

IZOLYATOR *120 years*

CENTURIES-OLD TRADITIONS – STATE-OF-THE-ART TECHNOLOGIES

SPECIAL ISSUE #1/2016



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The 46th CIGRE session is an important step in development of the global power industry



DR. ALEXANDER SLAVINSKY,

Chairman of the Board of Directors at Izolyator, Head of RNC CIGRE SC D1, Vice President AES RF, Vice President TRAVEK Association

Throughout its existence, Izolyator has set ambitious goals. One of our key priorities today is development of strong relations with foreign partners all over the world. A big event for us was receipt by Izolyator of the status of Leading Science and Technology partner of the Russian National Committee of the International Council on Large Electric Systems — CIGRE (Conseil International des Grands Reseaux Electriques — CIGRE), which is the largest nongovernment, non-commercial international organization in power sector.

We are confident that our cooperation with CIGRE would allow us to take the quality of our work to a new level in the interests of all its members and for the benefit of the power industry in Russia in general.

Izolyator actively engaged in the work of the 46th session of the International Council on Large Electric Systems — CIGRE, which took place in the Palace of Congresses in France on 21–26 August 2016.

Oleg Budargin, General Director at PJSC ROSSETI and Andrey Murov, Chairman of the Board of Directors at FGC UES JSC and RNC CIGRE Chairman headed the delegation of the Russian National Committee of CIGRE, which included the management of Russian power companies, leading scientists, representatives of power equipment OEMs, and design organizations also joined the delegation.

Izolyator representatives who entered the combined delegation:

Dr. Alexander Slavinsky, Representative of Russia in SC D1, Head of SC D1 RNC CIGRE, Chairman of the Board of Directors at Izolyator;

Vladimir Ustinov, SC D1 RNC CIGRE Coordinator, Dty Quality Director at Izolyator and Valery Rusov, Chief Engineer at Dimrus Ltd.

During discussions and poster sessions on the topics of SC D1 the following subjects were considered:



Opening of the 46th CIGRE Session

- compact insulation systems of alternating and direct current (the presented reports included details of application and measurements of various insulation systems);
- new materials (the presented reports were dedicated to new materials application in high-voltage equipment);
- new test techniques (the speakers focused on development of new procedures and test techniques for insulation systems used in electric equipment).

On 23–24 August, SC D1 RNC CIGRE members took part in the technical meeting of SC D1 where the Chairmen of the consulting and working groups of the Committee made their reports.

The executive committee of SC D1 SIGRE had contacts with IEC and working groups of the Study Committee D1 interacted with their counterparts in relevant fields during the session.

Parallel to the main agenda at the 46th Session of CIGRE, FSK UES and Izolyator delegates had business meetings with such companies as:

- GE Grid Solutions;
- Terna S. p. A.;
- Elia and CG Power Systems Belgium NV.

MEETING BETWEEN GE GRID SOLUTIONS, FGC UES AND IZOLYATOR REPRESENTATIVES

The starting point of the trilateral talks was FGC UES' interest in co-



Andrey Murov, right-forefront at the 46th CIGRE Session



Alexander Slavinsky (L) and Vladimir Ustinov at the 46th Session of CIGRE

operation with large foreign power grid companies. In this respect, GE Grid Solutions and Izolyator's positive experience with multinational companies, operating in power transmission and distribution provided a good basis for discussion. The sides agreed on the next steps that would help further develop business ties in the global power system.

No less important was the topic of activities consolidation in CIGRE's study committees. The preceding discussion took place during Steffen



Meeting of Terna S. p. A., FGC UES and Izolyator representatives

Breuer's visit to Izolyator on the eve of the Session. The sides outlined the main directions of cooperation meeting their common interests.

MEETING OF TERNA S. P. A., FGC UES AND IZOLYATOR REPRESENTATIVES

Terna S. p. A. and FGC UES executives made their first contact and set up business ties with Izolyator's assistance. The sides shared interest to develop interaction by discussing various aspects of power networks operation.

MEETING OF ELIA, CG POWER SYSTEMS BELGIUM NV, FGC UES AND IZOLYATOR

The meeting appeared as a follow-up and development of Russia-Belgium business talks held earlier at FGC UES headquarter in Moscow.

The sides mapped the nearest steps in cooperation development between the power networks of Belgium and Russia and continued sharing experience in power equipment operation including high-voltage RIP bushings made by Izolyator.

The 46th CIGRE Session resulted in the expansion of international contacts, scientific and technical exchanges and a productive dialogue on the present issues of the global power industry development, including cooperation plans between the combined Russian delegation and the partners.



Meeting of Elia, CG Power Systems Belgium NV, FGC UES and Izolyator representatives

UNIQUE EVENTS IN THE WORLD'S POWER INDUSTRY

"The only way to have sustainability in life is to keep moving". Modern trends in power industry prove the saying true: it develops demanding more and newer technologies for an unstopping and more reliable operation. Izolyator faces the challenge by offering the best solutions to the market. Ivan Panfilov, Commercial Director at Izolyator is telling about the achievements that won a particular recognition from the market.



SHARING UNIQUE EXPERIENCE

We have been very active internationally and have already gained reputation of an open company with partner contacts in many countries around the world.

One of Izolyator's priority objectives is setting partnerships with power grid and generation companies, transformer plants of Europe and Asia. In order to provide representatives of the leading world's grids and power equipment OEMs with an opportunity to have a close look at our newest technologies, especially the proprietary HV bushings with RIP insulation, we organized an international conference dedicated to the 120th Anniversary of Izolyator company in Italy in the beginning of June.

22 delegates attended the event in Italy

The participants of the event received an opportunity to witness the highest level of quality of the innovative products and professionalism of our specialists. Our team presented to the partners a unique product, which appeared as a result of mass use application of HV RIP bushings. For more than 15 years, HV bushings with RIP insulation of up to 750 kV voltages have been successfully operated, so we do have what to say about their design, manufacture, installation and operation in transformers.

1896 foundation of Izolyator

PROVED BY EXPERIENCE

In the framework of the conference, we carried out a series of successful seismic tests of 420 kV high-voltage bushings with RIP insulation designed and custom-made under



Participants in the international events dedicated to the 120th Anniversary of Izolyator

Izolyator exports products to more than 30 countries

order of the state company Power Grid Corporation of India. The test went in one of the world's leading test laboratories CESI S. p. A. in Italy.

AN OUTLOOK OF THE FUTURE

The conference became a closing stage of a large work. In the result, we collected a great amount of positive feedback. It is important for us to know that our partners share the idea of active cooperation in promotion and integration of innovative products in the global market of power products. Izolyator's experience and innovations allow us to say that we truly strive to be a global leader in design, production and implementation of modern technologies in power industry!

We thank our partners for their sincere interest to Izolyator's achievements and hope to see our dialogue on power industry development continued and transformed in a solid foundation for cooperation.

Representatives of 10 companies in 5 countries took part in the conference

CESI

CESI is an independent center of expertise and a global provider of technical and engineering services to customers throughout the energy value chain, including business and technical consultancy, engineering and operational support. The center acts as owner's engineer and provides qualified third-party opinion to power utilities worldwide. Through its top-class modern testing facilities located in Milan, Berlin (IPH GmbH) and Mannheim (FGH GmbH), CESI is among the leading international organizations providing measurements and inspection, testing & certification and design review services to the global power industry.



All planned activities went successfully!



The experts are overseeing the tests

The International Conference dedicated to the 120th Anniversary of Izolyator

To mark its 120th Anniversary, Izolyator organized an international conference where representatives of the world's leading power grids and power equipment OEMs shared unique experience in design, manu-

facture, operation and technical maintenance of high-voltage bushings with hard RIP insulation. Besides, the participants of the event used the opportunity to discuss present issues of power genera-

tion, transmission and distribution development and evaluate modern trends in power industry development in general.

Ivan Panfilov, Commercial Director at Izolyator opened the conference

by introducing all the participants and pointing out how unique and important the event was for the history of the world's power industry.

Izolyator company was then introduced, from a brief overview



Ivan Panfilov introducing the participants of the conference



Ivan Panfilov speaking. R — Pavel Kiryukhin and Andrey Shornikov



Giuliano Bertolazzi making a report. L – Yaroslav Sedov

of its century-long history milestones, to the modern production potential and key technical policy directions. The speaker said about the company's achievements and advantages, namely, 570 000 bushings ever made, international recognition and the 15-year experience

with RIP technology as well as other facts. A special emphasis was made on Izolyator's adherence to modern approaches to partnerships development. The report also contained the HV bushings market indicators and general trends including RIP bushings demand growth.

In the closing remarks, the speaker presented a general overview, structure and key indicators of the Russian power industry.

Giuliano Bertolazzi, Izolyator's partner in Europe, dedicated his report to the European segment of the global power and electrical engineer-

ing products markets starting with macroeconomic indicators of Europe as the third region in terms of power generation. A lot of materials were presented on the structure of power industry and equipment makers in Europe as well as dominating trends on the market of HV RIP bushings.



Natalia Mazova speaking



Andrey Shornikov making a report. R – Dr. Ashok Singh

Yaroslav Sedov, BDM at Izolyator made a summary of activities with European power equipment OEMs.

Izolyator received official supplier status from various European transformer plants. On their side, European companies expressed readiness to promote RIP bushings in their projects. The speaker presented plans and prospects of cooperation

expansion with leading companies in the segment.

Natalia Mazova, International BDM at Izolyator told the audience about Izolyator's results achieved in partnership with leading power grid companies of Europe. The joint activities resulted in setting up direct contacts with Izolyator and experience sharing between power grids

of Russia and Belgium, making an important input in the integration processes in the global power industry.

Izolyator's CIGRE membership and activities are an important form of international cooperation and strategic development, for example, in research carried out by the Study Committee D1, where Russia is represented by Alexander Slavinsky,

Chairman of the Board of Directors at Izolyator.

In the end, Natalia Mazova summarized results of cooperation with European partners and presented nearest and long term plans of joint activities development with the leading power grid companies and power equipment OEMs in Europe.



Vikram Singh Bhal speaking

Izolyator's partner in India — Dr. Ashok Singh — gave an overview of the economy in India as very attractive for investment and its power sector — as a dynamic industry with a growing demand for innovative technologies and products. The speaker told the audience about the structure and generation capacity distribution in the power network of India and production capacities of local transformer OEMs pointing out their annual growth rates reaching 15 %.

Speaking about the company's progress in India, Andrey Shornikov, International BDM at Izolyator provided details on the following achievements:

- Establishment of solid partnerships with the state power corporations;
- Knowledge and experience sharing on a regular basis between India and Russia;
- Setting up business ties with the power equipment manufacturers;
- RIP bushings delivery to the power facilities of the country.

The speaker made an emphasis on the practical results of cooperation with the strategic partner —

the Indian state power network operator — Power Grid Corporation of India Limited. The reciprocal visits of PowerGrid representatives and Russia's Federal Grid Company, organized with Izolyator's facilitation, laid foundation for experience sharing and multi aspect Russia-India exchanges in power sector.

Izolyator specialists' visiting seminars at the Indian transformer plants held a substantial part among activities: the staff of the plants got an introduction to design, installation and operation of RIP bushings.

In the end of report, the speaker sounded plans of further cooperation promotion with the Indian companies.

In his speech, Vikram Singh Bhal, Deputy General Manager at Power Grid Corporation of India summarized the successful cooperation with Izolyator. The main result of joint activities is a clear understanding of absolute advantage of the RIP technology and, as a consequence, orientation of the Indian market to high-voltage bushings with this type of insulation.

In view of the bright future of RIP bushings, the speaker emphasized the importance of cooperation

intensification with Izolyator company.

Pavel Kiryukhin, Dpty Chief Designer at Izolyator introduced the RIP technology features and made a comparative analysis of OIP and RIP bushings. The analysis shows that RIP has evident qualitative and quantitative advantages in all lifecycle stages of an HV bushing: design, production, transportation and storage, installation, operation, modernization, and, finally, recycling.

HV RIP bushings are a new generation product, fully oriented to the modern demands of power men that ensures a reliable and safe operation of power networks in any ambient conditions.

All the delegates joined the discussion and shared opinions giving the event an atmosphere of a very open and vivid dialogue.

In the framework of the confer-

ence, Izolyator performed a series of successful seismic tests of 420 kV HV RIP bushings made by the plant. The main purpose of the tests was to confirm that the products are in full conformity with requirements of the customer — the Indian company Power Grid Corporation of India Limited — and the IEC standards.

The tests were held in 6-10 June 2016 in the world recognized electrical engineering test center CESI in Italy.

The independent center CESI provides expertise in measurements, inspection, testing, certification and evaluations for power grid companies and electrical engineering companies from all over the world.

According to the experts, the event became meaningful not only for RIP technology promotion, but for development of the power industry in the world in general.

The event organized by Izolyator in Italy has no analogues in the power industry and electrical engineering: representatives of the leading power networks of five countries gathered in one venue for the first time.



Closing the successful conference

INTRODUCING THE EXPERTS OF THE CONFERENCE



VIKRAM SINGH BHAL
Deputy General Manager



Power Grid Corporation of India Limited (PowerGrid) is an India-based company engaged in construction, operation and maintenance of inter-state transmission system (ISTS). The company's core business is transmission of bulk power across different States of India. The company also renders telecom and consultancy services. The telecom business is part of PowerGrid's transmission infrastructure across the country. As regards consultancy services business unit, it includes all projects in engineering, procurement and construction within and outside India: electrical power transmission and distribution by state-owned and private utilities, energy efficiency, smart grid and training.



ANDREA VALANT
*Substation Technology
Development Manager Technologies
and Specialist Support*



CLAUDIO SERAFINO
Service Engineer



The Terna Group (Terna S.p.A.) is the first grid operator for electricity transmission in Europe. Through Terna Rete Italia the Group safely manages the National Transmission Grid with over 72,000 km of HV lines. Terna Rete Italia is the company belonging to the Terna Group that deals with the national electricity grid's operation, maintenance and development fully respecting the environment and communities.



FRANCESCO POLI
Department Development Solutions



Enel is a multinational power company and a leading integrated player in the world's power and gas markets, with a particular focus on Europe and Latin America. The Group operates in over 30 countries across 4 continents, producing energy through a net installed capacity of more than 89 GW and distributing electricity and gas through a network spanning around 1.9 million km. Enel, with its 61 million end users worldwide, has the largest customer base among European competitors and Europe's leading power in terms of installed capacity and reported EBITDA.



CONSOLARO LORENZO
*Engineer Technical
Department*



DAL MOLIN LUCA
*Engineer Sales
Department*



S. E. A. Societa Elettromeccanica Arzignanese S. p. A. since 1959 devoted itself to electricity, starting its entrepreneurial experience as a small workshop and consolidating it as a leading industry player in the field during next years. The trademark implies the experience and engagement of a collaborative team who has been able to assert itself in Europe and all over the world. SEA has become synonymous of technology, reliability, safety and service thanks to its managers, to the creativity and experience of designers, to technicians' steady updating, to continuous investment in research and development derived by a strong motivation to constant improvement. Professional competence and the best technology are at disposal to meet any requirements: Single-phase & three-phase liquid immersed or dry cast resin and air insulated Nomex® transformers, amorphous & high efficiency transformers, reactors and coils with different powers, cooling and not standard executions.



ANDREA GAMBARDELLA
Head of Design Dept



Getra is an Italian Group leader in Design, Manufatcure and Supply of Power Transformers, Distribution Transformers and Grid Solutions. It was established in 1949 and nowadays it has a track record of 250.000 Transformers Supplied in Europe, America, Asia and Africa. With five Companies (Getra Power S.p.A., Getra Distribution S.r.l., Getra Service S.r.l., Getra Engineering & Consulting S.r.l. and Getra Eco-power), two Plants featured with the most advanced technologies for Production & Testing, two Branches in Africa and Middle East, Getra Group covers and accomplishes the needs of an increasingly dynamic and developing Global Market with a complete range of tailor made, efficient and high quality solutions.



FREDERIC VERARDO
*Supply Chain Manager
Power Activity*



Dedicated to the transformation of electrical energy for more than 60 years, JST transformateurs is proud to count among its worldwide customers the biggest names of electricity generation, transmission and distribution, railway transportation, as well as those of industrial sectors having the heaviest energy needs. Based in Lyon, France, where the transformers are designed, JST's activity consists of 3 different sectors: Power, Traction, Services. Due to JST's stellar record, strict quality requirements, excellent communication with customers and partners, and constantly renewed certifications, JST is considered a leader in the transformer industry with an undisputed reputation. JST transformateurs has grown around the France based head office and main production site as a solid group, dedicated to customers.



MATTHIAS BRULAND
Development Engineer



KINGA KASTENBERGER
Area Sales Manager



Maschinenfabrik Reinhausen GmbH (MR) is a leading company within the Reinhausen Group. It has designed and manufactured insulation tubes from glassfiber reinforced polymers for more than 30 years.

Based on this know-how and experience, it was a logical step to expand the business field insulation material and offer hollow composite insulators in MR-quality to the market. Under the brand name ReCoTec® (Reinhausen Composite Technology) a continuously growing range of hollow insulators with silicone rubber sheds for outdoor applications as well as without sheds for indoor use is available.



FEDERICO BIASIBETTI
*Sales Manager
Special Anhydrides*



MARCO DESIDERI
*Product Manager
Special Additives*



Polynt S. p. A. has been active in the production, sales, research and development of organic anhydrides and their derivatives for over 60 years.

Its membership of the major chemical intermediates sector means the Company plays a central role in the process that ranges from petroleum refining to the production, sale and distribution of finished products on the market. The company operates internally throughout the production-distribution chain divided into the following activities: Research and Development; Production planning and sourcing of raw materials; Production process, quality control and logistics; Storage; Sales and after-sales assistance with finished goods.

Seismic Tests of Izolyator Bushings



Installation of a bushing on a test rack



Connecting measuring equipment

The tests' objective is to confirm Izolyator 420 kV RIP bushings compliance with IEC 61463 requirements (insulated bushings — seismic qualification), AG5 level. The TCSIV-90-420/1250 bushing design and its electric parameters correspond to bushings with maximum operating voltage of 550 kV. According to IEC 61463, AG5 level corresponds to 9 on the MSK (Medvedev-Sponheur-Karnik) scale and over 7 on Richter magnitude scale.

The bushing was placed on a specially made for the seismic test rack so that the mounting flange was more than 3 meters above the surface of the vibration stand at an angle 17 degrees to the vertical. The rack imitated transformer installation.

As stipulated by IEC 61463, in order to qualify a bushing for any transformer, acceleration in all three axes during the test must be increased 1.5 times (amplification



The bushings is ready for testing

gain) against standard acceleration at AG5 level — 5 m/s².

The seismic test was organized in several phases:

Before the test, they installed accelerometers on the bushing: top side, bottom side, center and in the center of mass. Those devices were used for acceleration measurements in the axes. They mounted gauges on the coupling for tension and compression measurement at cantilever load.

Stage 1

Test with abrupt drop of cantilever load

The bushing was set in an erect position for the test. Before the test, they did tension and compression gauges calibration on the coupling. The calibration was performed by cantilever load application to each of the horizontal axes in the following order: 2000 N — 1 min, rest — 1 min, then 2000 N — 1 min, rest — 1 min, then 4000 N — 1 min.

Thereafter, they applied a 4000 N load to the top side of the bushing and dropped it. The accelerometers recorded damped oscillation at the drop of load. Thus, a 1.75% attenuation of the bushing was found. The test was done twice — for every horizontal axis.

Stage 2

Resonant frequencies scanning for each of the three axes. Sinusoidal input of 0.5 to 37 Hz at 0.05 g was applied. The sensors readings were recorded at the tests.

Stage 3

Seismic tests. Force is applied in three axes at a time with zero period acceleration (seismic activity level) over 0.75 g. Exposure duration — 32 sec, active part exceeding 20 sec.

Before applying a 100% force, the testers made the tests for 25%, 50% and 75% levels. Thus, before passing an earthquake with a magnitude of 9, the bushing withstood earthquakes measuring less



Fragment of the measuring circuit



Seismic tests in progress



Experts at CESI S. p. A. test laboratory



The tests are performed in presence of the international group of experts



Video recording of the tests

than 7 and between 7 and 9. After the seismic tests, the bushing was examined for any damages, technicians also checked thread torque — the bushing was sound.

Stage 4

Resonant frequencies scanning separately on each of the three axes. Sinusoidal input of 0.5 to 37 Hz at 0.05 g was applied. The sensors readings were recorded at the tests.

The frequency readings taken were compared to those received at phase 2 with no deviations found either. It says about an unchanged mechanical condition of the bushing after the seismic tests.

Stage 5

Electric acceptance tests at the plant's test laboratory.

Stability of electrical parameters of the main insulation of the bushing and successful acceptance tests will be one more proof of successful seismic tests of Izolyator 420 kV RIP bushing withstanding a seismic impact measured above 9 on the MSK scale.



Strengthening business ties



CESI S. p. A. staff are specialists of the highest level

CESI Test Protocol of Izolyator Bushings

Test Report

Document No.	B6012361	Copy No.	1	Number of pages	62
Apparatus	Bushing for Transformer 420 kV				
Designation	TCSIV-90-420/1250				
Serial Number	55934 201505				
Manufacturer	Massa LLC (Izolyator Company)				
Client	IZOLYATOR Company Izolyator Company (Massa LLC) 77 Lenina st., Pavlovskaya Sloboda Village 143581 ISTRRA DISTRICT, MOSCOW REGION Russia				
Tested for					
Date(s) of tests	June 06 – 08, 2016				
Tested by	CESI - LPS Laboratory Testing & Certification Division via Pastrengo, 9 24068 SERIATE BG - ITALY				
Test performed	Seismic Test				

PAD_B6012361 (2268737) - CONFIDENTIAL USE

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in this document has been subjected to the series of proving tests in accordance with:

IEC 60068-2-57: 2013
IEC 61463: 2000
Specification POWERGRID Co. of INDIA

The results are shown in the record of proving tests and the oscillograms attached hereto. The general performance is considered as mentioned above. The ratings assigned by the Manufacturer are listed on the ratings page. The document applies only to the apparatus tested. The responsibility for conformity of any apparatus having the same designations with that tested rests with the Manufacturer.

June 24, 2016

Bontempi Paolo
B6012361 3550 AUT

Test Engineer in charge


The Manager - Arcidiaco Lorenzo
B6012361 621814 APP

Approved By

Partial reproduction of this document is permitted only with the written permissions from CESI Group. The authenticity of this document is guaranteed by the integrity of hologram.



LAB N° 0030

The laboratory meets the requirements of the Standard EN ISO/IEC 17025: 2005 "General Requirements for the Competence of Testing and Calibration Laboratories". The in force status of the accreditation and the list of accredited tests may be checked in the WEB site: www.accredia.it



CESI

Trust the Power of Experience

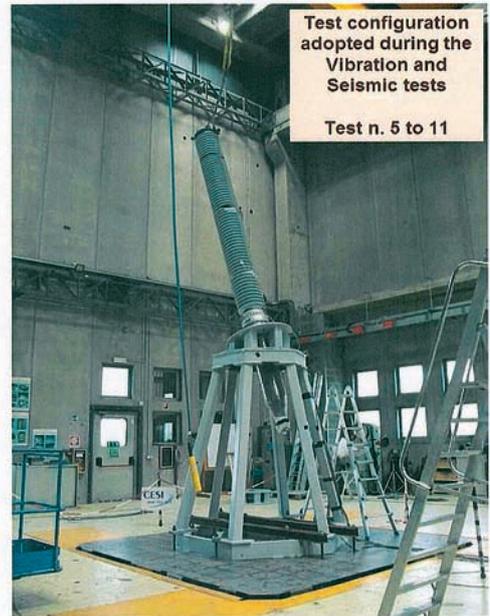
Photo 2



LAB N° 0030

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Photo 3



LAB N° 0030

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During the test series the bushing withstood seismic impact of 9 on the MSK-64 scale. Absence of mechanical damage and stability of the electric parameters of the main insulation before and after the tests once again proved the high quality and reliability of Izolyator's HV RIP bushings design.



Participants in the successful tests at CESI S. p. A.



**GIULIANO
BERTOLAZZI,**

*Partner of Izolyator
In Europe*

The tests and the international conference organized by Izolyator in Italy demonstrated the highest level of quality of its products and professionalism of its specialists

The tests of the innovative 420 kV RIP bushings sparked interest of a wide range of invited specialists and experts who represent power grid companies and power equipment OEMs from France, Italy, Germany and India.

The successful tests of the bushings by resonance method once again demonstrated the high level of R&D, design and manufacturing at Izolyator. It should be said that some of the attendees were not well acquainted with Izolyator company and were pleasantly surprised having learnt about its century-long experience, scientific and technical potential.

I would like to thank Izolyator team for their highest professionalism, effort and strive for successful and quality promotion of their products and new technologies to the European market.

Izolyator expresses a sincere gratitude to all the organizers and participants of the events held in Italy on the eve of the 120th Anniversary of the company:

Power Grid Corporation of India Limited



- Vikram Singh Bhal,
Deputy General
Manager.

Terna S. p. A.



- Andrea Valant,
Substation Technology
Development
Manager Technologies
and Specialist
Support;
- Claudio Serafino, Service
Engineer.

Enel S. p. A.



- Francesco Poli, Depart-
ment Development
Solutions.

SEA Transformatori S. p. A.



- Dal Molin Luca,
Engineer Sales Dept;
- Consolaro Lorenzo,
Engineer Technical Dept.

Getra S. p. A.



- Andrea Gambardella,
Head of Design Dept.

JST Transformateurs

- Frederic Verardo, Supply



Chain Manager Power
Activity.

Maschinenfabrik Reinhausen GmbH (MR)



- Matthias Bruland,
Development
Engineer;
- Kinga Kastenberger,
Area Sales Manager.

Polynt



- Federico Biasibetti,
Sales Manager Special
Anhidrites;

- Marco Desideri,
Product Manager
Special Additives.

Izolyator



IZOLYATOR

- Ivan Panfilov,
Commercial Director;
- Pavel Kiryukhin,
Deputy Chief
Designer;
- Natalia Mazova,
International BDM;
- Andrey Shornikov,
International BDM;
- Yaroslav Sedov,
BDM;
- Vladimir Okunev,
Chief Engineer.

Regional partners of Izolyator

- Giuliano Bertolazzi,
Partner in Europe;
- Ashok Singh,
Partner in India.

We would like to express our special thanks to the management and staff of CESI S. p. A. for the highest technical and professional level demonstrated during Izolyator bushings' tests.

The tests of high-voltage bushings with patented RIP insulation proved that the century-long traditions of Izolyator successfully blend with the newest designs and modern production technologies.

120 years

**IZOLYATOR**

Centuries-old traditions – state-of-the-art technologies

CERTIFICATE

This is to certify that

Mr. Vikram Singh Bhal

took part in a series of seismic tests of 550 (420) kV high-voltage bushings with solid RIP-insulation at CESI S.p.A. (Italy).

The bushings were developed and manufactured by Massa LLC – Izolyator company (Russian Federation) under order of Power Grid Corporation of India Ltd. (India).

Chairman of the Board of Directors
Izolyator Company
A.Z. Slavinsky



June 9, 2016

The personal certificate of Izolyator company for participants in the seismic tests of 420 kV bushings at CESI S. p. A.

**ASHOK SINGH,**

*Partner of Izolyator
in India*

The international conference, dedicated to the 120th Anniversary of Izolyator, held in the beginning of June, became a big event for all its participants.

It is worth mentioning the great job done by the company staff to prepare it over the preceding months. Primarily, it concerns the seismic tests of the 420 kV RIP bushings that were designed and custom made under order of Power Grid Corporation of India Ltd.

The tests at CESI were not an easy task for Izolyator company but it was organized to the world standards demonstrating the highest quality level and professionalism of engineers to the partners. The conference in Italy made it prominent and visible that Izolyator has the experience and the potential to offer value added products to the global markets.

I am convinced that every Izolyator employee made a positive input to achieve the company goals, and it makes me very proud to be the Chief Representative of the company in India.

The key priority for Izolyator in the near years remain European and Asian regions expansion and the strive to leadership in production and implementation of modern technologies in power industry.

The Final Stage Of the Tests Went Successfully!



Finalizing inspection plan, L-R: Andrey Shornikov, Richik Manas Das and Pavel Kiryukhin



Inspection plant agreed



At the Test Center of Izolyator plant

The state Indian Power Grid Corporation of India Limited inspected Izolyator 72.5 kV, 232 kV and 420 kV Izolyator bushings tests.

Izolyator plant ran the final stage of acceptance tests — electric tests of the 420 kV RIP bushing for 1250 A current (type TCSIV-90-420/1250, drawing IVUE.686354.603).

They were preceded by the successful electric tests under rain in the All-Russian electrical engineering Institute named after V.I.Lenin (VEI) in Moscow and the seismic tests in CESI S. p. A. laboratory in Italy.

The bushings were designed and made by Izolyator for installation in three-phase 500 MVA autotransformers made by Crompton Greaves T1 Division for operation in 400 kV Bamnauli substation owned by Delhi Transco Limited in Delhi, part of PowerGrid.

VEI carried out the final stage of type tests — electric tests under rain — of 72.5 kV / 800 A (type TCSIV-90-72.5/800, drawing IVUE.686351.611) and 252 kV / 1250 A (type TCSIV-90-252/1250, drawing IVUE.686353.612) bushings.

The bushings have been designed and made by Izolyator for installation in Toshiba Transmission & Distribution Systems (India) Pvt. Ltd. transformers designated for operation in power facilities of the state of Kashmir in India at over 3500 meters above the sea level.

Richik Manas Das, Inspection engineer at PowerGrid arrived in Moscow to supervise the tests.

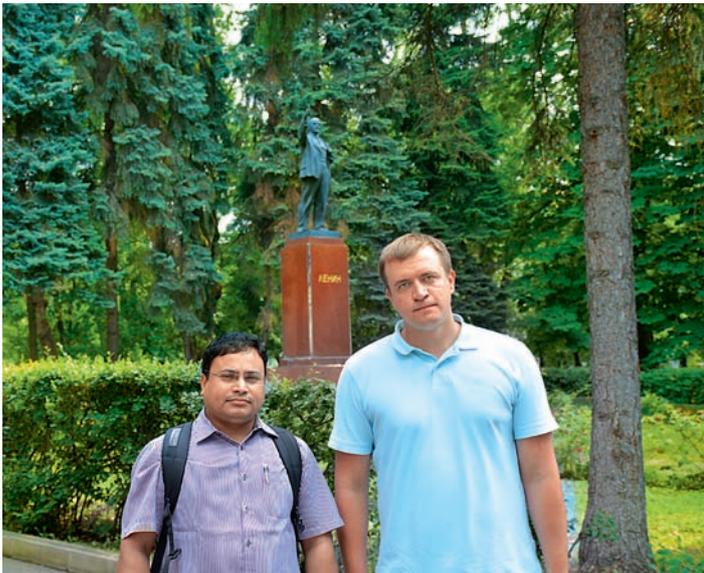
Dmitry Ivanov, Head of Test Center managed the tests procedures at Izolyator plant. Other Izolyator team members took part in the tests:

- Vladimir Ustinov, Deputy Quality Director,
- Pavel Kiryukhin, Deputy Chief Designer,
- Andrey Shornikov, International BDM.

PowerGrid confirmed the successful results of the HV bushings' tests with official letters.



At the Test Center of VEI, L-R: Andrey Shornikov, Richik Manas Das and Vladimir Ustinov



At VEI premises



Discussing the tests results



पावर ग्रिड कारपोरेशन ऑफ इंडिया लिमिटेड
 (भारत सरकार का उद्यम)
POWER GRID CORPORATION OF INDIA LIMITED
 (A Government of India Enterprise)



संघीय कार्यालय : 'सौदामिनी' ब्लॉक, प्लॉट नं. 2, सेक्टर-29, गुर्गाँव-122 001, हरियाणा
 फोन : 2571700 - 719, फैक्स : 2571760, 2571761 तार : 'नेटग्रिड'
 Corporate Office : 'Saudamini' Plot No. 2, Sector-29, Gurgaon-122 001, Haryana
 Tel. : 2571700 - 719, Fax : 2571760, 2571761 Gram : 'NATGRID'

संदर्भ संख्या/Ref. Number

CIN: L40101DL1989GO11038121

संदर्भ / Ref: C-ENG/Tr. Core/IZOLYATOR/BSG/420-1250/TT/AUG/01 दिनांक / Date: 08.08.2016

संग / To: **M/s Izolyator High Voltage Electrical Equipment**
Massa Ltd. Company, Lenina Street 77, Pavlovskaya
Sloboda village, Istra District,
Moscow region, Russia, 143581

Kind Attn: Mr. Andrey Shornikov, International Business Development Manager
Dr. Ashok Singh, Chief Representative Massa, India

विषय / Sub: **Type Test approval of 420kV/1250A RIP Bushing – M/s Izolyator, Russia Make**
 Dear Sir,

Please refer to your letter ref NIL, dated 02/08/2016 & dated 04/01/2016 and email dated 08/08/2016 regarding the submission of type test reports of above subject bushing. The type test were carried out at M/s Izolyator, Russia, M/s VEI, Russia and M/s CESI, Italy in line with IEC 60137-2008 and witnessed by POWERGRID.

Sr. No	Test Description as per IEC 60137-2008 On 420kV/1250A (S/L/AC=1050kVp/1425kVp/695kVrms) RIP Bushing Drawing/GTP No. 686354.603 Type:TCSIV-90-420/1250 Bushing Sr. No. n-65934	TEST REPORT	Remarks
01	Long Duration Power Frequency voltage withstand test (ACLD)	325 Part 1	Found generally in order
02	Dry Lightning Impulse withstand test	325 Part 1	
03	Dry & wet switching impulse voltage withstand test.	325 Part 1 & 11020-092-2015	
04	Temperature Rise Test	325 Part 2	
05	Thermal Stability Test	325 Part 1	
06	Electromagnetic compatibility test	325 Part 1	
07	Verification of Thermal Short Time current withstand	Enclosed	
08	Cantilever Load withstand Test	325 Part 1	
09	Verification of Dimension	325 Part 1	
10	Snap Back Test	B6012361	
11	Seismic Test	B6012361	
12	Routine Tests	325 Part 1 & after seismic	

With these the requirement of type test on above bushing is completed.

Thanking you.

Yours truly,

 (Gunjan Agrawal)
 Ch. Manager (Engg-S/s)

पंजीकृत कार्यालय : बी-9, कृष्ण इंस्टीट्यूशनल एरिया, कल्याणिया सारण, नई दिल्ली - 110016 दूरभाष : 6560121 फैक्स : 011-6560039 तार : 'नेटग्रिड'
 Registered Office : B-9, Krishna Institutional Area, Kalyanias Saran, New Delhi - 110016 Tel. : 6560121 Fax : 011-6560039 Gram : 'NATGRID'

Official confirmation of the successful tests results



NATALIA MAZOVA,

*International Business
Development Manager
at Izolyator*

Today, Izolyator is actively working with the leading power grid companies and electrical engineering plants in the European Union. Giuliano Bertolazzi, Representative of our company in EU, helps us to organize a productive cooperation with our European partners. The ongoing activities were only possible thanks to a large work on our side to promote high-voltage bushings with solid RIP insulation done in the past few years.

It is no secret that the European power market is oriented to OIP bushings at the moment. However, with the HV bushing's design perfection, we are confident that the time of OIP technology has passed. Our European partners are fully aware of that. The international conference, held in the beginning of June in Italy, was also aimed at orienting our partners in Europe towards application of HV RIP bushings. We discussed global trends in power industry, told about innovative designs and achievement of our company as well as features of the new equipment.

Many participants of the event marked how informative it was, so we hope to see orders for our products in the result.

Cooperation With the Leading Global Companies

In the framework of international promotion expansion and new partnerships development, Izolyator organized a quadripartite meeting with participation of representatives of the Belgian state grid company Elia, transformer plant CG Power Systems Belgium NV and Federal Grid Com-

pany of Unified Energy System of Russia. The sides shared experience in HV equipment operation including RIP bushings. Belgium, represented by the state power company Elia, became the first in Europe to start a transition program from OIP to RIP bushings making Izolyator the first

HV RIP bushings supplier for the program.

In the result of the meeting, Elia and FGC UES representatives expressed a common opinion about considering our company as a regular RIP bushings supplier to the power network of Belgium and Europe in general.



The quadripartite meeting at FGC UES HQ in Moscow



Elia is not just Belgium's transmission system operator — it is also a key player at European level. Elia is Belgium's high-voltage transmission system operator (30 kV to 380 kV), operating over 8000 km of lines and underground cables throughout Belgium.



CG Power Systems Belgium NV (formerly Pauwels Trafo Belgium NV) is a developer of innovative, high-quality, reliable products and turnkey solutions for a wide range of power applications with manufacturing units in Belgium, Ireland, USA, Canada and Indonesia.



Federal Grid Company is the operator and manager of Russia's unified electricity transmission grid system, including high voltage transmission lines, and holds the status of a natural monopoly. The Company's assets include more than 139,000 km of transmission lines and 924 substations with more than 332 GVA of 35–750 kV transformer capacity.



Izolyator plant audit by Elia

Izolyator – Reliable and Forward-Looking Partner



Meeting at Terna S.p.A. in Italy



Qualification audit of Izolyator plant by Getra S. p. A. industrial group in presence of Terna S.p.A. representatives



YAROSLAV SEDOV,
*Business Development
 Manager at Izolyator*

We started our cooperation with European partners by setting targets for RIP technology active promotion — as the most advanced modern alternative to OIP bushings.

In the past few years, Izolyator accomplished a number of important projects with European partners. We value every project and its importance for further promotion of our products. Today, Izolyator is not only recognized in Europe, but is perceived as a reliable and forward-looking partner.

We enter negotiations with power grid companies in Europe on admittance of our company to bushings replacement programs. Izolyator is a pioneer on this market, so we actively discuss application opportunities for our high-voltage RIP bushings in power facilities of Italy and Czech Republic.

The international conference organized by our company in Italy is a great opportunity to not only tell about our projects and capabilities but also to have a direct contact with partners. It was particularly pleasant to see our partners providing expert input at the tests of our products in one of the world's leading laboratories CESI.

We Put Our Partners Above All



Participants in the meeting at Enel S. p. A. in Italy

We design
 and produce
 innovative
 PRODUCTS

TAMINI

Tamini is the leading Italian company in the world for the design and production of industrial, power and special transformers. Founded in 1916 in Milan, it supplies its products to the most important industrial sectors (i.e. steel, aluminum, mining, oil & gas, chemical and transportation) and the most highly qualified operators in the electrical energy sector (production, distribution and transmission). With a century of experience in the market and world records in the field, Tamini combines the quality of its products, designed and hand manufactured with the unmatched expertise of the Made in Italy.



Participants in the meeting Tamini Trasformatori S. r. L in Italy

Saudi Arabia – Discussing Future Projects

Abdulaziz Mohammed Alnamlah Holding Group Company (Amnest Group, Saudi Arabia) representatives paid a working visit to Izolyator.

On Izolyator side, the visitors were received by Ivan Panfilov, Commercial Director, Andrey Shornikov, International BDM and Yaroslav Sedov, BDM.

The hosts presented the plant's production capabilities and discussed cooperation on joint projects in power industry.



Sitting down for the talks



Abdulaziz Mohammed Alnamlah Holding Group Company (AMNEST) was established in 1996 by Eng. Abdulaziz Bin Mohammed Al Namlah as a family Group Company under which 14 companies do business in various sectors; industrial sector, services sector, trading sector, construction and contracting, and real estate development as well.

Interests
and success of our
PARTNERS
IS THE KEY
objective in our work!



At the paper insulation winding station 220 – 1150 kV



At the 220 — 1150 kV bushings assembly station



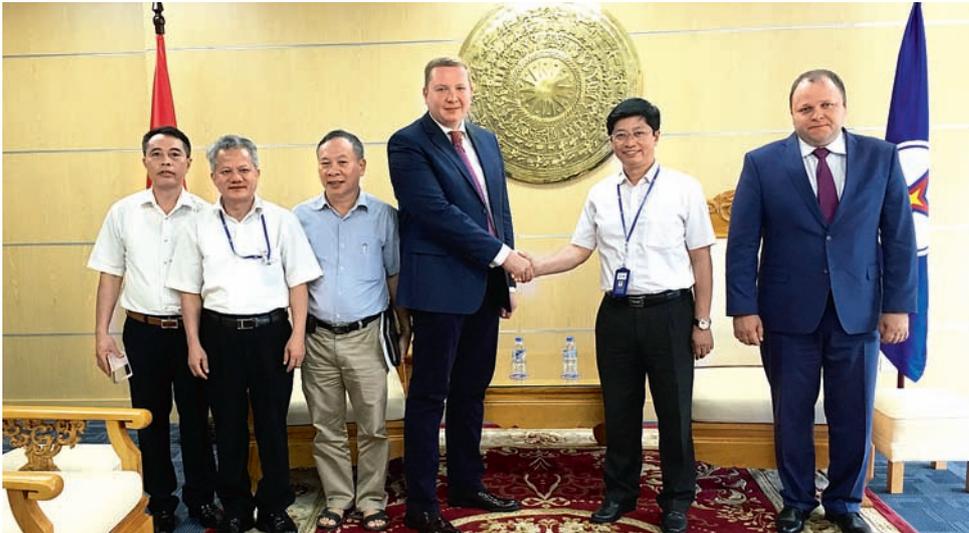
Discussing the results of the visit

Cooperation Development With the Leading Power Companies in Vietnam

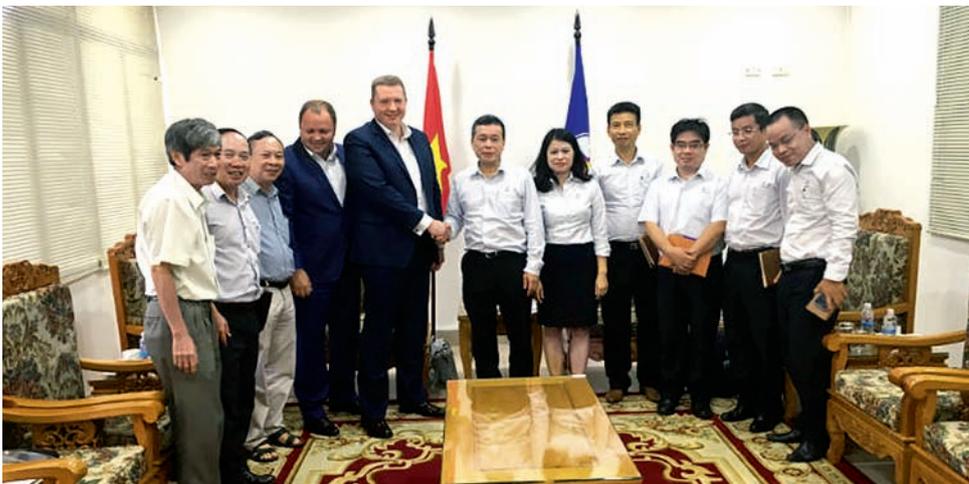
Ivan Panfilov, Commercial Director and Dmitry Mashinistov, Head of SVN Service at Izolyator visited a number of Vietnam's leading power companies. All visits were made with the support of Industrial Equipment and Material Joint-Stock Company — Partner of Izolyator in Vietnam.



Participants of meeting at Vatco



Participants of meeting at EVN



Participants of meeting at EVN NPT

INDUSTRIAL EQUIPMENT AND MATERIAL JOINT-STOCK COMPANY

The companies entered talks resulting in the agreement to grant Vatco the status of Izolyator's Partner on the power engineering products market of Vietnam. By the partnership agreement, Izolyator will deliver all required information about RIP bushings design and technical features and 15 year operational record in various geographic and climate conditions.

VATCO

Industrial Equipment and Material Joint-Stock Company (Vatco) is the leading supplier of materials, equipment, spare parts for Vietnam hydro and thermal power plants built with help from former USSR, as well as strong and reliable provider of power plant equipments originated from developed countries.

In the course of talks, EVN representatives informed that Izolyator high-voltage RIP bushings have been awarded the top assessment in EVN, so the company is intended to use them in its new projects by including in the terms of EPC contracts. Besides, EVN has planned further activities to better familiarize its staff with Izolyator-made products.



The State Power Company Vietnam Electricity (EVN) EVN takes full responsibility for transmission and distribution of electric power across the country. Among its major activities are: generation, transmission and distribution of electric power, management system operation in the national grid, import and export of electric power.

EVN NATIONAL POWER TRANSMISSION CORPORATION

At the meeting, EVN NPT representatives expressed interest in cooperation with Izolyator in regard to residual operating life evaluation and replacement of the high-voltage bushings, some of which have been in operation for 25-30 years.

During the talks, Dr. Dang Phan Tuong confirmed intention to take practical steps towards a closer cooperation with the Federal Grid Company of Russia and Izolyator in regard to experience sharing on 220 kV substations operation.



National Power Transmission Corporation (EVN NPT) was founded on 1 July 2008 with the reorganization of four companies' activity: Power Transmission Company No. 1, 2, 3, 4 and three Project management offices: Northern, Central and Southern.

DONG ANH ELECTRICAL EQUIPMENT CORPORATION

The sides shared experience of operation of high-voltage bushings with various types of internal insulation discussing the advantages and prospects of RIP bushings application on EEMC power equipment.



Dong Anh Electrical Equipment Corporation (EEMC) has years of tradition and experience of design, manufacture, supply and maintenance of electrical equipment for the national grid, for instance, for such large national projects as NhoQuan 500 kV, thermal power substation VungAng 500 kV, many other stations: laly, Da Nhim.

HOA BINH HPC

Izolyator representatives held a practical seminar for the HPP's technical staff members, which detailed installation, testing and operation aspects of high-voltage RIP bushings. Izolyator representatives also examined the high-voltage equipment with 110 and 220 kV bushings.

In most cases those were OIP bushings made and supplied by Izolyator plant in the past many of those exceeding 30 years in service.

In connection with the above mentioned, Izolyator suggested to run an objective evaluation of each operating bushing's technical condition by checking parameters obtained from Hoa Binh HPC. Depending on the results of this evaluation, the Russian side would prepare an official report with the HV bushings' technical condition status and recommendations on further operation of the equipment.



The Hoa Binh Hydropower Plant — the Hoa Binh Hydropower Company (Hoa Binh HPC) — is the largest in Vietnam and entire South Eastern Asia comparable with Son La HPP.

PETROVIETNAM

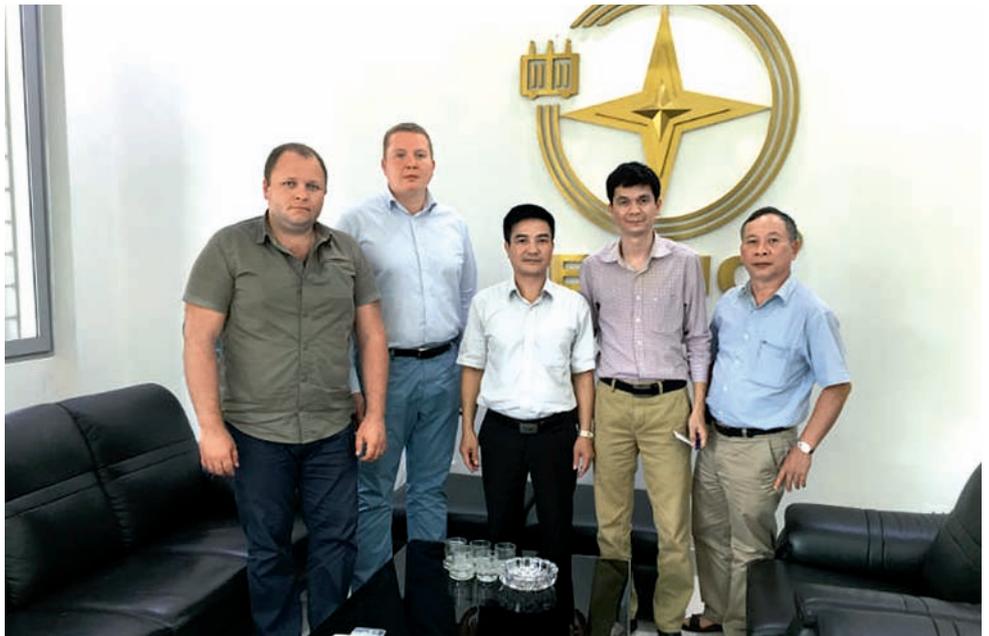
The sides discussed possible cooperation directions, for instance, forms of Izolyator involvement in such PVN projects as thermal power plant Long Phu — 1 erection.



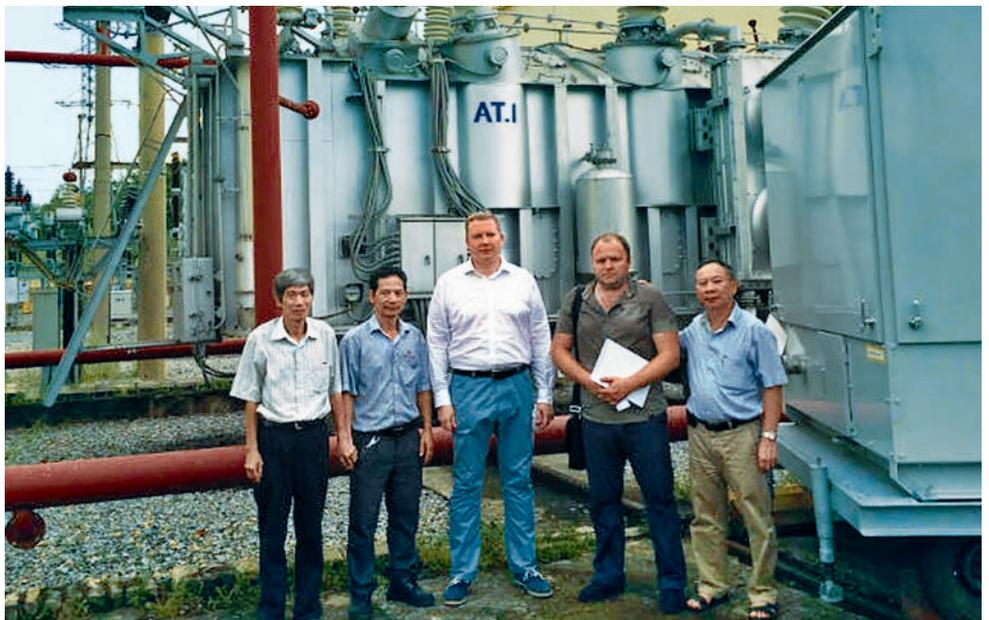
Vietnam Oil and Gas Group is a state-owned company with international transaction name is Petrovietnam (PVN). Petrovietnam — a strong economic group in Vietnam is known worldwide.

We would like to thank all participants of the meetings for a productive dialogue and deep interest in cooperation development!

We also wish to thank Industrial Equipment and Material Joint-Stock Company for the business visits organization and activities in business ties development with Vietnamese companies!



Participant of meeting at EEMC



Participants of meeting at Hoa Binh



Participants of meeting at PVN



ANDREY SHORNIKOV,

*International Business
Development Manager
at Izolyator*

Today, the power market of India is rapidly developing, and in the recent years we have been able to establish productive relations with the largest power grid companies of the region as well as private electrical engineering plants — potential consumers of our products.

There was a large work preceding the tests of HV RIP bushings in Italy in the beginning of June this year. A year ago, Izolyator delivered 52, 252 and 420 kV RIP bushings as completing parts for Crompton Greaves transformers made for Bamnauli 420 kV substation of Delhi Transco Limited. By the way, we have already worked with Crompton Greaves before: in 2008 we supplied three bushings for nominal voltage of 600 kV that the customer is now using on the test reactors in the laboratory.

We invited the Indian colleagues to our plant and carried out a series of type tests of our products. The final chords in the series were tests that we did in one of the world's leading test laboratories — CESI S. p. A. in Italy.

An inspection from PowerGrid and other experts — representatives of grid companies and transformer plants from European countries — arrived to see the tests.

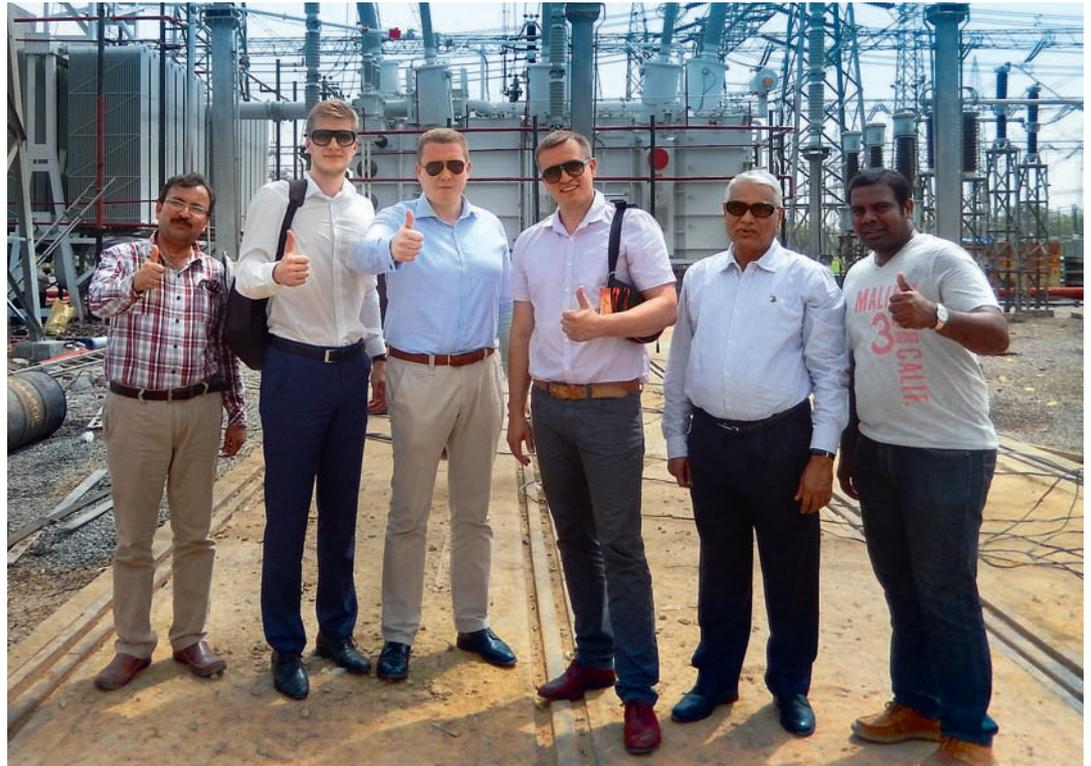
Decades-long History of Cooperation With India

The history of cooperation between Izolyator and its Indian partners dates back to the USSR times when the state generation company of India NTPC installed transformer equipment with Izolyator bushings. Some of them still soundly operate in power facilities

of India for over twenty five years. There exists a large demand for 800 kV bushings in India today: more than a thousand transformers and reactors of the type should be replaced together with bushings.

Presently we are discussing technical requirements and agree

the bushings designs. There are not so many manufacturers in the world able to supply bushings of that voltage — and it is good to be among them. We view the project as our priority and hope to continue cooperation with our Indian partners.



Putting into operation the Bamnauli substation transformer



Participants of the conference at PowerGrid

The Bamnauli Substation is located in Delhi and is owned by the largest national power grid operator in India — Power Grid Corporation of India Limited. Izolyator became the first supplier of HV RIP bushings to India for power transmission and distribution facilities.



Meeting with PowerGrid management



The talks were a success

WE ALWAYS
aim at
products
PERFECTION

We have
delivery experience
TO COUNTRIES
all around the world



PowerGrid inspecting Izolyator bushing' tests

WE THANK ALL OUR PARTNERS



SALES DEPARTMENT OF IZOLYATOR COMPANY

OUR MISSION IS TO CREATE BASIS FOR STABLE AND SUSTAINABLE POWER SUPPLY. WE CAN ACHIEVE THIS GOAL ONLY WITH COMMON EFFORT IN CLOSE COOPERATION, JOINT CREATION AND DEVELOPMENT. THAT IS WHY WE VALUE DIALOGUE WITH YOU SO HIGHLY AS IT IS A STARTING POINT TOWARDS SUCCESS IN OUR COMMON GOAL.



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Commercial Director
1st Deputy General Director



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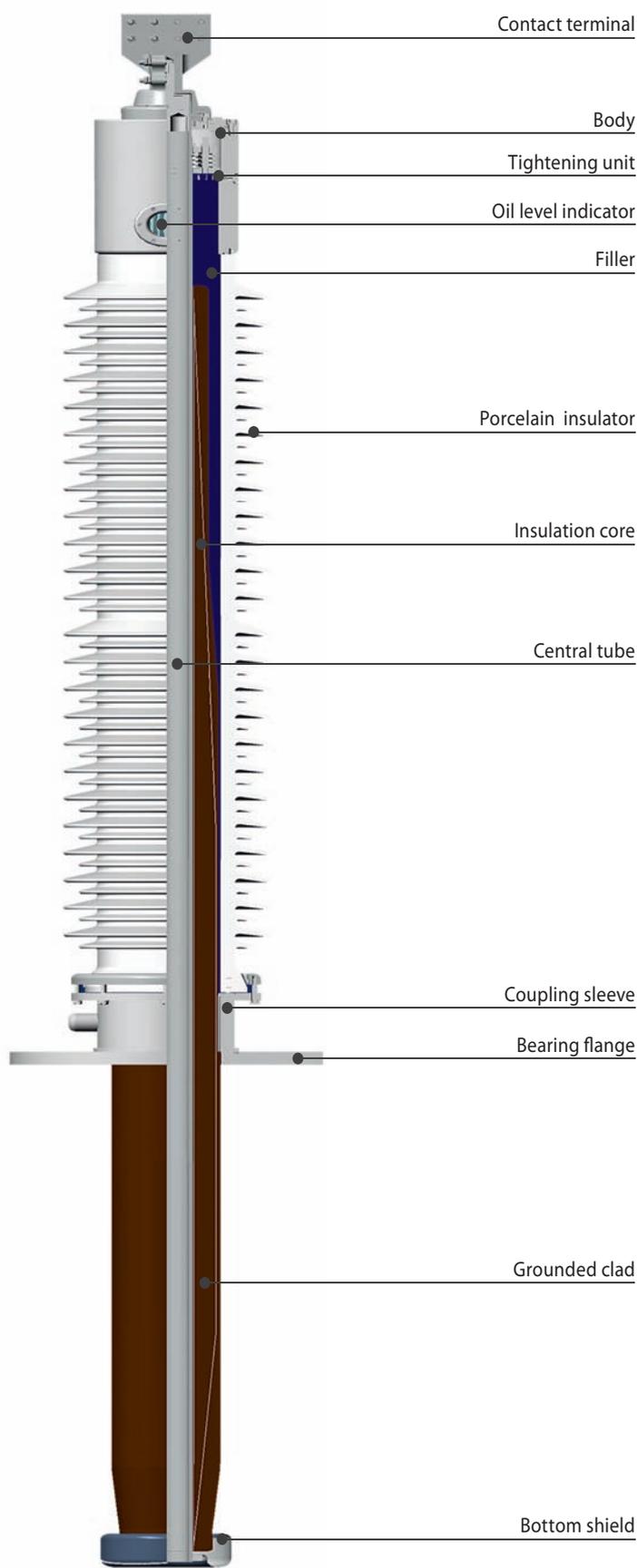
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Advantages of RIP bushings

Internal solid RIP insulation (resin impregnated paper) — paper saturated with resin — is the main construction element of a HV-bushing. It is a core which is formed by insulating crepe paper winding on the central tube with subsequent thermal vacuum dry out and a special epoxide compound saturation.

After drying out under pressure, any occluded gas is ousted from insulation. In the winding process, condenser plates are used to level electric field.

- **Reliability**
- **Security**
- **Advanced design**
- **Durability**
- **Ecologically friendly**
- **Service free**
- **Ease of operation**



RIP insulated bushing in section