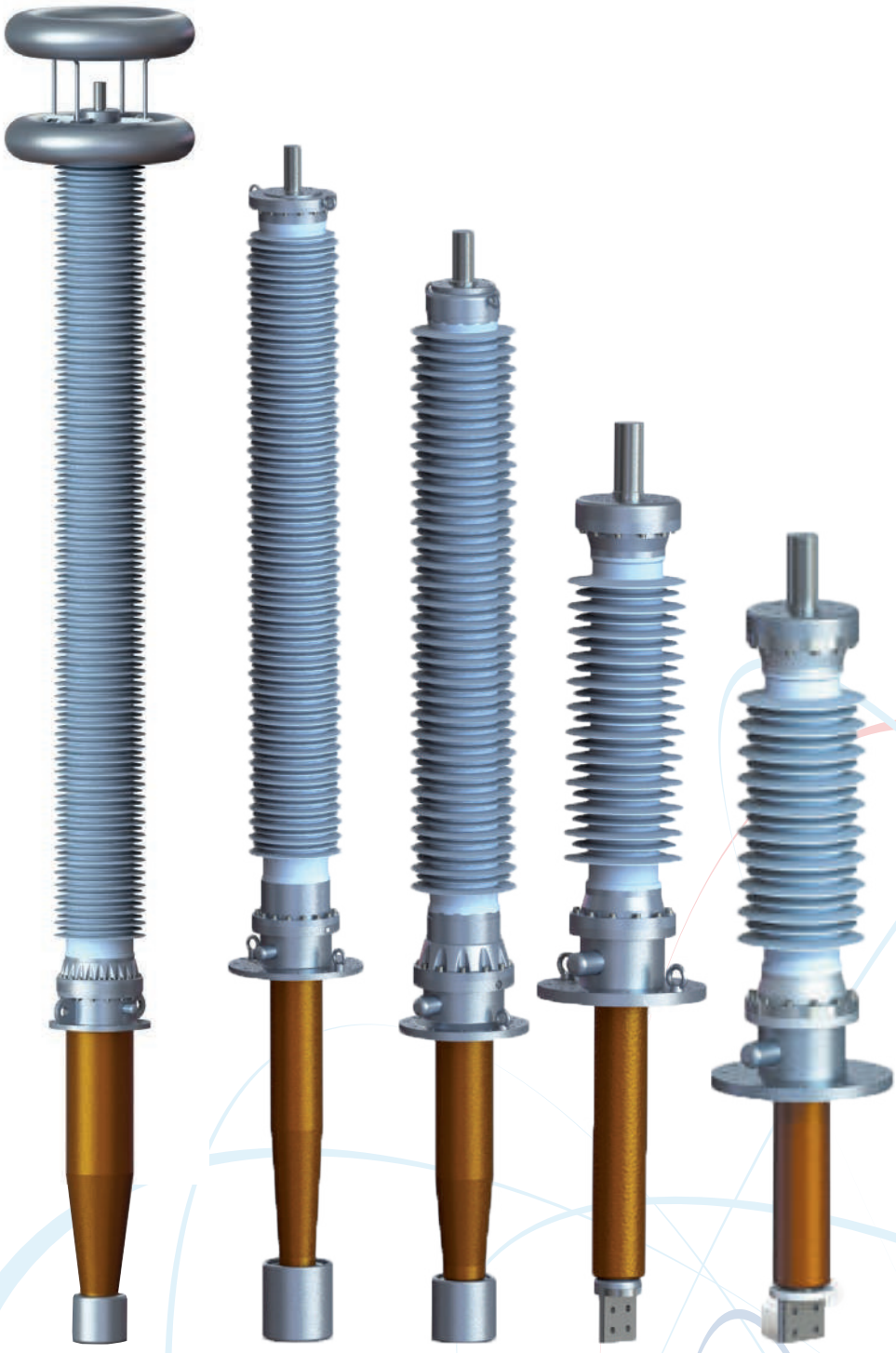
Massa Izolyator Mehru

HIGH-VOLTAGE BUSHINGS FOR POWER TRANSFORMERS



Air — Oil
RIP insulation
Voltages: 52–420 kV
Currents: 800–3150 A

www.mimpower.com

2021

MISSION VISION VALUES

Mission

To integrate our innovative solutions into the international power system to ensure a stable Future for global power sector.

Vision

We create innovation products and solutions to ensure end-users all over the world in stable power supply.

Values

We do not compromise on quality and constantly improving our product. We value and respect people.

MASSA IZOLYATOR MEHRU Pvt. Ltd.

Massa Izolyator Mehru

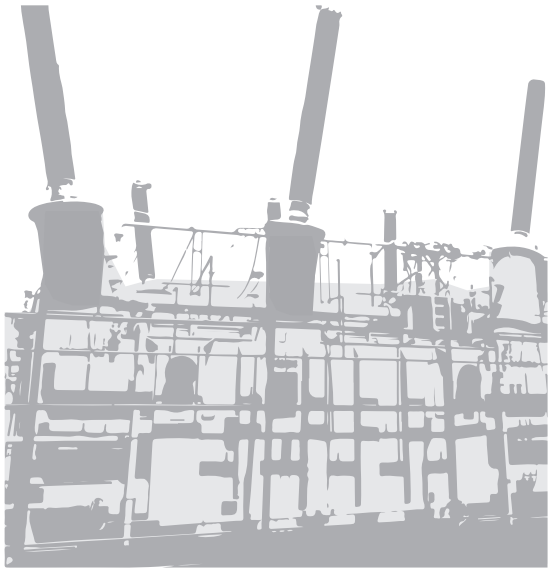
Massa Izolyator Mehru Pvt. Ltd.

The company produces, maintains and sells high-voltage RIP bushings rated up to 420 kV for power equipment in World Wide.

MIM is approved by Power Grid Corporation of India Limited and in various Govt. Utilities as manufacturer of RIP bushings up to 420 kV.

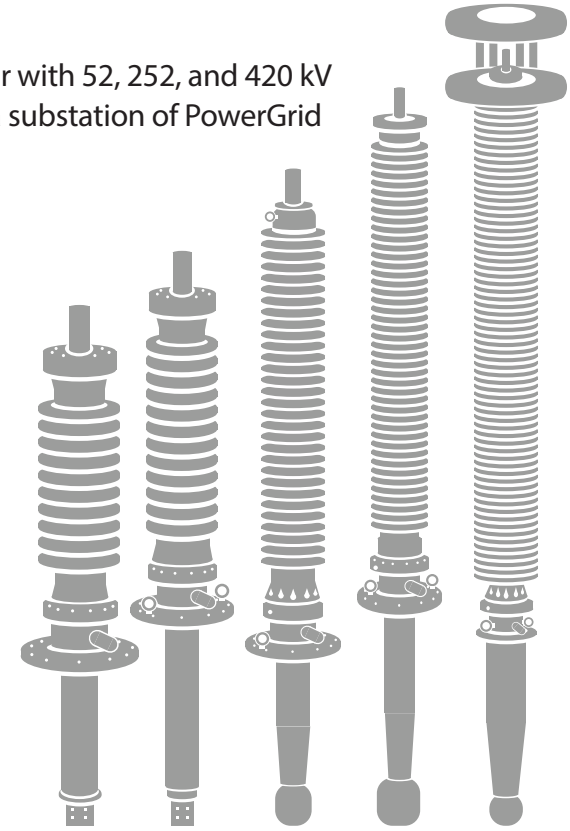
CONTENTS

MIM ADVANTAGES



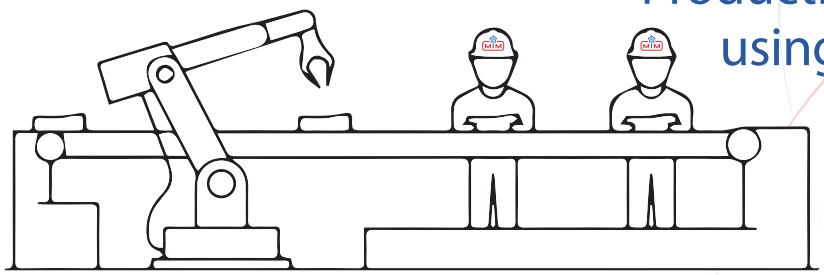
MIM has been approved by PowerGrid as manufacturer of RIP bushings up to 420 kV.

A 500 MVA transformer with 52, 252, and 420 kV Izolyator bushings at a substation of PowerGrid



Technical control of insulation cores carried out by Izolyator.

Insulation cores are tested in an IEC 17025 certified test center of Izolyator.



Production equipment developed using the Izolyator experience.

The MIM staff are trained at Izolyator.

Fast testing inspections with local manufacturer.

Fast & easy 24-hours service support and maintenance of equipment.

Shortened production / lead time.
Easy commercial cooperation with local partner in India.
Price advantages compared to foreign suppliers.

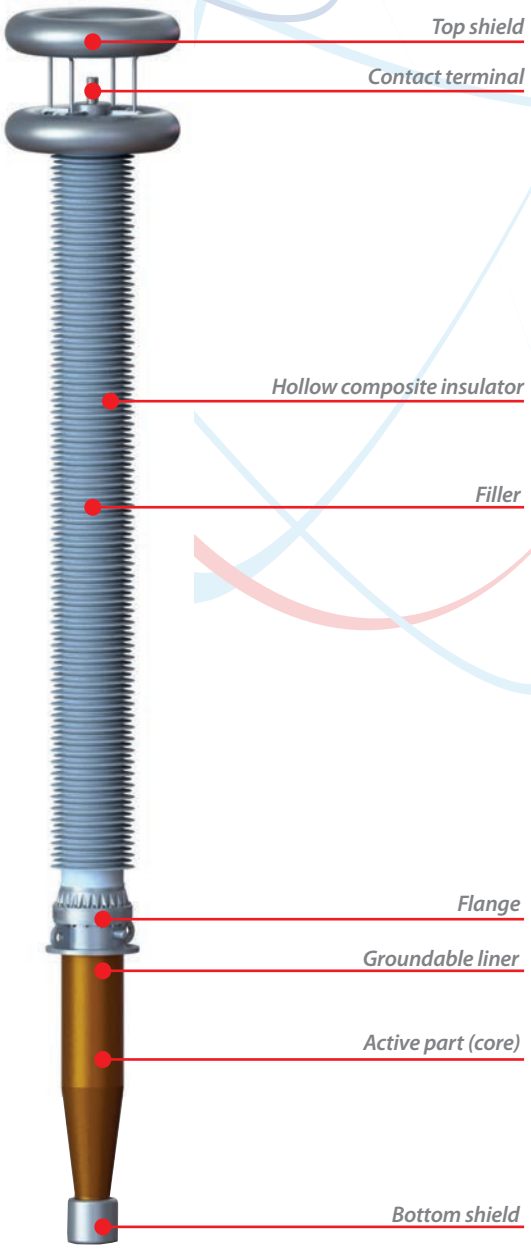


Fig. 1. RIP bushing design

RIP bushing design

Body contains the following bushing's elements:

Active part (core) is an internal insulation of the bushing, equalizing electric field in radial and axial directions using condenser liners.

Hollow composite insulator covers the upper part of the insulation core, located outisde a transformer or reactor, and is made of polymer housing.

It also protects the internal insulation against moistening and provides the required length of external surface creepage path.

Hollow composite insulator is made on epoxy glass tube, external silicone insulation is made of HTV or LSR silicone. Composite insulators conform to IEC 61462.

Filler — a dry substance, protecting the bushing's internal space between composite insulator and RIP core against moistening.

Flange contains test tap and used for securing the bushing on the equipment.

Groundable liner — the last layer of insulation core staying in permanent electric contact with the test tap.

Contact terminal is intended for connecting high potential to it, made of copper alloy

Bottom shield equalizes external electric field in the bottom part of the bushing.

Top shield is used in designs of bushings for equalizing electric field in the top part of the bushing.

Bushings with polymer external insulation have the following advantages:

- absolutely dry, explosion and fire safe **service-free design**
- stability of insulating properties throughout entire operation;
- high tracking resistance;
- hydrophobicity of external insulation that decreases flashover probability even on moist dirty insulation surface;
- elasticity of external insulation, decreasing damage risks at transportation and installation;
- absence of installation angle restrictions on equipment;
- seismic load withstand;
- minimal weight;
- ecological safety.

Fig. 2. 252 kV/2000 A RIP bushing

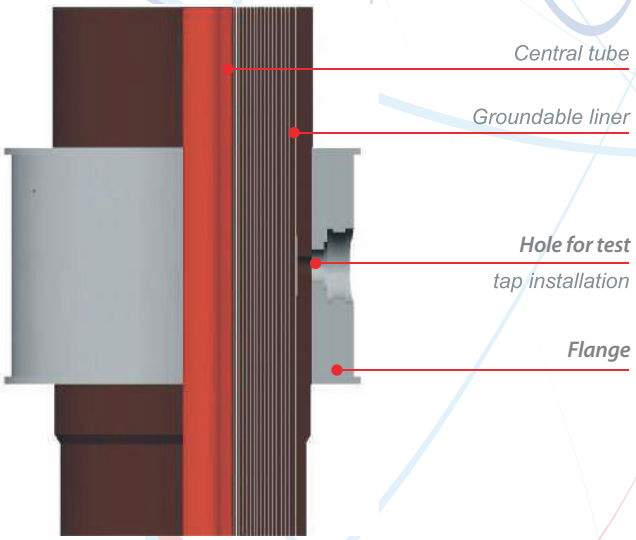


Fig. 3. Internal RIP insulation

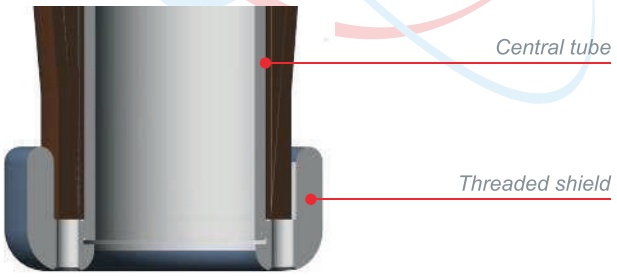


Fig. 4. Factory set shield

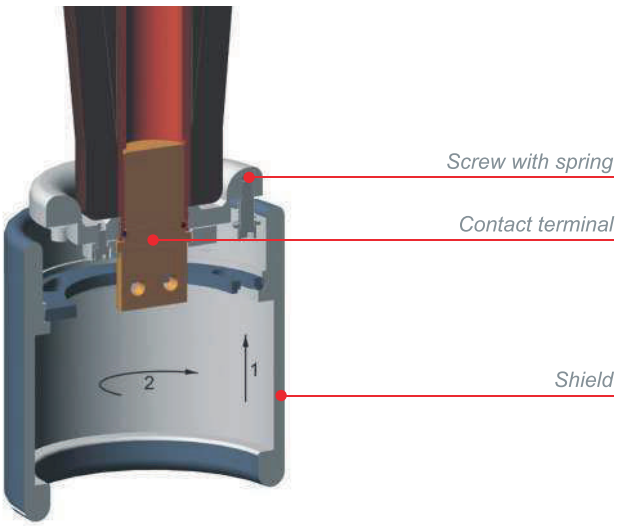


Fig. 5. Shield secured with bayonet lock

Assemblies and parts of the RIP bushing

Solid internal RIP insulation (core)

Internal RIP insulation is the main constructional part of a bushing (Fig. 3). It has a high reliability and operation life due to low dielectric loss and level of partial discharges in the insulation, as well as heat resistance. This insulation allows to eliminate usage of transformer oil as insulating component greatly improving convenience of operation.

Condenser liners are used to equalize the electric field and evenly distribute potential inside the insulation core. The nearest to the central tube liner is in electric contact with it and the last one is in permanent electric contact with the pin of the measuring tap. The materials used for making insulation core ensure required mechanical strength and crack resistance of the insulation. This fact is verified by mechanical, climatic and seismic tests and long term operation of RIP bushings in the field.

Bottom part of the bushing

Depending on the bushing type and rated voltage, its bottom part may be installed both without the shield and with the shield for electric field equalizing.

The shields may be installed either at Izolyator plant (Fig. 4) or on the installation site with the use of screws or a bayonet lock (Fig. 5) according to the operation manual, supplied with each bushing.

In the standard design, up to 0.5 mm layer of electric insulating coating is applied on the shield using powder paint. If necessary, bushings can be completed with up to 12 mm thick insulating paper covering. In this case, the shield is shipped inside a separate tank filled with transformer oil in the bushing packing.

Test tap

Test tap from the last equalizing liner of the insulation core serves to control the condition of the internal insulation and must be grounded when measurements are not performed.

Fig. 6 shows a test tap, made since 2014. To unground the tap, it is necessary to unsrew the cap and take off the jumper with multicontact. After the measurements are made on a bushing, the multicontact is to be put back by placing the pin in the hole of the test tap body and setting the multicontact on the pin of the test tap. The cap is used to seal the cavity of the test tap. it is required to screw on the cap by hand to pressing on the rubber O-ring on the test tap body.

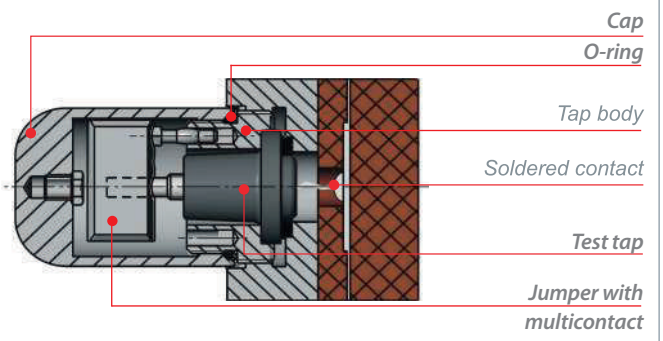


Fig. 6. Test tap with grounded multicontact

External diagnostic tools

External diagnostic tools connected to the test tap provide a possibility to monitor the condition of the bushing under operating voltage.

Herewith, for protection of the test tap against long-lasting occurrence of unacceptably high voltage, a special sensor with protection against cable break (Fig. 7) shall be installed on the test tap. The cable is connected not to the test tap, but to the sensor contact.

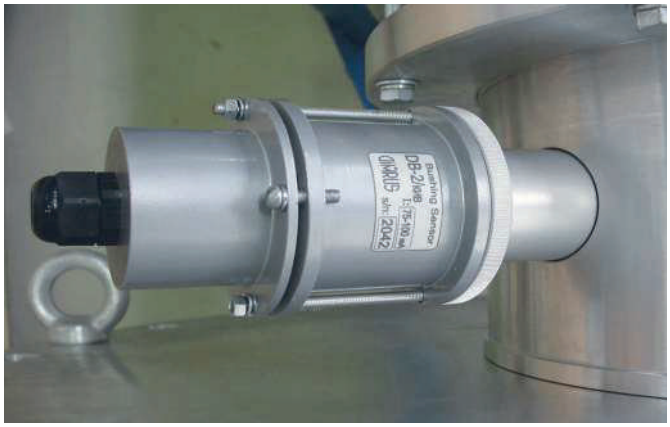


Fig. 7. Sensor for protection of the test tap

The sensor is included in the delivery set of all bushings with voltage of 420 kV and higher. For the bushings with other voltage the sensor can be ordered additionally.

Current transformers

Bottom part of the bushing is made suitable for installing current transformers, as shown in Fig. 8. In addition, the current transformers shall be located within the grounded liner, while the distance from the bushing axis to the grounded parts of the transformer must be not less than R.

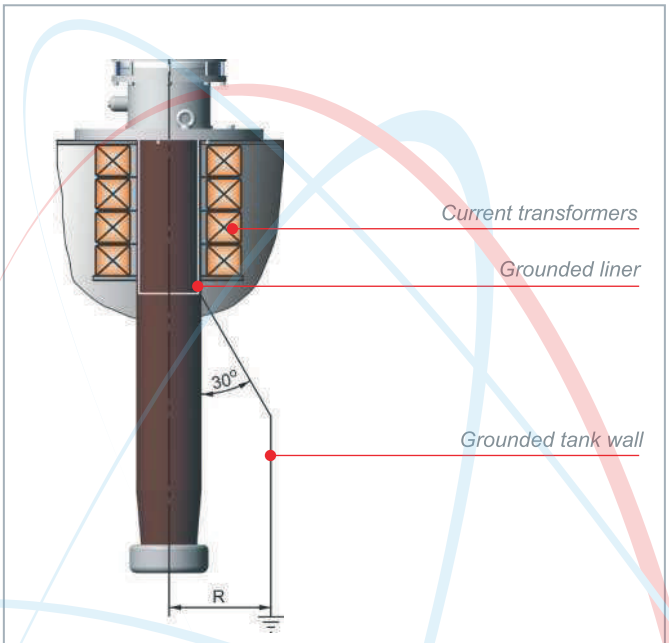


Fig. 8. Installation diagram of current transformers

OPERATION AND PRODUCTS

Operation

RIP bushings maintenance provides for merely periodic measurement of insulation tgδ1 of main insulation capacity C1 and insulation resistance of the test tap.

Interchangeability of bushings

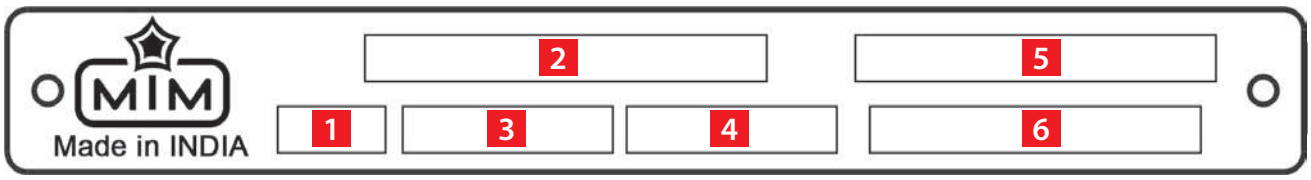
Izolyator high-voltage bushings are installed both on new transformers and reactors and as replacement to spent bushings of obsolete design. For that reason, equivalence of the submerged bushing part and the length of the drawn lead as well as fitting dimensions of the mounting flange, are observed. If necessary, these characteristics may be coordinated with the manufacturer of particular power equipment where the bushings need to be substituted.

Key to Bushing Designation Code

T C S IV - 90 - 252 / 2000

- 2000 — Rated current, A
- 252 — Maximum operating voltage, kV
- 90 — Limit angle of vertical oreintation, angular degree
- IV — **External insulation contamination level (IV — minimum 31 kV/mm)**
- S — **Composite external insulation with silicone finning**
- C — **RIP-insulation (compound imregnation of paper core)**
- T — **For transformers**

MIM nameplate on bushings



1. Bushing weight
2. Drawing number
3. Serial number
4. Production date
5. Bushing type
6. IEC standard number

Products

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Made in India

MIM makes high voltage bushings in the voltage range 52–420 kV with Air — Oil applications.

The RIP core, which has a higher reability and durability, is used in the produced bushings.

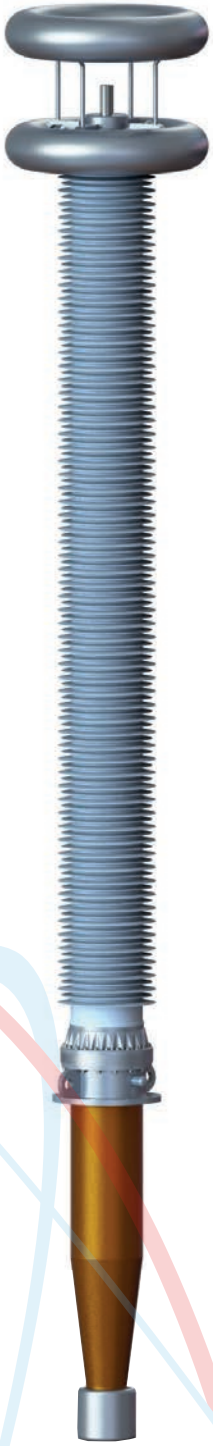
Combination of RIP core with dry filled design with outdoor composite hollow insulator with silicone sheets — give the balance of reliability, ease of use, installation and maintenance.

Air — Oil bushing
for power transformers
Voltage: 52 kV
Current: 3150 A
Insulation: RIP

Air — Oil bushing
for power transformers
Voltage: 72.5 kV
Current: 800–2000 A
Insulation: RIP

Air — Oil bushing
for power
transformers
Voltage: 145 kV
Current: 1250 A
Insulation: RIP

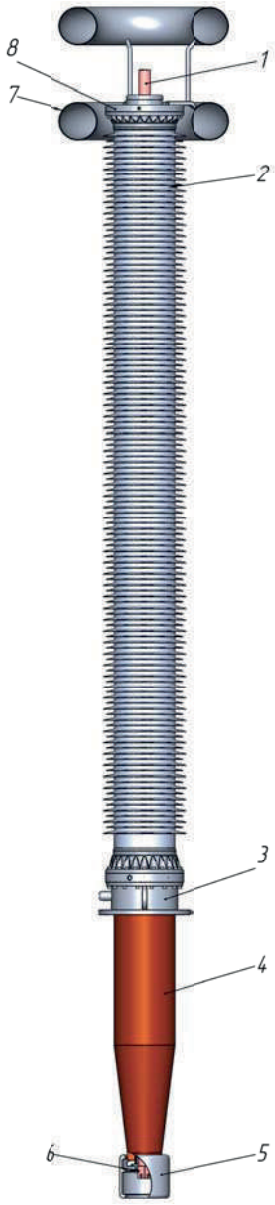
Air — Oil bushing
for power
transformers
Voltage: 252 kV
Current: 1250–2000 A
Insulation: RIP



Air — Oil bushing
for power
transformers
Voltage: 420 kV
Current: 1250–3000 A
Insulation: RIP

General technical parameters of transformer bushings

Design		
Standard applicable	IEC 60137-2017	
Condenser core	Epoxy Resin Impregnated Paper	
Rated voltage Um	50/60 Hz	
Ambient temperature	°C	-60 to +55
Temperature of transformer oil (max)	°C	100
Angle of mounting	degree	0 - 90
The temperature limits for metal parts in contact with insulating material axis on the top terminal	°C	120
Max. tan delta at ambient temperature at Um	%	≤ 0,5
Paper	Crepe paper	
Housing		
- material	High temperature vulcanization (LSR or HTV silicone rubber)	
- silicone content	35 %	
- track resistance	Class 1A4.5 according to IEC 60587	
- shed profile	Alternate (as dr. enclosed)	
- processing	Injection molding, hightemp & pressure	
- color	Grey	
Terminal	Electrolytic copper	
Flange	Aluminum alloy	
Test tap	For capacitance and tan delta measurement; 2.5 kV withstand voltage	
Packing	Complete wooden package. Bottom end with metal housing. Air end protected by metallized Polyethylene sleeve.	

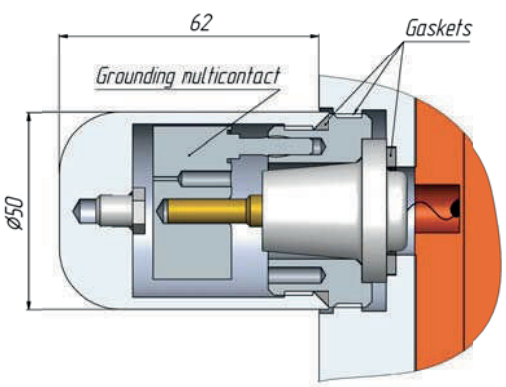


Position	Description	Qty	Material	Finish
1	Contact terminal	1	Electrolytic copper	Tin coated* (grey)
2	Composite insulator	1	Silicone LSR or HTV	Light grey
3	Flange	1	Aluminium	Blank
4	Active part (core)	1	RIP	Epoxy resin coating (brown)
5	Shield	1	Aluminium	Epoxy resin coating (grey) or Paper coating (beige)***
6	Bottom contact	1	Electrolytic copper	Tin coated (grey)
7**	Corona shield	1	Aluminium alloy	Blank
8	Upper flange	1	Aluminium	Blank

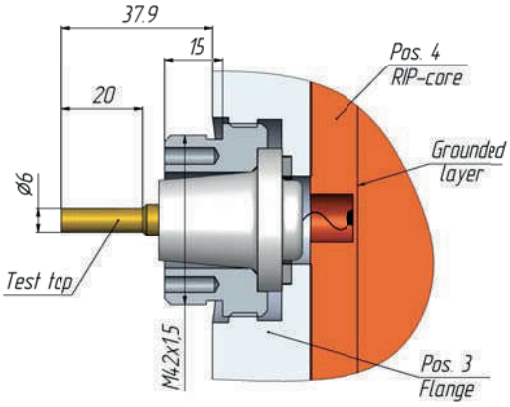
*Silver coating on request.
**Only for bushing of 420 kV & 3000 A.
***Paper coating for bottom shield only for bushing 420 kV & 3000 A.

Test tap

Grounded position



Test tap without hood position for measurement



Technical parameters of transformer bushings

Type	**TCSIV-90-52/3150**
Drawing	**686351.601**
Title	**RIP transformer bushing**

Design		
Conductor material & cross section area	Copper & 3318 mm^2	
Current-carry form	Bottom connection (Stem type)	
Rated voltage Um	kV	52
Max. service voltage line-ground	kV	32
Partial discharge extinction voltage	kV	≥70
P.d - level	pC	≤10
Test voltage 50 Hz, 1 min.	kV	105
Lightning impulse test voltage 1.2/50 µs full wave	kV	305
Switching impulse test voltage 250/2500 µs	kV	---
Rated current	A	3150
Rated short time current (1s/2s) I_{th}	kA	78/56
Rated dynamic current I_d	kA	140
Flashover distance	mm	550
Creepage distance, min	mm	2000
Test bending load at room temp., applied at right angle to bushing axis on the top terminal	N	3150
Length for CT	mm	200
Weight	kg	62
Altitude	meters	1000

Routine test voltage levels		
Power frequency withstand voltage dry	50 Hz, 1 min	105 kV
Maximum value of partial discharge		≤10 pC
Partial discharge extinction voltage		≥70 kV
Power frequency withstand voltage	Test tap 50 Hz, 1 min	2.5 kV
Lightning impulse test voltage	BIL 1.5/50 µs pos./neg.	---/--- kV
Chopped lightning impulse test voltage	Time to sarkover: 2…6 µs pos./neg.	---/--- kV

Type test voltage levels		
Power frequency withstand voltage wet	50 Hz, 1 min	95 kV
Lightning impulse test voltage	BIL 1.5/50 µs pos./neg.	305/305 kV
Chopped lightning impulse test voltage	Time to sarkover: 2…6 µs pos./neg.	---/--- kV
Switching impulse test voltage	SIL 250/2500 µs pos./neg.	---/--- kV
Switching impulse test voltage wet	pos./neg.	---/--- kV

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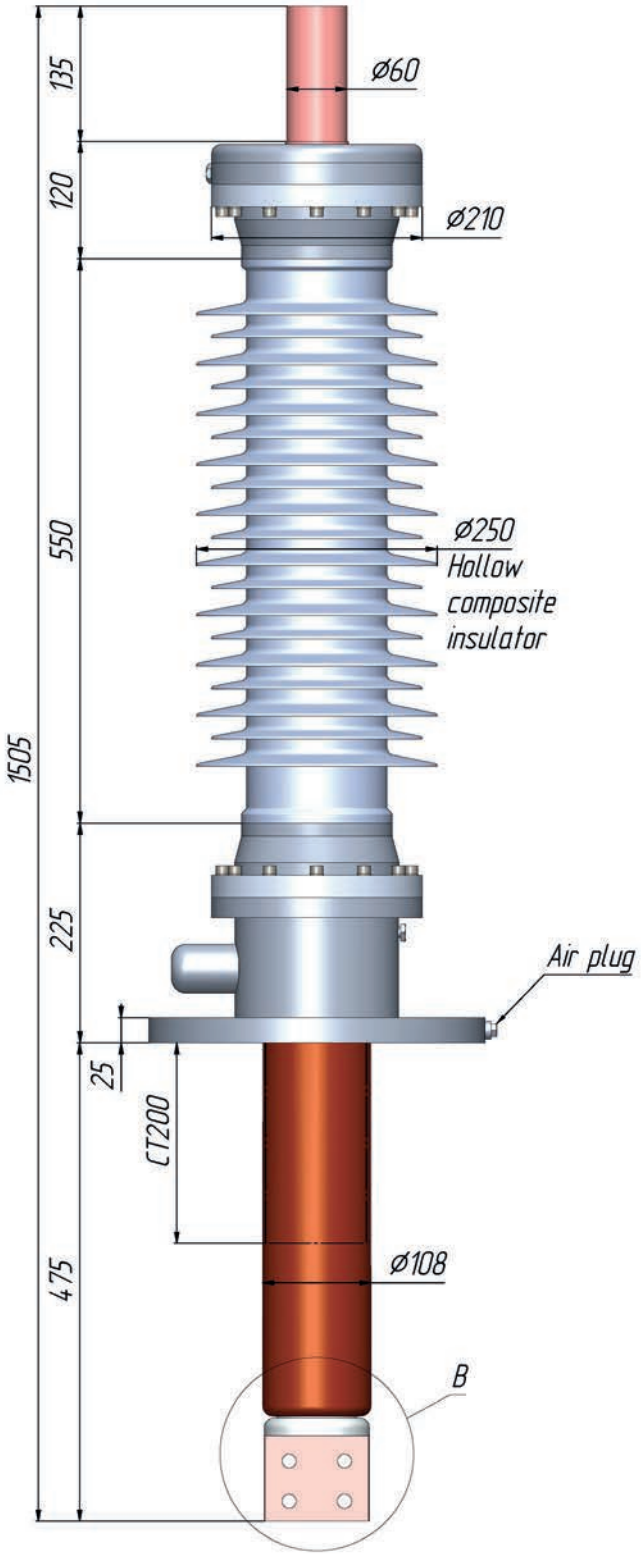
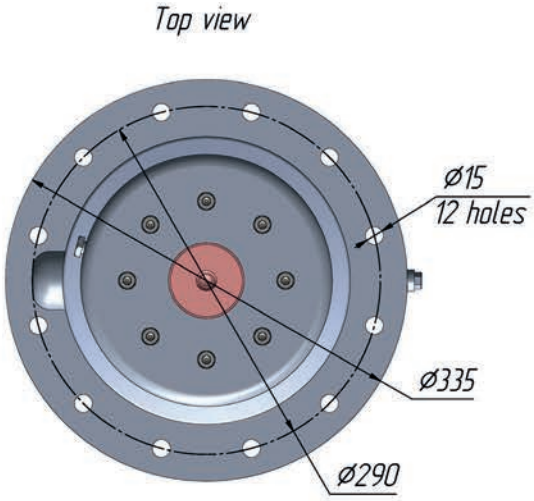
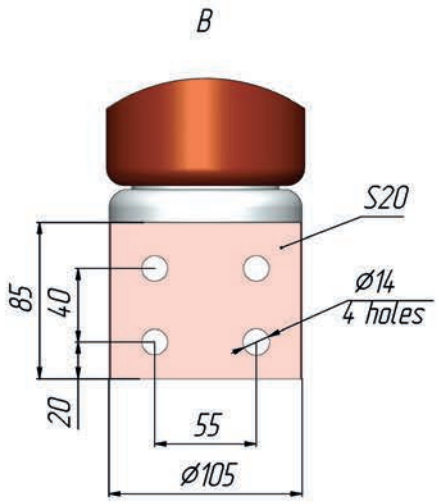

135
120
550
225
475
1505
25
CT200
Ø60
Ø210
Ø250
Hollow
composite
insulator
Air plug
Ø108
B


Top view
Ø15
12 holes
Ø335
Ø290


B
S20
Ø14
4 holes
85
40
20
55
Ø105

Type	**TCSIV-90-72.5/800**
Drawing	**686351.611**
Title	**RIP transformer bushing**

Design		
Conductor material & cross section area	Copper & 1698 mm^2	
Current-carry form	Bottom connection (Stem type)	
Rated voltage Um	kV	72.5
Max. service voltage line-ground	kV	42
Partial discharge extinction voltage	kV	72.5
P.d - level	pC	≤10
Test voltage 50 Hz, 1 min.	kV	155
Lightning impulse test voltage 1.2/50 µs full wave	kV	325
Switching impulse test voltage 250/2500 µs	kV	---
Rated current	A	800
Rated short time current 2s I_{th}	kA	31.5
Rated dynamic current I_d	kA	78.75
Flashover distance	mm	1010
Creepage distance, min	mm	2250
Test bending load at room temp., applied at right angle to bushing axis on the top terminal	N	2000
Length for CT	mm	300
Weight	kg	80
Altitude	meters	3514

Routine test voltage levels		
Power frequency withstand voltage dry	50 Hz, 1 min	155 kV
Maximum value of partial discharge		≤10 pC
Partial discharge extinction		72.5 kV
Power frequency withstand voltage	Test tap 50 Hz, 1 min	2.5 kV
Lightning impulse test voltage	BIL 1.5/50 µs pos./neg.	---/--- kV
Chopped lightning impulse test voltage	Time to sarkover: 2…6 µs pos./neg.	---/--- kV

Type test voltage levels		
Power frequency withstand voltage wet	50 Hz, 1 min	140 kV
Lightning impulse test voltage	BIL 1.5/50 µs pos./neg.	325/325 kV
Chopped lightning impulse test voltage	Time to sarkover: 2…6 µs pos./neg.	---/--- kV
Switching impulse test voltage	SIL 250/2500 µs pos./neg.	---/--- kV
Switching impulse test voltage wet	pos./neg.	---/--- kV

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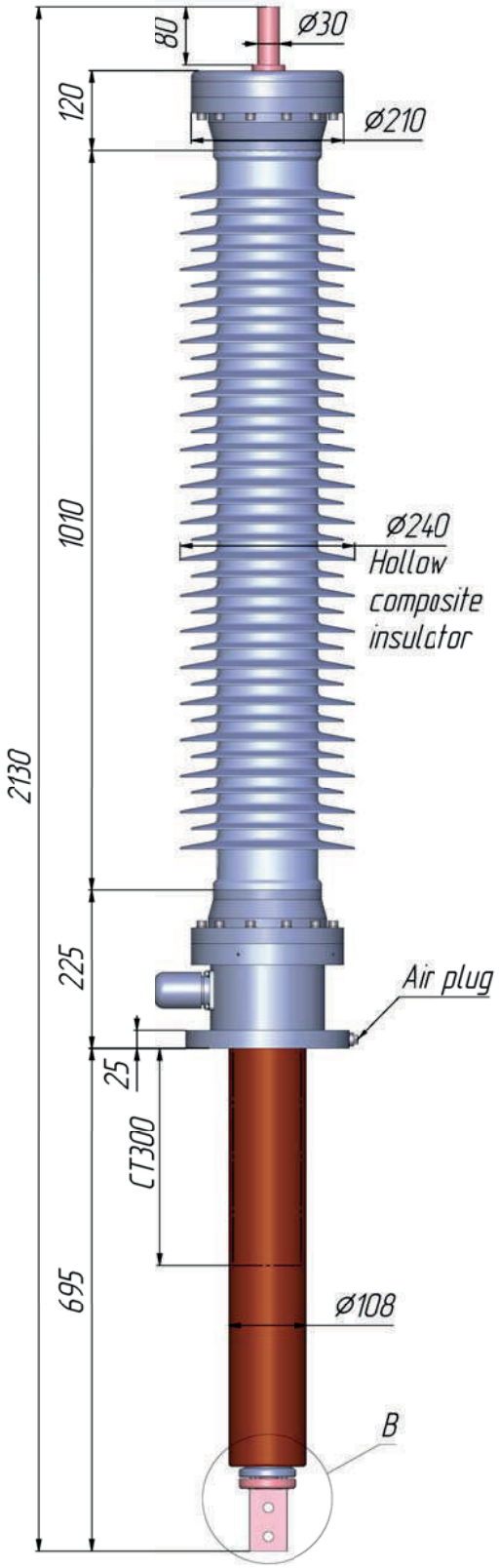
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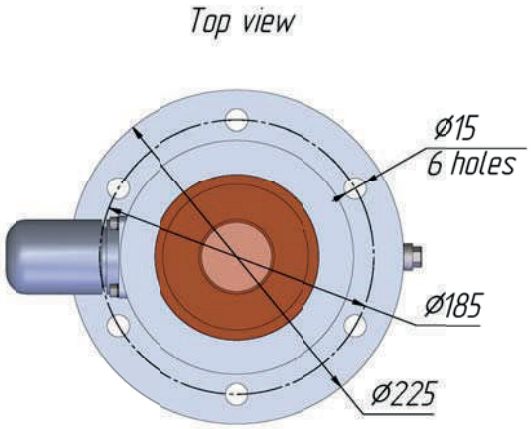
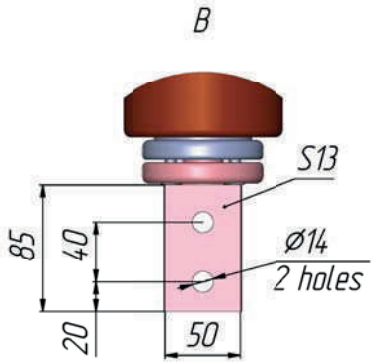
Ø30
120
Ø210
1010
Ø240
Hollow
composite
insulator
2130
225
Air plug
25
CT300
695
Ø108
B


Top view
Ø15
6 holes
Ø185
Ø225


B
S13
85
40
Ø14
2 holes
20
50

Type TCSIV-90-72.5/2000
Drawing 686351.619
Title RIP transformer bushing

Design		
Conductor material & cross section area	Copper & 1698 mm^2	
Current-carry form	Draw rod	
Rated voltage Um	kV	72.5
Max. service voltage line-ground	kV	44
Partial discharge extinction voltage	kV	72.5
P.d - level	pC	≤10
Test voltage 50 Hz, 1 min.	kV	160
Lightning impulse test voltage 1.2/50 µs full wave	kV	350
Switching impulse test voltage 250/2500 µs	kV	---
Rated current	A	2000
Rated short time current (2s/3s) I_{th}	kA	50/25
Rated dynamic current I_d	kA	125
Flashover distance	mm	650
Creepage distance, min	mm	2250
Test bending load at room temp., applied at right angle to bushing axis on the top terminal	N	3150
Length for CT	mm	300
Weight	kg	73
Altitude	meters	1000

Routine test voltage levels		
Power frequency withstand voltage dry	50 Hz, 1 min	160 kV
Maximum value of partial discharge		≤10 pC
Partial discharge extinction		72.5 kV
Power frequency withstand voltage	Test tap 50 Hz, 1 min	2.5 kV
Lightning impulse test voltage	BIL 1.5/50 µs pos./neg.	---/--- kV
Chopped lightning impulse test voltage	Time to sarkover: 2...6 µs pos./neg.	---/--- kV

Type test voltage levels		
Power frequency withstand voltage wet	50 Hz, 1 min	140 kV
Lightning impulse test voltage	BIL 1.5/50 µs pos./neg.	350/350 kV
Chopped lightning impulse test voltage	Time to sarkover: 2...6 µs pos./neg.	---/--- kV
Switching impulse test voltage	SIL 250/2500 µs pos./neg.	---/--- kV
Switching impulse test voltage wet	pos./neg.	---/--- kV

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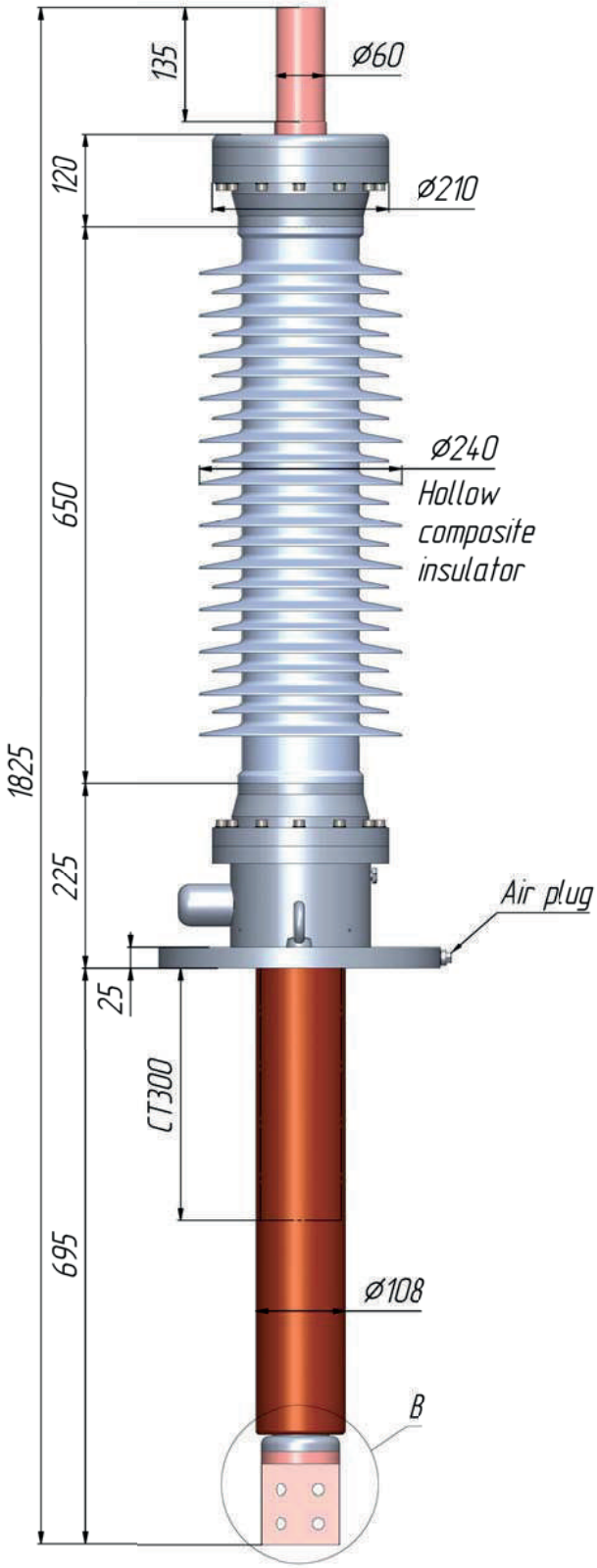
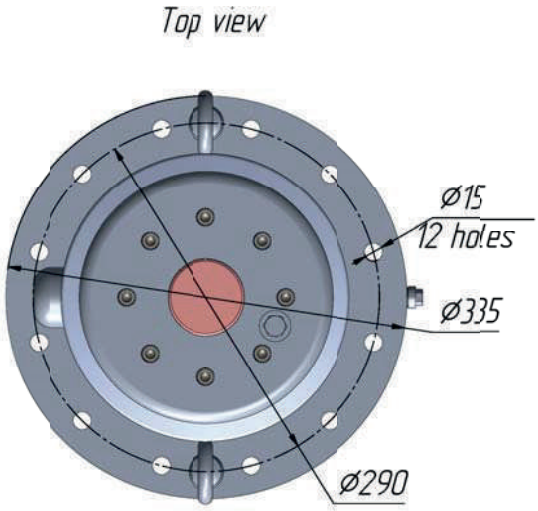
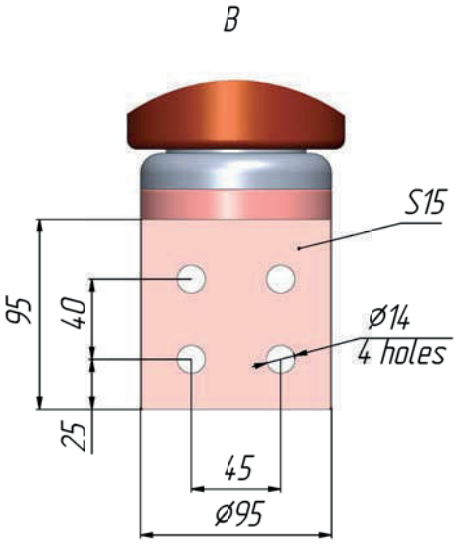

135
Ø60
120
Ø210
650
Ø240
Hollow
composite
insulator
1825
225
Air plug
25
CT300
695
Ø108
B


Top view
Ø15
12 holes
Ø335
Ø290


B
S15
95
40
Ø14
4 holes
25
45
Ø95

Type	**TCSIV-90-145/1250**
Drawing	**686352.604**
Title	**RIP transformer bushing**

Design		
Conductor material & cross section area	Copper & 1380 mm^2	
Current-carry form	Bottom connection (Stem type)	
Rated voltage Um	kV	145
Max. service voltage line-ground	kV	88
Partial discharge extinction voltage	kV	145
P.d - level	pC	≤10
Test voltage 50 Hz, 1 min.	kV	305
Lightning impulse test voltage 1.2/50 µs full wave	kV	650
Switching impulse test voltage 250/2500 µs	kV	---
Rated current	A	1250
Rated short time current (1s/2s) I_{th}	kA	44/31.25
Rated dynamic current I_d	kA	100
Flashover distance	mm	1540
Creepage distance, min	mm	5800
Test bending load at room temp., applied at right angle to bushing axis on the top terminal	N	4000
Length for CT	mm	300
Weight	kg	130
Altitude	meters	1600

Routine test voltage levels		
Power frequency withstand voltage dry	50 Hz, 1 min	305 kV
Maximum value of partial discharge		≤10 pC
Partial discharge extinction		145 kV
Power frequency withstand voltage	Test tap 50 Hz, 1 min	2.5 kV
Lightning impulse test voltage	BIL 1.5/50 µs pos./neg.	---/--- kV
Chopped lightning impulse test voltage	Time to sarkover: 2...6 µs pos./neg.	---/--- kV

Type test voltage levels		
Power frequency withstand voltage wet	50 Hz, 1 min	275 kV
Lightning impulse test voltage	BIL 1.5/50 µs pos./neg.	650/715 kV
Chopped lightning impulse test voltage	Time to sarkover: 2...6 µs pos./neg.	---/787 kV
Switching impulse test voltage	SIL 250/2500 µs pos./neg.	---/--- kV
Switching impulse test voltage wet	pos./neg.	---/--- kV

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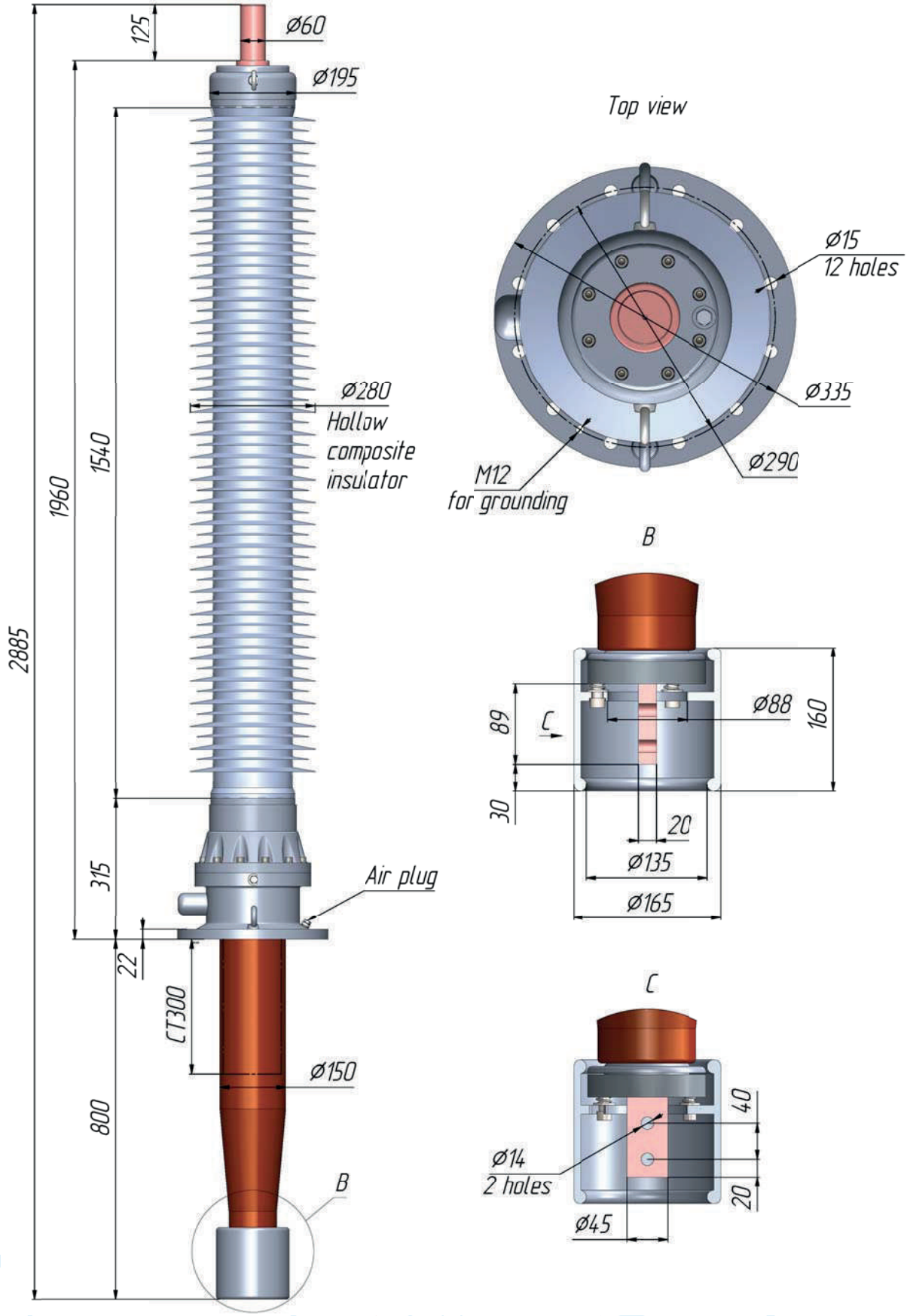
125
Ø60
Ø195
2885
1960
1540
Ø280
Hollow
composite
insulator
315
Air plug
22
CT300
Ø150
800
B
Top view
Ø15
12 holes
Ø335
Ø290
M12
for grounding
B
89
C
Ø88
160
30
20
Ø135
Ø165
C
40
Ø14
2 holes
20
Ø45

Type	**TCSIV-90-252/1250**
Drawing	**686353.605**
Title	**RIP transformer bushing**

Design		
Conductor material & cross section area	Copper & 1256 mm^2	
Current-carry form	Draw rod	
Rated voltage Um	kV	252
Max. service voltage line-ground	kV	153
Partial discharge extinction voltage	kV	318
P.d - level	pC	≤10
Test voltage 50 Hz, 1 min.	kV	505
Lightning impulse test voltage 1.2/50 µs full wave	kV	1050
Switching impulse test voltage 250/2500 µs	kV	850
Rated current	A	1250
Rated short time current 3s I_{th}	kA	40
Rated dynamic current I_d	kA	100
Flashover distance	mm	2200
Creepage distance, min	mm	8400
Test bending load at room temp., applied at right angle to bushing axis on the top terminal	N	4000
Length for CT	mm	300
Weight	kg	220
Altitude	meters	1600

Routine test voltage levels		
Power frequency withstand voltage dry	50 Hz, 1 min	505 kV
Maximum value of partial discharge		≤10 pC
Partial discharge extinction		318 kV
Power frequency withstand voltage	Test tap 50 Hz, 1 min	2.5 kV
Lightning impulse test voltage	BIL 1.5/50 µs pos./neg.	---/1103 kV
Chopped lightning impulse test voltage	Time to sarkover: 2…6 µs pos./neg.	---/1208 kV

Type test voltage levels		
Power frequency withstand voltage wet	50 Hz, 1 min	---
Lightning impulse test voltage	BIL 1.5/50 µs pos./neg.	1050/1155 kV
Chopped lightning impulse test voltage	Time to sarkover: 2…6 µs pos./neg.	---/1270 kV
Switching impulse test voltage	SIL 250/2500 µs pos./neg.	---/935 kV
Switching impulse test voltage wet	pos./neg.	850/850 kV

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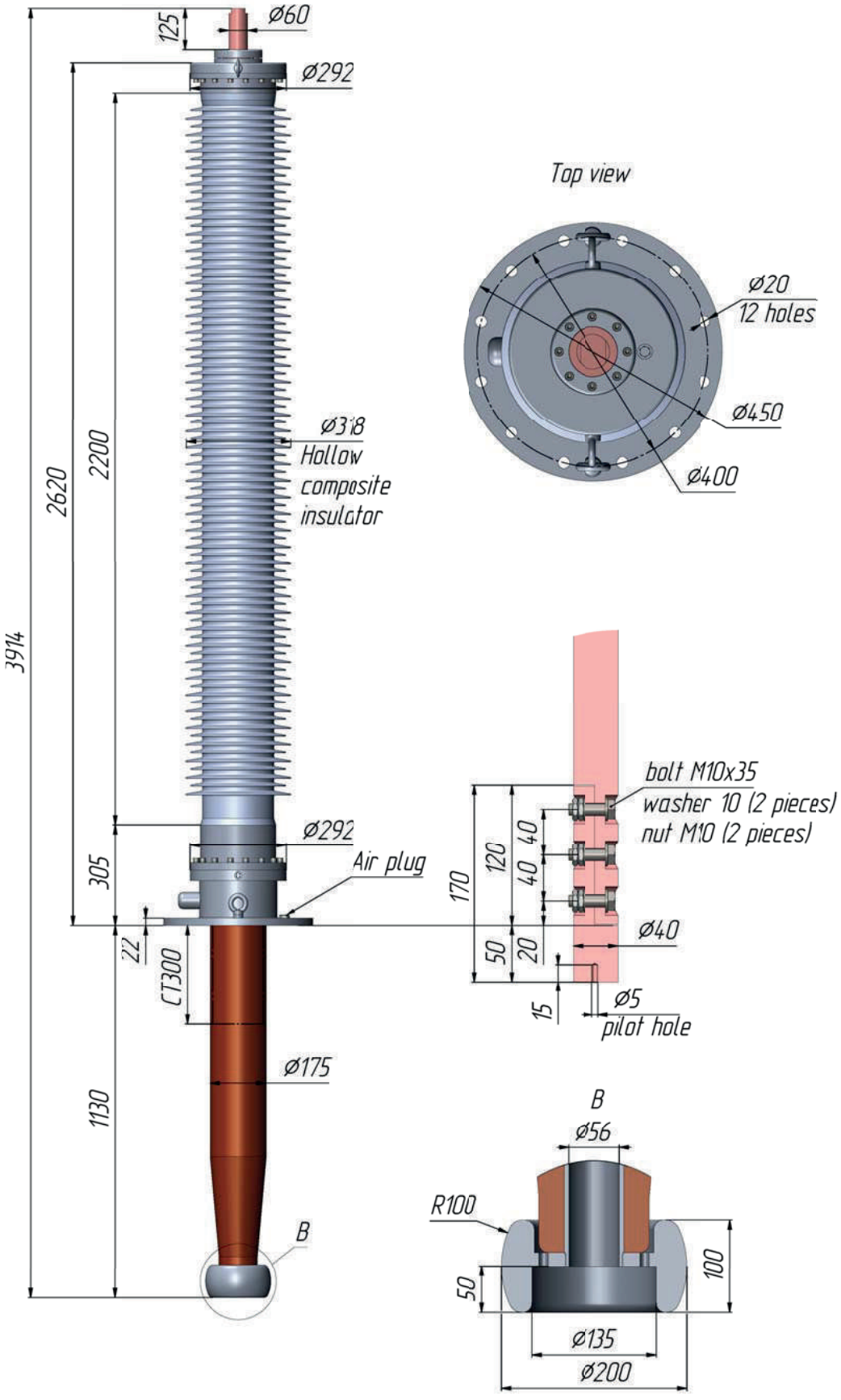
Ø60
125
Ø292
2620
2200
3914
Ø318
Hollow
composite
insulator
Ø292
Air plug
305
22
CT300
1130
Ø175
B
Top view
Ø20
12 holes
Ø450
Ø400
bolt M10x35
washer 10 (2 pieces)
nut M10 (2 pieces)
170
120
40
40
50
20
15
Ø40
Ø5
pilot hole
B
Ø56
R100
50
100
Ø135
Ø200

Type	**TCSIV-90-252/1250**
Drawing	**686353.612**
Title	**RIP transformer bushing**

Design		
Conductor material & cross section area	Copper & 1380 mm^2	
Current-carry form	Bottom connection (Stem type)	
Rated voltage Um	kV	252
Max. service voltage line-ground	kV	153
Partial discharge extinction voltage	kV	≥318
P.d - level	pC	≤10
Test voltage 50 Hz, 1 min.	kV	505
Lightning impulse test voltage 1.2/50 µs full wave	kV	1050
Switching impulse test voltage 250/2500 µs	kV	850
Rated current	A	1250
Rated short time current 2s I_{th}	kA	40
Rated dynamic current I_d	kA	100
Flashover distance	mm	3000
Creepage distance, min	mm	11000
Test bending load at room temp., applied at right angle to bushing axis on the top terminal	N	4000
Length for CT	mm	300
Weight	kg	280
Altitude	meters	3514

Routine test voltage levels		
Power frequency withstand voltage dry	50 Hz, 1 min	505 kV
Maximum value of partial discharge		≤10 pC
Partial discharge extinction		318 kV
Power frequency withstand voltage	Test tap 50 Hz, 1 min	2.5 kV
Lightning impulse test voltage	BIL 1.5/50 µs pos./neg.	---/1103 kV
Chopped lightning impulse test voltage	Time to sarkover: 2…6 µs pos./neg.	---/1208 kV

Type test voltage levels		
Power frequency withstand voltage wet	50 Hz, 1 min	460 kV
Lightning impulse test voltage	BIL 1.5/50 µs pos./neg.	1050/1155 kV
Chopped lightning impulse test voltage	Time to sarkover: 2…6 µs pos./neg.	---/1271 kV
Switching impulse test voltage	SIL 250/2500 µs pos./neg.	---/935 kV
Switching impulse test voltage wet	pos./neg.	850/850 kV

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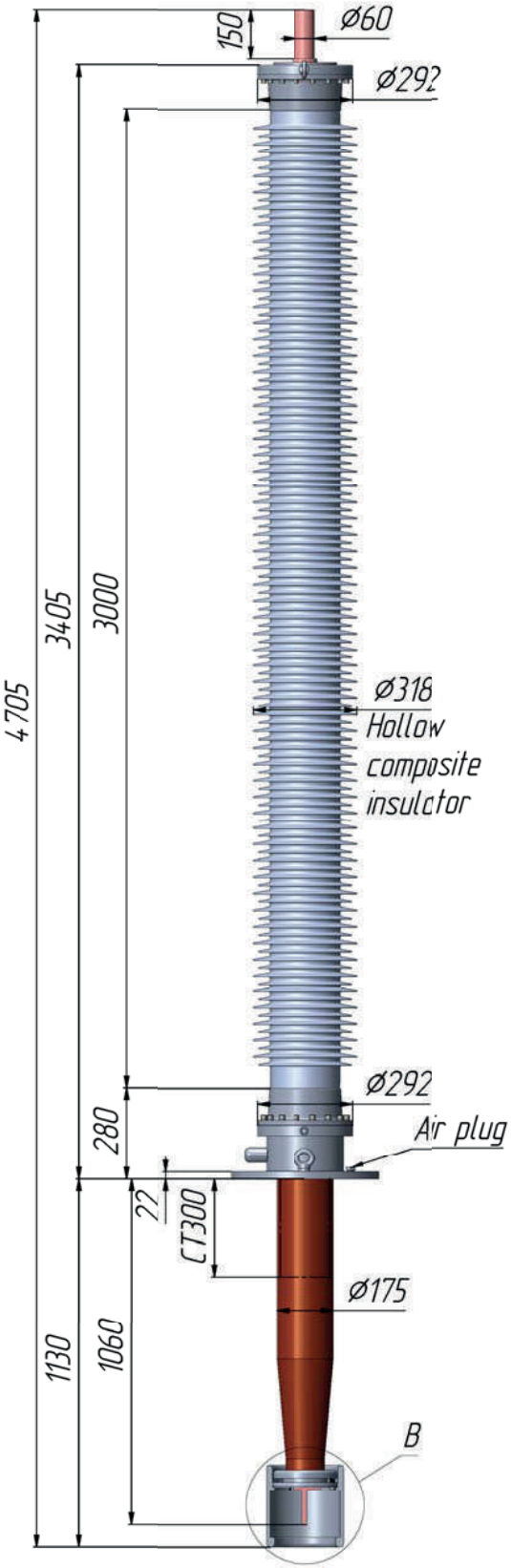
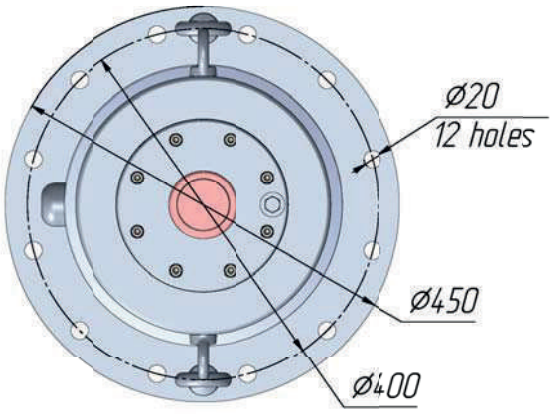
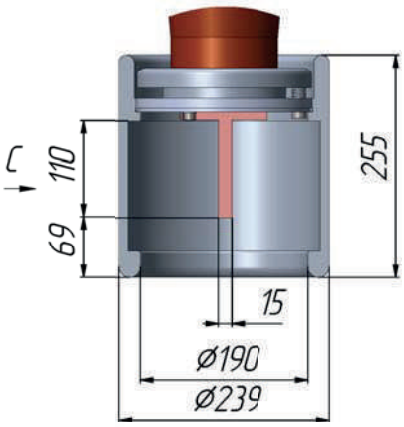

150
Ø60
Ø292
4 705
3405
3000
Ø318
Hollow
composite
insulator
Ø292
280
Air plug
22
CT300
Ø175
1130
1060
B

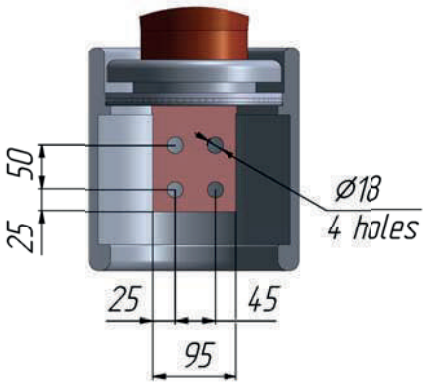
Top view


Ø20
12 holes
Ø450
Ø400

B


C
110
69
255
15
Ø190
Ø239

C


50
25
Ø18
4 holes
25
45
95

Type	**TCSIV-90-252/2000**
Drawing	**686353.602**
Title	**RIP transformer bushing**

Design		
Conductor material & cross section area	Copper & 1380 mm^2	
Current-carry form	Bottom connection (Stem type)	
Rated voltage Um	kV	252
Max. service voltage line-ground	kV	153
Partial discharge extinction voltage	kV	≥318
P.d - level	pC	≤10
Test voltage 50 Hz, 1 min.	kV	505
Lightning impulse test voltage 1.2/50 µs full wave	kV	1050
Switching impulse test voltage 250/2500 µs	kV	850
Rated current	A	2000
Rated short time current (1s/2s/3s) I_{th}	kA	63/44/40
Rated dynamic current I_d	kA	125
Flashover distance	mm	2200
Creepage distance, min	mm	8400
Test bending load at room temp., applied at right angle to bushing axis on the top terminal	N	5000
Length for CT	mm	300
Weight	kg	240
Altitude	meters	1600

Routine test voltage levels		
Power frequency withstand voltage dry	50 Hz, 1 min	505 kV
Maximum value of partial discharge		≤10 pC
Partial discharge extinction		318 kV
Power frequency withstand voltage	Test tap 50 Hz, 1 min	2.5 kV
Lightning impulse test voltage	BIL 1.5/50 µs pos./neg.	---/1103 kVp
Chopped lightning impulse test voltage	Time to sarkover: 2...6 µs pos./neg.	---/1208 kVp

Type test voltage levels		
Power frequency withstand voltage wet	50 Hz, 1 min	---
Lightning impulse test voltage	BIL 1.5/50 µs pos./neg.	1050/1155 kV
Chopped lightning impulse test voltage	Time to sarkover: 2...6 µs pos./neg.	---/1270 kV
Switching impulse test voltage	SIL 250/2500 µs pos./neg.	---/935 kV
Switching impulse test voltage wet	pos./neg.	850/850 kV

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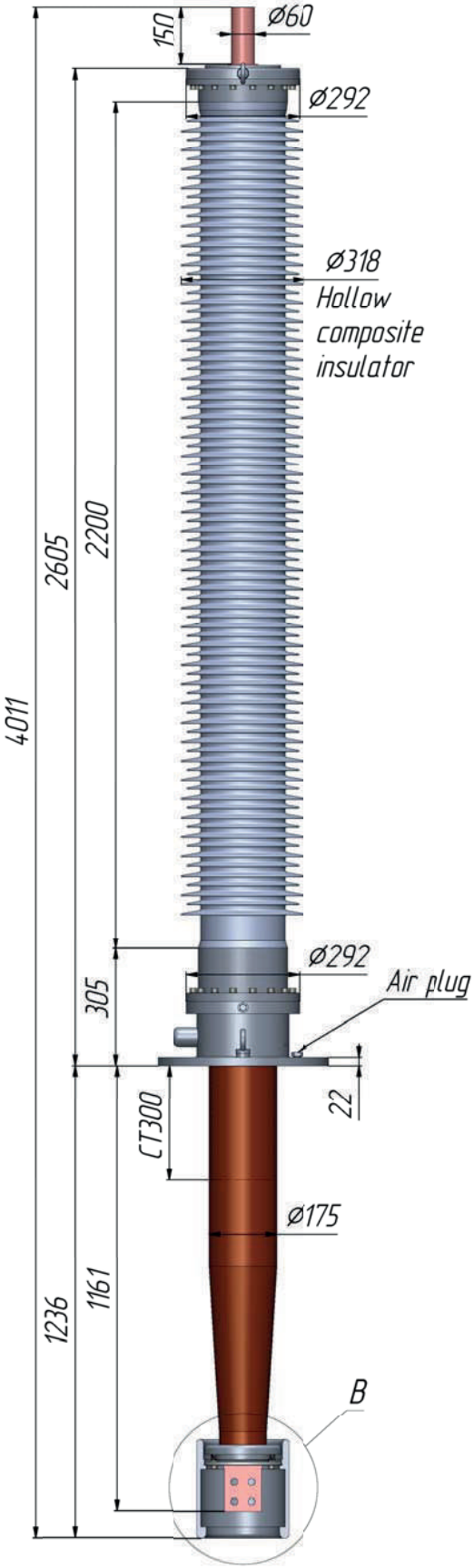

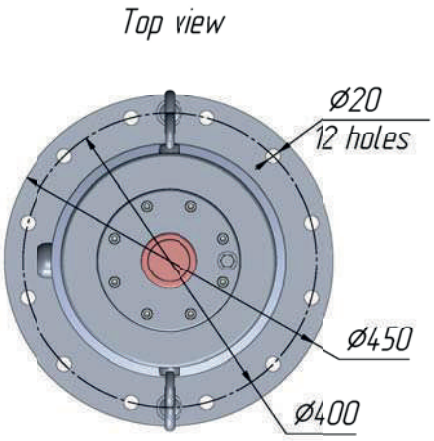

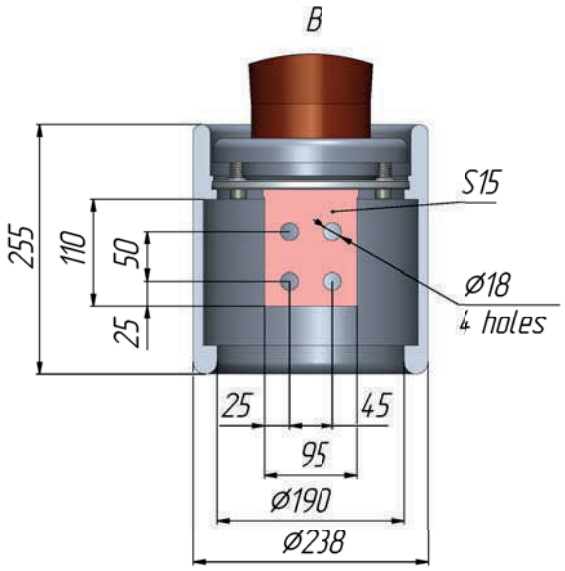

MIM
Massa Izolyator Mehru

Type	**TCSIV-90-420/1250**
Drawing	**686354.603**
Title	**RIP transformer bushing**

Design		
Conductor material & cross section area	Copper & 1809 mm^2	
Current-carry form	Bottom connection (Stem type)	
Rated voltage Um	kV	420
Max. service voltage line-ground	kV	255
Partial discharge extinction voltage	kV	550
P.d - level	pC	≤10
Test voltage 50 Hz, 1 min.	kV	695
Lightning impulse test voltage 1.2/50 µs full wave	kV	1425
Switching impulse test voltage 250/2500 µs	kV	1050
Rated current	A	1250
Rated short time current (1s/2s) I_{th}	kA	63/44
Rated dynamic current I_d	kA	100
Flashover distance	mm	3790
Creepage distance, min	mm	14740
Test bending load at room temp., applied at right angle to bushing axis on the top terminal	N	4000
Length for CT	mm	400
Weight	kg	650
Altitude	meters	1000

Routine test voltage levels		
Power frequency withstand voltage dry	50 Hz, 1 min	695 kV
Maximum value of partial discharge		≤10 pC
Partial discharge extinction voltage		550 kV
Power frequency withstand voltage	Test tap 50 Hz, 1 min	2.5 kV
Lightning impulse test voltage	BIL 1.5/50 µs pos./neg.	---/1497 kV
Chopped lightning impulse test voltage	Time to sparkover: 2...6 µs pos./neg.	---/1639 kV

Type test voltage levels		
Power frequency withstand voltage wet	50 Hz, 1 min	---
Lightning impulse test voltage	BIL 1.5/50 µs pos./neg.	1425/1568 kV
Chopped lightning impulse test voltage	Time to sparkover: 2...6 µs pos./neg.	---/1725 kV
Switching impulse test voltage	SIL 250/2500 µs pos./neg.	1050/1155 kV
Switching impulse test voltage wet	pos./neg.	1050/1050 kV

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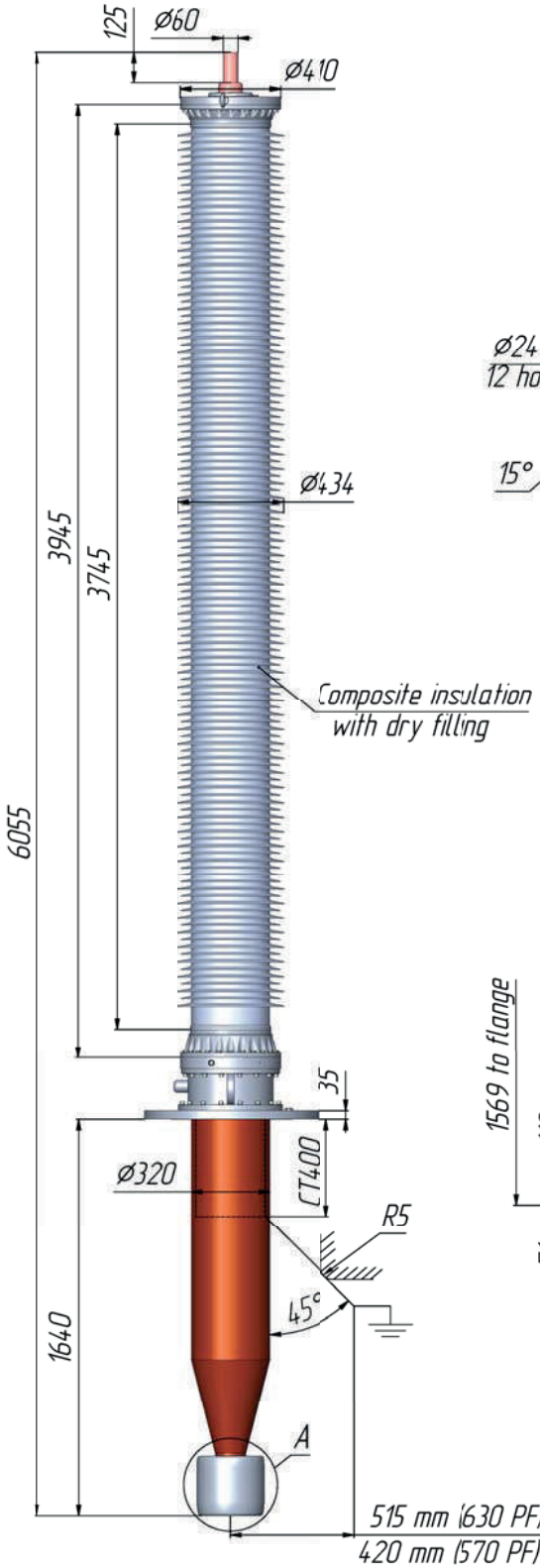
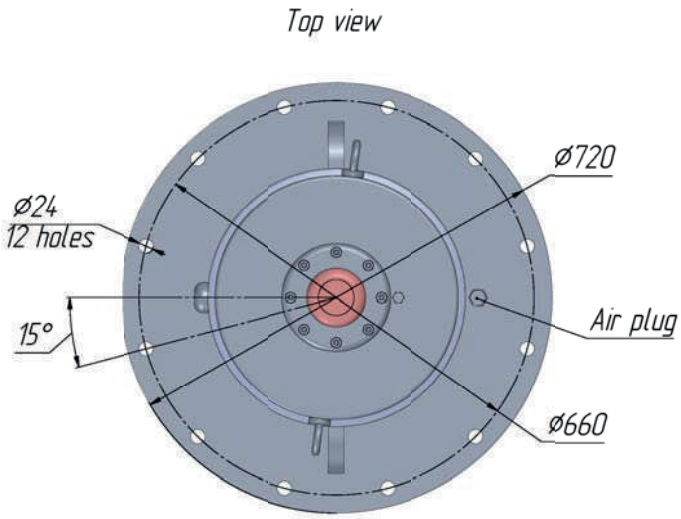
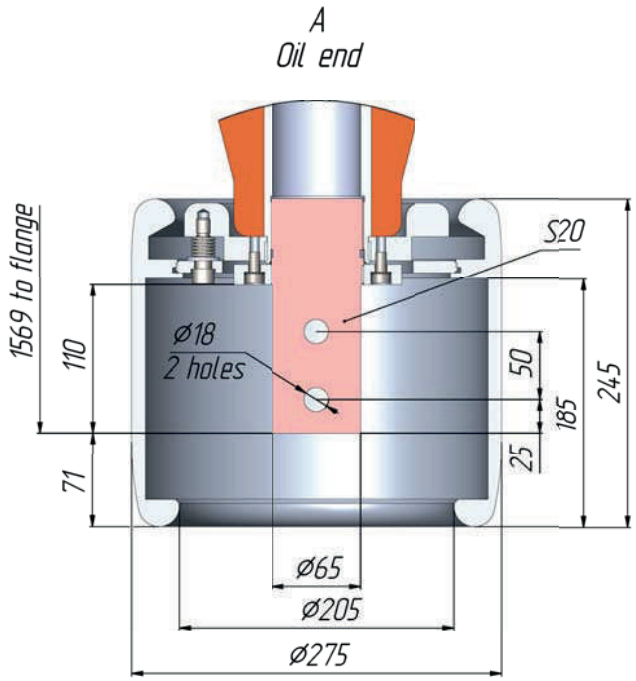

125
Ø60
Ø410
Ø434
3945
3745
6055
Composite insulation
with dry filling
35
Ø320
CT400
R5
45°
1640
A
515 mm (630 PF)
420 mm (570 PF)


Top view
Ø720
Ø24
12 holes
15°
Air plug
Ø660


A
Oil end
1569 to flange
110
71
Ø18
2 holes
S20
50
185
25
245
Ø65
Ø205
Ø275

Type	**TCSIV-90-420/3000**
Drawing	**686354.622**
Title	**RIP transformer bushing**

Design		
Conductor material & cross section area	Copper & 3318 mm^2	
Current-carry form	Bottom connection (Stem type)	
Rated voltage Um	kV	420
Max. service voltage line-ground	kV	255
Partial discharge extinction voltage	kV	420
P.d - level	pC	≤5
Test voltage 50 Hz, 1 min.	kV	750
Lightning impulse test voltage 1.2/50 µs full wave	kV	1425
Switching impulse test voltage 250/2500 µs	kV	1175
Rated current	A	3000
Rated short time current 2s I_{th}	kA	75
Rated dynamic current I_d	kA	188
Flashover distance	mm	3865
Creepage distance, min	mm	14975
Test bending load at room temp., applied at right angle to bushing axis on the top terminal	N	5000
Length for CT	mm	500
Weight	kg	810
Altitude	meters	1000

Routine test voltage levels		
Power frequency withstand voltage dry	50 Hz, 1 min	750 kV
Maximum value of partial discharge		≤5 pC
Partial discharge extinction voltage		420 kV
Power frequency withstand voltage	Test tap 50 Hz, 1 min	2.5 kV
Lightning impulse test voltage	BIL 1.5/50 µs pos./neg.	---/1497 kV
Chopped lightning impulse test voltage	Time to sparkover: 2...6 µs pos./neg.	---/1639 kV

Type test voltage levels		
Power frequency withstand voltage wet	50 Hz, 1 min	---
Lightning impulse test voltage	BIL 1.5/50 µs pos./neg.	1425/1568 kV
Chopped lightning impulse test voltage	Time to sparkover: 2...6 µs pos./neg.	---/1725 kV
Switching impulse test voltage	SIL 250/2500 µs pos./neg.	1175/1293 kV
Switching impulse test voltage wet	pos./neg.	1175/1175 kV

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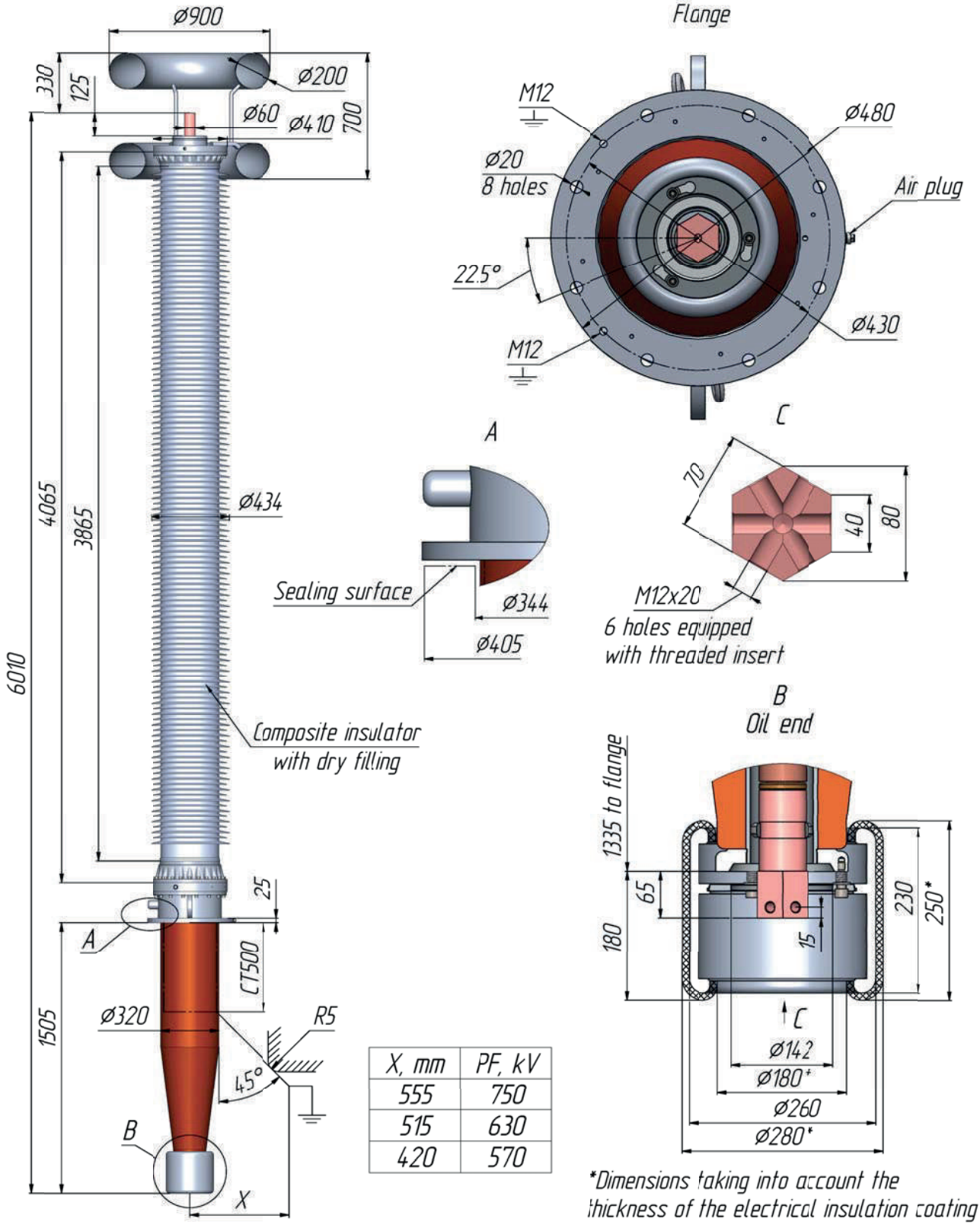


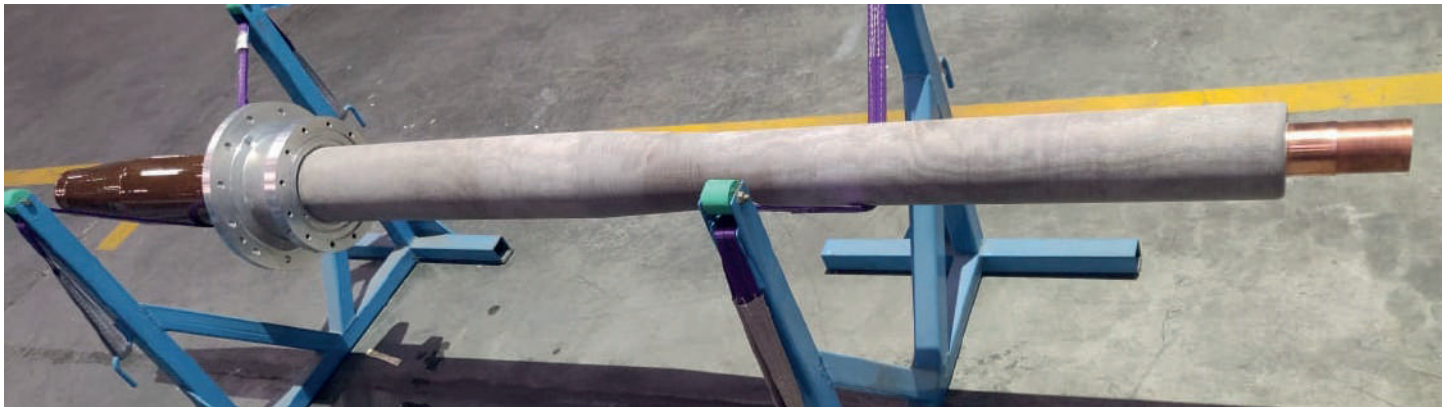
X, mm	PF, kV
555	750
515	630
420	570

*Dimensions taking into account the thickness of the electrical insulation coating

MANUFACTURING AND TESTS OF HIGH-VOLTAGE BUSHINGS

▶ Unpacking of a 252 kV Izolyator insulation core in the presence of PowerGrid representatives

▼ A 145 kV insulation core with preinstalled mounting flange is all ready for final assembly



◀ Assembled 75.5 kV bushing on a technological rack

▶ Testing of the 252 kV bushing — the first product of Massa Izolyator Mehru Pvt. Ltd., assembled on 20 November 2020

Seismic testing of 420 kV RIP bushing in CESI S. p. A. test center in Italy

Seismic and electrical tests of 420 kV RIP bushing in the Central Power Research Institute in India

In June 2016, Izolyator carried out a series of successful seismic tests of 420 kV RIP bushings designed and custom-made under the order of the PowerGrid Corporation of India Limited. The 5-day test program was performed in one of the world's leading electrical engineering test centers — CESI S. p. A. in Italy. The test facility is used for measurements, tests, certification and product expertise for electrical engineering companies from all over the world.

We have completed the full cycle of type tests of 420 kV/3000 A and 800 kV/2000 A HV RIP bushings. The testing was organized at the Central Power Research Institute (CPRI) - the world recognized leader in specialized testing of electrical equipment and products. The tests program included a full cycle of high-voltage current and special seismic tests.

Terms and Acronyms

Autotransformer — a transformer in which two or more windings share a common part.

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.

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 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.

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.

Dielectric loss tangent (tanδ, tgδ) 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.

LSR or HTV Polymer composite insulator has seamless sheath of a silicone rubber compound.

The housing & weather protect the bushing against environmental influences, external pollution and humidity. The weather sheds of the insulators have alternate shed profile as per IEC 60815.

The weather sheds are vulcanized to the sheath (extrusion process) or moulded as part of the sheath (injection moulding process) and free from imperfections.

The vulcanization for extrusion process is occurring at high temperature and for injection moulding at high temperature & high pressure. The track resistance of housing and shed material has class 1A4.5 according to IEC60587. The strength of the weather shed to sheath interface is greater than the tearing strength of the polymer. The composite insulator is capable of high pressure washing.

Since the structure of the RIP insulation contains cellulose, the insulation core is subject to moistening during long-term storage without special measures taken against moinstening. It is not recommended to store the bushing for longer than 6 months in the standard factory packing.

Should the bushings be purchased for emergency reserve storage exceeding 6 month period, we recommend to set the bushing in a special long-term storage case, filled with transformer oil. The bushing can be stored for unlimited time there.

Massa Izolyator Mehru

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MIM SALES DIVIZION IS INVITING
TO SET UP COOPERATION
IN ANY SUITABLE FORM FOR YOU

THINKING OF BECOMING OUR PARTNER?

We will provide you with extensive information on commercial, organizational, technical and other aspects of our company activities.

HAVE QUESTIONS YET?

We will submit all information in hard copy or by email on your first request.