



IZOLYATOR

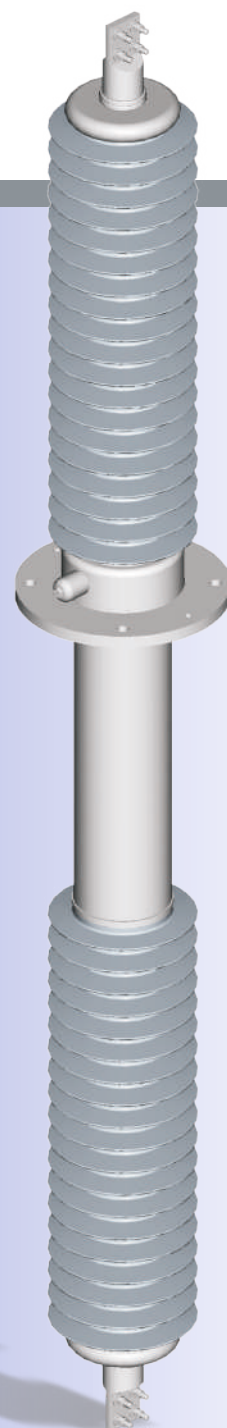
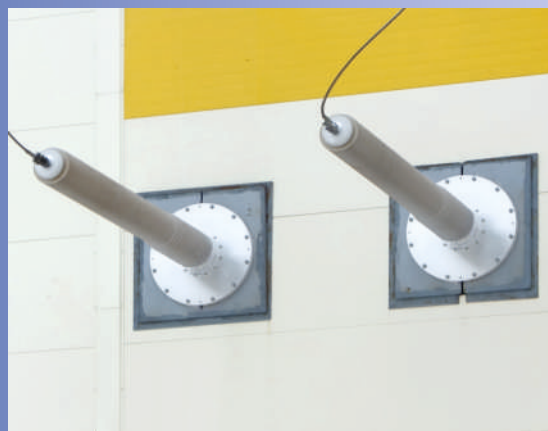
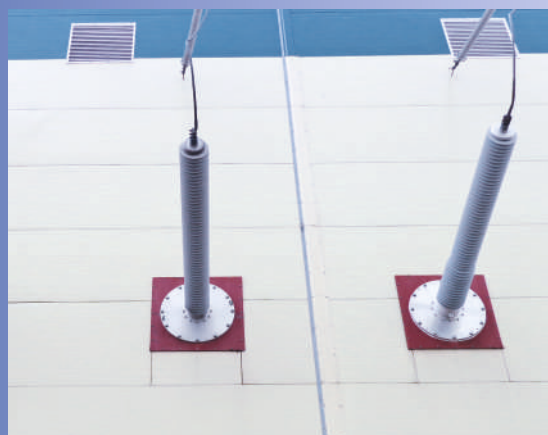
Centuries-old traditions – state-of-the-art technologies

HIGH-VOLTAGE WALL BUSHINGS

«AIR—AIR»

Rated voltage: 72.5–252 kV AC
Rated current: 2000–4000 A

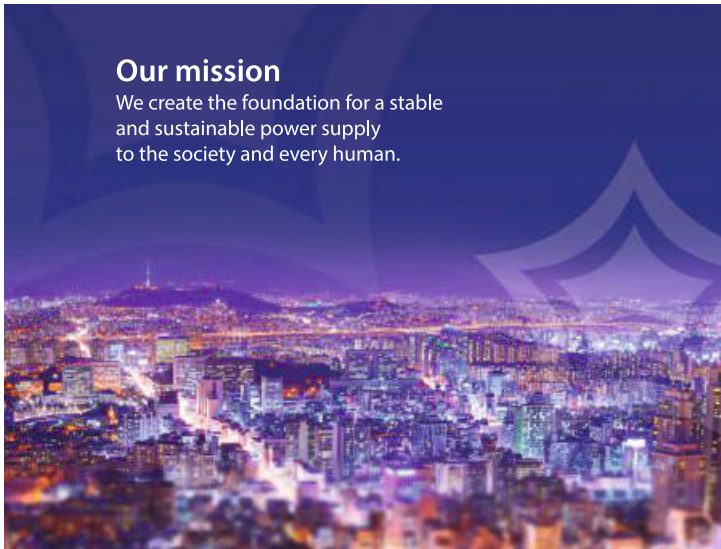
**WE CREATE THE FOUNDATION
FOR A SUSTAINABLE
POWER SUPPLY**



MISSION. VISION. SOCIAL RESPONSIBILITY.

Our mission

We create the foundation for a stable and sustainable power supply to the society and every human.



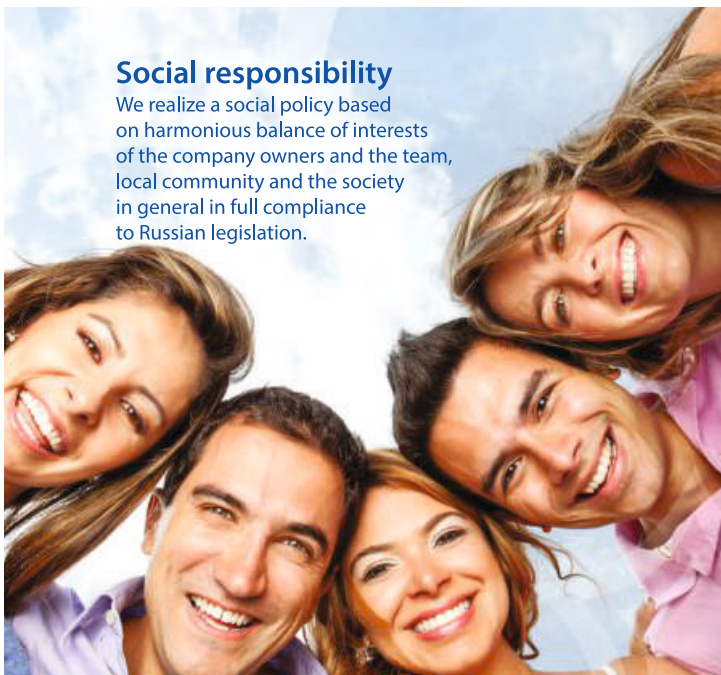
Our Vision

We aim at being a global leader in development, manufacture and implementation of modern technologies in power industry.



Social responsibility

We realize a social policy based on harmonious balance of interests of the company owners and the team, local community and the society in general in full compliance to Russian legislation.



The history of high-voltage bushings development in Russia is inseparably connected with Izolyator. In its more than a century-long history, the plant has produced more than 620 thnd HV bushings that are operating in the overwhelming majority of power facilities in Russia and the CIS countries as well as 30 more countries of the world.

All Izolyator achievements were only possible thanks to a well-coordinated work of our highly professional team and the all-round support of our partners. We will continue to make every effort in order to prove our clients' trust by timely fulfilling our obligations in high-voltage bushings production and technical support of our customers.

"Century-long traditions, state-of-the-art technologies" — these words became a motto for those, who work at the plant, rightly believed a global leader in development and production of high-voltage bushings.

Handwritten signature of Dr. Alexander Slavinsky.

Dr. Alexander Slavinsky

Chief Executive Officer of Izolyator Plant LLC
Vice-President AES RF,
Vice-President TRAVEK Association,
Head of CIGRE National Study Committee D1

COMPANY STRUCTURE

Special design bureau

- creation of new designs of high-voltage bushings
- development of advanced production technologies
- research activities and development engineering
- serial items modernization



Production

- the most advanced process equipment from the world's best OEMs
- patented technology of RIP insulation production
- patented technology of external polymer insulation production
- manufacture of internal insulation up to 12 m long and up to 750 mm diameter



Test Center

- alternating current voltage testing up to 1200 kV
- direct current voltage testing up to ± 1600 kV
- 1.2/50 ms full and chopped lightning impulse testing
- 250/2500 ms switching impulse testing
- testing of insulating materials and prototypes



SVN-Service Center

- highly qualified technical service
- complex diagnostics
- warranty and post-warranty service of bushings
- consulting engineering staff of customers



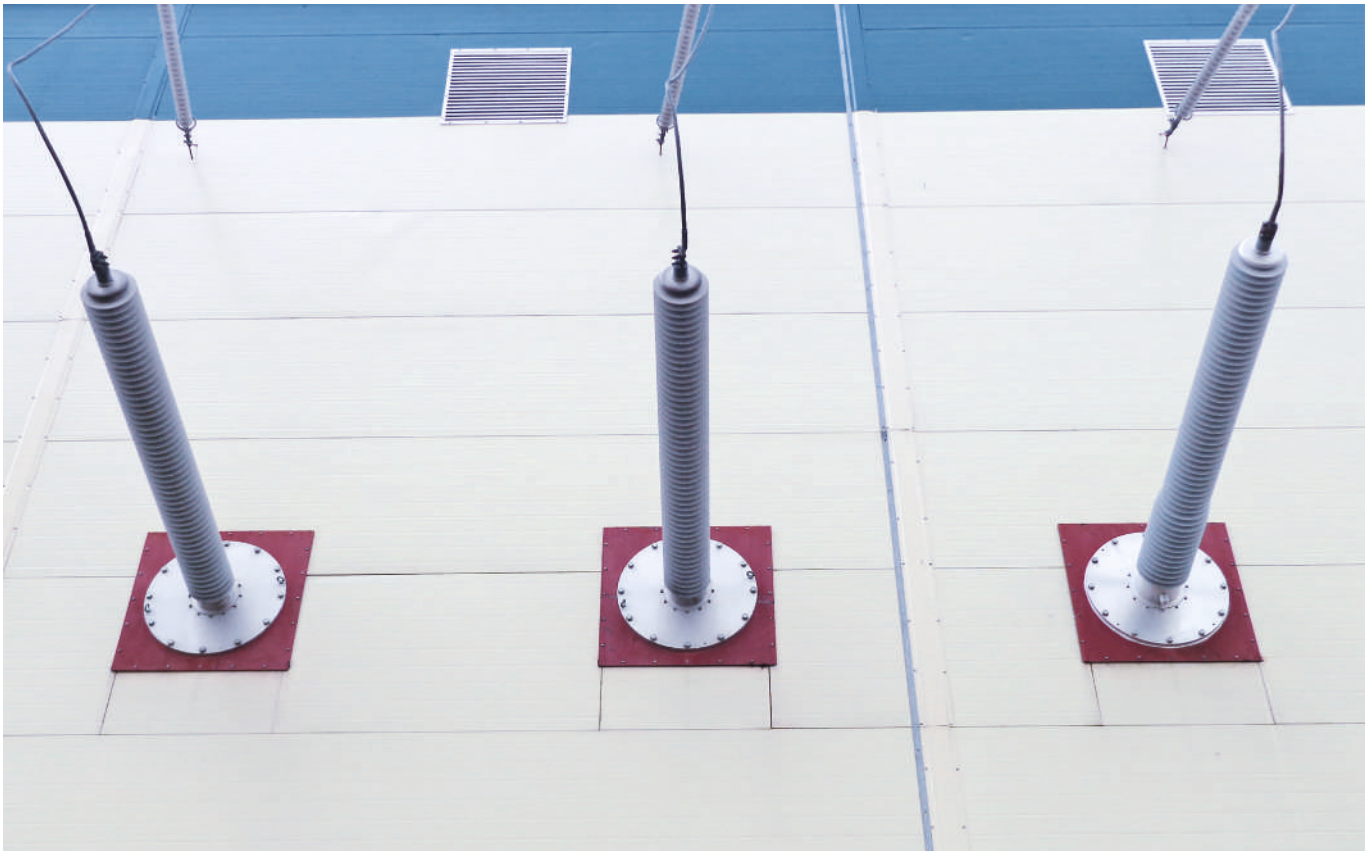
COMPLETE
RANGE OF
SERVICES



Design
Manufacture
Testing warranty and
Post warranty service

CONTENTS

Wall bushings	5
Wall bushing design	6
Wall bushing assemblies and parts	8
Internal insulation	8
External insulation	8
Tightening spring-loaded assembly	9
Connection	9
Test tap	9
Manufacturing of wall bushings	10
Fabrication of internal insulation	10
Bushing assembly	11
Testing	12
Transportation and storage	12
Operation	13
Interchangeability of bushings	13
Key to bushing designation code	13
Izolyator nameplate on bushings	13
Specifications of wall bushings	14
FAQ	16
Terms and acronyms	17



Wall Bushings

High-voltage wall bushings are designed for installation in walls and intermediate floor of switchgear buildings.

A high-voltage bushing is structurally independent product and represents a through insulator of complicated design with external and internal insulation intended for operation under most unfavorable environmental conditions. Dimension of the bushing is determined by switch gear voltage class.

Izolyator company produces wall bushings only with solid internal insulation of capacitor type according to RIP technology (Resin Impregnated Paper), being the most effective one.

Both polymer insulation or porcelain sheds can be used for external insulation.

In this case the space between the housing and internal insulation is filled with dry filling.

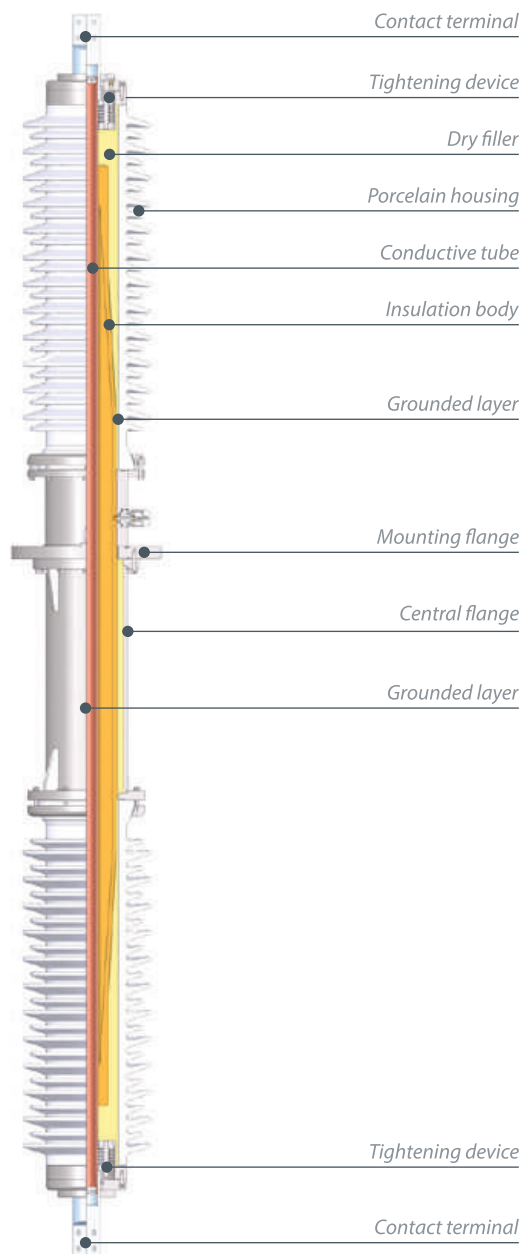


Fig. 1. Bushing with porcelain external insulation

Wall Bushing Design

Contact terminal is intended for connecting high potential to it; it is made from brass (Fig. 1).

Tightening assembly provides the required mechanical strength and leaktightness of the bushing.

Dry filler protects the internal space of the bushing against moistening.

Porcelain housing is an external insulation of the bushing, providing necessary arcing distance and creepage distance along its outer surface.

Insulation body is internal insulation of the bushing, equalizing electric field in radial and axial directions by placing condenser liners.

Central flange is intended for installation of the test tap and mounting flange of the bushing.

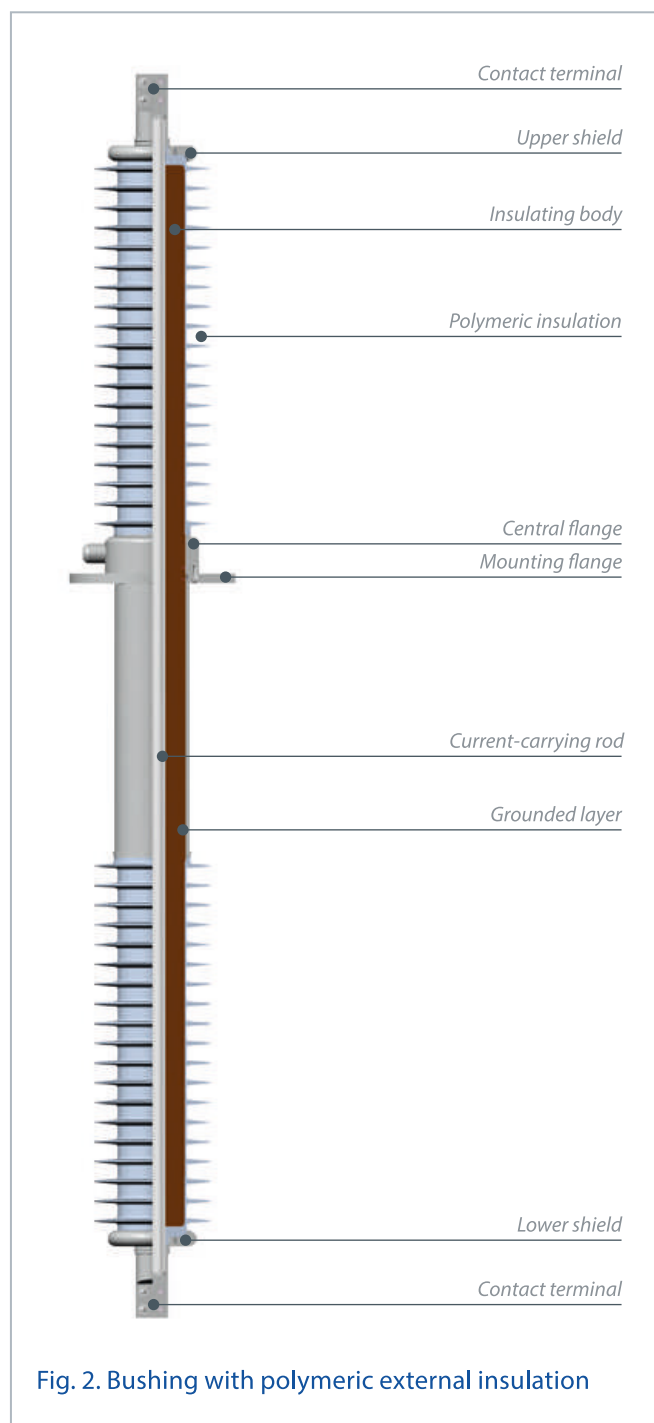
Mounting flange is intended for securing the bushing at the place of its installation and, in its turn, is secured by screws to the central flange of the bushing.

Grounded layer is last equalizing layer of insulation body, being in permanent electrical contact with test tap.

Shields are used in the design of bushings with polymeric external insulation and are intended for equalizing the external electric field in upper and lower parts of the bushing (Fig. 2). In bushings with porcelain housing the upper and lower flanges serve as shields. Polymeric insulation is used as an alternative to porcelain insulation and executes the same functions.

The bushings with polymeric external insulation have the following advantages:

- ★ absolutely dry explosion-proof and fire-proof maintenance-free design;
- ★ stable insulation properties throughout the service life;
- ★ high tracking resistance;
- ★ hydrophobic behavior of external insulation, reducing risk of flashover, even in case of contaminated insulation moistening;
- ★ polymer insulation elasticity, reducing the risk of damage during transportation and mounting;
- no limitation of the bushing vertical alignment angle;
- ★ seismic load resistance;
- ★ minimum weight;
- ★ environmental safety.



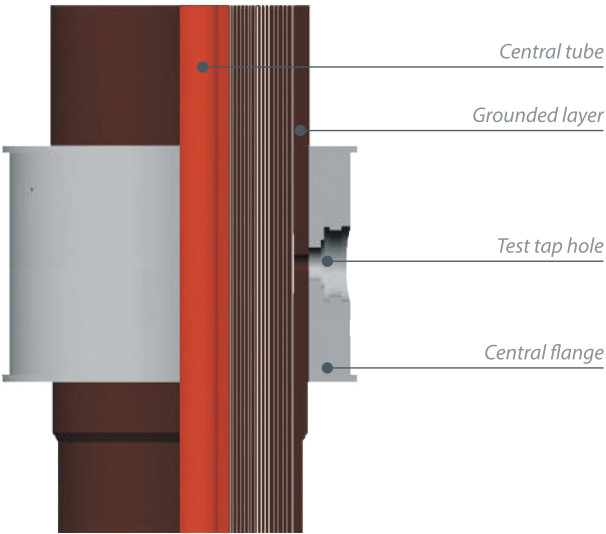


Fig. 3. Internal RIP-insulation



Fig. 4. Porcelain housing profile

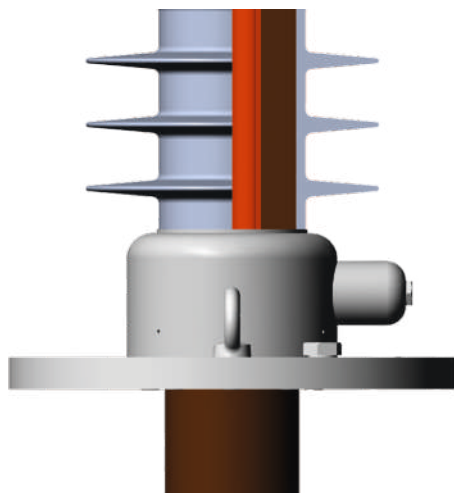


Fig. 5 Polymeric insulation profile

Wall Bushing Assemblies and Parts

Internal insulation

Internal solid RIP-insulation is the main structural part of the bushing (Fig. 3). It has high reliability and long service life due to low dielectric losses and low level of partial discharges inside the insulation, and its thermal strength. This insulation eliminates the use of transformer oil as an insulating component, thus substantially improving the serviceability of the bushings.

The capacitor layers are arranged inside the insulating body for electric field equalization and even distribution of electric potential. The layer nearest to the central tube has an electric contact with it; the last (earthed) layer has permanent contact with the test tap pin. The earthed layer is manufactured from specially treated foil, making it possible to solder the test tap conductor directly to the plate, thereby nullifying the probability of loss of contact between the test tap conductor and the layer. The materials used for manufacturing of the insulating body provide the required mechanical strength and crack resistance of the insulation, which is confirmed by the mechanical, climatic and seismic tests as well as by long service life of the bushings with RIP-insulation.

External insulation

External insulation covers the upper and lower parts of the insulating body and is made of porcelain (Fig. 4) or polymer (Fig. 5).

External insulation protects internal insulation against moistening and provides the required creepage distance along the external surface.

Tightening spring-loaded assembly

It is intended to compensate the difference between elongations of the central tube and external porcelain insulation caused by different thermal linear expansion coefficients. The tightening device creates a tightening force required for providing bushing leak-tightness at any ambient temperatures through generation of the required pressure onto the sealing washer between the compensator and porcelain housings.

Connection

The wall bushings are connected with the help of contact terminals located at both ends of the bushing (Fig. 6).

Test Tap

Test tap from the last equalizing layer of the insulating body serves for checking of internal insulation condition and must necessarily be grounded, when measurements are not performed.

The measuring tap design is shown on figure 7a. The grounding is done with a special springloaded multicontact offering a possibility of further visual and instrumental control of the grounding efficiency. In this case the hood serves only for sealing of the test tap cavity.

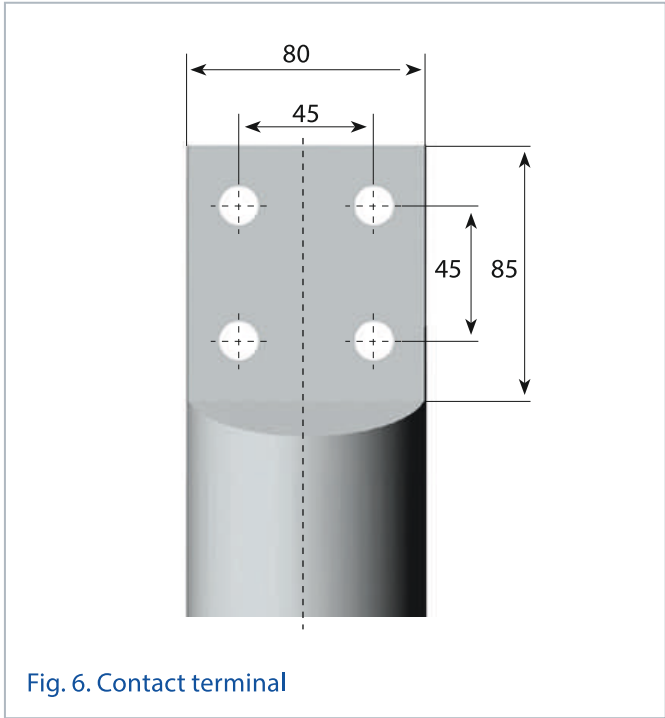


Fig. 6. Contact terminal

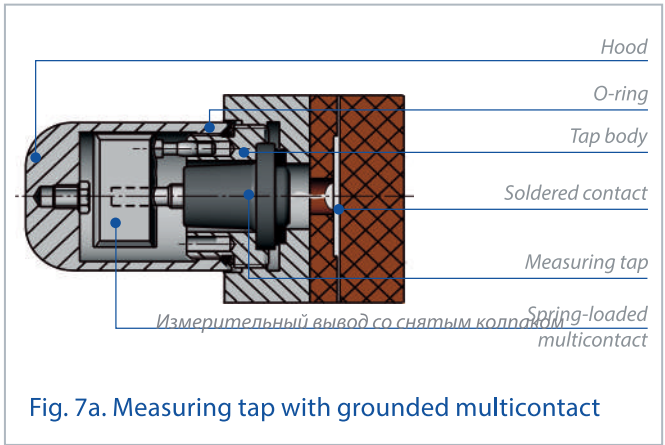


Fig. 7a. Measuring tap with grounded multicontact



Fig. 7b. Measuring tap with dismantled hood



Fig. 8. Shop area of 40.5-800 kV paper insulation winding at the Izolyator plant



Fig. 9. Hubers machine for vacuum impregnation of insulation at the Izolyator plant



Fig. 10. Lathe turning of 252 kV RIP-insulation at the Izolyator plant

Manufacturing of Wall Bushings

Fabrication of internal insulation

The main insulation represents a body formed by winding of high-quality dielectric crepe paper supplied by Weidmann on the central tube (Fig. 8).

The paper winding is divided into layers by conductive equalizing layers intended for optimal distribution of electric field in radial and axial directions. This provides the highest values of dielectric strength of both internal and external insulation.

The wound insulation undergoes thermal vacuum drying in order to eliminate residual moisture, and then is impregnated with epoxy compound consisting of ingredients supplied by the best world manufacturers (Fig. 9). Subsequent solidification under pressure completely removes gaseous inclusions from the insulation.

The epoxy compound formulation and technological parameters of RIP-insulation manufacturing process are intellectual property of Izolyator company.

As a result, the insulating body forms a solid core, which undergoes mechanical processing (Fig. 10).

Bushing Assembly

After machining of the external surface the central flange is mounted on the insulating body by press fit method.

Then the porcelain insulation (Fig. 11) is mounted or external polymer insulation is applied on the insulating body.

Porcelain insulation represents two housings, joints of each of them with the central flange on one side and with upper or lower flange of the bushing on the other side being sealed with special gaskets compatible with internal filler. Stable compression of the gaskets is performed by a tightening spring assembly, compensating temperature changes of length of the insulation body and of the housings within the range from -60°C to $+60^{\circ}\text{C}$.

The space between the insulating body and porcelain housings is filled with dry filler for protection against moistening. The compression gel Unigel is used as filler (Fig. 12).

Polymeric insulation is molded from elastic material created on the basis of original Wacker organosilicon compositions of RTV-2 type.

Molding and polymerization take place directly on the insulation body according to “direct molding” technology in special molds developed in the Izolyator company (Fig. 13). Such technology eliminates the necessity for any filler and tightening spring assembly.



Fig. 11. 40.5-172 kV bushing assembly area at the Izolyator plant



Fig. 12. Unit for degassing and metering feed of compression gel at the Izolyator plant



Fig. 13. Direct molding of silicon rubber on solid RIP-insulation at the Izolyator plant



Fig. 14. Testing area for 252-1200 kV bushings at the Izolyator plant



Fig. 15. Electrical tests of 126 kV bushings at the Izolyator plant



Fig. 16. Packing of bushings at the Izolyator plant

Testing

Each new type of bushing undergoes the acceptance tests for compliance with all requirements of GOST P 55187-2012 and IEC standard 60137 (Fig. 14 and 15).

Each batch-produced bushing undergoes the acceptance tests for checking the conformity to its type and to the manufacturing quality, including tests with measurement of the partial discharge level and $\text{tg}\delta$ of the insulation according to the above mentioned documents.

Transportation and Storage

The bushings, which have passed tests, are packed into wooden packages, are completed with mounting parts, spare parts and documents according to design documentation (Fig. 16). A packed bushing is turned in for storage in the finished product storage area.

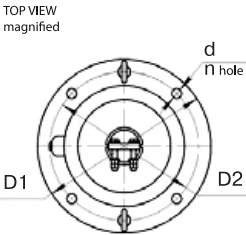
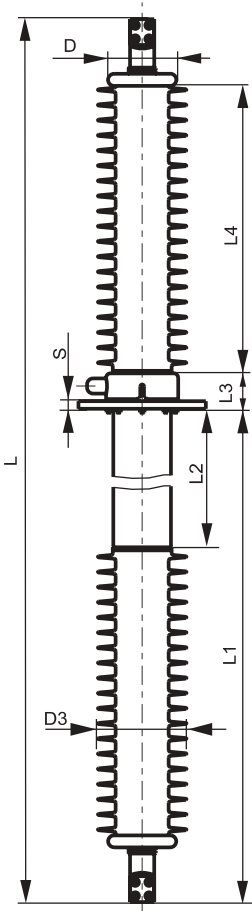
For the period of transportation and storage the external polymeric insulation is covered with polyethylene covers for protection against contamination. The bushings are carried in packages in the horizontal position by air, by rail or by roads with asphalt pavement or by dirt roads and by sea in holds in accordance with shipping rules applicable for a respective mode of transportation. It is allowed to carry the bushings in two tiers.

Packed bushings are stored in the indoor and outdoor storage areas in the horizontal position (two-tier storage is allowed) and unpacked bushings are stored in the vertical position on the special racks.

Specifications of Wall Bushings

Bushing type	Drawing No.	Type of internal insulation	Max operating voltage, effective value, kV	Phase voltage, effective value, kV	Rated current, A	Test voltage, kV		Leakage path length, mm	Test cantilever load, N	Weight, kg	Connection, No. of Fig.
						One-min. effective value, frequency 50 Hz	Full wave lightning pulse 1.2/250, mx				
66 kV bushings											
ГКЛПІV-90-72,5/4000	ИВУЕ.686351.251	RIP	73	42	4000	140	350	2395/910	4000	160	6
110 kV bushings											
ГКЛПІІ-90-126/2000	ИВУЕ.686352.234	RIP	126	73	2000	230	550	2500	4000	144	6
ГКЛПІІІ-90-126/2000	ИВУЕ.686352.234-03	RIP	126	73	2000	230	550	3150	4000	150	6
ГКЛПІV-90-126/2000	ИВУЕ.686352.234-04	RIP	126	73	2000	230	550	3900	4000	153	6
ГКЛПІІІ-90-126/2000	ИВУЕ.686352.234-01	RIP	126	73	2000	230	550	3150	4000	155	6
ГКЛПІІІ-90-126/2000	ИВУЕ.686352.234-02	RIP	126	73	2000	230	550	3150	4000	160	6
ГКЛПІV-90-126/2000	ИВУЕ.686352.234-05	RIP	126	73	2000	230	550	3900	4000	185	6
ГКЛПІV-90-126/2000	ИВУЕ.686352.234-06	RIP	126	73	2000	230	550	3900	4000	170	6
ГКЛІІІ-90-126/2000	ИВУЕ.686352.386	RIP	126	73	2000	230	550	3150	4000	360	6
ГКЛІІІ-90-126/2000	ИВУЕ.686352.386-01	RIP	126	73	2000	230	550	3150	4000	367	6
ГКЛІV-90-126/2000	ИВУЕ.686352.386-02	RIP	126	73	2000	230	550	3900/1900	4000	355	6
ГКЛІV-90-126/2000	ИВУЕ.686352.386-03	RIP	126	73	2000	230	550	3900/1900	4000	360	6
150 kV bushings											
ГКЛПІІІ-90-172/2000	ИВУЕ.686352.291	RIP	172	104	2000	275	650	4250/4250	4000	187	6
ГКЛПІІ-90-172/4000	ИВУЕ.686352.252	RIP	172	104	4000	230	550	3600/970	5000	230	6
ГКЛПІІІ-90-172/4000	ИВУЕ.686352.298	RIP	172	104	4000	325	750	4770/4470	5000	370	6
220 kV bushings											
ГКЛПІІІ-90-252/2000	ИВУЕ.686353.235	RIP	252	153	2000	460	1050	6300	5000	370	6
ГКЛПІV-90-252/2000	ИВУЕ.686353.235-01	RIP	252	153	2000	460	1050	7900	5000	395	6
ГКЛПІІІ-90-252/2000	ИВУЕ.686353.235-03	RIP	252	153	2000	460	1050	7900	5000	383	6
ГКЛІІІ-90-252/2000	ИВУЕ.686353.335	RIP	252	153	2000	460	1050	7900	5000	720	6

Mounting and connecting dimensions, mm										
L	L1	L2	L3	L4	D	D1	D2	D3	d/n hole	S
2145	1050	230	125	795	225	400	360	292	15/8	25
2950	1655	485	125	945	225	420	360	292	24/4	25
3150	1760	485	125	1045	225	420	360	292	24/4	25
3300	1655	485	125	1295	225	420	360	292	24/4	25
3350	1950	685	125	1045	225	420	360	292	24/4	25
3500	2150	835	125	1045	225	420	360	292	24/4	25
3820	2180	650	125	1295	225	420	360	292	24/4	25
3570	1930	650	125	1295	225	420	360	292	24/4	25
3490	1960	680	250	1030	225	420	360	365/290	24/4	25
3490	1960	680	250	1030	225	510	450	365/365	24/4	25
3660	1780	510	250	1380	225	420	420	365/290	24/5	25
3765	1885	615	250	1380	225	360	360	365/290	24/6	25
3740	1945	280	185	1450	225	450	400	292	16/8	25
3335	1825	650	185	1200	225	400	360	292	15/8	25
4725	2745	1005	185	1600	225	450	400	330/292	18/4	35
5815	3245	870	185	2155	225	890	840	330/292	22/12	35
6315	3245	870	185	2655	225	890	840	330/292	22/12	35
6060	3285	700	185	2466	225	890	840	330/294	22/12	35
5540	3080	870	185	1960	225	890	840	360	22/12	35



FAQ

What is the lead time for delivery of your products?

The lead time depends on the voltage class of the ordered bushings. For example, 110 kV serial bushings are delivered in 45 days, 220 kV – in 60 days, etc.

What warranty period is set for the bushings produced by you? The warranty period is subject to agreement with the customer, and is determined in course of signing the purchase-and-sale contract.

What should be done if an obsolete bushing needs replacement?

Please get in touch with our aftersales department SVN-Service, or with sales department – contact details are listed on our website www.mosizolyator.com, or use our corporate number +7 (495) 727 3311, or e-mail address: mosizolyator@mosizolyator.ru

What are the advantages of the bushings with solid RIP insulation as compared to their predecessors with oil-in-paper insulation?

The bushings with solid RIP insulation have higher electric characteristics, and feature the following advantages:

- simple design, hence – shorter delivery time;
- less weight;
- no maintenance is required during operation.

How to protect the bottom part of the bushing with RIP insulation during long-term storage?

Taking into consideration the hygroscopic properties of the insulation core material, it is recommended to install a special sealed case filled with transformer oil on the bottom part of the bushing.

It is possible to order a bushing with already installed sealed case, or to order the sealed case for a previously supplied bushing.

What are the advantages of the bushings with polymer external insulation as compared to porcelain insulation?

The key advantages of the bushings with polymer external insulation:

- fire safety and explosion safety of the bushings due to oil-free design;
- tracking erosion resistance;
- high pollution resistance due to high hydrophobic properties of the polymer;
- high dielectric strength of contaminated insulation, 15-20% higher than that of porcelain insulators;
- high shock resistance and seismic resistance due to elasticity of the material;
- no limitations in regard to bushing installation angle;
- less weight.

How to clean the polymer external insulation?

The polymer external insulation should be cleaned using soft cloth soaked with white spirit or acetone; do not use abrasive cleaning agents. For detailed information please get in touch with Izolyator, and appropriate instruction will be sent to you in case of necessity.

If you have other questions, or need more detailed information, please visit our website

www.mosizolyator.com or contact Izolyator directly:

tel: +7 (495) 727 3311

fax: +7 (495) 727 2766

e-mail: mosizolyator@mosizolyator.ru

Terms and Acronyms

Autotransformer — a transformer in which two or more windings share a common part (GOST 30830-2002).

Bushing — a device used for passing one or several live conductors through a barrier (e.g., wall, transformer tank, reactor tank etc.) and insulating the conductors from the barrier. The bushing is furnished with an fastening part (flange or fixing) which is an integral part of the bushing attaching it to the barrier.

GOST 55187-2012 — Russian technical standard for bushings.

Dielectric losses — energy dissipated in electric insulating material under the impact of electric field.

Creepage distance — the shortest distance on the surface of external insulation between two conducting zones. Creepage distance is selected pursuant to GOST 9920-89, it depends upon the contamination of the environment where the bushing operation is planned and is designated by digits from I to IV. The higher the level of contamination of the environment, the higher the category of external insulation of the bushing should be selected. For our bushings, the minimal category of external insulation is category III.

IEC 60137:2017 — International standard for bushings.

Main capacitance of the bushing C1 — capacitance between the high-voltage central conductor and the measuring tap of the bushing.

Acceptance tests are performed for each bushing at release from the plant.

Development acceptance tests are performed for each new bushing type during launch of mass production.

Shunt reactor — reactor connected in parallel intended for compensation of capacitive current (GOST 18624-73).

Reactor bushing — a bushing which bottom part is inside the reactor tank, in transformer oil, in alternating magnetic field with induction not over 0,35 T for bushings with rated voltage up to 550 kV inclusive, and not over 0,4 T for bushings with rated voltage 787 kV. The upper part of the bushing is in the open air.

Power transformer — a static device having two or more windings, designed for transformation (by means of electromagnetic induction) of one or several systems of alternating voltage and current into other, one or several, systems of alternative voltage and current, usually of different values at the same frequency, for the purpose of transfer of power (GOST 30830-2002).

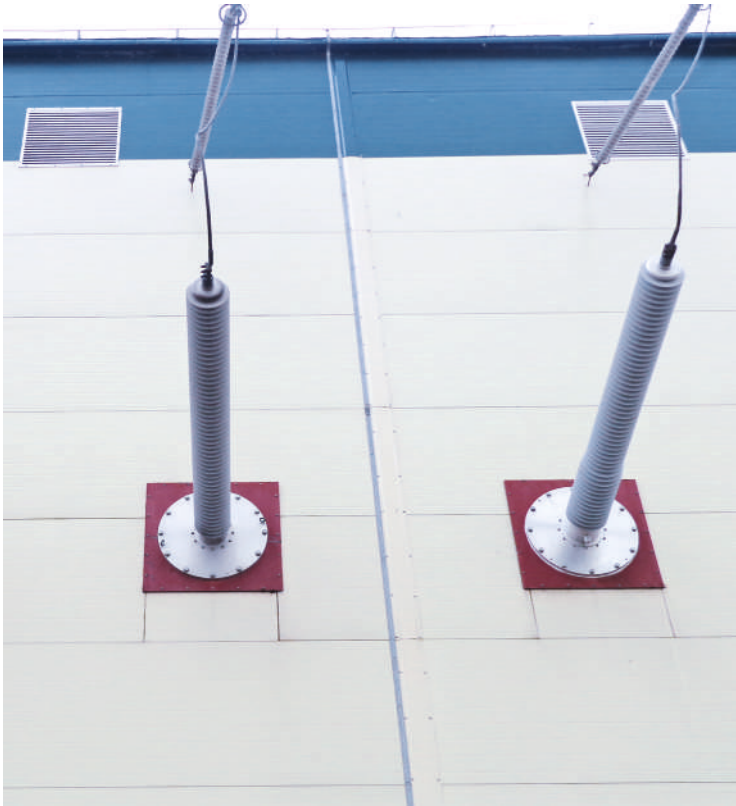
Dielectric loss tangent ($\tan\delta$, $\text{tg}\delta$) is the ratio of active component of insulation leakage current to its reactive component. If alternating voltage is applied, this value is an important characteristic of the insulation of high-voltage transformers and bushings.

Transformer bushing — a bushing which bottom part is inside the transformer tank, in transformer oil, while the upper part is in the open air. In addition, the conductor either may be a part of the bushing (bottom connection type bushing), or may be drawn through the central tube of the bushing (draw-lead type bushing).

The bushing for cable connection of transformers is a bushing with both ends designed for submerging into insulating medium other than ambient air (e.g., oil or gas). The insulating medium may be homogeneous (oil-oil, gas-gas) or heterogeneous (oil-gas).

RIP — Resin Impregnated Paper. A type of solid internal insulation of high-voltage bushings.

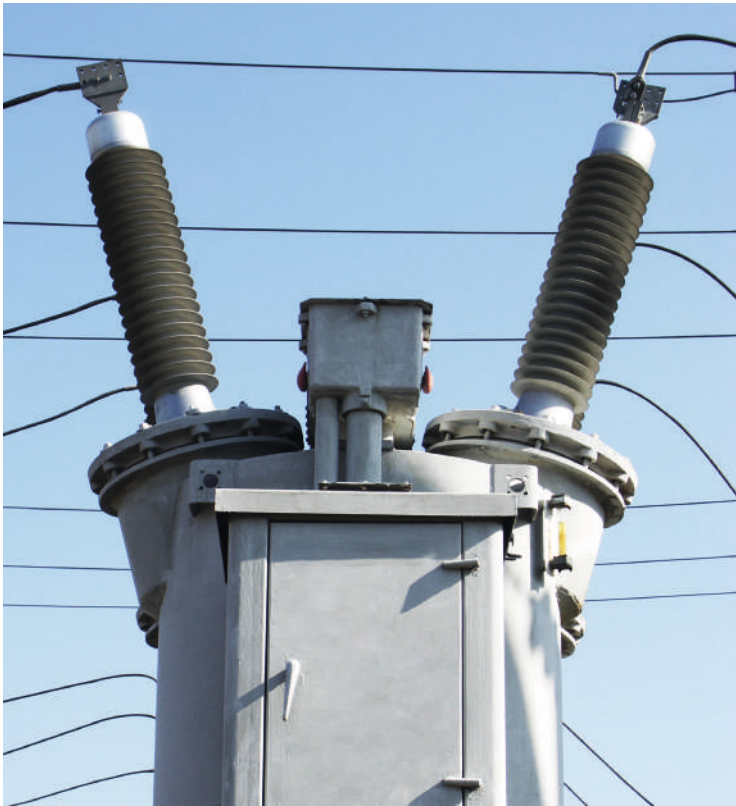
RTV-2 (Room Temperature Vulcanization) — a polymer compound solidified at room temperature.



Izolyator 220 kV wall bushings in a switchgear at oil refinery



Izolyator 330 kV bushings in a Main Power Transmission Lines transformer



Izolyator 110 kV bushings in an oil switch of Interregional Distribution Grid Company



220 kV bushings in a transformer at HPP

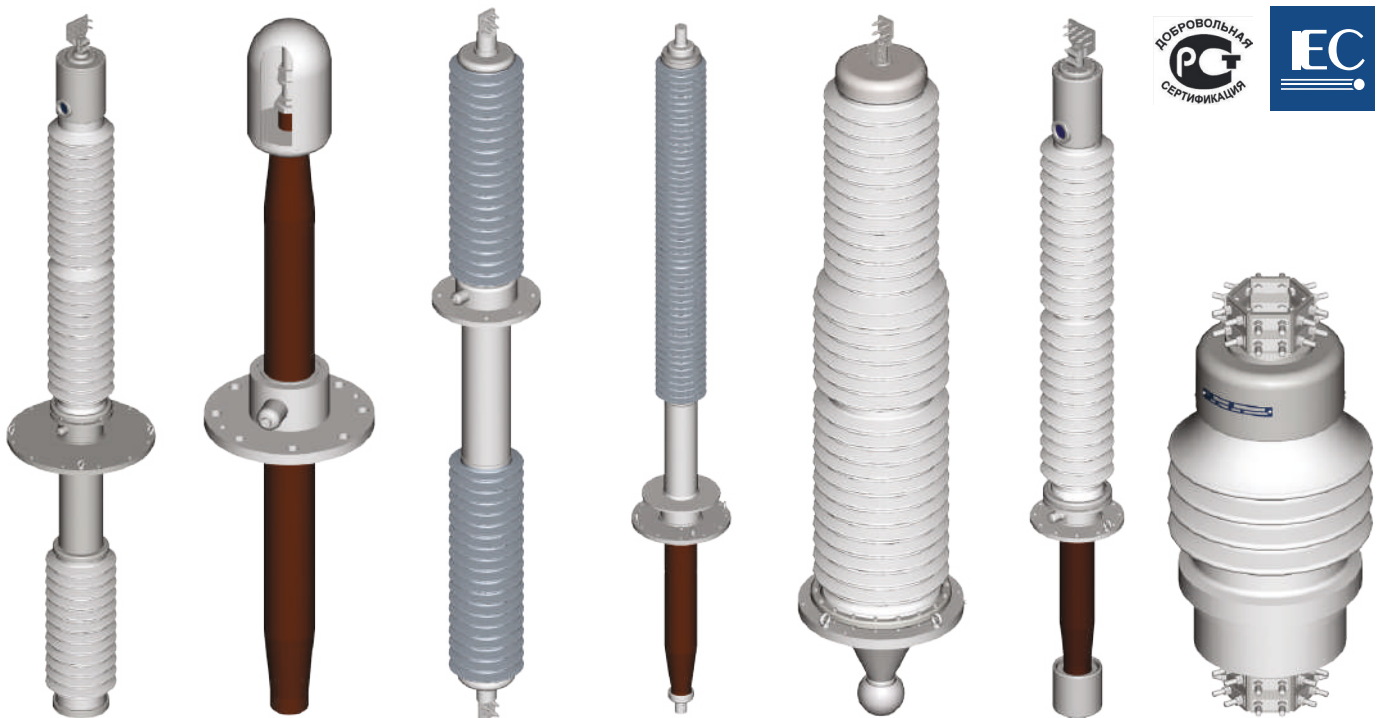
Full range of HV bushings
12–1200 kV available



THE WHOLE
RANGE OF HV
BUSHINGS

Izolyator designs, manufactures, services and repairs high-voltage AC and DC bushings for up to 1200 kV rated voltage for power transformers, shunt reactors, oil switches, SF6 switchgear and wall HV bushings.

12 to 800 kV AC bushings and all DC bushings come with solid internal RIP insulation of own design that has a high reliability and long operation life.



Air — Oil bushing for oil circuit breakers
Voltage: 35–220 kV
Current: 1000–3150 A

Oil — Oil bushing for cable connection of transformers
Voltage: 110–500 kV
Current: 630–1000 A

Air — Air wall bushing
Voltage: 66–220 kV
Current: 2000–4000 A

DC bushings
Voltage: ± 126 –800 kV
Current: 1800–5400 A

Air — SF6 bushings for switchgear
Voltage: 220 kV
Current: 2000–3150 A

Air — Oil bushing for power transformers and shunt reactors
Voltage: 12–1200 kV
Current: 315–2500 A

Air — Oil detachable bushings for power transformers
Voltage: 20–35 kV
Current: 6–20 kA

120 years



IZOLYATOR

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

**IZOLYATOR'S SALES TEAM EXPRESSES A DEEP INTEREST,
INTENTION AND READINESS TO SET UP COOPERATION
IN ANY CONVENIENT TO YOU FORM**

THINKING OF BECOMING A PARTNER?

We will provide complete information about commercial, organizational, technical and other aspects of our company activities.

NEED MORE INFORMATION?

We will provide all materials of interest by e-mail or in hard copy at your first request.

WOULD YOU LIKE TO VISIT THE PLANT?

We will arrange an informative plant tour to show all production stages.

Izolyator sales contacts:

Tel +7 495 727 3311

Fax +7 495 727 2766

mosizolyator@mosizolyator.ru

Massa Ltd, 77 Lenin ul., Pavlovskaya Sloboda,
Istra Region, Moscow Region, Russia, 143581

For details about our products and services — www.mosizolyator.com

Tel. +7 495 727 33 11

Fax. +7 495 727 27 66

Email: mosizolyator@mosizolyator.ru

