120 years

IZOLYATOR

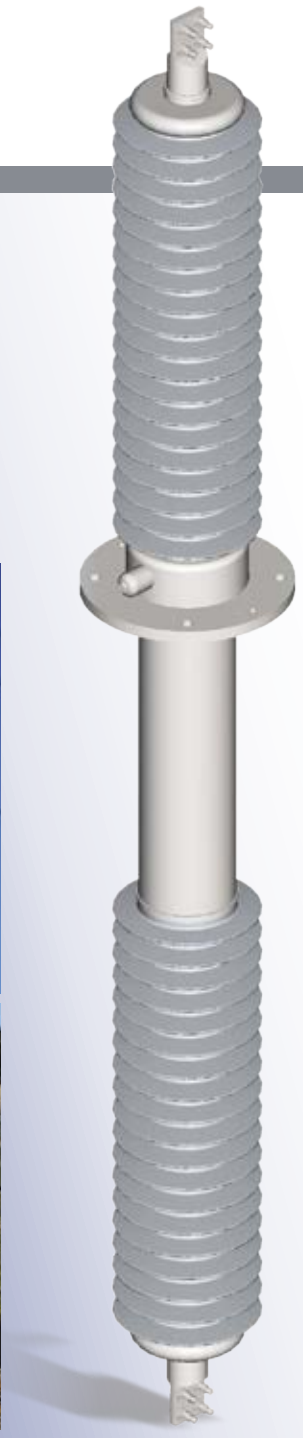
Centuries-old traditions – state-of-the-art technologies

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



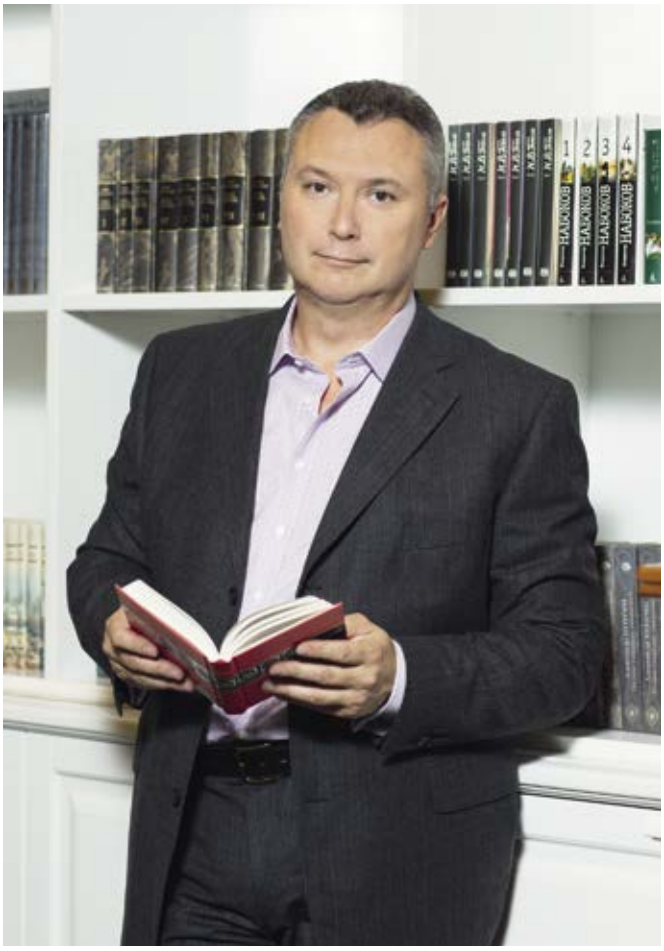
Edition 2016

Izolyator company is a major Russian manufacturer of high-voltage bushings with the professional experience of more than 120 years. The long-term development having been performed by our company has convinced us that the base of our company's success is successes of our clients. In the conditions of the surging energetic market we are trying to be attentive and sensitive as much as possible to growing requirements of our customers. We are always ready to show understanding and render assistance in any, often very complicated situations.

In late 2007 we completed a large-scale project to transfer production facilities out of the Moscow city territory – to Istra region of Moscow Oblast. This allowed fully renovating and improving production process with the use of modern innovative equipment, as well as made possible to achieve significant reduction of production terms together with power increase.

Izolyator company is a permanent leader in the field of high-voltage bushing manufacturing and realization in RF. One of our main operation principles is constant improvement of product quality. By the moment, the company's plant has the Russia's only laboratory for the full testing cycle of AC and DC high-voltage bushings The full our production range is put through the full testing cycle before delivering to the customer.

Currently, our product quality not only conforms to all international requirements and standards, but also has been confirmed by audits of such world-known transformer manufacturers as Siemens, Crompton Greaves, Alstrom. Operational comfort, flexible cooperation conditions and customer attention have been confirmed by many favorable reports and letters of recommendation from our customers and partners.



We wish to be a world leader in development, manufacturing and implementation of modern technologies in energetics, creating the bases for stable and sustained power supply of the society in whole and each person individually! This is the strategic goal and mission of Izolyator company!

Dr. Alexander Slavinsky
Chairman of the Board of Directors of Izolyator Company
Vice-President of Russian Electrotechnical Academy
Vice-President of TRAVEK International Association

Izolyator Company

Production
High voltage bushings:
- AC (alternative current) for the voltage level from 12 up to 1200 kV, certified for compliance with IEC 60137 and GOST 10693-81.
- DC (direct current) for the voltage level from 110 up to 800 kV in conformity with IEC 62199.

Production consumers
- Nuclear, thermal and hydroelectric power stations
- Long-distance electrical networks, distributing networks and municipal networks
- Power substations of major enterprises of industry, transport and oil-and –gas complex
- Major world transformer plants

The year of foundation
1896

Examples of participation in historical projects
- GOELRO Plan in the twenties
- Nuclear energetic startup in the fiftieth
- Construction of Assuan hydroenergetics complex in the sixties
- Construction of Yenisei cascade of hydroelectric stations in the seventies

Export
20% of the sales volume

Market share in Russia and CIS
70 – 80%

Status of authorized supplier
- "Rosseti" company
- "Inter RAO" Group
- "Rosenergoatom" Concern (Rostekhnadzor license for design and manufacturing of bushing for nuclear power stations)
- Siemens
- Alstom
- Crompton Creaves

Enterprise capacity
12000 bushings per annum

Personnel
more then 300 persons

Production area
24 thousand sq.m

Quality management system standard
EN ISO 9001:2008


Manufacturing of bushing main insulation in Izolyator factory


Assembly of extra-high voltage bushings in Izolyator factory


Testing Center of Izolyator factory

CONTENTS

Wall Bushings

High-voltage wall bushings are designed for installation in walls and intermediate floor of switchgear buildings. The feature of insulation design of these bushings is that the possibility of their operation in the open air is taken into consideration.

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 switchgear 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.

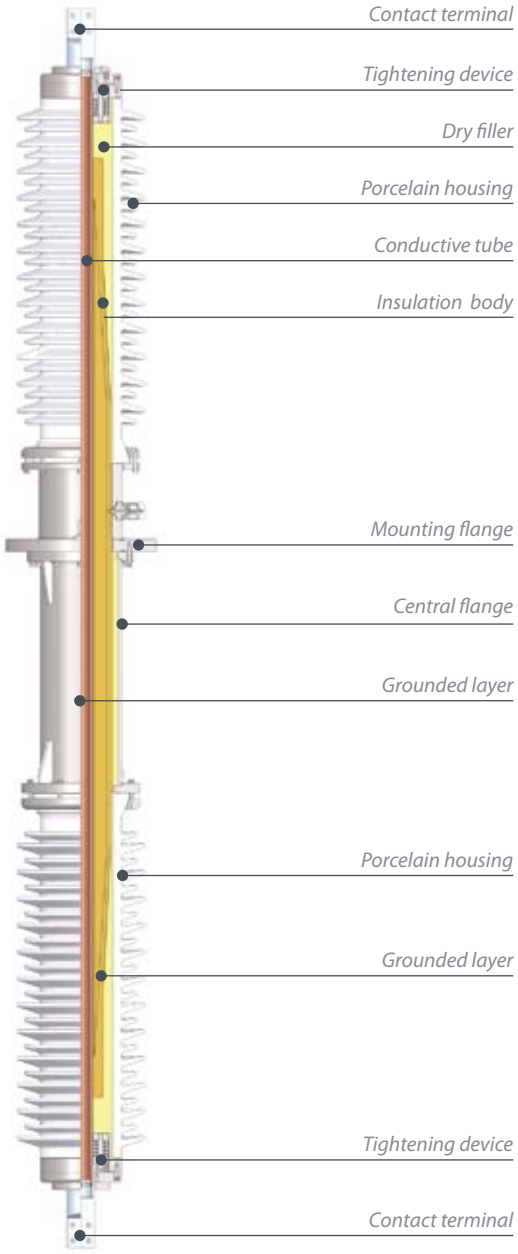


Fig. 1. Bushing with porcelain external insulation

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 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.

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.

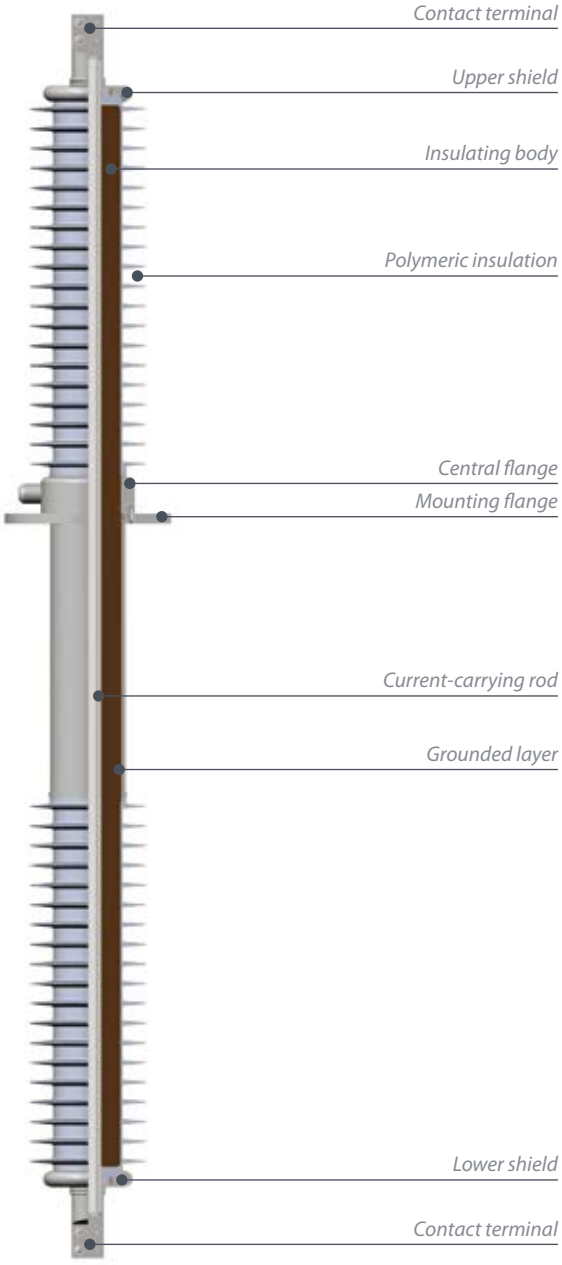


Fig. 2. Bushing with polymeric external insulation

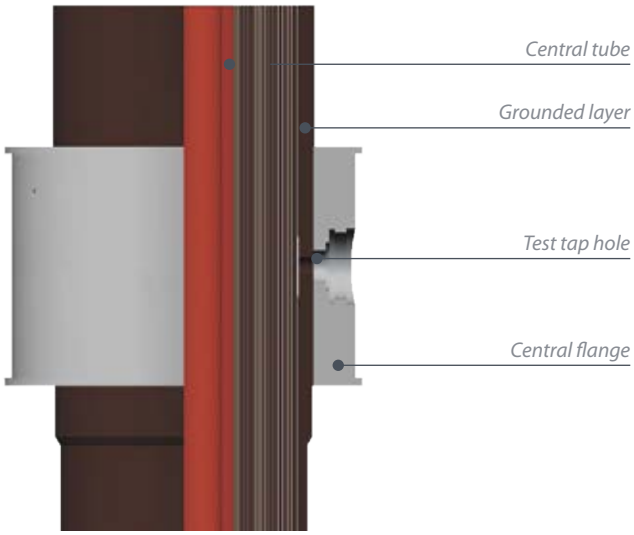


Fig. 3. Internal RIP-insulation

Fig. 4. Porcelain housing profile

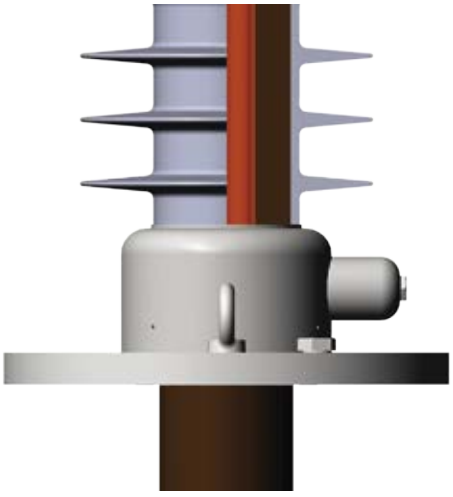


Fig. 5 Polymeric insulation profile

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 copper 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.

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.

Various grounding principles may be employed in the test taps. Fig. 6 shows a test tap, which is grounded and sealed by means of screwing-on a hood with spring-loaded contact. Fig 10 shows a test tap, which is grounded and sealed by screwing-on the grounding hood with spring-loaded contact. Fig. 7 shows a test tap, which is grounded by means a special-purpose spring-loaded multi-contact, with subsequent possibility of visual and instrumental checking of grounding reliability. In this case the hood serves only for sealing of the test tap cavity.

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.

At the top of the central tube there is a contact pin intended for soldering the transformer taps in it. During mounting of the bushing the pin with soldered-in taps is pulled through the central tube of the bushing and fixed at the top of the central tube by means of a stud or a special nut. This procedure is described in more detail in the Operation Manual, which comes with each bushing.

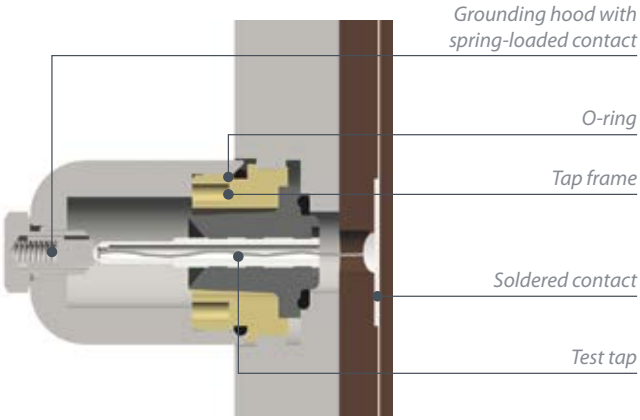


Fig. 6. Test tap with a grounding hood

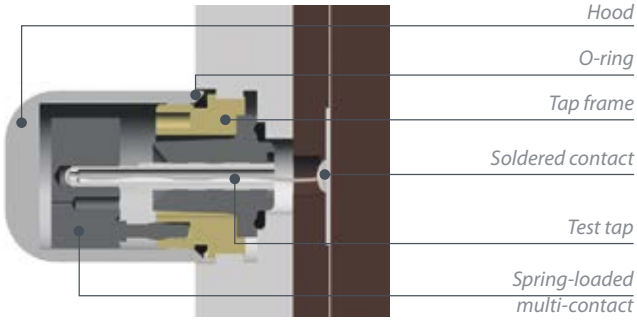


Fig. 7. Test tap with grounding multi-contact

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 or Fislage Company 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°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 10693-81 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 tgδ 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.

Connection

The wall bushings are connected with the help of contact terminals located at both ends of the bushing (Fig. 17).

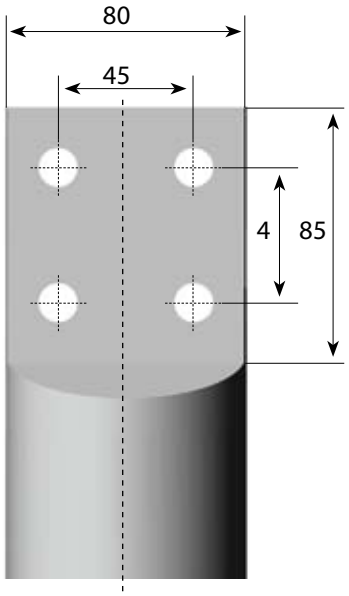


Fig. 17. Contact terminal

Operation

Maintenance of bushings with solid RIP-insulation provides for merely periodic measurement of insulation tgδ, main insulation capacity C1 and insulation resistance of the test tap.

Interchangeability of Bushings

Wall bushings produced by the Izolyator company are installed on new switchgears as well as in substitution of spent bushings of obsolete design. Herewith, identical connecting dimensions of the mounting flange are observed.

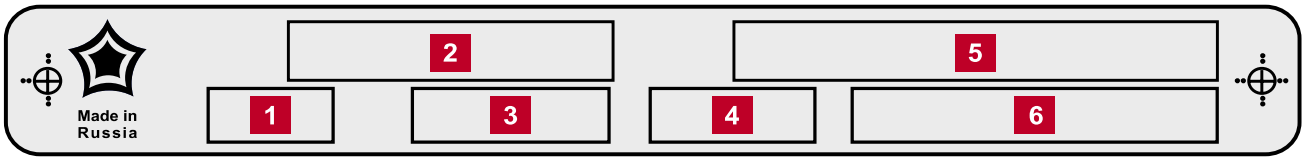
Key to bushing designation code

C – Internal solid RIP-insulation
W – wall bushing
S – Silicone external insulation
II…IV – External insulation category, depending on ambient contamination, according to GOST 9920–89 (State Standard) and Standard IEC 60137

60-220/2000

Rated current, A
Rated voltage, kV
Limit angle of vertical orientation, angular degree

Nameplate of Izolyator company

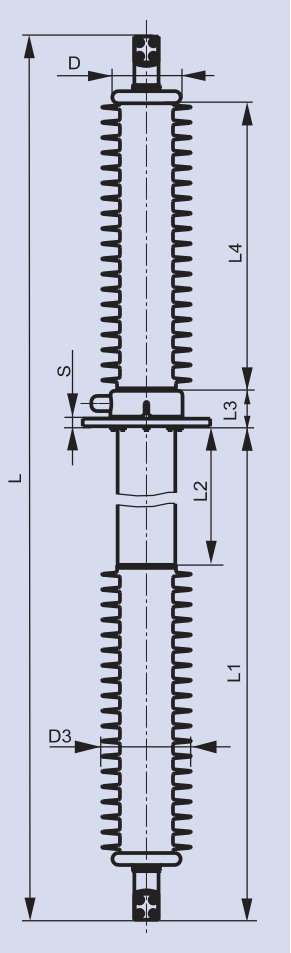


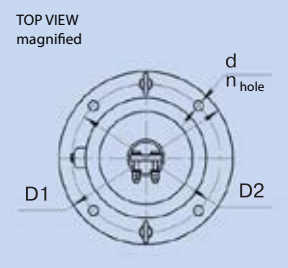
1. Bushing weight
2. Drawing number
3. Serial number
4. Date of manufacture
5. Type of bushing
6. Technical specifications or State Standard number

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	Switching impulse 250/250 mx	Full wave lightning pulse 1.2/250, mx					
66 kV bushings													
CWSIV-90-73/4000	686351.251	RIP	73		4000								
110 kV bushings													
CWSII-90-126/2000	686352.234	RIP	126	73	2000	230	—	550	2500	4000	144	17	
CWSIII-90-126/2000	686352.234-03	RIP	126	73	2000	230	—	550	3150	4000	150	17	
CWSIIV-90-126/2000	686352.234-04	RIP	126	73	2000	230	—	550	3900	4000	153	17	
CWSIII-90-126/2000	686352.234-01	RIP	126	73	2000	230	—	550	3150	4000	155	17	
CWSIII-90-126/2000	686352.234-02	RIP	126	73	2000	230	—	550	3150	4000	160	17	
CWSIV-90-126/2000	686352.234-05	RIP	126	73	2000	230	—	550	3900	4000	185	17	
CWSIV-90-126/2000	686352.234-06	RIP	126	73	2000	230	—	550	3900	4000	170	17	
CWIII-90-126/2000	686352.386	RIP	126	73	2000	230	—	550	3150		360	17	
CWIII-90-126/2000	686352.386-01	RIP	126	73	2000	230	—	550	3150		367	17	
150 kV bushings													
CWSIII-90-172/2000	686352.291	RIP	172	100	2000	275		650	4250/4250	4000	187	17	
CWSIII-90-172/4000	686352.252	RIP	172		4000								
220 kV bushings													
CWSIII-90-252/2000	686353.235	RIP	252	153	2000	460	—	1050	6300	5000	370	17	
CWSIV-90-252/2000	686353.235-01	RIP	252	153	2000	460	—	1050	7900	5000	395	17	

	Mounting and connecting dimensions, mm										
	L	L1	L2	L3	L4	D	D1	D2	D3	d/n hole	S
	2950	1655	485	125	945	225	420	360	292	24/4	
	3150	1760	485	125	1045	225	420	360	292	24/4	
	3300	1655	485	125	1295	225	420	360	292	24/4	
	3350	1950	685	125	1045	225	420	360	292	24/4	
	3500	2150	835	125	1045	225	420	360	292	24/4	
	3820	2180	650	125	1295	225	420	360	292	24/4	
	3490	1960	680		1030		420		360	24/4	
	3490	1960	680		1030		510		450	24/4	
	5815	3245	870		2155	225	890	840	330/292	22/12	35
	6315	3245	870		2655	225	890	840	330/292	22/12	35





Questions and Answers

Does the company produce support insulators and link suspension insulators for power transmission lines?
No. Izolyator company designs, manufactures and services through-lead insulators – high-voltage bushings for voltages ranging from 12 kV to 1200 kV, for power transformers, reactors, oil switches, cellular-type gas insulated switchgear, and line high-voltage bushings.

What is the lead time for delivery of your products?
The lead time depends on the voltage class of the ordered bushings. For example, batch-produced bushings 126 kV are delivered in 45 days, 252 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 outdated bushing needs replacement?
Please get in touch with our aftersales servicing department SVN-Service, or with sales department – contact details please find at our web site www.mosizolyator.com, or use our phone 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 with the predecessors employing paper-oil insulation?
The bushings with solid RIP insulation have higher electric characteristics, and feature the following advantages:
- simple design, hence – shorter delivery times;
- less weight;
- no maintenance is required during operation

What are the advantages of the bushings with polymer external insulation as compared with porcelain insulation?
The main advantages of the bushings with polymer external insulation:
- fire safety and explosion safety of the bushings due to absence of oil in the structure;
- tracking erosion resistance;
- high pollution resistance due to high hydrophobic properties of the polymer;
- high electric 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 of bushing installation angle;
- less weight.

What are the advantages of the new design of the test tap?
The previous designs of the test tap assembly did not preclude the possibility of unreliable grounding caused by errors during assembling and testing. On condition that the requirements of the operating manual are observed, the new terminal completely prevents the possibility of leaving the test tap assembly ungrounded upon completion of assembly works and tests. The upgraded design implements the principle "reliably grounded at all times when no tests or measurements are performed".

What is the purpose of installing the test tap on the bushings of the voltage class 40.5 kV?
It was done following numerous requests from the customers. In whole, it facilitates the procedure of measuring the insulation of the bushings.

How to protect the bottom part of the bushing with RIP insulation during long-term storage?
Taking into consideration the hygroscopic properties of the material of the insulating frame, 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 the bushing with already installed sealed case, or to order the sealed case for a previously supplied bushing.

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 company, and appropriate instruction will be sent to you in case of necessity.

Is it necessary to measure R1 (by straightforward scheme)? Some people do it, others do not!
It depends: what is understood under "measuring R1". If it implies measuring of the resistance of the main insulation of the bushing (using megohmmeter), – we do not think that it is necessary. It is a non-informative parameter, it is not normalized neither by the enterprise, nor by the document РД 34.45-51.300-97. The result will always be good, certainly on condition that the bushing is clean, not burnt-out and has no mechanical damage. But all this may be verified by visual inspection. We have no answer, why some testing specialists measure this parameter.

I do not know, where to begin? What should I do?
If you have other questions, or need more detailed information, please visit our web site www.mosizolyator.com or communicate with Izolyator company: phone: +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 have a common part (GOST 30830-2002).

OIP — Oil Impregnated Paper. Type of internal insulation of high-voltage bushings.

Bushing – a device implementing passage of 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 attachment (flange or fixing arrangement) which is an integral part of the bushing fastening it to the barrier.

GOST 10693-81 – Russian 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. The category of external insulation is included in the code designation of the bushing presented in this catalog.

IEC 60137:2008 – International standard for bushings.

Main capacitance of the bushing C_1 – capacitance between the high-voltage central conductor and the test tap of the bushing.

Hand-over tests are performed for each bushing at release from the plant.

Acceptance tests are performed for each new bushing type during launch of batch production.

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 alternative voltage and current into other, one or several, systems of alternative voltage and current, usually of different amplitude and of the same frequency, for the purpose of transfer of power (GOST 30830-2002).

Dielectric loss tangent (tanδ, tgδ) is the ratio of active component of insulation leakage current to its reactive component. If alternative 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. At that, the conductor either may be a part of the bushing (bottom-connection bushing), or may pass through the central tube of the bushing (pulled-through type bushing).
The bushing for cable connection of transformers is a bushing which both ends are designed for submerging into insulating medium other than ambient air (e.g., oil or gas). At that, the insulating medium may be homogeneous (oil-oil, gas-gas) or heterogeneous (oil-gas).

Partial discharge – spark discharge of very low power occurring inside the bushing insulation or on its surface due to presence of micro-defects. It is one of the most important checked characteristics of the bushing. Pursuant to the regulatory information for bushings (GOST 10693-81 and IEC 60137:2008), apparent partial discharge level shall be not over 10 pC at maximum operating voltage of the bushing.

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

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

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

Izolyator Product Line

"Air-oil" bushings for oil switches
Voltage: 40.5–252 kV
Current: 1000-3150 A

"Oil-oil" bushings for cable connection of transformers
Voltage: 126–550 kV
Current: 630-1000 A

"Air-oil" bushings for power transformers and shunt reactors
Voltage: 12-1200 kV
Current: 315-2500 A

«Air-oil» bushings for oil switches
Voltage: 40.5–252 kV
Current: 1000-3150 A

"Air-air" line bushings
Voltage: 72.5–252 kV
Current: 2000-4000 A

"Air-SF_6" bushings for cellular-type gas insulated switchgear (GIS)
Voltage: 252 kV
Current: 2000-3150 A

Wall bushings 252 kV produced by Izolyator company on the switchgear of an oil-processing plant

Bushings 363 kV produced by Izolyator company on the transformer of main power grids

Bushings 126 kV produced by Izolyator company on the oil switch of an inter-regional distribution grid company

Line bushings 820 kV DC at the testing center of Izolyator factory

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Izolyator company continues development of new and improvement of existing batch-produced designs of high-voltage bushings. Therefore, some data presented in the catalogue may be outdated.
When ordering a particular product, please communicate with Izolyator company for obtaining the updated characteristics.