in terms of its exterior is the reshaped sidewall and radial windows, which have never been used in domestic production of double-deck cars. The new exterior painting has considerably improved the overall look of the car. Cars with seats are offered in two options – with improved or standard interior. The car with improved interior features 60 passenger seats, including two seats in the passenger compartment. The car with standard interior is characterized by high occupancy – a total of 102 seats: 50 on the first floor and 52 on the second floor. In 2015, fifteen cars will be delivered to the customer (FPC) on a contract basis: 10 with standard interior and 5 with improved interior.
Prospects

Hand in Hand with RZD: Forward Motion

In 2008 RZD, JSC set the path for its scientific and technical development until 2015 (including locomotive building). Currently, most objectives (12 out of 15) have been attained by locomotive manufacturers.

The following tasks have been achieved: development of hybrid locomotives, enhancement of the coefficient of friction and increase in tyre resource. The objective of distributed traction control has been technically addressed, too. Currently, Transmashholding is ready to offer locomotives with the axle load of 27 tonnes.

Speaking of locomotive building prospects, one should rely on the areas delineated in the Strategy for Rail Transport Development in the Russian Federation Until 2030. According to the

**DEVELOPMENT CONCEPT FOR ELECTRIC LOCOMOTIVE**

- **2014**
  - **FREIGHT**
    - PHASE 1 — KEY EQUIPMENT
    - **2ES5**
  - **ELECTRIC LOCOMOTIVES**
    - **PASSENGER**
      - **ELECTRIC LOCOMOTIVES**
        - **EP20**

Sergei Kobzev, Technical Director at CJSC Transmashholding in 2014–2015. By the publication date of this issue, he left Transmashholding and was appointed head of Northern Railways.
document, by 2030 rail freight traffic will grow 1.7-fold; the speeds of freight trains will increase by 26%, and the weight of trains will reach 7,100–9,000 tonnes. These data are key to understanding the desired characteristics of the next generation of freight locomotives.

In the near term, Transmashholding will deliver new locomotives for trains weighing 7,100 tonnes to the Eastern Operational Domain and 9,000 tonnes to Kuzbass — Northwest, Kuzbass — South operational areas.

“Strategy for Rail Transport Development in the Russian Federation Until 2030” provides for high passenger carriage growth rates in the heaviest traffic areas, whereas the expected growth rate for total passenger flow by 2030 is 16.2–32.9%.

It is still uncertain which methods carriers intend to use for meeting their transportation objectives, namely: longer trains in terms of cars, higher speeds or a wider scope of utilization of double-deck cars. It is extremely important to specify these methods with the view of understanding prospects for passenger locomotive building.

Meanwhile, technical requirements to prospective locomotives are non-existent.

For example, the relatively young EP20 dual-system passenger electric locomotive was developed for towing 24-passenger car trains, but in reality it is used to tow 12-car trains and operates at less than 50% of its capacity.

VLADIMIR TUNIKOV, Deputy Technical Director of Transmashholding:
— Currently, all new locomotives are being developed in strict compliance with the Customs Union Technical Regulations for Rolling Stock Safety and its supporting standards. This offers Transmashholding new opportunities for promoting its products within and beyond the Customs Union.

PHASE 1 — KEY EQUIPMENT IMPORT SUBSTITUTION

PHASE 2 — DEVELOPMENT OF UNIFIED FAMILY OF ELECTRIC LOCOMOTIVES

TRANSMASHHOLDING SUCCEEDED WITH DEVELOPMENT OF A SUITE OF TECHNICAL SOLUTIONS BASED ON TRACTION DRIVE WITH ASYNCHRONOUS Traction MOTORS FOR BUILDING THE NEXT GENERATION OF PASSENGER AND FREIGHT ELECTRIC LOCOMOTIVES

building
Prospects

The Scythian freight electric locomotives with asynchronous traction motors have already proven their efficiency during operational tests. Practical tests have shown that traction force per one axle of such electric locomotive is virtually 1.5-fold higher as compared with electric locomotives equipped with commutator traction motors.

MORE EFFICIENT, MORE POWERFUL, MORE COST-EFFECTIVE

In the past few years, Transmashholding succeeded with development of a suite of technical solutions based on the traction drive with the asynchronous traction motor for building the next generation of passenger and freight electric locomotives.

Comparison between the features of commutator and asynchronous locomotives proves the advantages of the latter. For example, analysis of the axle load on the track shows that the 2ESSS electric locomotive developed on the basis of Russian elements slightly excels (by 4.3%) the 2ES5K electric locomotive. At the same time, it significantly outperforms the latter (by 49%) in rail tractive effort per one axle. As a result, the 2ES5S two-section electric locomotive is capable of substituting the 3ESSK three-section electric loco.

Relying on this experience, Transmashholding plans to develop a plethora of freight locomotives for heavy haul, namely: the 2ES4 and 2ES5S single-system locomotives and the 2ES20 dual-system two-section locomotive. All of them will be able to operate trains weighing up to 9,000 tonnes at slopes of up to thousandths.

For towing container trains, the company is planning to develop the ES20 single-section dual-system locomotive. It should be stated that the employment potential of dual-system freight electric locomotives with the asynchronous motor is still underestimated. Therefore, Transmashholding and RZD are considering the need for such locomotives with the view of the possibility to start their development and production.

Employment of the unified family of electric locomotives will allow the operator to increase train weight to 9,000 tonnes in lowlands.

DEVELOPMENT CONCEPT FOR DIESEL LOCOMOTIVE BUILDING

<table>
<thead>
<tr>
<th>MAINLINE DIESEL LOCOMOTIVES</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
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<tbody>
<tr>
<td>2TE25A</td>
<td></td>
<td></td>
<td>2TE30K</td>
<td></td>
<td>2TE25AU</td>
</tr>
<tr>
<td>2TE25KM</td>
<td></td>
<td></td>
<td>3TE25KM</td>
<td></td>
<td>2TE25KU</td>
</tr>
<tr>
<td>TEP70BS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TEP35</td>
</tr>
<tr>
<td>SHUNTING DIESEL LOCOMOTIVES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TE18DM</td>
<td></td>
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<tr>
<td>TEM19</td>
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<td>TEM23</td>
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<tr>
<td>TEM28</td>
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DEVELOPMENT CONCEPT FOR DIESEL LOCOMOTIVE BUILDING

2014 2015 2016 2017 2018

MAINLINE DIESEL LOCOMOTIVES

2TE25A 2TE30K 2TE25AU

2TE25KM 3TE25KM 2TE25KU

TEP70BS TEP35

SHUNTING DIESEL LOCOMOTIVES

TE18DM TEM19 TEM23 TEM28
Operating costs will decrease significantly due to reduced power and sand consumption. An increase in service interval mileage and overhaul life, in its turn, will raise the locomotive’s utilization rate. Additionally, the unification of components will considerably improve the electric locomotive’s maintenance conditions.

A PATH TOWARDS IMPORT SUBSTITUTION
The challenging economic situation of the recent period has been one of the major stimuli fostering search for the most optimal and acceptable technical solutions in modern locomotives with the asynchronous traction motor.

Specifically, it was decided to upgrade the structure of the 2ES5 electric locomotive without undermining its traction properties, reliability and safety. This will make the locomotive more affordable to customers.

Traction motors, bogies, electric power equipment, sanitary module, driver’s cabin and other equipment will be replaced with their domestic counterparts.

It should be stated that Transmashholding will remain committed to the principles of the basic platform; the unification of models even under the existing conditions will exceed 80%. The underframe, braking equipment, control and safety systems will be the same irrespective of the model.

DIESEL LOCOMOTIVES OF TOMORROW
Transmashholding will keep adhering to the platforming principles in the diesel locomotive building as well. The 2TE25A diesel locomotive is a pioneer of the next generation of freight locomotives. The experience in operating these machines allowed devising optimal proposals for further development of the model lineup. Specifically, this year BMZ has built the 2TE25KM – the first domestic freight diesel locomotive meeting the requirements set forth in the Customs Union Technical Regulations. There are plans to build a gamut of locomotives with the commutator traction motor on the basis of 2TE25KM.

The main plans of Transmashholding for development of the diesel locomotive building are related to the next generation of diesels under the Federal Target Program “National Technological Base.” From the standpoint of technical characteristics, they are equal to state-of-the-art foreign models. As soon as the company launches production of D300 and D500 diesels, it will start equipping future locomotives with these motors.

Transmashholding proposes development of a diesel locomotive with 2TE30K eight-axle sections to operate heavy-tonnage trains on steep-grade railroads. It will be equipped with new high-capacity diesel generators on the basis of the D500 power supply unit. Development and testing of its underframe may be followed by development of the 2TE30A diesel locomotive with an asynchronous traction motor.

The lineup of shunting locomotives, with the TEM18DM diesel locomotive as its core element, will incorporate the TEM23 four-wheel locomotive. The TEM18DM locomotive will be upgraded in compliance with the requirements set forth in the Technical Regulations. In the future, these locomotives will be equipped with D200 state-of-the-art diesels.

The unified six-axle platform of shunting diesel locomotives will serve as a basis for building locomotives with a gas reciprocating engine as well as dual-diesel and hybrid diesel locomotives.
The past 20 years have not been the best period in the history of Russia’s iron and steel industry. Reasons include strong competition with Western manufacturers as well as Chinese industrialists (which have accumulated enormous steel production capacity of some 830 million tonnes).

A BURDENSOME HERITAGE
The industry has been suffering from almost total long-term lack of investments in production development and maintenance and the resulting employment of obsolete technologies and rundown equipment. The rolled product manufacturing sector keeps afloat in the current situation, whereas the casting production sector has been fully exposed to all challenges of recent years.

In the USSR, casting production development followed two paths. One path consisted in construction of large specialized foundries, which provided machine-building enterprises or the industry in general with casting products. The other path involved construction of foundry shops within machine-building enterprises. In the latter case, during the formation of corporations and holding companies, casting production was perceived as an auxiliary activity and, accordingly, received funding when funds became available. Naturally, due to the absence of production development during that period, the existing casting production technologies have not evolved since the 1950s and band aid approach is unable to improve the situation as such. Considerable capital investments are required to solve the problem fundamentally. However, since the payback period in casting production businesses is fairly long, their owners are reluctant to incur costs and would rather invest solely in production preservation and critical local upgrades. The only exception is specialized foundries. They have several parallel process chains and therefore can upgrade their full process cycle gradually, without significant non-recurring capital investments and suspension of production.

Earlier, Transmashholding production facilities were in a similar situation. Before
TMH CENTERS OF EXCELLENCE

Center of excellence in steel casting for rail car and locomotive building at BSW

Center of excellence in steel casting for electrical machinery production at Novocherkassk Electric Locomotive Plant

Center of excellence in light iron casting and casting for braking equipment at Liteinoye Proizvodstvo, LLC (Tver Carriage Works)
casting production business was launched by the company, it existed at almost every facility but was extremely inadequate due to the above reasons. Partial upgrading was performed locally. The only exception is complete modernization of foundry shop 3 at Bezhitasa Steel Works without production suspension and output reduction, which will result in additional capacity for producing 75 thousand tonnes of car casting per year. Currently, modernization is undergoing its final phase.

**NEW WAY OF CASTING**
Restructuring concepts for steel casting and iron casting production have been developed with the view of optimization of Transmashholding’s casting production. They provide for more efficient utilization of the existing facilities, implementation of state-of-the-art technologies, development of intra-holding and external cooperation, and establishment of centers of excellence by casting types. Restructuring is aimed at reducing production costs and improving product quality, as well as offering the possibility of more flexible management of the holding’s casting production. Additionally, restructuring includes efforts under the import substitution program that focus on the key components of diesel locomotive building. Currently, the concept is undergoing an implementation phase.

Activities include creation of a center of excellence in steel casting for rail car and locomotive building at BSW and development of the casting section with employment of the “foscon” process (cold hardening mixtures) within foundry shop 2. This technology allows producing more accurate molds with lower mechanical processing tolerances, thus significantly increasing metal utilization rate and decreasing labor-intensive subsequent mechanical processing. This allowed launching small-batch casting production for the holding’s production facilities without the existing casting conveyers designated for medium and large batches and utilizing an obsolete technology of casting in sand clay forms and molding by jarring machines.

A center of excellence in steel casting for electrical machinery production was created at Novocherkassk Electric Locomotive Plant. Production upgrading has been accompanied by the launch of molding in cold hardening mixtures for large- and medium-size castings, including the castings of the traction motor framework. The innovation allowed significant (manifold) reduction of the number of defects, improvement of production culture and reduction of production costs. During 2016–2017, efforts will be aimed at switching over to cold hardening mixtures and demolishing the old mixing shop. This will free up production space and improve the overall environmental situation, which is especially important.

A center of excellence in light iron casting and casting for braking equipment was created at Liteinoye Proizvodstvo, LLC (Tver Carriage Works). To that end, state-of-the-art bar-type, shot-processing and melting equipment has been installed. Partial modernization allowed expanding the lineup by adding castings made of high-strength cast iron.

**OPTING FOR IN-HOUSE PRODUCTION**
It should be emphasized that the concepts of iron casting production restructuring and the import substitution program overlap with regard to diesel locomotive building. A critical objective associated with arranging diesel production is the availability of key components. These include slip cast block of cylinders, cover and cylinder liner. Currently, fine-tuned production of cast V-shaped cylinder blocks of a required standard size is not available at the holding’s production facilities in particular and in Russia in general. Some time ago, the Kolomna plant, a manufacturer of these blocks, developed slip cast block technology. The technology consists in section-by-section block manufacturing, i.e. the so-called stands – segments of cylinder blocks — are cast from steel at the initial stage. Casting is followed by mechanical processing. At the next stage, a weld-fabricated blank of the block is molded from machined stands with utilization of a unique resistance welding machine and then processed thermally and mechanically. The technology is very labor-intensive and costly. In addition, “stand” casting as such is very non-technological, difficult to carry out and has a very high rework rate at the initial stage of mechanical processing. Rework
after preliminary mechanical processing can increase the labor-intensity of casting up to 15%. The domestic and international markets of large-size iron casting were thoroughly studied for the purpose of abandoning this labor-intensive technology. A number of potential suppliers that satisfy quality and cost parameters were found. Currently, the plant purchases cast and mechanically processed serial blocks of cylinders abroad. Cylinder covers and bushings are partially supplied from abroad due to the lack of domestic production capacity and casting quality issues. However, the existing economic and political situation gives reasons to doubt the feasibility of this approach. Drastic EUR rate growth significantly increased the cost of end products; the holding’s specialists were forced to look for other solutions in order to ensure competitiveness on the market.

Currently, Transmashholding is implementing a program aimed at creating a new lineup of diesels. Diesel locomotive enterprises of the holding participate in the program. The new lineup of diesels is designated for a one-piece casting block made of high-strength cast iron. The objective of complete abandonment of import supplies of cast blocks, covers and cylinder liners was attained through the project for rehabilitation of iron casting production at KZ, JSC. The project calls for a new iron-casting shop with a capacity of up to 15 thousand tonnes per year and will allow producing up to 1,200 blocks, 2,000 covers and 2,000 liners per year and manufacturing large- and medium-size iron castings for the holding’s production facilities, including key diesel components for PenzaDieselmash. The project’s implementation provides for significant reduction of the cost of end products due to abandonment of import supplies, lower rework rate, shorter production cycle, staff reduction, and reduced costs associated with energy resources and equipment operation. For example, new shop costs will be reduced more than six-fold.

The restructuring of casting production will allow enhancing its efficiency and will fully conform to the objective of making the holding’s products more competitive in the domestic and international markets.
he diesel locomotive presentation was hosted by Bryansk Machine Building Plant. The event was attended by President of RZD Vladimir Yakunin and Director General of Transmashholding Kirill Lipa. The heads of both companies noted the advantages of the new machine, the new project’s implementation time frame and the quality of work performed.

**FAST IN ANY WEATHER**
The 2TE25KM diesel locomotive is unique in many respects. For instance, for the first time in its history, Bryansk Machine Building Plant devised design engineering and process documents on a very tight schedule and built the diesel locomotive in only 70 days! Currently, it is the first domestic diesel locomotive certified as compliant with the Customs Union Technical Regulations. The diesel locomotive is manufactured under the import substitution program; 90% of its components are of domestic origin. Large-batch production of mainline freight diesel locomotives is launched in Russia for the first time ever.

The 2TE25KM freight diesel locomotive compares favorably with currently operated machines (both in Russia and abroad) in terms of its quality-price ratio. Even though relatively inexpensive, the diesel locomotive boasts excellent technical capabilities.

The 2TE25KM is a freight two-section diesel-electric switcher with axle-by-axle traction control designated to operate freight trains on the railroads of RZD, JSC in areas with moderate climate and temperatures of +40 to –50 Celsius. The following power unit is installed in the diesel locomotive: the 18-9DG diesel generator manufactured by the Kolomna plant, i.e. the 16-cylinder diesel generator with
Diesel Locomotive in 70 Days

OLEG KRAVCHENKO, Director of the engineering center of BMZ MC, CJSC:

— The 2TE25KM is a multi-purpose machine. It can be used in any conditions and is like a workhorse that will allow RZD to operate it in Bryansk, Yelets, Yershovo and Krasnodar with maximum efficiency. Currently, the 2TE25KM is the most advanced domestic diesel locomotive designed with utilization of the best technical solutions. Its advantages include microprocessor control system, which allows delivering the highest traction force possible for this type of machines. A key advantage of the system is that it allows the driver to be fully focused on operating the train. He has to set required traction parameters, and the system will select the necessary load on the diesel generator and traction machines and control the operation of the compressor, the cooling system and the remaining auxiliary equipment of the diesel locomotive.

EQUIPPED TO A HIGH STANDARD

As compared with the locomotives currently in use, the new diesel locomotive allows increasing the weight of operated freight trains by 20% or more and significantly reducing operating expenses, which results in lower...
KIRILL LIPA, Director general of Transmashholding:

"We can manufacture impressive technical equipment. This is possible due to the efforts and the confidence in us on the part of our partner — RZD's management — and the drivers that operate it."

WITH THE NEW DIESEL LOCOMOTIVE THE WEIGHT OF OPERATED FREIGHT TRAINS GOES UP BY 20% AND OPERATING EXPENSES ARE REDUCED SIGNIFICANTLY.
The diesel locomotive is equipped with multicyclone filters with enhanced purification in diesel refrigerating systems of electric traction machines and air intake, which has positive impact on the reliability of these assemblies and, as a result, the reliability of the diesel locomotive itself.

Additionally, it should be noted that the advantages of the diesel locomotive include the layout solutions in the design of the high-voltage cabinet built as a single module, which will have positive impact on the diesel locomotive maintenance.

Design engineers focused on the working conditions for the locomotive crew. The driver’s cabin meets all modern safety and comfort requirements: it has a passive safety system designed to protect the locomotive crew in case of emergency collision; it features an air conditioning system and an autonomous space heater; new noise-proof and vibration reducing materials have been utilized. The ergonomics of the driver’s cabin and the diesel locomotive in general has been improved.

Key advantages of the diesel locomotive include easy and convenient maintenance due to the easy accessibility and maintainability of its principal assemblies. Switch over to the new locomotives will allow reducing maintenance and repair costs associated with the diesel locomotive fleet.

As BMZ is currently launching the production of mainline diesel locomotives, its short-term plans include the development of diesel locomotives of various (single- and three-section) models on the basis of the 2TE25KM with unified key assemblies and systems.

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**Technical characteristics**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diesel locomotive capacity, KWh</td>
<td>2 × 2650</td>
</tr>
<tr>
<td>Service weight (at 2/3 of fuel and sand reserves), tonnes</td>
<td>2 × 144 ± 3%</td>
</tr>
<tr>
<td>Static load of wheel set on track, kN (tonne-force)</td>
<td>235.4 (24.0)</td>
</tr>
<tr>
<td>Wheel arrangement</td>
<td>2 × (30 — 30)</td>
</tr>
<tr>
<td>Rail tractive effort, kN (tonne-force)</td>
<td></td>
</tr>
<tr>
<td>– design maximum traction force at starting</td>
<td>2 × 419</td>
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<tr>
<td></td>
<td>(2 × 42.77)</td>
</tr>
<tr>
<td>– at continuous rating</td>
<td>2 × 323.6</td>
</tr>
<tr>
<td></td>
<td>(2 × 33)</td>
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<tr>
<td>Speed, km/h</td>
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</tr>
<tr>
<td>– design speed</td>
<td>100</td>
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<tr>
<td>– speed at continuous rating</td>
<td>23.6</td>
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<tr>
<td>Servicing stocks, kg</td>
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</tr>
<tr>
<td>– fuel</td>
<td>2 × 7000</td>
</tr>
<tr>
<td>– sand</td>
<td>2 × 1520</td>
</tr>
</tbody>
</table>

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*VLADIMIR YAKUNIN, President of Russian railways:*

— The fact that now Bryansk Machine Building Plant is manufacturing these machines is very important to Russia. RZD and Transmashholding have been reliable partners since long ago. Russians value friendship, comradeship, and partnership. Naturally, they value good, reliable and responsible work.

I am confident that the new diesel locomotive will be the main machine operated on railroads.
OKTYABRSKY ELECTRIC RAILWAY CAR REPAIR PLANT, JSC (OEVZRZ) IS SUCCESSFULLY IMPLEMENTING THE PROGRAM FOR OVERHAUL OF ROAD-RAIL BUSES. THE ENTERPRISE HAS ALREADY RESTORED TWO BUSES AND IS NOT GOING TO REST ON ITS LAURELS.
EVRZ (a member of TMH) is one of the largest enterprises in St. Petersburg and will turn 190 in 2016. In the past few years, the plant has implemented a large-scale development program, including the upgrading of its production complex and launching of new business lines — construction of metro cars and construction and repairs of urban electric transport.

On December 26, 2014, OEVRZ successfully completed its efforts on the overhaul of two road-rail buses—rolling stock for suburban and local rail service (RA-1 and RA-2) manufactured by Metrowagonmash, JSC and delivered it to the customer — RZD. Road-rail buses are designed to transport passengers along non-electrified sections of railroads and may be used for urban, suburban and interregional service.

The road-rail buses manufactured in 2007 have undergone the first phase of their scheduled overhaul at OEVRZ, which involved bus painting in RZD corporate colors, replacement of running gear parts, and full interior restoration accompanied by partial replacement of the interior parts, passenger seat covers, and fillers. The utilized solutions allow improving the aesthetic qualities of the car and its ergonomic and operational characteristics due to utilization of energy-efficient LED lamps, seat covers resistant to mechanical damage and dirt, and state-of-the-art linoleum.

The work performed by the plant’s specialists includes painting with state-of-the-art wear-proof paints and lacquers, whose surface is resistant to the so-called graffiti – unauthorized inscriptions and advertisements. The floor inside the compartment was renovated; state-of-the-art comfortable seats were installed. Energy-efficient technologies were utilized – fluorescent bus lights were replaced with LED lamps.

The repaired RA-1 and RA-2 will be operated on Oktyabskaya Railways. The pilot project for road-rail buses overhaul allowed the

OEVRZ, JSC IS A STATE-OF-THE-ART, HIGH-TECH ENTERPRISE SPECIALIZING IN MANUFACTURING AND OVERHAUL OF METRO CARS, TRAM CARS, AND COMPLEX TYPES OF ROLLING STOCK REPAIRS
When implementing the project for overhaul of its RA-1 and RA-2 road-rail buses, OEVRZ successfully achieved a number of engineering objectives related to the structural characteristics of this type of rolling stock. The plant prepared a set of technical activities aimed at repairing the underframe, electrical equipment, pneumatic equipment and other parts and assemblies of the road-rail bus. The road-rail bus overhaul was followed by startup and commissioning operations. The project has proven to be beneficial for cooperation between OEVRZ, JSC, DMZ, JSC and a few other companies'.
plant’s specialists to master new competences, namely, to perform maintenance operations related to diesel engines installed in the buses.

Successful fulfillment of the first order for road-rail buses overhaul allowed the enterprise to expand its railroad equipment maintenance capabilities.

Consequently, the enterprise is successfully implementing its concept for product lineup diversification, which allows providing it with necessary output volumes and maintaining a high professional level of its employees in the context of the unstable domestic and global economic situation.

For reference

RA-1 is road-rail bus type 1. It has cabins at both car ends; no turning is required. Furthermore, it can be operated both as a single-section and 2-3-section bus. The model features two exits on both sides at the end of the car, exit for high platforms and extendable step for descending to low platform. Sliding doors open automatically. It features 78 seats; its maximum occupancy is 160 people. Unladen weight is 37 tonnes; full weight is 48 tonnes. Hydraulic retarder and compressed air brakes. Primary suspension with cylindrical springs and absorbers, secondary suspension with pneumatic springs and absorbers. All-metal body made of corrosion-resistant steel. Design speed is 120 km/h.

RA-2 is road-rail bus type 2. RA-2 is designated for passenger carriage along non-electrified railroad tracks with intense passenger flows, as well as for suburban and interregional service. It is a train set. It consists of two head cars and one engineless trailer car (HC + ETC + HC). Control system allows joint operation of one or two three-car road-rail buses at a time. The road-rail bus has an all-metal body made of stainless steel with heat insulation. Vestibules feature individually-controlled plug doors. Adjustable foot rest allows passengers to board the train from low platforms. Head cars feature one exit in the middle. Trailer cars feature two exits at both ends. Three-car road-rail bus has 222 seats; its total occupancy is 600 people.
In many respects, their quality (steel grade, processing accuracy) affects the reliability of machines. In most cases, the magnitude of rolling friction is much lower compared with sliding friction, other things equal; therefore, rolling is common for moving machinery. The advantages of rolling axle bearings over sliding axle bearings are unquestionable.

New foreign locomotives increasingly feature rolling axle bearings. Their utilization allows performing phase 2 of locomotive maintenance after at least 10–12 days instead of 3–4. It is for the application of axle lubricant to sliding axle bearings.

Disadvantages of sliding axle bearings:

- considerable amount of damages due to unsatisfactory lubricant feed to the working area;
- high consumption of traction motor lubricant due to the impossibility of reliable sealing of axle bearings;
- discharge of traction motor lubricant into the environment; 50-60% of lubricants stay in the side ditches of locomotive depots and on tracks;
- reduction of the service life of gear wheels and motor-armature bearings of the traction motor due to quick wear of the brass bushings of sliding axle bearings;
- high consumption of non-ferrous metals (brass).
ELECTRIC LOCOMOTIVE RELIABILITY AND MOTION SAFETY, TO A CONSIDERABLE EXTENT, ARE AFFECTED BY UNINTERRUPTIBLE OPERATION OF THE UNDERFRAME, PRIMARILY THE ENTIRE WHEEL AND MOTOR UNIT (WMU). AN AXLE BEARING (AB) IS A CRITICAL PART OF WMU MOUNTING ASSEMBLIES.
axle bearings that 90% of the electric locomotives fleet require phase 2 of maintenance so frequently.

The design life of the rolling axle bearing is at least 5 million km of distance traveled by a locomotive. The installation of wheel and motor units with the rolling axle bearing makes the electric locomotive more costly. However, payback is achieved due to the following factors:

- removal of axle oils from WMU maintenance and repair process and elimination of the need for their seasonal replacement;
- reduction of costs associated with maintenance and routine repairs of WMUs with a rolling axle bearing;
- enhancement of reliability and extension of service life of traction gears and traction motors due to the lack of misalignment caused by wear of brass bushings in sliding axle bearings;
- extension of the wheel set service life due to eliminated wear of axle necks underneath sliding axle bearings;
- no charge for environmental pollution due to the elimination of axle oil discharges on the track superstructure;
- improvement of cost efficiency of the electric locomotive – increased utilization rate with regard to power for machine rimpull and capacity efficiency enhanced due to the reduction of the principal resistance to locomotive motion.

RELIABLE AXLE BEARING
Utilization of rolling bearings in locomotives has a very good economic effect for RZD.

The plant in collaboration with VEINII has made repeated attempts to use rolling bearings in the wheel and motor unit (WMU) structure. Specifically, in the following electric locomotives:

- VL80K No. 552, 541, 551, 617 with utilization of two spherical double-row bearings;
- VL80K No. 10 with traction motor NB 418R relying on the axle through cylindrical roller bearings;
- VL85 No. 223, which was operated in Vkhorevka Depot of the East Siberian Railways from 1991 to 1994 and traveled 307,790 km.

However, for a number of reasons related to structural and technological characteristics, all pilot electric locomotives were not put into operation. WMUs were subsequently replaced with sliding axle bearings. These solutions were not used in mass production.

In May 2006, with the view of mastering the structure of the running gear of the electric locomotive with the rolling axle bearing, RZD approved the Schedule of Development and Implementation of the Running Gear Structure with Traction Motors of the 2ES5K Electric Locomotive Mounted on Rolling Axle Bearings. In order to fulfill it, NEVZ manufactured a pilot electric locomotive – 3ES5K No. 020 with a rolling axle bearing, which underwent prior commissioning and certification tests.

In March 2008, an acceptance commission was set up; as a result, letter O1 was assigned to the design documents. This was followed by the obtaining of a conformity certificate for the pilot batch consisting of 15 pieces.

The 3ES5K No. 20 electric locomotive was delivered to RZD for operational tests at the Smolyaninovo locomotive test.
Depot of Far Eastern Railways. After the electric locomotive traveled 102,000 km, the inspection performed as part of the commissioning in May 2009 revealed defects of rolling axle bearings, which resulted in its discontinuation.

NEVZ undertook a number of measures for the purpose of reducing the downtime of the 3ES5K No. 20 electric locomotive. 3ES5K No. 20 was equipped with six serial bogies with sliding axle bearings and Flexicoil springs. After restoration, this electric locomotive was kept for operation at the Smolyaninovo depot. All wheel and motor units with rolling axle bearings from 3ES5K No. 20 electric locomotive were delivered back to NEVZ.

In parallel, work was performed to ensure reliable operation of the rolling axle bearing unit. When a meeting of STC (Scientific and Technical Council) of NEVZ was held, its participants agreed to manufacture the 3ES5K pilot electric locomotive with employment of the roller spherical double-row bearings by FAG Schaeffler, Germany, installed with one floating support. It was decided to devise design documents with due consideration for positive experience in operating the VL60 No. 608 electric locomotive featuring the rolling axle bearing, which had traveled more than 1 million km.

In early 2012, relying on the design documents developed by VEINII, NEVZ manufactured the 3ES5K No. 250 electric locomotive with the rolling axle bearing and put it into pilot operation in January 2012 at the Khabarovsk locomotive depot of Far Eastern Railways. The results of the pilot operation and subsequent three-year monitoring of the technical condition of the rolling axle bearing showed that the customer’s costs during maintenance and operation were reduced by approximately 10%.

The period from 2012 to 2015 saw manufacturing of the pilot batch of fifteen 3ES5K locomotives and three 4ES5K electric locomotives featuring WMUs with the rolling axle bearing. Positive feedback was received as a result of their operation at Khabarovsk, Vikhorevka and Smolyaninovo locomotive depots.

In accordance with paragraph 2.3.6 of the “Activities Aimed at Improving the Structure of Electric Locomotives Manufactured by PK NEVZ, LLC for 2014–2015” approved by the customer (RZD, JSC), since April 1, 2015, NEVZ has manufactured all electric locomotives — 2 (3, 4) ESSK and 3ES4K — with the rolling axle bearing. In 2015, NEVZ will produce forty 3ES5K electric locomotives and twenty-nine 3ES4K electric locomotives with the rolling axle bearing.
The SU-76: from Mytishchi to Berlin

Today, the SU-76 self-propelled gun can be seen mounted on the stone pedestal in front of the office building of Metrowagonmash, JSC. It symbolizes the efforts of the workers, engineers and others who forged the victory on the home front during the Great Patriotic War by supplying military vehicles to the frontline.

On October 23, 1942, the People’s Commissariat (“Narkomat”) of the Tank Industry ordered that self-propelled guns be manufactured on the basis of all available tanks with different types of artillery and assimilated on a very tight schedule. The production of military vehicles at Mytishchi Carriage Works is believed to date back to 1943, when an order was issued to organize mass production of the lightweight tank (weight category: T-80) invented before the war at Gorky Automobile Plant. Simultaneously, the plant launched mass (military, special) production and established a special design office (SDO-40) headed by the famous and talented design engineer of lightweight military track-type vehicles – Nikolai Alexandrovich Astrov.
morning until late at night, often sleeping at their workplaces. Individual workers and whole teams competed with each other. Assignments were fulfilled with honor!

Since 1944, the plant consistently increased its output of military vehicles, primarily the SU-76. In January, its output was 50% higher than in December 1943: the plant was ranked third in the competition. In February, the number of military vehicles that rolled off the production line was 30% higher against January. Many reliable military vehicles were required to defeat the fascist army.

In March, the plant’s personnel exceeded their assignment by 25% as compared with February. The enterprise was ranked first and awarded the challenge red banner of the State Defense Committee of the USSR. Every month, the plant was given a more challenging assignment than in the previous month. High awards were bestowed on many workers for regular provision of military vehicles to the frontline.

SOLDIER’S FAVORITE
The SU-76 maneuvering small-size self-propelled guns made by the machine builders of the Mytishchi plant heroically made their way from the Battle of Kursk to Berlin. Marshal Rokossovsky wrote in his memoirs, “Soldiers were especially enthusiastic about the SU-76 self-propelled guns. These lightweight moving vehicles were always fast enough to come to aid to the infantry; and soldiers, in their turn, were eager to protect them against the fire of hostile anti-tank riflemen with their own chests.”

The basis for the SPG was the running gear of the T-70, a tank that was already being manufactured. The motor system consisted of two 6-cylinder car engines for the GAZ-202 with a total capacity of 140 h.p.

The universal division cannon (ZIS-3) was installed on the armored vehicle. From 5,000 m away, its shell could penetrate up to 91 mm thick armor that is any place on the body of average German tanks. The gun featured ammunition consisting of 60 high-explosive fragmentation and piercing shells, as well as the DT portable machine gun for self-defense. Armor protection shielded the crew (four people) against small arms fire, high-density fragments, and machine-gun battery. All SU-76Ms were equipped with radio stations.

On the road, the maximum vehicle speed was 45 km/h; off-road, up to 25 km/h. Endurance distance is 320 km and 190 km, respectively. The self-propelled gun could overcome a 2 m-wide trench, 30° elevation, 0.9 m deep ford. Due to its small dimensions and low average per-unit ground pressure the vehicle was able to successfully cross marshy and forested terrain, accompanying infantry in places where medium tanks and other self-propelled machinery were unable to move. The well-designed cooling system and faultless starting preheater allowed the SU-76M to be operated successfully in any season along the entire frontline.

AT AN ACCELERATED PACE
Pursuant to the resolution of the State Defense Committee of the USSR dated December 17, 1942, the plant was renamed into Works No. 40. In July 1943, the plant was ordered to produce SU-76 self-propelled guns. As soon as practical, it had to ensure that the manufacturing of vehicles was in place, specifically to install new equipment in the assembly shop, organize training for workers, equip workplaces, prepare technical documents, develop processes, and design an array of fittings, stamps, instruments, and tools.

For almost one month, the engineering team was “confined to barracks” working from early in the morning until late at night, often sleeping at their workplaces. Individual workers and whole teams competed with each other. Assignments were fulfilled with honor!

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**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

**HOLDING’S PRODUCTS AND SERVICES:**

- EG2Tv electric train TVER

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