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BMZ is conducting tests of Russia’s first hybrid diesel locomotive page 14
Famous companies will create a joint venture for diesel engine production

The major rolling stock manufacturer in Russia, CJSC Transmashholding, and the German machine building concern, Tognum, have reached an agreement on the establishment of a joint venture that will manufacture diesel engines in Kolomna, a city in the Moscow region.

Transmashholding president, Andrey Bokarev, and Tognum Chairman of the Board, Joachim Coers, signed the agreement during the Economic Forum in Saint Petersburg.

It is expected that the new enterprise will produce up to 1,000 diesel engines of various application per year. They plan to put into place production, test work, and engine painting as well as after-sale service. Moreover, Transmashholding and Tognum will establish a joint engineering center for diesel engine development.

The partners are intent upon finishing the project documentation development needed for the construction of the enterprise before November 1, 2013, and starting the production output before December, 2015.

Required investment of funds for the project is estimated at about 80 million.

Implementation

System approach

This manufacturing system increases the enterprises’ operational efficiency by 15%, according to information released to the public during a conference that took place on April 2 at the Demikhovo machine building plant (DMZ makes up a part of CJSC Transmashholding).

The information on the top priorities set for the manufacturing system for 2013, and on results of the implementation of this system at the Holding’s enterprises was presented in the course of the conference.

At present the focus is on overall tools that allow increasing the operational efficiency: the reference line, the logistic and supply tools, the KPI-oriented work. Currently, the top priority of the project is the development of the pilot workshops (there are no less than 120 of them appearing every year) and the engagement of all of the staff at all enterprises of the Holding.

It is expected that 75% of the factories’ production area will be covered by pilot workshops in 2013, and that the implementation of the manufacturing system will be finished by 2014. The manufacturing system implementation program proposes education of the personnel and improvement of working conditions. At this point, more than 26 thousand people — workers, engineers, managers — have completed the training courses.

Something new

Luhanskteplovoz has presented the 3TE116U

Luhansk Locomotive works (Luhanskteplovoz makes up a part of CJSC Transmashholding) has presented the mainline diesel freight locomotive 3TE116U.

The new locomotive was created based on the diesel-electric locomotive 2TE116U that is produced in lots at Luhanskteplovoz. What is its main difference? In the first place, it has a booster (middle) section that features, instead of the control cabinet, an adapter section with a control unit for load test performance and shunting on engine roads. Furthermore, in addition to the control unit, the middle section is equipped with a sanitary and hygiene unit and a heating and ventilating machine. Because of the independent middle section, the diesel-electric locomotive can operate in two-section mode under the condition that the section that has the conductor’s cabin is the master section.

Reference

The 3TE116U can drive rolling stock up to 9,420 tons (as opposed to the 6,280 tons that can be driven by the 2TE116U).

It is expected that the diesel-electric locomotive 3TE116U, which can drive heavy trains, will be exploited mostly in territories with rugged topography. Putting the new locomotives into operation will reduce the use of double twin-unit diesel locomotives, which in turn will reduce pool maintenance costs and allow for outdated locomotives to be removed from service.
CJSC Transmashholding, OJSC Russian Railways, and Alstom have signed an agreement on the development of the double-system mainline electric freight locomotive 2ES20 with asynchronous driving motors.

The new locomotive will be able to operate under direct current (3 kW) as well as under alternating current (25 kW). Putting this kind of equipment into use will allow a significant reduction in the duration of stays at stations where the kind of current is changed, and will reduce the costs on pool maintenance and locomotive change.

In accordance with the agreement signed, a joint working group will be created that will develop and negotiate the approval of the technical requirements for the electric 2ES20 locomotive. It is expected that design engineering for the electric locomotive will be finished by September, 2013, and that in March, 2014, the first locomotive will be ready, and the test performance will start. 2ES20 locomotive deliveries for the use of OJSC RZD will start in December, 2014.

“The double-system electric freight locomotive is a modern and new machine for our national industry,” declared Andrey Bokarev, the Transmashholding president. “The use of this kind of equipment will allow us to significantly reduce the freight time on the important sections of the railroad system. We expect that the appearance of the double-system electric freight locomotives in our network will allow for the significant increase in the operational performance of railroad transportation.”

“This is the third project connected to locomotives that we have implemented in Russia due to the effective co-operation with our partner, Transmashholding,” noted Alstom Transport president Henri Poupart-Lafarge. “This new locomotive is able to increase the freight traffic productivity for our customers. I can proudly say that Alstom, together with Transmashholding, is a reliable strategic partner of the Russian Railways in the implementation of an ambitious RZD program with the goal of renewing the pool of more than 20,000 locomotives by 2030.

The joint engineering center TRTrans will deal with the development and the designing of the new electric locomotive and its key elements, including traction equipment. The actual manufacturing of the locomotives will be based at the Novocherkassk Electric Locomotive Plant (which makes up a part of CJSC Transmashholding).
THROUGH ITS ALMOST TWO CENTURIES OF HISTORY, THE OKTYABRSKY ELECTRIC RAILWAY CAR REPAIR PLANT HAS ACQUIRED MANY TECHNOLOGIES IN THE ROLLING STOCK REPAIR FIELD. Frequently this is not just ordinary repair work required by usage standards, but a deep upgrading of numerous types of railroad cars that requires not only following the established standards, but discovering new out-of-the-box solutions as well. The design-engineering department of the plant and the pilot production workshop solve, at times, extremely sophisticated problems.

Making old things new again

FROM REPAIR TO MODERNIZATION

During the Soviet period, the integrated client — the Ministry of Communication lines — did not pay much attention to car modernization. High production volumes of new passenger cars and multiple-unit cars supplied the demand of the country railways entirely, and one did not take into account the indexes of economic efficiency. The situation began to change in the 1990s with the transition to the market economy.

The management of Russian railways and other CIS republics learned to consider affordability and to optimize expenses. Many of the former Soviet republics began to look for their own ways to solve the problems of rolling stock renewal. Even the Baltic States, which seemed to have similar economic and territorial conditions, demonstrated different solutions to this problem. Some bought new cars; others equipped the railroads with second-hand cars from Europe. The Lithuanian railway administration chose an optimal route by sending its outdated locomotive-hauled cars to the Oktyabrsky Electric Railway Car Repair Plant, where they were subject to overall repair with a life extension. During what appeared to be ordinary repair work, the plant specialists had to master new standards and meet the requirements of
the European Union. Specifically, the EU required that the old cars be upgraded with new anti-vandal paints and coatings which needed to be applied inside a special internal environment with rigid temperature controls. When the plant successfully met this requirement, they then passed the renewed cars to the client.

The Oktyabrsky Electric Railway Car Repair Plant was the first organization in former Soviet Union territory that started to solve the problems of rolling stock modernization. OEVRZ began to upgrade the cars and to install new interior elements as early as the late 1980s. At that time, from 1986 to 1989, the plant developed the normative and technical documentation and mastered the repair and maintenance of the high-speed passenger trains Aurora and Red Arrow.

It was the Oktyabrsky Plant that upgraded the first national high-speed electric train, the ER200, as well as that runs between Moscow and Saint Petersburg.

At the dawn of perestroika, when the Iron Curtain began to go up, and the USSR started to attract more and more tourists from non-CIS countries, it became necessary to improve the face of national transportation for our visitors. The plant got the task to construct a tourist train that would fundamentally differ from the third-class cars and sleeping cars that existed at that time. In 1988, the enterprise took an active hand in the creation of the premium service train “Rus” that served tour itineraries, and in “Mifolog”, a state program implemented in 1992 while constructing a special army-map train under the order of the Ministry of Defense of the Russian federation.

International communication increased and strengthened, and Russia’s nearest neighbor to the north — Finland — began to size up Russia. At that point, the plant then honorably represented the country at the international level while carrying out large-scale deliveries of the 18100 model load trolleys for the Finnish coach building works.
EXPERIENCE AND IMPROVEMENT
The foreign market opened with the collapse of the Soviet Union, and foreign investors came to Russia. As one of the few enterprises that worked consistently at that time, OEVIZ, in 1995, implemented the investment program with the participation of the German concern, DWA (Bombardier), and put into use manufacturing facilities for the assembly of new passenger cars.

For the first time in Russia, the manufacturing of cafeteria cars and of cars with special equipment for disabled people, was established.

Starting in 1999, OEVIZ mastered the repair of cafeteria cars, and electric trains of the ER2T and the ET2 series; up-to-date production processes on overall repair and modernization of passenger cars were implemented. At the same time, a promising framework for some units of the passenger cars was developed and widely implemented.

Starting with the provision of comfortable cars for foreign visitors, RZD management then turned their attention to the national passengers, including the guests and citizens of Saint Petersburg, who began to visit the nearest cities on a large scale: Pskov, Veliky Novgorod, and Vyborg.

Comfortable rolling stock was necessary for these trips. The company carried out large-scale work while constructing a series of luxury electric trains (“Severnaya zvezda”, “Ladoga”, “Baltica”, etc.), performing overall repair and modernization of high-speed train cars “Aurora” and “Nikolaevsky Express”, with updated interiors based on advanced European technologies.

And in the decade beginning in the year 2000, based at the workshop for special-purpose cars, the production facilities for overall repair and re-equipping of electric trains were created in compliance with the requirements to enhanced comfort. From 2001 till 2004, the plant specialists mastered the overall repair with life extension and modernization of the rolling stock; pilot production and car painting workshops were put into operation.
operation; and the non-destructive testing laboratory was open. Moreover, the plant shifted more heavily to the repair of rolling stock, and they work closely with different railways and underground railway systems in the country.

In addition, the production of wheel pairs for passenger cars, including multiple-unit cars and metro coaches, has been a success.

COMPETENCIES EXPANSION

The recently-resumed dynamic development of the Saint Petersburg, Moscow, Novosibirsk and Yekaterinburg underground railway systems required up-to-date rolling stock, i.e., cars fitted with all required equipment for a safe and comfortable trip. Therefore, starting in 2008, the company began to master construction and repair of production that was new for the plant — metro coaches.

In 2011, the next generation metro train of the 81780/781 series, the “Ladoga”, was constructed at the plant. Since 2012, OEVRZ has been successfully fulfilling a three-year contract on the construction of coaches for the state unitary enterprise, The Underground Railway Systems of Saint Petersburg.

Investment programs on existing production capacity maintenance, assortment enlargement, and the mastering of new types of products have been successfully implemented within OJSC OEVRZ. Now, the plant is not only a repair enterprise; it is the third largest manufacturer of rolling stock for underground railway systems in Russia.

Other railway systems in the former Soviet territories require a large volume of work on rolling stock recovery as well. Thus, starting in 2007, Kazakhstani Railways started to order repair and modernization work for their coaches at the Oktyabrsky plant.

THE SECOND LIFE

The first thing that is updated in the electric trains is the pulling drives operating system. The new equipment allows the reduction in energy consumption by up to 20% in comparison to off-market models; therefore, railways order the modification of the operating system while trying to reduce the usage costs.

The next modernization spheres mastered by OEVRZ specialists are the coach design and passenger cabin. All basic elements are modified, from color scheme to passenger cabin renewal in the electric trains. Up-to-date finishing materials are used, double-glazing units are installed, the seats are replaced by anti-vandal plastic seats, a fire alarm system is set up, and video control systems are mounted.

The key advantage to the applied modernization scheme is that almost every passenger, at first glance, concludes that he has a new type of coach in front of him. Therefore, railways get a relatively cheap opportunity to demonstrate to the passengers the renewal and updating of the rolling stock. In addition to the elements of interior design, new slip-proof floor cloth is laid, and electric route marking systems and display panels are mounted in the cabin.

Thanks to the OEVRZ specialists, the updated coaches emerge from the gates of the plant where they have received their second life, and this second life is often even more successful than the first one.
Director General of OJSC OEVZRZ

“We have new horizons ahead”

In the car painting workshop, a paint and drying system, manufactured in the Netherlands, was mounted; it allows us to paint the rolling stock bodies using the most up-to-date paint materials.

— The manufacturing of metro coaches and the repair of rolling stock are long established types of operations for your company. But underground railway systems and railroads could not be limited to just the coaches. What does your business do besides manufacturing coaches? Have you been enlarging your market channels?

— We have a workshop that manufactures new wheel pairs that was put into operation in 2005, as well. At present, we manufacture all types of freight and passenger wheel pairs, and starting in 2008, we began to produce wheel pairs for underground railway systems. The underground railway systems of Saint Petersburg, Moscow, Novosibirsk, Yekaterinburg, the Federal Passenger Company, and railways that make up a part of RZD are our customers. The current number of orders at the plant demonstrate an increasing number of foreign orders: in the intervening years, close business relations have been established with the railways of Lithuania, Kazakhstan and other former Soviet countries.

— Please, tell us a little more about how manufacturing of the underground railway systems is developing at OJSC OEVZRZ?

— This sphere is new for us. In 2008, we manufactured coaches for the underground railway systems of Kiev; we fulfilled a heavy order for the Yekaterinburg and Novosibirsk underground railway systems. At present, the plant is almost operating at full capacity and is in the process of fulfilling a large order manufacturing new coaches for the Saint Petersburg underground. Our company is not only a repair facility now; it has become the third largest manufacturer of metro rolling stock in Russia.

— Traditionally, the plant has tried not only to master coach repair and new coach manufacturing, but to supply itself with components as well. As far as what concerns manufacturing for

— Boris Yurievich, what changed at the Oktyabrsky plant when Transmashholding came?

— Beginning in 2005, when our company joined Transmashholding, we started large-scale technical upgrades in workshops and subdivisions of OJSC OEVZRZ that were aimed at the replacement of obsolete and worn-out equipment. More than 250 million rubles were invested from 2005–2013 in the overall program of the modernization of the production workshops and the technical development of the plant.

The average salary has increased by 198.4% over the last five years.

An investment program was adopted in order to keep in place and maintain manufacturing facilities and to master new types of products. As part of this program, in the car painting workshop, a paint and drying system, manufactured in the Netherlands, was mounted; it allows us to paint the rolling stock bodies using the most up-to-date paint materials.

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the underground railway systems, does your company follow the same business strategy?
— Yes, from 2009 to 2013, OEVRZ mastered manufacturing and repair of the most important components for metro coaches: traction motors, undercarriage boxes with electrical equipment, and motor and non-motor wheel pairs for metro coaches.

— The Oktyabrsky plant and its staff have always taken an active part not only in production, but in public activities as well. Are you continuing this type of social partnership at present?
— In order to develop and strengthen industrial communication, to experience exchange, and to facilitate operations improvement, the OJSC Oktyabrsky Electric Railway Car Repair Plant participates in the work of the professional organizations and associations of Saint Petersburg, the Union of Industrialists and Entrepreneurs, and the Chamber of Commerce and Industry.

In 2011, the plant became a participant in the suppliers’ system as part of a government order. The Russian Ministry of Transport, the Saint Petersburg governor, and the administration of the Nevsky city district highly appreciate the work of the plant personnel and the specialists’ merits in mastering new products - over the last several years, many specialists have been honored with state and departmental awards.
RUSSIAN TRANSMASHHOLDING AND FRENCH ALSTOM TRANSPORT ESTABLISHED THE RAILCOMP COMPANY IN NOVOCHERKASSK — a joint venture for key component manufacturing for railroad transportation.
WE ARE STARTING TO MANUFACTURE ONE OF THE MOST HIGH-END SYSTEMS FOR THE MODERN ELECTRIC TRAIN AND IT WILL SIGNIFICANTLY REDUCE THE USAGE AND MAINTENANCE COSTS OF THE LOCOMOTIVE.

On April 25, the opening of the Russian-French enterprise for key component production for electric locomotives — OJSC Railcomp — took place.

The main goal for establishing this joint venture is the localization of the production of components for electricity supply transformative equipment and the operating systems for electric locomotives EP20, 2ES5, KZ8A, KZ4AT on Russian Federation territory.

The electricity supply transformative equipment system is complex semiconductor equipment, manufactured on the basis of IGBT transistor technology (Insulated Gate Bipolar Transistor). It is used to transform the voltage of the overhead system into the frequency and level of the operating voltage of the asynchronous driving motors and supporting machines.

The electric equipment systems will be mounted into locomotives, manufactured by the joint efforts of the partners of Russia and Kazakhstan.

WESTERN TECHNOLOGIES ON THE NATIONAL FIELD

The senior Vice-President of OJSC Russian Railways, Valentin Gapanovich, the Director General of Transmashholding, Andrey Andreev, and the President of Alstom Transport, Henri Poupart-Lafarge, took part in the grand opening of the new company.

— Alstom not only cooperates with Transmashholding in the matter of

Key requirements for the people who would like to work at Railcomp

• Industry-specific education
• Work experience in the field
• Technological literacy
• Desire to work at the start-up stage (that means to be prepared for intense work)
• For engineers: knowing the English language is important
technologies, declared Henri Poupart-Lafarge. — We facilitate the development of the Russian economy as well while offering highly competitive next generation products that are more efficient and that entirely meet Russian requirements.

— The mastering of the manufacturing of the electricity supply transformative equipment system for electric locomotives using bipolar transistors is an important landmark in the development of the national industry, commented Andrey Andreev. — We are starting to manufacture one of the most high-end systems for the modern electric train, and it will significantly reduce the usage and maintenance costs of the locomotive. It will allow the Holding’s production to achieve all new levels of competitive ability.

Work on production localization includes localized project management, personnel training, establishment and certification of the production lines for product manufacturing and testing, transferring quality requirements, and the technological certification of the first electricity supply system produced by the new enterprise.

FASTER AND EASIER

The electricity supply system is the heart of any rolling stock that provides traction and other operating requirements. Asynchronous driving motors allow decreasing the unsprung mass of wheel-motor units compared to collector driving motors while at the same time increasing locomotive axial power up to 1,200 kW.

The electricity equipment unit is manufactured using a modular approach. 1 electric train with six axes (or 1 section with four axes) is comprised of the following units:

- 3 (2) electric equipment units (the quantity of units depends on the type of electric locomotive, 1 or 2-unit), including the body, traction converters, contactors, condensers, the cooling circuit,

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The Alstom syndicate and Transmashholding are designing one of the most powerful modern electric passenger and freight trains in the world. Not less than 400 electric trains (200 passenger trains and 200 freight trains) will be manufactured for OJSC RZD use. 295 trains more (95 passenger trains and 200 freight trains) will be manufactured by the joint venture, created by Kazakhstani Railways, Alstom, and Transmashholding for Kazakhstan use.

Peaceful mutually profitable expansion

The director general of the new enterprise, Franz Verrol, reveals that at present, French companies pay very close attention to the development of international cooperation. In its turn, OJSC RZD, the main buyer of electric locomotives in Russia, considers the assimilation of new technologies as an obligatory condition while concluding contracts with foreign partners.

— Power conversion equipment that is installed on our locomotives is technologically new to Russia, — says Franz Verrol, when outlining the necessity for the establishment of the new enterprise. — It will allow us to significantly increase the traction characteristics of the locomotives, while at the same time reducing the usage costs.

The idea to create a joint production site, according to Mr. Verrol, appeared as the response to the stated demand on the necessity of the technological modernization of rolling-stock manufacturing.

Not far to seek

— The decision to establish the enterprise based at NEVZ was made because Novocherkassk Electric Locomotive Plant is at the same time the main consumer of the manufactured product, says Franz Verrol. — One of our priorities at present is to seek and enlarge the component suppliers network that we use while producing the traction systems. According to our business plan, the Railcomp Company will be localizing about 50% of all components.

— The standard manufacturing flow of Alstom plants in Europe became the technological basis for workshop re-equipment — two production lines for traction converter assembly and testing were established, as well as lines for high-voltage and low-voltage unit assembly and testing, one line for each kind of equipment. The workshop features all necessary process sections: assembly (for electrical cabinets), testing (where production is tested in bench testing units) and a repair section, where guarantee commitments are fulfilled.

Work, people, money

At present, the investment program is not yet entirely fulfilled. After achieving its full production capacity, Railcomp will be able to manufacture 17 sets of electric equipment per month. The total investment in the project will amount to about 10 million. For the Novocherkassk economy, the establishment of Railcomp will signify the creation of new work places and the attraction of highly-qualified specialists.
early 55 years ago, in July 1958, the Bryansk Machine Building Plant released TEM1, the first shunting locomotive. This was how the Bryansk plant, for many years, became the largest supplier of this type of locomotive, not only for railways, but for the industry in general.

New times dictated their terms; manufacturers had to undergo major structural adjustments that primarily implied the ability to promptly design sought-after, innovative and promising locomotive models. BMZ, which currently has highly-qualified engineering staff, three-dimensional design capabilities and upgraded production capacities at their disposal, has focused on the integration of the most diverse tasks.

Thus, in 2005, it took only a year to design and manufacture the 2TE25K main line two-unit freight locomotive. Nine years later, the 2TE25A Vityaz, Russia’s first main line freight locomotive with asynchronous traction drive, came into being.

**PRINCIPAL DIRECTION**

Still, shunting locomotive building remains the principal focus for plant workers. Today, the range of diesel locomotives produced at the Bryansk Machine Building Plant includes the TEM18DM, the TEM18V, and the TEMTMH. The two-diesel TEM33 and the TEM19 gas-turbine locomotive are under construction. This range of promising inventions produced by the Bryansk Machine Building Plant will shortly be supplemented with the TEM35 hybrid locomotive.

This new BMZ project is a timely response to today’s challenges, as corporate leaders all over the world (Alstom, GE, Hitachi) are making efforts to introduce hybrid transmission in railway transportation.

**BMZ IS CONDUCTING TESTS OF RUSSIA’S FIRST hybrid locomotive**
JSCo Russian Railways is implementing an innovative development program that includes locomotive stock renewal. Apparently, Russian Railways has been targeted as cost-effective, reliable and eco-friendly machines.

The times are near at hand when private carriers, apart from JSCo Russian Railways, will purchase locomotives. These private carriers will be particularly interested in the machines that enable POL and operational cost savings and that have a single-unit capacity of 500-600 kW.

TEM35: ECOLOGY AND COST EFFECTIVENESS
The TEM35 is a six-axle shunting locomotive with a combined (hybrid) power supply unit and AC-AC power transmission. The locomotive design is based on the undercarriage of the TEM18DM shunting locomotive, which is well-proven as to its reliability using wheel and motor units with traction motor support roller bearings.

Various components used in locomotive design help dramatically increase runs between repairs, and reduce the number of repairs and the amount of time it takes for both repairs and scheduled maintenance. This is what makes the new diesel locomotive attractive in the first place.

The hybrid locomotive features the utmost performance in shunting operations when shunting, braking action, acceleration or shutting down is needed.

The TEM35 shunting locomotive uses electrochemical condensers as energy storage units. Vector intelligent control systems are used to control the new diesel locomotive model.

In addition to all other advantages, the TEM35 offers the most comfortable conditions for train conductors.
When the hybrid diesel locomotive is running, energy from the diesel generator is transferred to asynchronous motors and condensers and during braking action, a part of the energy is delivered to reservoir capacitors — thus, the recuperation phenomenon occurs. This mode of operation ensures considerable savings of diesel fuel. According to the project engineers, both in motion and braking modes, the energy savings will be 20 to 30 percent. Projects are also under way to use storage accumulator batteries in hybrid diesel locomotives. Hybrid locomotives are intended to operate in temperature conditions from minus 40 to plus 50 degrees Centigrade.

The new locomotive features a host of essential advantages. With the same capacity as in the series-produced diesel locomotives, it consumes less fuel and its maintenance is less costly. In addition, the TEM35 is eco-friendly. The application of a high-power diesel unit in its design ensures a dramatic decrease in harmful air emissions. The hybrid locomotive features utmost performance in the mode that includes frequent braking action, stops, start and acceleration. The TEM35 has six asynchronous traction engines, a diesel generator, an electric traction drive intelligent vector control system and energy storage units. The vector control system ensures the diesel generator energy transfer to the storage unit and engines as well as the recuperation energy return to the storage unit. Benefits of this system are longer operational life of wheel pair transmission (at least by half again); the high quality of motion dynamics control and a considerable decrease of roadbed deformation; an increase in reliability and durability of storage units; the conformance to up-to-date standards of locomotive control automation, troubleshooting and testing; and the decrease of specific traction energy costs by 20-30%.

**MATTER OF PRINCIPLE**

The diesel unit design makes use of the Caterpillar C18 ACERT diesel with a capacity of 571 kW and rotation frequency of 1800 rpm, the GS523UKHL traction alternator.

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**EXPECTED BENEFITS OF TEM35 INCLUDE**

**EMISSION REDUCTION THROUGHOUT THE DIESEL LOCOMOTIVE LIFECYCLE BY UP TO 30% DUE TO THE APPLICATION OF A LOWER-POWER ENGINE**

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<th>Parameters and systems</th>
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<td><strong>Nominal power of diesel locomotive, kW (HP)</strong></td>
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<td><strong>Rail tractive effort, kN (tf):</strong></td>
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<td><strong>Power supply unit</strong></td>
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traction converters using IGBT transistors, electrochemical condensers, wheel and motor units with traction motor support roller bearings with the AD917A asynchronous motors.

The diesel locomotive has been designed using the modular assembly principle, thanks to which the energy storage unit may be replaced with a second unit with a diesel-electric set over a shift when the locomotive is under repair.

All the primary and auxiliary equipment is concentrated in five units: the diesel-electric set, the electric equipment, the brake equipment, the energy storage unit and the conductor’s cabin. The main design units consist of smaller sections: the rheostatic brake, the compressor, the traction inverters, and the factory load converter sections, which significantly improve locomotive operation conditions and maintenance. Thus, the main structural elements are standardized. This ensures cost reduction. The same design concept is used in the TEMTMH shunting locomotives.

The turret-type conductor’s cabin offers a panoramic view that has been designed with regard to applicable safety, ergonomics and labor requirements. It is fitted with the microprocessor troubleshooting and control system that displays locomotive operation data to the command console. A WEBASTO self-contained fuel heater has been installed to heat the cabin. The TEM35 also makes use of advanced brake equipment. General noise reduction in the conductor’s cabin has been attained thanks to the use of advanced noise insulation materials and package glazing. All these features ensure the train conductor’s comfort.

Expected benefits of the TEM35 include emission reduction throughout the diesel locomotive lifecycle by up to 30% due to the application of a lower-power engine; fuel savings; an increase in run between repairs, a decreased number of scheduled maintenance and running repairs; and a longer diesel operating life.

The hybrid shunting TEM35 is expected to significantly (up to 30%) decrease harmful emissions.

The most interesting work for the BMZ specialists who took part in the project was the adjustment of the diesel locomotive control systems. In general, energy storage units are hardly ever used in railway transportation; normally, accumulator batteries are used instead. Unfortunately, the available information cannot be shared: for diesel locomotive manufacturers who use the diesel traction hybrid control approach, this information constitutes intellectual property and is not yet widely used. Still, thanks to the synergistic efforts of project specialists, they have managed to settle quite complicated issues.

The new locomotive has yet to undergo additional pre-production stages: full-size preliminary and acceptance tests, an operation run of 300 diesel machine hours, certification tests, and acceptance board and consistency batch manufacture.

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### Comparison specifications of TEM35 and TEM2 shunting locomotives

<table>
<thead>
<tr>
<th></th>
<th>TEM35</th>
<th>TEM2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nominal power of diesel locomotive, kw (HP)</strong></td>
<td>571 (777) + 500 (680)</td>
<td>882 (1200)</td>
</tr>
<tr>
<td><strong>Rail tractive effort, kN (tf):</strong></td>
<td>362 (36.9)</td>
<td>275.2 (28.1)</td>
</tr>
<tr>
<td><strong>in breakaway</strong></td>
<td>226 (23.0)</td>
<td>200 (20.4)</td>
</tr>
<tr>
<td><strong>continuous rating</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Power supply unit</strong></td>
<td>hybrid as a part of S18 diesel (Caterpillar) and condenser energy storage unit</td>
<td>PD-1M diesel (6CHN31.8/33)</td>
</tr>
<tr>
<td><strong>Specific fuel consumption by diesel at nominal power, g/kw•h (g/HP.h)</strong></td>
<td>196.5 (144.5)</td>
<td>224 (165)</td>
</tr>
<tr>
<td><strong>Diesel fuel flow rate at idle speed, kg/h</strong></td>
<td>1.7</td>
<td>6.0</td>
</tr>
</tbody>
</table>
Before they managed to eye the double-deck production of Tver Carriage Works, Transmashholding correspondents were lucky to peep into three shops and watch the process of coach manufacturing.

The coach assembly shop, with some 1,000 staff members, was the first on the list. It is engaged in coach assembly and the delivery of finished products. The shop is divided into four main areas: A and B coach assembly, the calibration run section, and the painting and acceptance test areas.

After the coach assembly shop, we moved to the frame and body shop. Five years ago, the equipment was fully replaced here to enable the production of coaches of a range of new models. Today, the shop employs some 500 people who are mainly engaged in assemble-welding production for the manufacture of locomotive traction coaches.

As is the case with the previous shop, this one is divided into several principal work areas: frame manufacturing, lateral wall assembly, roofing, end walls, the roof assembly and delivery area, and the pipe and boiler area.

The last shop that we managed to visit is a cold-press shop that specializes in the manufacture of flat steel and profile iron parts and blanks. It is divided into three areas: the laser, the press and the blank production shop. Today, the press makes use of high-tech equipment which enables prompt assimilation of new production.
Already this August, Russian travelers will be able to get to Adler in a new double-deck coach. THREE FULL-SCALE DOUBLE-DECK TRAINS WILL TRAVERSE THE COUNTRY UNTIL THE END OF THE YEAR to transport supporters of the Sochi Olympics. We have decided to evaluate the coach in all its glory...

Compartments are several steps up or down

Corridors of the upper and lower floor are arranged on different sides of the coach
After we followed the assembly of a double-deck coach, we had a chance to look at the masters’ output. Three double-deck coaches (dining, sleeping and staff coaches) were submitted for the correspondents’ approval.

TWICE AS MUCH!
Each level of a double-deck coach has 8 compartments. While their width has remained the same, their height has decreased to 2 meters 10 centimeters. There are no luggage recesses. Passengers may place their luggage beneath the lower bench only. Yet coaches are fitted with an air conditioning system. All compartments have an illumination system and electrical sockets. Coaches have been made using energy-saving technologies — a centralized power supply ensures a decrease in power consumption of 35–40%.

Staff coaches are fitted with a device for the transportation of low-mobility passengers in wheelchairs. The coaches are equipped with a convenient and reliable lift unit to facilitate the boarding and unloading of passengers. Information boards inside the compartments provide visual data and voice messages.

The dining coach also has two decks; it offers video broadcasting.

Ivan ERMISHKIN, Chief Designer of TVZ JSC:

Compare a traditional sleeping coach with 36 seats and this one with 64 seats. It’s nearly twice as many. The labor and material costs per passenger are nearly half as much.
Double-deck coaches are fitted with an auxiliary safety system. A special-purpose frame has been used in the design and the center of gravity of the coach is low. New coaches meet all riding comfort and safety requirements.

Sergey GORIN, Technology and Production Director of TVZ JSC:

COACH TRANSFORMATION

TVZ is concurrently engaged in the extension of the double-deck coach model range. 2014 is expected to set up production of double-deck passenger coaches for interregional service. Two coach designs will be employed: economy and business class. The first type of coach will have 104 passenger seats arranged in a 2+2 pattern. Business class coaches will have 29 2+1 luxury seats. Seat backs will be fitted with monitors for watching video. Seats will be able to change direction as the train does. Each compartment will have a cloakroom. All the coaches will be fitted with air conditioning systems, eco-friendly toilets, and Wi-Fi capability. Batch production is scheduled for 2015.

and each table has a waiter call button. The dining hall on the second floor seats 48, whereas the bar down below can hold 6 visitors.

Ticket prices are not yet known, but they definitely will be a welcome surprise. Enhanced passenger capacity and use of low-maintenance units and assemblies in the coach design will ensure that a dramatic cost reduction is passed on to the customers.

Enhancement of the double-deck coach model range. 2014 is expected to set up production of double-deck passenger coaches for interregional service. Two coach designs will be employed: economy and business class. The first type of coach will have 104 passenger seats arranged in a 2+2 pattern. Business class coaches will have 29 2+1 luxury seats. Seat backs will be fitted with monitors for watching video. Seats will be able to change direction as the train does. Each compartment will have a cloakroom. All the coaches will be fitted with air conditioning systems, eco-friendly toilets, and Wi-Fi capability. Batch production is scheduled for 2015.
On April 4, 1866, an attempt was made on the life of Alexander II. This gave rise to the reinforcement of the emperor’s security, including during travel. During this time, the Alexandrovsky plant built a 15-car emperor train to run on 1,524 mm gauge Russian railways. Initially, it was comprised of a luggage car, a locomotive, a shop, and cars for the minister of railway transportation and the servants of the czar, the empress, and the crown prince, plus a kitchen, a lunchroom and a dining hall. In addition, five cars for the retinue were attached to the tail end of the train.

**EVERYTHING FOR THE SAKE OF COMFORT**
The main focus in train design was on comfort and finish. One of the main requirements was to ensure

<table>
<thead>
<tr>
<th>Car</th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>a locomotive with attending personnel.</td>
</tr>
<tr>
<td>2</td>
<td>a luggage car.</td>
</tr>
<tr>
<td>3</td>
<td>first- and second-class compartments intended for servants.</td>
</tr>
<tr>
<td>4</td>
<td>seven compartments for top members of the czarist retinue.</td>
</tr>
<tr>
<td>5</td>
<td>six compartments were occupied by the emperor’s court minister, the commander of the emperor’s headquarters, the chief of security, a high-ranking military officer (a marshal), and a physician. One compartment was left empty.</td>
</tr>
<tr>
<td>6</td>
<td>The sixth car, also with six compartments, was for ladies. There were two Imperial compartments. Two one-seat compartments were intended for maids of honor. The empress’ ladies-in-waiting occupied the double-seat compartment.</td>
</tr>
<tr>
<td>7</td>
<td>The seventh car was named The Imperial Car. It was designed with five compartments.</td>
</tr>
</tbody>
</table>

The eighth car — the sleeping car. Each bedroom had three windows. The emperor’s...
THE GLORIFIED HISTORY OF THE OKTYABRSK ELECTRIC CAR REPAIR PLANT, THE FORMER ALEXANDROVSKY PLANT IN CZARIST DAYS, HAS MANY NOTABLE CHAPTERS. One of the most significant projects of the day was building cars for the czarist train, on which Alexander II, Alexander III and Nickolay II traveled around the country with their retinues and from where Nickolay renounced the throne in 1917.

comfortable temperature and ventilation. Thus, at a temperature of +8° to –20°С, a constant temperature of 13 to 15°C was to be maintained in the cars, both at the floor and ceiling.

The large compartments were fitted with dampeners to maintain a certain moisture level (48–58% in winter).

Air conditioners and fans were installed in fours of the cars to cool the air coming into cars in summer.

The interior was indeed czarist: for example, the empress’ car had a silver washbasin. Water-closets (toilets) were pre-arranged in cars, too.

The train was intended to become a wheeled palace. Apart from luxury and comfort for passengers, it had to ensure quiet running and a proper safety level.

In the final version, cars were distributed in the train as follows:

- The eighth car
- The ninth car
- The tenth car
- The eleventh car
- The twelfth car
- The thirteenth car

bedroom had a desk, a sofa, a small toilet table, double lamps on walls and a washbasin. Each bedroom had individual toilet rooms. The interiors of the emperor’s and the empress’ premises differed in style. The same car had a cloakroom and two compartments for the emperor’s valet and the empress’ ladies of the bedchamber.

The ninth car accommodated the emperor’s salon and study.

The tenth car housed the emperor’s dining room; it was divided into three areas: a dining hall, a snack bar and a lunchroom. Two set closing cars were for household purposes.

The eleventh car accommodated a kitchen that also comprised three areas: a kitchen, a lunchroom and a foodstuffs section.

The eleventh car of the second class housed compartments for four cooks and four waiters, 14 sleepers for servants, and six seats for Cossack guards.

Later on one more car was added, it was used as a church.
DESTINY OF THE TRAIN
Following the February Revolution, the emperor train was used by Provisional Government ministers for a short time.

After the October Revolution, parts of the train were assembled for L.D. Trotsky to use when he became the Foreign Commissar in October 1917 for his journeys to civil war fronts.

The further destiny of the train is uncertain. Before the war, the czarist train was exhibited in the Peterhof museum park along with materials evidencing the circumstances of the abdication and the fate of Emperor Nickolay II and his family. Some memorable items that once were on the train are kept in the Peterhof reserve. The Oktyabrsk plant museum displays a candlestick and thermometer from this amazing train.

In November, 1889, a critical decision was made to build a second train for foreign trips made by the czarist family. An upscale order was once again placed with the Alexandrovsky Mechanical Plant of Nicolaevsky Railways.

The seven-car train was completed by February, 1896. While the train for the emperor’s foreign trips was under construction, it was decided to use it for the domestic trips of the czarist family, too. To this end, a procedure to change the slopes of the foreign gauge of 1,435 mm to the Russian 1,524 gauge was initiated.

Initially, slope changing took up to three days to change the gauge of the entire train. In case of emergency, railway workers managed to do it over a period of 18 hours.

To enable communication, a telephone system was arranged between all cars. All cars were fitted with Siemens and Halske handsets.

Incandescent lamps for 8, 16 and 25 candles each were powered by a dynamo and accumulators with a voltage of 50 volts; in case of failure, the kitchen-car had an accumulator battery that ensured illumination of the entire train for up to 3 hours.

Bodies — made of wood: both roof boarding and frame with channel beams.

Bogies (under-carriages) with a metal frame were used; two-axle, fitted with a triple buffer spring system: elliptical of an underframe type, bolster plate and bolster special-purpose. Reinforced slopes were used.

The train had a total of 200 electric lamps.

In daytime, light penetrated cars via lantern-type skylights, in addition to regular windows.

• length of cars between outer edges of buffer bars was 18 m, dormitory and children cars — 19.6 m,
• height of the car inside — 2.9 m,
• width — 2.94 m.

Traditions
PRODUCTS AND SERVICES OF THE HOLDING:

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- mainline and shunting locomotives;
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- electric train and subway cars;
- rail buses and diesel trains;
- car casting;
- diesel locomotive engines and marine diesels;
- diesel generators and turbochargers;
- transport components;
- spare parts;
- repair and service maintenance.

OVER THE PAST FIVE YEARS, THE COMPANY HAS PRODUCED:

- over 3000 locomotives
- over 4000 passenger cars
- over 3000 electric train cars
- over 230 rail bus cars
- over 1500 subway cars
- over 2700 diesels

PRODUCTS AND SERVICES OF THE HOLDING:

- Over the past five years, the company has produced:
  - locomotives: over 3000
  - passenger cars: over 4000
  - electric train cars: over 3000
  - rail bus cars: over 230
  - subway cars: over 1500
  - diesels: over 2700

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