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Editor's

Artur Rojek

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Dear Readers,

The final stage of European funding for railway investment entails numerous certification and authorisation processes as well as placing in service of railway lines. In this respect, the overhead contact line (OCL) as an interoperability component, the energy subsystem and the return circuit, among others, are subject to certification. IK's Department of Electrical Power Engineering actively participates in the type of work by carrying out dynamic tests of the interaction of the pantograph with the OCL, evaluates the design and imple-

mentation of the Energy subsystem and conducts the return circuit testing. As part of the study of the return circuit testing, short-circuit tests are performed, on the basis of which the protection against electrical shock is assessed - the value of the touch and shock voltage and the time of its occurrence.

The unique measuring apparatus developed at the Institute allows dynamic tests of the interaction of the pantograph with the OCL to be carried out efficiently, irrespective of the speed of train drive while testing. The measuring apparatus and technical solutions developed by the employees of the Department of Electrical Power Engineering enable short-circuit tests to be carried out in the field, at any chosen location in DC traction power supply systems, including tram and metro systems.

One of the most important parameters of the Energy subsystem is the performance of the power supply system. These parameters should be determined in the first phase of the power system

design on the basis of simulations performed using specialised software. IK is equipped with such software, which additionally meets the requirements of PN-EN 50388 and EN 50641. Using such software, we carry out, among other things, the verification of power supply system parameters, often in cases where catenary power supply facilities cannot be built in the locations initially indicated in the early design phases. With the aforementioned simulation software in hand, IK staff have begun to analyse phenomena and problems relating to the 25 kV AC system, recuperation, energy storage, etc.

The IK activities are not only focused on certification issues, but also on research into equipment and systems used in rail transport. In recent years, the Department of Electrical Power Engineering has significantly expanded its research potential, due to the implementation of the project 'Purchase of modern research and laboratory equipment for the Railway Research Institute' (RPMA.01.01.00-14-061/17). As part of this project, the short-circuit laboratory has been equipped with a new 6.3 MVA rectifier transformer with reduced short-circuit voltage, fitted on-load tap changer with a special winding system. This solution allows electrical equipment to be tested at DC voltages from 400 V to more than 5 kV and to achieve a short-circuit current of more than 20 kA and, and after connecting additional rectifier units, more than 50 kA.

The laboratory of the Department of Electrical Power Engineering is also equipped with a new climate chamber operating from -55 °C to 95 °C, whose dimensions of 3 x 3 x 2 m allow even very large equipment measurement at extreme temperatures.

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Signing of the Agreement

On 22 September 2022, a Memorandum of Understanding was signed between the Railway Research Institute and the German Centre for Rail Traffic Research during the International Trade Fair for Transport Technology INNOTRANS.

The establishment of the partnership will bring mutual benefits in terms of knowledge sharing, information exchange and joint railway research.

2nd International Workshop on High-Speed Rail Socioeconomic Impacts

The 2nd International Workshop on High-Speed Rail Socio-economic Impacts, an international conference organised by the UIC Alliance of Universities, was held on 13-14 September 2022. Organised online by the University of Naples Frederick II and the UIC, the conference provided an opportunity to exchange views on non-technical aspects of high-speed rail. It was attended by more than 100 participants from Europe, Africa, Asia and North America. Speakers included representatives from the UK, Italy, Spain, USA, China, India,

Poland, Germany, Belgium, Turkey, Japan, Finland, Sweden, Taiwan and Hong-Kong. Topics discussed during the conference referred to the results of recent research, analyses and quantification of the effects of high-speed rail investment on both the economy and society. A representative of the Railway Research Institute – Agata Pomykała also took an active part in the conference and presented Polish experience connected with the first high-speed trains operation.

TransBaltica Conference

The 13th International Scientific Conference "Transbaltica 2022: Transportation Science and Technology", held on 15 and 16 September 2022, was organised by the Vilnius University of Technology (VILNIUS TECH) Faculty of Transport Engineering. Nearly 70 presentations were heard during the 8 conference sessions. The conference, in a hybrid mode, was attended by about 100 participants, representing compa-

nies and organisations of the transport sector and scientific institutions. The Railway Research Institute was represented by Agata Pomykała, Senior Specialist in the Unit for Coordination of Projects and International Cooperation, who presented the issue of the COVID-19 impact on the passenger sector.

Transport Means Conference

The 26th International Scientific Conference Transport Means 2022, organised by Kaunas University of Technology, took place on 5 - 7 October 2022.

The main issues discussed in the plenary session and in the individual thematic sessions covered design development, maintenance and exploitation of transport means, implementation of advanced transport technologies, development of defence transport, advanced and intelligent transport systems, transport demand management, traffic control, specifics of transport infrastructure, safety and pollution problems, integrated and sustainable transport, modelling and simula-

tion of transport systems and elements, and environmental and social impact. The Railway Research Institute was represented by 7 persons: Andrzej Toruń, Lucyna Sokołowska with the paper "Field tests of all-purpose interface between interlocking system and line block system", Agata Pomykała presented "Changes in transportation due to the influence of SARS-CoV-2" and Andrzej Soczówka and Piotr Chyliński with the presentation "International passenger railway connections in Poland after 1989". Eliza Wawrzyn and Renata Barcikowska with article "Joint Undertakings for Research and Development of Railway".

30th Anniversary of the General Council of Research Institutes

The 30th anniversary of the Central Council of Research Institutes was held on 12 September in the main building of the Warsaw University of Technology. The Railway Research Institute received a distinction and a statuette for outstanding achievements in the field of railways and active cooperation with the General Council of Research Institutes. The statuette was received by Assist. Prof. Marek Pawlik, D.Sc. Ph.D. - Deputy Director of the Railway Research Institute for Railway Interoperability. During the exhibition of research Institutes,

the achievements of the Railway Research Institute were also presented.

The most innovative achievements of research institutes in Poland were presented at the gala event.



International Scientific Conference Transport of the 21st Century

The International Scientific Conference "Transport of the 21st Century", organised by the Faculty of Transport of the Warsaw University of Technology, took place on 30.08.2022 - 02.09.2022 in Józefów near Warsaw. The aim of the conference was to present the achievements of scientific and research centres in Poland and abroad, dealing with the issues of rail, road, air and sea transport in the technical-technological and organisational aspect, as well as the integration of the scientific research and education community in the discipline of CIVIL AND TRANSPORT ENGINEERING.



The conference was attended by many representatives of the Railway Research Institute who presented their research papers:

- Przemysław Brona, Andrzej Massel, Beata Piwowar - Qualitative assessment of variants of rail infrastructure modernisation.
- Jacek Kukulski, Witold Groll, Sławomir Walczak - Railway brakes for high speed trains - research and challenges.
- Andrzej Wolff, Jacek Kukulski - Numerical and experimental analysis of the heat transfer process in a railway disc brake tested on a dynamometer stand.
- Robert Kruk, Krzysztof Ochociński - Southern corridor of the "New Silk Road" a chance to increase the role of railroad border crossings with Ukraine in intermodal transport.
- Lucyna Sokołowska, Marek Pawlik - Cybersecurity and transmission safety in interfaces of the railway traffic control systems and devices.
- Andrzej Toruń, Lucyna Sokołowska - Standardization of Selected Interfaces of Railway Traffic Control Equipment and Systems.
- Krzysztof Polak, Jarosław Korzeb - Modelling the acoustic signature and noise propagation of higher speed rail-way vehicles.
- Kamil Białek, Patryk Wetoszka, Jacek Paś, Tomasz Klimczak - Analysis and testing of immunity of selected electronic devices of security systems to intentional electromagnetic interference of radio frequency.
- Jerzy Górski, Andrzej Miszkiewicz - Planning the secure interoperability zones IT/OT systems deployed on the railroad.
- Konrad Zakrzewski, Marcin Gołębiowski, Monika Sawicka - The role of changes to the control-command and signalling technical specification for interoperability in the development of automatic train operation systems.
- Krzysztof Ortel, Andrzej Białoń - Impact of metal mass distribution in a railway vehicle on the performance of axle counters.
- Iwona Karasiewicz, Paweł Gradowski - Does the choice of parameters describing the ETCS system affect the significance of the change?
- Paweł Gradowski - A class system on a comprehensive network.
- Jacek Kukulski, Jacek Makowski - Simulation and experimental studies used to assess the condition of the CWR track.
- Jakub Młyńczak, Mateusz Jurczak, Andrzej Toruń - Example of implementation of a method for automated creation of interlocking tables for railway traffic control systems.
- Renata Barcikowska, Eliza Wawrzyn - Selected aspects of obtaining funding for research and development in the area of rail transport on the example of Railway Research Institute.

Academic degrees awarded to Railway Research Institute's employees

Recently, three employees of the Railway Research Institute obtained PhD degrees in the field of engineering and technical sciences in the discipline of Civil Engineering and Transport.

On 27.06.2022, Krzysztof Polak defended his dissertation entitled "Assessment of the impact of noise generated by high speed railway vehicles on the surroundings".

On 28.06.2022, Magdalena Kycko defended her dissertation entitled "Method of risk analysis in investments introducing changes to the control-command and signalling subsystem".

On 12.07.2022, Iwona Karasiewicz defended her dissertation entitled "Method of multi-criteria risk assessment of risks caused by human factor in the rail transport system".



Krzysztof Polak



Magdalena Kycko



Iwona Karasiewicz

Fire Safety of Rolling Stock

Adrian Kaźmierczak

Research and Technical Specialist, Railway Research Institute



Ensuring a safe level of fire risk in rolling stock, is one of the key objectives of the public rail transport operation. Reaching an acceptable level of fire safety is achieved primarily by preventing the occurrence of a possible fire source and, should a fire occur, by limiting the extent and consequences to a level that will enable effective extinguishing to be undertaken using available fire-fighting equipment. One crucial method of preventing the occurrence and growth of fire

in rolling stock is the selection of non-metallic materials for their flammability/smoke properties. All materials must meet the requirements in this respect as described in EN 45545-2. The specified standard contains a number of test methods that define the permissible critical parameters in the case of thermal effects. The Structure and Materials Laboratory of the Railway Research Institute has fully equipped laboratory facilities to carry out fire tests according to all sets of requirements covered by EN 45545-2. The laboratory is accredited by the Polish Centre for Accreditation no. AB 369.

The carried out fire tests provide a better understanding of the behaviour of materials and products under real fire conditions. The laboratory's extensive technical facilities allow conducting fire tests on, inter alia, seats, interior lining materials for vehicles, electrical wiring, painting systems, insulation and materials used in electrical equipment in which the following properties are determined depending on the material group:

- spread of fire,
- amount of heat release,
- smoke density,
- toxicity,
- flammability,
- glow wire resistance tests,
- oxygen index.

The laboratory owns test equipment for testing properties in accordance with the requirements of EN 45545-2 and referenced standards:

- PN-EN ISO 9239-1 (CHF, HF-X),
- ISO 5658-2 (CFE),
- ISO 5660-1 (MARHE),
- PN-EN ISO 11925-2 (flame propagation);
- PN-EN ISO 4589-2 (OI),
- PN-EN ISO 5659-2 (Ds max, Ds(4), VOF₄),
- PN-EN 45545-2+A1 Appendix A and PN-EN 16989 (cut resistance),
- ISO/TR 9705-2 and PN-EN 45545-2+A1 Appendix B (MARHE, RHR peak),
- PN-EN ISO 17084 (CIT_G),
- PN-EN 16989 (MARHE, RHR peak, TSP, (flame height),
- PN-EN 60332-3-24 and PN-EN 50305 p. 9 (burned beam length),
- PN-EN 60332 1-2+A1+A11), (non-burned length),
- PN-EN 61034-2+A1 (transmittance),
- PN-EN 60695-11-10 (burning and glowing time),
- PN-EN 60695-2-11 (occurrence of burning and incandescence).

The activities of the Structure and Materials Laboratory in the area of fire protection also include consultations at the design stage on the selection of suitable construction materials and equipment for rolling stock, expert opinions, risk assessments

and evaluation as well as assessments of compliance with the requirements for fire safety according to: PN-EN 45545:1-7, TSI SRT, TSI Loc & Pas and TSI Wag. Through independent testing, we offer support to rolling stock owners and vehicle and component manufacturers to develop a safe and compliant product. As an accredited body, we perform system fire protection tests in accordance with recognised standards and regulations at national and international level, which form the basis for authorisation or acceptance for the rolling stock or infrastructure subsystem.



Photo 1. Cone calorimeter test according to ISO 5660-1

As part of our activities, we run training programmes that cover the following areas:

- implementation of existing fire safety standards for specific projects,
- the definition of fire testing requirements for non-metallic materials,
- creation of safety concepts for fire protection and also for the evacuation of passengers from the train or infrastructure,
- requirements for emergency and rescue situations in rolling stock.



Photo 2. Flame spread test in vertical configuration in accordance with ISO 5658

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Installation of an SAC-3m Semi Anechoic Chamber for Specialised EMC Tests at the Signalling and Telecommunication Laboratory of the Railway Research Institute in Warsaw

Łukasz John

Main Research and Technical Specialist, EMC and Disturbances Coordinator, Railway Research Institute



In the measurement of disturbance emissions as well as in EMC immunity tests, mainly four types of chambers are used, which are based on an open area test site called OATS (Open Area Test Site). OATS is a test ground that is located in an open area. A good location for an OATS entails so-called radio silence, there are no waves from e.g.: radio and TV stations, digital mobile communication, aviation radio communication or any other radio transmission. Therefore, the best places for such a test

sites are mountain valleys. Since there are fewer and fewer such places with radio silence, instead of measurements on open test sites, measurements are performed in specially made chambers that meet the relevant requirements defined in international and European standards.

The most common types of chambers include:

– **Semi Anechoic Chamber (SAC)**. The SAC chamber is characterised by the walls and ceiling being completely or partially covered with absorbers, while the floor is metal, or the metal floor is covered with a special lining;

– **Gigahertz Transverse Electromagnetic (GTEM) chamber** is characterised by its specific design and locating the tested device between the ground plane of the outer casing and the hot plane, known as the septum. It owes its popularity to two aspects, price and the amount of space it takes up. At the same time, it is the chamber that has the greatest limitations in terms of its universal application, due to the size and weight of the test object that can be placed in it. The GTEM chamber resembles a pyramid in shape and is designed for testing small objects;

– **Fully Anechoic Room (FAR)** is a modification of the SAC chamber. The main difference between a SAC and a FAR is the number of absorbers placed in the chamber. The interior of the FAR is completely lined with absorbers;

– **a reverberation chamber**, which, unlike all the chambers described above does not have any absorbers inside. This is the least common type of chamber due to the fact that there are still many standards that do not present test methods and acceptable levels (limits) of measured electromagnetic disturbances made in this type of chamber.

Each of the chambers described above can be either a pre-compliance or a full-compliance chamber. Whether a chamber is full or pre-compliance is determined by whether the chamber was built in accordance with the relevant standards. Thus, full-compliance means a chamber that is fully compliant with the requirements of the relevant standards, and pre-compliance means a chamber that is not fully compliant with the requirements of the relevant standards. Furthermore, just because we have performed tests in a full-compliance chamber, it does not at all mean that the measurements performed are also fully compliant with the requirements of the standard we have chosen to assess compliance for our product. It is important to bear in mind that each full-compliance chamber has its own limitations regarding the maximum size of the test object.

In connection with the intensive development of the Signalling and Telecommunication Laboratory of the Railway Research Institute in Warsaw due to purchases of new measurement equipment as well as the construction of new test stands, primarily in the field of electromagnetic compatibility (EMC), in 2021, an open EU tender was announced under the procedure of the "Public Procurement Law" for the delivery of a new test stand for measurements of emissions as well as EMC

immunity - the construction of a specialised EMC SAC-3m semi-anechoic chamber with a measurement distance inside of up to 3m for electromagnetic compatibility (EMC) tests, equipped, as the first in Poland, with a power supply system for the equipment tested in it (EUT) up to 3kV DC.

The modern test stand is currently being installed in 2022 by ASTAT Sp. z o.o. from Poznań together with Albatross Project GmbH from Germany as part of the RPOWM project: **"RPMA.01.01.00-14-9845/17-00 Purchase of modern test and laboratory equipment for the Railway Research Institute"**.

The chamber construction of a is a very complex topic. Attention should be paid to the following aspects during its installation:

- weight of the chamber including support structure, ferrite plates and absorbers;
- the precision of the chamber workmanship;
- cable bushings;
- filtering of inputs and outputs of the chamber;
- provision of suitable dedicated interfaces through floor panels and transition panels;
- use of dedicated lighting in the chamber and adjacent areas;
- video monitoring in the chamber to observe the tested equipment during testing;
- a rotating table;
- an antenna mast;
- the types of absorbers used and how they are mounted.

This state-of-the-art test stand for EMC testing is being built in the modernised ETO Building no. 26 in test room 11. The semi anechoic chamber will provide the infrastructure and electromagnetic environment for electromagnetic compatibility testing with measurement equipment. This semi anechoic chamber will be part of the laboratory space and must have sufficient functionality to allow the use and the efficient and safe performance of tests in accordance with relevant standards. The semi anechoic chamber will be suitable primarily for the testing of electrical and electronic railway equipment supplied with both AC and DC voltage, including high voltage up to 3500 V DC.

The aim of this project is to expand activities in the field of EMC, in which the following measurements will be carried out:

- radiated emissions for a measurement distance of 3 m from the EUT (Equipment Under Test),
- conducted disturbance emissions,
- radiated electromagnetic field immunity for a measurement distance of 3 m from the EUT.

In the near future, the Signalling and Telecommunication Laboratory will apply to the Polish Centre for Accreditation (PCA) for an extension of its scope of activities and accreditation of test methods in the field of disturbance emission measurements as well as radio-frequency radiated electromagnetic field immunity tests for railway equipment, thus eliminating its current subcontractors.

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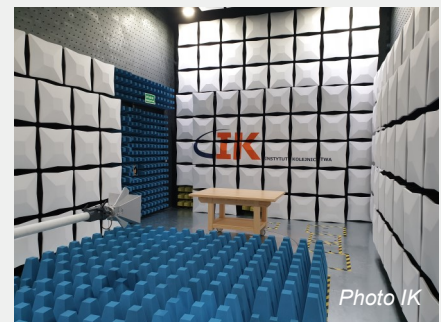


Photo 1. View of the chamber interior after the installation of absorbers on part of the chamber walls

SIRTS Workshop with IK Rail Vehicles Department Staff's Participation

Adam Kamiński

Engineering and Technical Specialist, Rail Vehicles Department, Railway Research Institute



The workshop on this year's changes to the Technical Specifications for Interoperability (TSI) was an opportunity for staff from IK Rail Vehicles Department to share their knowledge of the proposals for these TSI changes, prepared by the European Union Railway Agency (ERA) Working Group.

The Technical Specifications for Interoperability standardise rail transport within the European Union. They contain a number of guidelines,

both for the construction and the functioning of the vehicles themselves and for the infrastructure facilities. The implementation of the provisions contained in the TSIs allows trains to run smoothly - from a technical point of view - within the EU. Currently, there are 11 Technical Specifications for Interoperability in the regulations, which cover energy, telematics applications for passenger and freight services or command control and signalling. Staff from IK Rail Vehicles Department made presentations within the TSIs dedicated to rolling stock. These included:

- Loc&Pas TSI, for locomotives and passenger rolling stock,
- Noise TSI NOI,
- TSI PRM, on disabled and priority persons, on rolling stock,
- WAG TSI freight wagons.

The first presentation, on the Loc&Pas TSI, was prepared by the author of this article. As noted in the introduction, the size and complexity of the material - both the regulations themselves and the proposed changes - challenged the limited time of the presentation, so it was a compromise between a comprehensive presentation of the topic and a thorough listing of all the changes proposed before the European Union Agency for Railways (ERA). The introduction of the presentation featured a brief historical overview of the regulation, the first version of which was published as early as 2011, while the present version, from 2014, has seen many amendments. Reference was then made to deleted points, e.g. the elimination of transition periods (which had actually already expired) and diesel exhaust quality requirements as well as water restocking equipment. Proposals were made for new points, which will, on the one hand, facilitate the placing in service process for new vehicles by, among other things, allowing the use of magnetic brake components with different geometries than those permitted to date, and will also improve the driver's control of the vehicle as a result of the regulation of passenger alarms. The introduction of provisions for the implementation of the energy measurement function (EMF), as well as for the detection and prevention of derailment of wagons on freight trains was also highlighted.

A separate issue concerned paragraphs with amended content, where some provisions were replaced by others. It was shown there that some of the changes were indeed substantive, resulting from the evolving standards, which are reference documents for the TSI Regulation, or coinciding with the technological progress in the railway area, but there were also changes of a purely editorial nature with only a change in the choice of words to better clarify the issue. Another worth mentioning fact is that several significant errors were found by the author in the drafting of the amendments to the Loc&Pas TSI, such as citing erroneous abbreviations for the names of implemented systems or misspelled reference points. These errors were brought to the attention of the relevant people shortly after the presentation, hopefully these obvious mistakes will

be corrected, whereas the mere possibility of such discussions added value to the workshop itself.

The next presentation was on the WAG TSI and was prepared by Witold Groll. Given the less extensive scope of the changes, it was possible to explain in more detail the revised, deleted or added points presented by ERA. Among others, the paper focused on three safety-relevant features:

- derailment prevention (DPF),
- derailment detection (DDF),
- derailment detection and brake actuation (DDAF).

Their use will reduce the cost of potential accidents involving freight trains, which comprises the cost of both repairing the infrastructure and damaging the transported property.

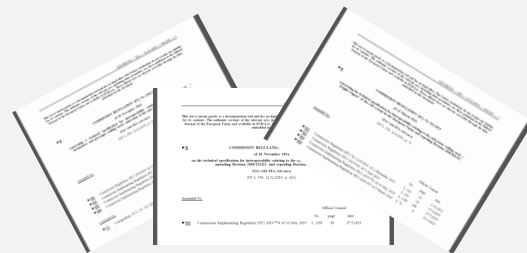
Reference was also made to the provisions in each TSI concerning the management of unit and unit type changes and the authorisation process for placing a new vehicle in service itself, and the need for changes to the so-called appendices of the TSI, such as Appendix A, which regulates the transition periods between versions of the regulation, and Appendix H, which specifies the codification of intermodal transport.

An analysis of the changes in the TSI NOI was also carried out by Witold Groll. Contrary to original assumptions, these turned out to be significant. For the first time, the TSI NOI received an interoperability component, which became the 'friction element of brake blocks', applicable only to freight wagons and definitely affecting the pass-by noise by causing unevenness on the wheel rolling surface during braking.

The last TSI analysed by the IK Rail Vehicles Department was the PRM TSI on rolling stock, with an assessment of the changes made by Marceł Lalik. The presentation outlined, inter alia, which areas of rolling stock it refers to, and outlined the changes in the appendices of the TSI, also taking into account the new normative documents referencing the requirements.

The focus then shifted to the main content, where changes were made to, for example, seats (both privileged and normal), wheelchair spaces, external doors or passageways inside the vehicle. The author also critically evaluated some of the provisions, suggesting a change in content or even in the way the certification problem is approached.

All the presentations discussed above had common elements, due to the fact that each TSI has a unified structure. This included the determination of a new seven-year transition period and rules for EC type or design examination certificates.



The workshop brought together people representing a wide range of rail industry players, including rolling stock manufacturers, i.e. PESA Bydgoszcz, Newag Nowy Sącz or Stadler. As a result, the materials prepared by the staff of the IK Rail Vehicles Department went directly to the companies concerned, raising awareness of the challenges they will face in terms of approval once the proposed changes to the TSI come into force.

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Central European Hydrogen Technology Forum H2POLAND

Paweł Winciorek

Senior Engineering and Technical Specialist, Rail Vehicles Department, Railway Research Institute



On 17-18 May 2022, the first edition of the Central European Hydrogen Technology Forum H2POLAND was held at the premises of the Poznań International Fair in Poznań. The H2POLAND Forum is a platform for the exchange of expert knowledge during conferences and debates combined with an exhibition of the latest solutions devoted to the low and zero economy. The event took place at the Poznań Congress Center, where over the course of two days nearly 100

speakers (representatives of government administration and local governments, investors, scientists and entrepreneurs, who presented up-to-date achievements and solutions necessary for the development of Poland's hydrogen economy), more than 1500 visitors from all over Europe, who attended trade fairs, panel discussions and conferences on, inter alia, financial perspectives, production technology, certification, safety and security, infrastructure, education, partnerships and hydrogen-valleys in Poland and Europe.

As hydrogen enables low-carbon transport and modern energy and fuel technologies - the rail industry is adopting hydrogen technology for rail vehicle propulsion on an ever-increasing scale. For the development of hydrogen-powered rail transport in Poland, it is crucial to create infrastructure related to the transport, storage and refuelling of hydrogen fuels. Hydrogen is set to be the fuel that revolutionises the EU's energy industry and enables the potential of renewable sources to be exploited even more fully - with the aim of bringing Europe closer to climate neutrality. With the help of hydrogen, passengers can travel exhaust fumes-free, CO₂-free, in a comfortable and safe manner. In addition, the hydrogen economy is one of the promising directions for reducing global climate change. It should be mentioned that Poland is the fifth largest producer of hydrogen in the world and the third largest in the European Union.

In this connection, the staff from the Rail Vehicle Department and the Rolling Stock Testing Laboratory of the Railway Research Institute took part in the Central European Hydrogen Technology Forum H2Poland, which provided an opportunity to expand knowledge and make new contacts. IK specialists participated in such social blocks, panel discussions or conferences such as:

- What is the future of hydrogen in Europe? What power of change does it have? – where it was discussed what is commonly referred to as the fuel of the future of energy, or the most common element in the world occupying an increasingly important place in the economy.
- Personnel training, competence development and popularization of knowledge. How to build a modern hydrogen community? – this panel addressed education and competences related to the hydrogen economy.
- Certification of hydrogen and certificates of origin. – as the use of hydrogen as a fuel can bring economic and environmental benefits, and as hydrogen is currently produced from 95% fossil fuels in processes that emit large amounts of CO₂, a suitable certification process and legislative tools were considered, without which the energy transition in Poland will not be efficient and rapid.

- Hydrogen and safety & security. – due to the fact that hydrogen poses certain risks due to its flammable and explosive properties, the discussion focused on the safety of hydrogen use and the systems that enable this safety.

An event related to rail transport was the signing of an agreement on strategic cooperation between Polski Koncern Naftowy Orlen S.A. and Alstom in the supply of zero-emission, eco-friendly trains and hydrogen fuel for public rail transport. The Polish oil and energy company will provide the refuelling infrastructure for the Alstom-produced trains, and the first hydrogen vehicles are likely to roll out on regional lines within two years.



Photo 1. SANCITY 12LFH bus powered by a hydrogen cell manufactured by Autosan sp. z o.o. presented at the H2POLAND Central European Hydrogen Forum [Photo: P. Winciorek]

During the Central European Hydrogen Forum H2POLAND in Poznań, the Podkarpackie voivodeship presented a bus of the SANCITY 12LFH type produced by Autosan sp. z o.o in Sanok. The vehicle is powered by a hydrogen cell and is intended for public transport. SANCITY 12LFH is a 12-metre long low-floor bus. It was designed on the basis of a bus with electric drive. An electric engine is installed in the bus, together with a fuel cell power module. Energy storage is provided by lithium-titanium batteries and H₂ gas tanks



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InnoTrans 2022

Lukasz Mroczkowski

Specialist at Electrical Power Engineering Department, Railway Research Institute



After a break caused by COVID-19, the subsequent 13th edition of the InnoTrans 2022 rail fair took place in Berlin on 20 - 23 September 2022.

Those disembarking at S-Bahn Messe Süd station were welcomed with a Polish sign. In front of the entrance to Hall A, huge charts depicting the future HSR junctions coming out in all directions from the planned Central Transport Port (Hub).

The fair exhibitors presented not only finished vehicles, but also the latest components used in their production.

Poland was represented by more than 80 entities, inter alia, NEWAG, PESA, PKP IC.

The Railway Research Institute's stand was located in the City Cube, Hall A.



A noticeable trend in traction vehicles is the use of hydrogen as an environmentally friendly means of propulsion.

Examples of vehicles with this type of drive include: Stadler's Metrolink or PESA's shunting locomotive exhibited at the fair. Stadler presented a vehicle equipped with as many as three types of drive: catenary voltage, diesel drive and high-capacity batteries operating non-electrified sections.

VPS from Poznań exhibited an electric traction vehicle, PLUS 227M, a three-car train in which each unit had its own bogie, with both electric and diesel drive. Such a solution allows virtually any configuration of the train set, and in the event of a failure of one of the sets, it can be easily replaced with a working one, without taking the entire train set out of service.

The installation of the wheelchair platform perpendicular to the wheel axle provides additional wheelchair space.

SHUNK presented a patented arrangement of pantograph contact strips with embedded magnets for spark compensation and, in addition, a pantograph with an contact wire line

fault detection recording system, which facilitates sending information to maintenance services regarding the location of faults. The company has its business office in Warsaw.

SKF GmbH presented its own patented horizontal shift system for wheelsets during riding, allowing even wear on the rolling surfaces of the wheels, prolonging failure-free operation.

PANTO presented a comprehensive diagnostic system for the measurement of overhead contact line parameters (wear of structural contact wire, suspension height, stagger, etc.). On the basis of the geolocation data, the exact location of the failure is indicated.

The fair enabled direct contact with exhibitors, informative talks and the presentation of the Railway Research Institute's research capabilities to potential customers. The Institute's range of services includes:

- analyses and opinions in the field of rail transport,
- product certification in accordance with the requirements of PN-EN ISO/IEC 17065:2013-03,
- National Technical Assessments for construction products intended for use in rail superstructure,
- safety assessment in accordance with European Commission Implementing Regulation (EC) No 402/2013 of 30 April 2013, as amended, with regard to:
 - a) structural subsystems: INFRASTRUCTURE, ENERGY, ROLLING STOCK, CONTROL-COMMAND AND SIGNALLING On-board and CONTROL-COMMAND AND SIGNALLING Track-side,
 - b) the functional subsystems: OPERATION AND TRAFFIC MANAGEMENT, MAINTENANCE.



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