

Lot No. 1

Main spare parts, gaskets and materials for turbine generator type: TBB-100-4Y3

1. List of alternative spare parts to be supplied

Table III-1

No.	Alternative spare part/material name	Conformity of the original spare part, designation No.	Technical Requirements/characteristics/ drawing/dimensions/ presented as a minimum to the alternative spare part/material	Msrt Unit	Q-ty.
1.	Sealing rubber cords				
1.1	Rubber cord 12x12mm	Cord 12x12, 7889 as per TY 38-105.108-90	in compliance with the requirements indicated in items: 2.1.1., 4.3 and 5.1 of Appendix 1.	m	150
1.2	Silicone cord 12x12mm	Eurosil 060 E 51 RAL 9010	in compliance with the requirements indicated in items: 2.1.2 and 5.1 of Appendix 1.	m	150
1.3	Silicone cord ø5mm	Cord ø5, 5P-129 as per TY38-105.1165-90	in compliance with the requirements indicated in items: 2.1.3. and 5.1 of Appendix 1.	m	150
1.4	Silicone cord ø5.4mm	-	in compliance with the requirements indicated in items: 2.1.3. and 5.1 of Appendix 1.	m	150
1.5	Silicone cord ø5.5mm	-	in compliance with the requirements indicated in items: 2.1.3. and 5.1 of Appendix 1.	m	150
1.6	Silicone cord ø5.6mm	-	in compliance with the requirements indicated in items: 2.1.3. and 5.1 of Appendix 1.	m	150
1.7	Silicone cord ø10mm	Cord ø10, 5P-129 as per TY38-105.1165-90	in compliance with the requirements indicated in items: 2.1.3. and 5.1 of Appendix 1.	m	150
1.8	U-shaped rubber cord	Seal 8BC.766.940	in compliance with the requirements indicated in items: 2.1.4. and 5.1 of Appendix 1.	m	20
2.	Rubber gaskets of the generator shell				
2.1.	Manhole gasket	Gasket 8BC.766.672	in compliance with the requirements of items 2.2.1, 2.2.1.1.1, 2.2.1.2. and 4.3 of Appendix 1.	pcs	20
2.2	Gas cooler gasket	Gasket 8BC.768.479	in compliance with the requirements of items 2.2.1, 2.2.1.1.2, 2.2.1.2. and 4.3 of Appendix 1.	pcs	10
2.3	Gasket for the housing of sealing unit on the exciter side.	Gasket 8BC.766.744	in compliance with the requirements of items 2.2.1, 2.2.1.1.3, 2.2.1.2. and 4.3 of Appendix 1.	pcs	4
2.4	Gasket for the housing of sealing unit on the turbine side	Gasket 8BC.766.744-01	in compliance with the requirements of items 2.2.1, 2.2.1.1.4, 2.2.1.2. and 4.3 of Appendix 1.	pcs	4
2.5	Oil catcher gasket on the turbine side	Gasket 8BC.766.181-21	in compliance with the requirements of items 2.2.2, 2.2.2.1.1 and 2.2.2.2 of Appendix 1.	pcs	4
2.6	Oil catcher gasket on the exciter side	Gasket 8BC.766.181-20	in compliance with the requirements of items 2.2.2, 2.2.2.1.2 and 2.2.2.2 of Appendix 1.	pcs	4
3.	Moulded rubber gaskets for end terminals				
3.1	Gasket type 1 - O-ring	Ring 105-115-58-2-2 as per IOCT 9833-73	in compliance with the requirements of item 2.3.1 of Appendix 1	pcs	20
3.2	Gasket Type 2	Gasket 8BC.370. 483	in compliance with the requirements of items 2.3.2.1.1 and 2.3.2.2 of Appendix 1.	pcs	20
3.3.	Gasket Type 3	Gasket 8BC.370. 482	in compliance with the requirements of items 2.3.2.1.2 and 2.3.2.2 of Appendix 1	pcs	20
3.4	Gasket Type 4	Gasket 8BC.719.007-01	in compliance with the requirements of items 2.3.2.1.3 and 2.3.2.2 of Appendix 1	pcs	20
3.5	Gasket Type 5	Gasket 8BC.371.522-01	in compliance with the requirements of items 2.3.2.1.4 and 2.3.2.2 of Appendix 1	pcs	20
4.	Flat rubber sheets				
4.1	Rubber sheet – oil-resistant δ=1mm.	-	Technical characteristics in compliance with items 2.4.1, 2.4.1.1.1, 2.4.1.2 and 5.2 of Appendix 1	m ²	5
4.2	Rubber sheet – oil-resistant δ=2mm.	-	Technical characteristics in compliance with items 2.4.1, 2.4.1.1.2, 2.4.1.2 and 5.2 of Appendix 1	m ²	15

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4.3	Rubber sheet – oil-resistant $\delta=3\text{mm}$.	-	Technical characteristics in compliance with items 2.4.1, 2.4.1.1.3, 2.4.1.2 and 5.2 of Appendix 1.	m ²	15
4.4	Rubber sheet – oil-resistant $\delta=4\text{mm}$.	-	Technical characteristics in compliance with items 2.4.1, 2.4.1.1.4, 2.4.1.2 and 5.2 of Appendix 1.	m ²	40
4.5	Rubber sheet – oil-resistant $\delta=5\text{mm}$.	-	Technical characteristics in compliance with items 2.4.1, 2.4.1.1.5, 2.4.1.2 and 5.2 of Appendix 1.	m ²	10
4.6	Rubber sheet – oil-resistant, electrical insulation $\delta=6\text{mm}$.	-	Technical characteristics in compliance with items 2.4.2 and 5.2 of Appendix 1	m ²	15
4.7	Rubber sheet – Heat/Cold Resistant $\delta=4\text{mm}$.	-	Technical characteristics in compliance with items 2.4.3, 2.4.3.1.1, 2.4.3.2, 4.4 and 5.2 of Appendix 1	m ²	70
4.8.	Rubber sheet – Heat/Cold Resistant $\delta=5\text{mm}$.	-	Technical characteristics in compliance with items 2.4.3, 2.4.3.1.2, 2.4.3.2, 4.4 and 5.2 of Appendix 1	m ²	10
5.	Wedges and groove insulation for bus bar immobilization from the stator winding in the stator grooves.				
5.1.	Wedges for normal stator channels				
5.1.1	Wedge groove extreme on the Turbine side	8BC.784.471-01	Dimensions in compliance with drawing No.23.30.EO.GQ.PIIP.5633.00.18 –Appendix 1.19. Technical information in compliance with item 2.5.1 of Appendix 1.	pcs	30
5.1.2	Wedge for groove extreme on the Exciter side	8BC.784.471-02	Dimensions in compliance with drawing No.23.30.EO.GQ.PIIP.5633.00.19 – Appendix 1.20. Technical information in compliance with item 2.5.1 of Appendix 1.	pcs	30
5.1.3	Wedge for groove - upper (main)	8BC.784.475	Dimensions in compliance with drawing No.23.30.EO.GQ.PIIP.5633.00.23 – Appendix 1.21. Technical information in compliance with item 2.5.1 of Appendix 1.	pcs	100
5.1.4	Wedge for groove - lower, length 1	8BC.784.474	Dimensions in compliance with drawing No.23.30.EO.GQ.PIIP.5633.00.14 – Appendix 1.15. Technical information in compliance with item 2.5.1 of Appendix 1.	pcs	100
5.1.5	Wedge for groove - lower, length 2	8BC.784.474-01	Dimensions in compliance with drawing No.23.30.EO.GQ.PIIP.5633.00.15 – Appendix 1.16. Technical information in compliance with item 2.5.1 of Appendix 1.	pcs	100
5.1.6	Wedge for groove - lower, length 3	8BC.784.474-02	Dimensions in compliance with drawing No.23.30.EO.GQ.PIIP.5633.00.16 – Appendix 1.17. Technical information in compliance with item 2.5.1 of Appendix 1.	pcs	100
5.1.7	Wedge for groove - lower, length 4	8BC.784.474-03	Dimensions in compliance with drawing No.23.30.EO.GQ.PIIP.5633.00.17 – Appendix 1.18. Technical information in compliance with item 2.5.1 of Appendix 1.	pcs	100
5.2.	Wedges for 2 pcs. of stator grooves to separate the gas streams in the stator				
5.2.1	Wedge for groove extreme on the side of “T” and “E”	8BC.784.471	Technical information in compliance with item 2.5.1 of Appendix 1.	pcs	10
5.2.2	Wedge for groove - upper, with rubber board, length 1	5BC.194.510	Dimensions in compliance with drawing No.23.30.EO.GQ.PIIP.5633.00.24 – Appendix 1.22. Technical information in compliance with item 2.5.1 of Appendix 1.	pcs	50

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5.2.3	Wedge for groove - upper, with rubber board, length 2	5BC.194.510-01	Dimensions in compliance with drawing No.23.30.EO.GQ.PIP.5633.00.25 – Appendix 1.23. Technical information in compliance with item 2.5.1 of Appendix 1.	pcs	30
5.2.4	Wedge for groove - upper, with rubber board, length 3	5BC.194.510-03	Technical information in compliance with item 2.5.1 of Appendix 1.	pcs	30
5.2.5	Wedge for groove - lower, length 1	8BC.784.470	Dimensions in compliance with drawing No.23.30.EO.GQ.PIP.5633.00.11 – Appendix 1.12. Technical information in compliance with item 2.5.1 of Appendix 1.	pcs	50
5.2.6	Wedge for groove - lower, length 2	8BC.784.470-01	Dimensions in compliance with drawing No.23.30.EO.GQ.PIP.5633.00.12 – Appendix 1.13. Technical information in compliance with item 2.5.1 of Appendix 1.	pcs	50
5.2.7	Wedge for groove - lower, length 3	8BC.784.470-02	Dimensions in compliance with drawing No.23.30.EO.GQ.PIP.5633.00.13 – Appendix 1.14. Technical information in compliance with item 2.5.1 of Appendix 1.	pcs	50
5.3.	Horizontal flat groove insulation (between the bus bar of the stator winding and lower wedges lines)				
5.3.1	Sealant flat insulation type 1, $\delta=1\text{mm}$	Gasket 8BC.761.551-21	Technical information in compliance with items 2.5.2, 2.5.2.1.1., 2.5.2.2.1 of Appendix 1.	pcs	50
5.3.2	Sealant flat insulation type 2, $\delta=0.5\text{mm}$	Gasket 8BC.761.551-22	Technical information in compliance with items 2.5.2, 2.5.2.1.1., 2.5.2.2.2. of Appendix 1.	pcs	50
5.3.3	Sealant flat insulation type 3, $\delta=5\text{mm}$	Gasket 8BC.756.824-32	Technical information in compliance with items 2.5.2, 2.5.2.1.1., 2.5.2.2.3. of Appendix 1.	pcs	50
5.3.4	Sealant flat insulation type 4, $\delta=1.5\text{mm}$	Gasket 8BC.761.551-63	Technical information in compliance with items 2.5.2, 2.5.2.1.2., 2.5.2.2.4. of Appendix 1.	pcs	50
5.4.	Corrugated insulation gaskets for side sealing of bus bar immobilization from the stator winding in the stator grooves				
5.4.1	Corrugated gaskets type 1, $\delta=0.4\text{mm}$	Gasket 8BC.769.448-08	Technical characteristics in compliance with item 2.5.3.1. of Appendix 1. Dimensions in compliance with items 2.5.3.2. and 2.5.3.2.1 of Appendix 1.	pcs	150
5.4.2	Corrugated gaskets type 2, $\delta=0.6\text{mm}$	Gasket 8BC.769.448-19	Technical characteristics in compliance with item 2.5.3.1. of Appendix 1. Dimensions in compliance with items 2.5.3.2. and 2.5.3.2.2 of Appendix 1.	pcs	150
5.4.3	Corrugated gaskets type 3, $\delta=0.8\text{mm}$	Gasket 8BC.769.448-20	Technical characteristics in compliance with item 2.5.3.1. of Appendix 1. Dimensions in compliance with items 2.5.3.2. and 2.5.3.2.3 of Appendix 1.	pcs	150
6.	Insulation boxes for the electrical connections of the stator winding				
6.1	Terminal insulation box, female	box 8BC.786.114-01	General information in compliance with items 2.6.1 and 2.6.3. of Appendix 1.	pcs	5
6.2	Terminal insulation box, male	box 8BC.786.115-01	General information in compliance with items 2.6.1 and 2.6.3. of Appendix 1.	pcs	5
6.3	Insulation box to the outlet of bus bars, male	box 8BC.781.302	General information in compliance with items 2.6.2 and 2.6.3. of Appendix 1.	pcs	30
6.4	Insulation box to the outlet of bus bars, female	box 8BC.781.303	General information in compliance with items 2.6.2 and 2.6.3. of Appendix 1.	pcs	30
7.	Flexible plumbing hoses with electrical conduit for hydraulic connection of the stator winding branches				
7.1	Flexible water hose type 1	5BC.460.703	General technical information and requirements in compliance with item 2.7 of Appendix 1	pcs	2
7.2	Flexible water hose type 2	5BC.460.704	General technical information and requirements in compliance with item 2.7 of Appendix 1	pcs	2
7.3	Flexible water hose type 3	5BC.460.705	General technical information and requirements in compliance with item 2.7 of Appendix 1	pcs	2

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7.4	Flexible water hose type 4	5BC.460.706	General technical information and requirements in compliance with item 2.7 of Appendix 1	pcs	2
7.5	Flexible water hose type 5	5BC.460.707	General technical information and requirements in compliance with item 2.7 of Appendix 1	pcs	2
7.6	Flexible water hose type 6	5BC.460.708	General technical information and requirements in compliance with item 2.7 of Appendix 1	pcs	2
7.7	Flexible water hose type 7	5BC.460.709	General technical information and requirements in compliance with item 2.7 of Appendix 1	pcs	2
7.8	Flexible water hose type 8	5BC.462.252	General technical information and requirements in compliance with item 2.7 of Appendix 1	pcs	2
7.9	Flexible water hose type 9	5BC.462.253	General technical information and requirements in compliance with item 2.7 of Appendix 1	pcs	2
7.10	Flexible water hose type 10	5BC.460.579	General technical information and requirements in compliance with item 2.7 of Appendix 1	pcs	2
7.11	Flexible water hose type 11	5BC.460.583-05	General technical information and requirements in compliance with item 2.7 of Appendix 1	pcs	2
7.12	Flexible water hose type 12	5BC.460.642	General technical information and requirements in compliance with item 2.7 of Appendix 1	pcs	2
7.13	Flexible water hose type 13	5BC.460.643	General technical information and requirements in compliance with item 2.7 of Appendix 1	pcs	2
7.14	Flexible water hose type 14	5BC.460.644	General technical information and requirements in compliance with item 2.7 of Appendix 1	pcs	2
7.15	Flexible water hose type 15	5BC.460.644-01	General technical information and requirements in compliance with item 2.7 of Appendix 1	pcs	2
7.16	Flexible water hose type 16	5BC.460.645	General technical information and requirements in compliance with item 2.7 of Appendix 1	pcs	2
7.17	Flexible water hose type 17	5BC.460.646	General technical information and requirements in compliance with item 2.7 of Appendix 1	pcs	2
7.18	Flexible water hose type 18	5BC.460.647	General technical information and requirements in compliance with item 2.7 of Appendix 1	pcs	2
7.19	Flexible water hose type 19	5BC.460.648	General technical information and requirements in compliance with item 2.7 of Appendix 1	pcs	2
7.20	Flexible water hose type 20	5BC.460.710	General technical information and requirements in compliance with item 2.7 of Appendix 1	pcs	2
7.21	Flexible water hose type 21	5BC.462.258-01	General technical information and requirements in compliance with item 2.7 of Appendix 1	pcs	2
7.22	Flexible water hose type 22	5BC.462.260	General technical information and requirements in compliance with item 2.7 of Appendix 1	pcs	2
7.23	Flexible water hose type 23	5BC.462.261	General technical information and requirements in compliance with item 2.7 of Appendix 1	pcs	2
7.24	Flexible water hose type 24	5BC.462.263	General technical information and requirements in compliance with item 2.7 of Appendix 1	pcs	2
7.25	Flexible water hose type 25	5BC.462.261-01	General technical information and requirements in compliance with item 2.7 of Appendix 1	pcs	2
8.	Insulation components made of fiberglass				
8.1	Pipes				
8.1.1	Pipe 10.5x13.5-28mm	8BC.770.429-12	Technical characteristics in compliance with item 2.8.1 of Appendix 1	pcs	50
8.1.2	Pipe 12.5x16-21mm	8BC.770.433-01	Technical characteristics in compliance with item 2.8.1 of Appendix 1	pcs	50
8.1.3	Pipe 12.5x16-27mm	8BC.770.433-32	Technical characteristics in compliance with item 2.8.1 of Appendix 1	pcs	50
8.1.4	Pipe 12.5x16-35mm	8BC.770.433-08	Technical characteristics in compliance with item 2.8.1 of Appendix 1	pcs	50
8.1.5	Pipe 12.5x16-47mm	8BC.770.433-13	Technical characteristics in compliance with item 2.8.1 of Appendix 1	pcs	50
8.1.6	Pipe 12.5x16-54mm	8BC.770.433-31	Technical characteristics in compliance with item 2.8.1 of Appendix 1	pcs	50

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8.1.7	Pipe 16.5x20-26mm	8BC.770.284-15	Technical characteristics in compliance with item 2.8.1 of Appendix 1	pcs	50
8.1.8	Pipe 16.5x20-31mm	8BC.770.439-06	Technical characteristics in compliance with item 2.8.1 of Appendix 1	pcs	50
8.1.9	Pipe 16.5x20-35mm	8BC.770.439-07	Technical characteristics in compliance with item 2.8.1 of Appendix 1	pcs	50
8.1.10	Pipe 16.5x20-57mm	8BC.770.284-32	Technical characteristics in compliance with item 2.8.1 of Appendix 1	pcs	50
8.1.11	Pipe 16.5x20-61mm	8BC.770.439-22	Technical characteristics in compliance with item 2.8.1 of Appendix 1	pcs	50
8.1.12	Pipe 16.5x20-64mm	8BC.770.439-47	Technical characteristics in compliance with item 2.8.1 of Appendix 1	pcs	50
8.1.13	Pipe 25x30-57mm	8BC.770.447-12	Technical characteristics in compliance with item 2.8.1 of Appendix 1	pcs	50
8.1.14	Pipe 75x82-342mm	8BC.770.458-09	Technical characteristics in compliance with item 2.8.1 of Appendix 1	pcs	10
8.2	Washers				
8.2.1	Washer 32x48x5	8BC.715.836-02	Technical characteristics in compliance with item 2.8.2 of Appendix 1	pcs	50
8.2.2	Washer 80x130x5	8BC.712.740	Technical characteristics in compliance with item 2.8.2 of Appendix 1	pcs	50
8.2.3	Washer 90x150x5	8BC.710.541	Technical characteristics in compliance with item 2.8.2 of Appendix 1	pcs	50
8.2.4	Washer 17x32x3	8BC.712.721	Technical characteristics in compliance with item 2.8.2 of Appendix 1	pcs	50
8.2.5	Washer 21x40x3	8BC.712.727 and 8BC.712.006	Technical characteristics in compliance with item 2.8.2 of Appendix 1	pcs	50
9.	Outlets (terminals)				
9.1	Insulator	Insulator 8BC.720.015	General technical information and requirements in compliance with item 2.9 of Appendix 1, dimensions in compliance with drawing No.23.30.EO.GQ.PIIP.5633.00.32 – Appendix 1.29.	pcs	2
9.2	Terminal, set type 1	Terminal 5BC.516.195-05	Technical information and requirements in compliance with item 2.9 of Appendix 1	pcs	1
9.3	Terminal, set type 2	Terminal 5BC.516.195-31	Technical information and requirements in compliance with item 2.9 of Appendix 1	pcs	1
9.4	Terminal, set type 3	Terminal 5BC.516.195-35	Technical information and requirements in compliance with item 2.9 of Appendix 1	pcs	1
9.5	Terminal, set type 4	Terminal 5BC.516.195-36	Technical information and requirements in compliance with item 2.9 of Appendix 1.	pcs	1
10.	Rotor spare parts				
10.1	Sealant for rotor current-carrying bolt	Sealing washer 8BC.715.304-01	Technical characteristics, requirements and dimensions in compliance with item 2.10.1 of Appendix 1.	pcs	25
10.2	Bush for rotor current-carrying bolt	Bush 8BC.770.396-01	Technical characteristics and dimensions in compliance with item 2.10.2 of Appendix 1	pcs	25
10.3	Nut M120x3, for sealing group of rotor current-carrying bolt	Nut 8BC.946.479-01	General technical Information in compliance with item 2.10.3 of Appendix 1	pcs	12
10.4	Banding insulation - section type 1	Banding section 8BC.787.196-18	Technical information and requirements in compliance with item 2.10.4. Dimensions in compliance with item 2.10.4.1 Of Appendix 1.	pcs	36
10.5	Banding insulation - section type 2	Banding section 8BC.787.196-19	Technical information and requirements in compliance with item 2.10.4. Dimensions in compliance with item 2.10.4.2 Of Appendix 1.	pcs	36

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10.6	Pin, calibration bolt	Pin 8BC.934.766-02	Technical and geometrical characteristics in compliance with item 2.13.5 of Appendix 1	pcs	12
11.	Repair materials				
11.1	Rubber glue	Adhesive 88-CA as per TY38.105-1760-89	General information of material application - item 3.1 of Appendix 1	kg.	5
11.2	Silicone glue	-	Elastosil E43 Transperant /WACKER/. Moisture Curing Silicone Rubber (RTV-1), tube 400g, General information of material application - item 3.2 of Appendix 1	pcs	10
11.3	Electrical insulating epoxy varnish (two component), drying without being heated	Adhesive ЭК-4 as per ОБС.504.087ТУ	General information of material application - item 3.3 of Appendix 1	kg.	10
11.4	Rubber putty, component	Putty КЛСЕ-2 as per ОБС.504.011ТУ	General information of material application - item 3.4 of Appendix 1	kg.	10
11.5	Rubber compound (filler)	Putty КЛСЕ-А with accelerator К/1 as per TY 38.103.691-89	General information of material application - item 3.5 of Appendix 1	kg.	20
11.6	Putty, fixing, type 1	Putty component Э3-246 as per ОБС.504.062ТУ	General information of material application - item 3.6 of Appendix 1 1.	kg.	5
11.7	Putty, fixing, type 2	Putty component Э3-217, вар.1 as per ОБС.504.062ТУ		kg.	5
11.8	Putty, fixing, type 3	Putty component Э3-217, вар.2 as per ОБС.504.062ТУ		kg.	5
11.9	Electrical insulating paint	Paint type: ЭПИМА/Ь 9111 as per ТУ 2312-025-05758799”	General information of material application - item 3.7 of Appendix 1	kg.	5
11.10	Fiberglass banding tape 0.2x50	Тape ЛЭС 0,2x50 as per ГОСТ5937-81, dimension 0.2x50.	General information of material application - item 3.8 of Appendix 1	m.	100
11.11	Electrical insulating banding tape	Тape ЛСКН-160-ТТ 25 as per ТУ 16-503.030-2007		m.	100
11.12	Elastic banding tape 0.5x26	Тape ЛЭТСАР, Кф. 0.5x26, 2 группа (group), тип (type) «Х» as per ТУ38.103.171-80		m.	100
11.13	Banding cord Ø3.0mm	Corresponding to: „шнур (cord) - чулок для техн. целей Ø3.0 mm as per ТУ 6-13-05018335-73-98”, dimension Ø3.0mm.	General information of material application - item 3.9 of Appendix 1	m.	500

2. Physical and dimensional characteristics, requirements, clarifications and tolerances (known to Kozloduy NPP) required as a minimum to the project in selecting or manufacturing the alternative spare parts of Table II-1

2.1. Sealing rubber cords (item.1)

2.1.1. Rubber cord 12x12mm (item 1.1)

The rubber cord 12x12 is used to seal the end parts and the front shields (covers) to the middle part of the generator.

2.1.1.1. General technical requirements and characteristics.

- the rubber material used for cord manufacturing to be in compliance with the physico-mechanical characteristics of the natural Russian rubber compound mark 7889 as per TY38.105.108-76. and the following requirements of the chemical composition need to be met in item 4.3 of Appendix 1;

- cross-section: square with dimensions 12x12mm;
- maximum limit deviation of the cross-section dimensions (tolerance): +0.6mm/-0.1mm;
- working temperature range: +8°C to +80 °C (broader temperature range is admissible, but at a temperature no lower than the indicated positive temperature).

2.1.1.2. Minimum requirements for the physico-mechanical parameters of vulcanized rubber compound for the cord manufacturing (extrusion):

- conditional breaking strength: $\geq 16.7\text{MPa}$ (in accordance with ГOCT 270-75);
- relative elongation at rupture: $\geq 500\%$ (in accordance with ГOCT 270-75);
- Shore A hardness: from 45 to 60 units (in accordance with ГOCT 20403-75);
- relative residual shrinkage deformation at 40 % of the thickness size within 96 hours at a temperature of 70 °C/: $\geq 20\%$ (in accordance with ГOCT 9.029-74 method B);

2.1.2. Silicone cord 12x12mm (item 1.2.).

The silicone cord in item 1.2 to be made of silicone compound type: Eurosil 060 E 51 RAL 9010 or an analogue with the following minimum requirements regarding the physical and mechanical parameters:

- conditional tensile strength: $\geq 7.8\text{MPa}$ (in accordance with ГOCT 270-75);
- relative elongation at rupture: (in accordance with ГOCT 270-75);
- Shore A hardness: from 50 to 60 units (ГOCT 263-75);
- relative residual deformation due to air compression (at 200°C, 24 hours): $\geq 26\%$ (ГOCT 9.026, Method B).

2.1.3. Silicone cords with round section: $\varnothing 5$, $\varnothing 5.2$, $\varnothing 5.3$, $\varnothing 5.4$, $\varnothing 5.5$, $\varnothing 5.6$ and $\varnothing 10$ under TY38-105.1165-90 (items 1.3. ÷ 1.7.).

The cords are used to seal the bodies of sealing components to the front shields (covers), and they are mounted on elements of the sealing components.

2.1.3.1. General technical requirements and characteristics.

- the appearance and the deviation of the dimensions of the cords shall be in compliance with technical conditions (TY-TC) 38 1051165-95;

- cross-section: round, with the following dimensions:

- for $\varnothing 5$ – cross-section diameter 5mm, maximum limit deviation of the cross-section dimensions (tolerance): $\pm 0.5\text{mm}$;
- for $\varnothing 5.2$ – cross-section diameter 5.2mm, maximum limit deviation of the cross-section dimensions (tolerance): $\pm 0.4\text{mm}$;
- for $\varnothing 5.3$ – cross-section diameter 5.3mm, maximum limit deviation of the cross-section dimensions (tolerance): $\pm 0.4\text{mm}$;
- for $\varnothing 5.4$ – cross-section diameter 5.4mm., maximum limit deviation of the cross-section dimensions (tolerance): $\pm 0.4\text{mm}$;
- for $\varnothing 5.5$ – cross-section diameter 5.5mm, maximum limit deviation of the cross-section dimensions (tolerance): $\pm 0.4\text{mm}$;
- for $\varnothing 5.6$ – cross-section diameter 5.6mm, maximum limit deviation of the cross-section dimensions (tolerance): $\pm 0.4\text{mm}$;

- for $\varnothing 10$ – cross-section сечението 10mm, maximum limit deviation of the cross-section dimensions (tolerance): $+1/-0.5\text{mm}$;

- operating temperature range: -60°C to $+250^{\circ}\text{C}$;

2.1.3.2. Minimum requirements for the physico-mechanical parameters of vulcanized rubber compound for the cords manufacturing (extrusion).

The physico-mechanical characteristics of the rubber (silicone) material used for manufacture of the cords, conditions, operating temperature as well as the vulcanization technology shall meet as a minimum the TY 38 103321-75 requirements for the Russian silicone compound mark 5p-129, namely:

- conditional tensile strength: $\geq 2.4\text{MPa}$ (in accordance with ГОСТ 270-75);
- relative elongation at rupture: $\geq 170\%$ (in accordance with ГОСТ 270-75);
- Shore A hardness: from 45 to 70 units

2.1.4. U-shaped rubber cord (item 1.8)

U-shaped rubber cord is used for sealing of the internal barriers to the water chambers of the gas and air coolers of the generator and the exciter. It shall be made of rubber compound to ensure safe operation in demineralised water medium. The most important technical characteristics and dimensions to be complied with are:

- dimensions and form of the cross-section as per drawing No.23.30.EO.GQ.PIIP.5633.00.31 Appendix 1.1.;

- working temperature range: $+8^{\circ}\text{C}$ to $+80^{\circ}\text{C}$ (broader temperature range is admissible, but at a temperature no lower than the indicated positive temperature);

- Shore A hardness: from 55 to 65 units;

- working pressure of the medium where it shall be operated: $\sim 4.5\text{kgf/cm}^2$.

2.2. Rubber gaskets of the generator shell (item 2).

2.2.1. Rubber gaskets in items 2.1÷2.4 (Table П1-1).

The gaskets to the general shell in items 2.1÷2.4 prevent the leak of cooling gas (hydrogen) from the machine into the environment. These gaskets as well as the cords in item 1 of the table are directly related to ensure the gas density and the safe operation of the generator.

The gaskets shall be made of non-moulded flat rubber sheets that cover the following minimum:

- the physico-mechanical characteristics of the original rubber sheets used for their manufacture - natural Russian rubber compound mark 7889 in accordance with TY 38 105116-81;

- the requirements in item 4.3 (of Appendix 1).

When choosing a rubber material for the manufacture of the gaskets, the maximum operating pressure of the environment in which they will be operated, in this case the generator, shall also be considered – 6 kgf/cm^2 .

2.2.1.1. General technical characteristics required for the gaskets.

2.2.1.1.1. Dimensions of the manhole gasket to be compliant with the original gasket type: 8BC.766.672 - item 2.1 of Table П1-1:

- the thickness of the non-moulded flat rubber sheet required for manufacture of the gasket: $\delta=10\text{mm}\pm 0.8\text{mm}$.

- dimensions of the gaskets: as per drawing No.23.30.EO.GQ.PIIP.5633.00.02 - Appendix 1.2.

2.2.1.1.2. Dimensions of gas cooler to be compliant with the original gasket type: 8BC.768.479 - item 2.2 of Table П1-1:

- the thickness of the non-moulded flat rubber sheet required for manufacture of the gasket: $\delta=10\text{mm}\pm 0.8\text{mm}$;

- dimensions of the gaskets: as per drawing No.23.30.EO.GQ.PIIP.5633.00.01 - Appendix 1.3.

2.2.1.1.3. Dimensions of the gasket for the housing of sealing unit from the exciter side to correspond to the original type: 8BC.766.744 - item 2.3. Of Table П1-1:

- the thickness of the non-moulded flat rubber sheet required for manufacture of the gasket: $\delta=5\text{mm}\pm 0.5\text{mm}$;

- dimensions of the gaskets: as per drawing No.23.30.EO.GQ.PIIP.5633.00.26 - Appendix 1.4.

2.2.1.1.4. Dimensions of the gasket for the housing of sealing unit from the turbine side to correspond to the original type: 8BC.766.744-01 - item 2.4. Of Table П1-1:

- the thickness of the non-moulded flat rubber sheet required for manufacture of the gasket: $\delta=5\text{mm}\pm0.5\text{mm}$;

- dimensions of the gaskets: as per drawing No.23.30.EO.GQ.PIIP.5633.00.27 - Appendix 1.5.

2.2.1.2. Minimum requirements for the physico-mechanical parameters of vulcanized rubber compound for the manufacture of non-moulded flat rubber sheet for the gaskets items 2.1÷2.4 of Table П1-1:

- conditional breaking strength: $\geq 16.7\text{MPa}$ (in accordance with ГOCT 270-75);
- relative elongation at rupture: $\geq 550\%$ (in accordance with ГOCT 270-75);
- Shore A hardness: from 45 to 60 units (in accordance with ГOCT 20403-75);
- relative residual shrinkage deformation at 40 % of the thickness size within 96 hours at a temperature of 70°C : $\geq 20\%$ (in accordance with ГOCT 9.029-74 method B);
- rubber gasket working temperature range: $+8^\circ\text{C}$ to $+70^\circ\text{C}$ (broader temperature range is admissible, but at a temperature no lower than the indicated positive temperature).

2.2.2. Gaskets to the generator shell in items 2.5 and 2.6

Gaskets in items 2.5 and 2.6 of Table П1-1 are mounted between the sealing components and the end shields of the generator. They shall be made of oil and petrol resistant (hereinafter referred to as "oil resistant") non-moulded flat rubber sheets in compliance with physico-mechanical characteristics of gaskets made of Russian rubber compound type МБС as per ГOCT 7338-90 operating under pressure 1kgf/cm .

2.2.2.1. General technical characteristics to be applied to the gaskets.

2.2.2.1.1. Dimensions of the oil catcher gasket on the turbine side in compliance with the original gasket type: 8BC.766.181-21 - item 2.5. of Table П1-1:

- the thickness of the oil resistant non-moulded flat rubber sheet required for manufacture of the gasket: $\delta=5\text{mm}\pm0.7\text{mm}$.

- dimensions of the gaskets: as per drawing No.23.30.EO.GQ.PIIP.5633.00.28 - Appendix 1.6.

2.2.2.1.2. Dimensions of the oil catcher gasket on the exciter side in compliance with the original gasket 8BC.766.181-20 - item 2.6. of Table П1-1:

- the thickness of the oil resistant non-moulded flat rubber sheet required for manufacture of the gasket: $\delta=5\text{mm}\pm0.7\text{mm}$.

- dimensions of the gaskets: as per drawing No.23.30.EO.GQ.PIIP.5633.00.29 - Appendix 1.7.

2.2.2.2. The physico-mechanical parameters of vulcanized oil resistant rubber compound for the manufacture of non-moulded flat rubber sheet for the gaskets items 2.5÷2.6 of Table П1-1:

- conditional tensile strength: $\geq 8\text{MPa}$ (in accordance with ГOCT 269 and ГOCT 270-75);
- relative elongation at rupture: $\geq 200\%$ (in accordance with ГOCT 269 and ГOCT 270-75);
- Shore A hardness: from 55 to 70 units (In accordance with ГOCT 20403-75 or ГOCT 263);
- change in oil resistant rubber material specimen mass following impact in a medium of a mix of isooctane in accordance with ГOCT12433 and toluene in accordance with ГOCT 5789 in a 7:3 ratio at a temperature of 23°C over a period of 24 hours: $\leq 20\%$ (in accordance with ГOCT 9.030 method A);
- relative residual shrinkage deformation of the rubber sheet at $20\pm5\%$ in air medium at a temperature of 70°C over a period of 24 hours: $\leq 50\%$ (in accordance with ГOCT 9.029 method B);
- rubber gasket working temperature range: -30°C to $+80^\circ\text{C}$ (broader temperature range is admissible, but at a temperature no lower than the indicated positive temperature).

2.3. Moulded rubber gaskets for end terminals (item 3).

Gaskets, in item 3 of Table П1-1, are used for sealing the end terminals to the generator shell and are intended for static (stationary) operation.

2.3.1. Required Technical characteristics of the Gasket type 1 - O-ring (item 3.1 of Table П1-1), in compliance with the original O-ring (Кольцо): 105-115-58-2-2 as per ГOCT 9833-73.

2.3.1.1. O-ring dimensions:

- outer diameter: 115 mm;

- inner diameter: 108mm (tolerance -1.6mm);
- cross-section diameter: 5.8 mm

2.3.1.2. Minimum requirements for the physico-mechanical parameters of vulcanized rubber compound required for the O-ring manufacturing.

The physico-mechanical parameters, operational conditions and service life of the compound used for the manufacture of O-rings shall cover as a minimum the characteristics of the original rubber compound type: 7-B-14 (group 2) as per ГOCT 18829-2017, operating under pressure up to 50MPa at stationary assemblies in a medium of mineral oils and liquid fuels, namely:

- conditional tensile strength: $\geq 9.8\text{MPa}$;
- relative elongation at rupture: $\geq 160\%$;
- cold resistance coefficient on elastic recovery after shrinkage at a temperature of -45°C : ≥ 0.2 ;
- change in material specimen mass of the ring following impact in a medium of a mix of isooctane in accordance with ГOCT12433 and toluene in accordance with ГOCT 5789 in a 7:3 ratio at a temperature of 23°C over a period of 24 hours: $\leq 35\%$;
- relative residual deformation under constant value of rubber specimen shrinkage in the range of $25\pm 5\%$, in air medium at a temperature of 100°C , over a period of 24 hours: $\leq 60\%$;
- Shore A hardness: from 70 to 80 units;
- rubber gasket working temperature range: -50°C to $+130^\circ\text{C}$ (broader temperature range is admissible, but at a temperature no lower than the indicated positive temperature).

2.3.2. Required technical characteristics of the gaskets in items 3.2÷3.5 Table П1-1.

2.3.2.1. Dimensions.

2.3.2.1.1. Dimensions of the "Gasket Type 2" (item 3.2), in compliance with the original gasket type: 8BC.350.483 - specified in the drawing: No.23.30.EO.GQ.PIP.5633.00.04 – Appendix 1.8 of ToR;

2.3.2.1.2. Dimensions of the "Gasket Type 3" (item 3.3), in compliance with the original gasket type: 8BC.350.482 - specified in the drawing: No.23.30.EO.GQ.PIP.5633.00.05 – Appendix 1.9 of ToR;

2.3.2.1.3. Dimensions of the "Gasket Type 4" (item 3.4), in compliance with the original gasket: 8BC.719.007-01 - specified in the drawing: No.23.30.EO.GQ.PIP.5633.00.06 – Appendix 1.10 of ToR;

2.3.2.1.4. Dimensions of the "Gasket Type 5" (item 3.5), in compliance with the original gasket: 8BC.371.522-01 - specified in the drawing: No.23.30.EO.GQ.PIP.5633.00.07 – Appendix 1.11 of ToR.

2.3.2.2. Minimum requirements for the physico-mechanical parameters of vulcanized rubber compound required for the gasket manufacturing.

The physico-mechanical parameters of the rubber compound required for the new gaskets shall cover the requirements of the original rubber compound type: KP-407 rp.2T-C as per TY 2500-376-00152106-94, and most important are:

- rubber type: Heat resistant rubber compound, for operating medium of water vapor, air and water with operational temperature range: -30 to $+90^\circ\text{C}$ (broader temperature range is admissible, but at a temperature no lower than the indicated positive temperature);
- Shore A hardness: (medium) $50\div 75$ units;
- conditional tensile strength: $\geq 3.8\text{MPa}$;
- relative elongation at rupture: $\geq 200\%$.

2.4. Flat rubber sheets (p.4)

2.4.1. Flat rubber sheets made of oil and petrol resistant (hereinafter referred to as "oil resistant") rubber compound - items 4.1÷4.5 (Table П1-1).

Flat rubber oil resistant sheets are used to manufacture front gaskets for flange connections and gas-oil system hatches, as well as air barriers for the gas fillers of 9(10)GQ turbine generators. The manufactured gaskets are used in oil and gas medium, operating under pressure higher than 1kgf/cm^2 . The rubber material they should be made of should be resistant to oil operating medium, where the oils

are based on petrochemicals. As a minimum, the material should meet the requirements of Russian rubber compound type МБС under ГОСТ 7338-90 for Class 1 oil and petrol resistant rubber sheets (Thickness between 1 and 20 mm), type H (non-moulded - made by vulcanization in boilers and continuous vulcanization), type I (without internal textile reinforcement) operating under pressure $> 1 \text{ kgf/cm}^2$.

2.4.1.1. Required dimensions of rubber oil resistant sheets in item. 4.1÷4.5.

2.4.1.1.1. "Rubber sheet – oil-resistant $\delta=1\text{mm}$ "- p.4.1:

- sheet (roll) width range: $1000 \div 1400 \text{mm}$;
- sheet (roll) length range: $500 \div 10000 \text{mm}$;
- sheet thickness: $\delta=1\text{mm} \pm 0,2\text{mm}$.

2.4.1.1.2. "Rubber sheet – oil-resistant $\delta=2\text{mm}$ "- p.4.2:

- sheet (roll) width range: $1000 \div 1400 \text{mm}$;
- sheet (roll) length range: $500 \div 10000 \text{mm}$;
- sheet thickness: $\delta=2\text{mm} \pm 0.3\text{mm}$.

2.4.1.1.3. "Rubber sheet – oil-resistant $\delta=3\text{mm}$ "- p.4.3:

- sheet (roll) width range: $1000 \div 1400 \text{mm}$;
- sheet (roll) length range: $500 \div 10000 \text{mm}$;
- sheet thickness: $\delta=3\text{mm} \pm 0.5\text{mm}$.

2.4.1.1.4. "Rubber sheet – oil-resistant $\delta=4\text{mm}$ "- p.4.4:

- sheet (roll) width range: $1000 \div 1400 \text{mm}$;
- sheet (roll) length range: $500 \div 10000 \text{mm}$;
- sheet thickness: $\delta=4\text{mm} \pm 0.6\text{mm}$.

2.4.1.1.5. "Rubber sheet – oil-resistant $\delta=5\text{mm}$ "- p.4.5:

- sheet (roll) width range: $1000 \div 1400 \text{mm}$;
- sheet (roll) length range: $500 \div 10000 \text{mm}$;
- sheet thickness: $\delta=5\text{mm} \pm 0.7\text{mm}$.

2.4.1.2. Minimum requirements for the physico-mechanical parameters of vulcanized rubber compound for the manufacture of oil resistant sheets in items 4.1÷4.5 (Table ПI1-1):

- conditional tensile strength: $\geq 8 \text{MPa}$ (in accordance with ГОСТ 269 and ГОСТ 270-75);
- relative elongation at rupture: $\geq 200\%$ (in accordance with ГОСТ 269 and ГОСТ 270-75);
- Shore A hardness: from 55 to 70 units (in accordance with 20403-75 or ГОСТ 263);
- change in oil resistant rubber material specimen mass following impact in a medium of a mix of isooctane in accordance with ГОСТ 12433 and toluene in accordance with ГОСТ 5789 in a 7:3 ratio at a temperature of 23°C over a period of 24 hours: $\leq 20\%$ (in accordance with ГОСТ 9.030 method A);
- cold-resistance ratio based on snapback after shrinkage (pressure): ≥ 02 ;
- relative residual shrinkage deformation of the rubber sheet at $20 \pm 5\%$ in air medium at a temperature of 70°C over a period of 24 hours: $\leq 50\%$ (in accordance with ГОСТ 9.029 method B);
- rubber gasket working temperature range: -30°C to $+80^\circ\text{C}$ (broader temperature range is admissible, but at a temperature no lower than the indicated positive temperature)

2.4.2. Flat rubber sheets made of oil resistant electrical insulating rubber compound - item 4.6.

Flat oil resistant electrical insulating rubber sheets are used to manufacture on-site front gaskets for flange connections to the oil pipelines of the main bearings of generators and exciters. The electrical insulating properties of the gaskets are required to ensure the overall electrical grounding insulation of the bearing seats in accordance with the producer's specifications. Good electrical insulation prevents the appearance of electrocorrosion on the babbitt surfaces of bush bearings. The manufactured gaskets are used in a turbine oil medium type: Тп 32/L-TSA 32 and run under pressure up to 5kgf/cm^2 .

2.4.2.1. Required dimensions for the electrical insulating rubber sheet $\delta=6\text{mm}$ (item 4.6. from Table.ПI1-1).

- sheet (roll) width range: $1000 \div 1400 \text{mm}$;
- sheet (roll) length range: $500 \div 10000 \text{mm}$;
- sheet thickness: $\delta=6\text{mm} \pm 0.5\text{mm}$.

2.4.2.2. Minimum requirements for the physico-mechanical parameters of vulcanized rubber compound for the manufacture of flat electrical insulating oil resistant rubber sheet.

- conditional tensile strength: $\geq 8\text{MPa}$;
- relative elongation at rupture: $\geq 200\%$;
- Shore A hardness: from 60 to 70 units;
- rubber gasket working temperature range: $+15^{\circ}\text{C}$ to $+80^{\circ}\text{C}$ (broader temperature range is admissible, but at a temperature no lower than the indicated positive temperature).
- change in oil resistant electrical insulating rubber material specimen mass following impact in a medium of a mix of isooctane in accordance with ГOCT12433 and toluene in accordance with ГOCT 5789 in a 7:3 ratio at a temperature of 23°C over a period of 24 hours: $\leq 20\%$ (in accordance with ГOCT 9.030 method A);

2.4.2.3. Electrical insulation characteristics.

In terms of electrical insulation, the characteristics of the oil resistant electrical insulating rubber sheet should be in compliance with p. 5.6.4.2.2 from standard EN IEC 61111 on electrical insulating matting or Class 2 ÷ 4 from the same standard.

2.4.3. Flat rubber sheets made of heat-cold-acid resistant rubber compound - item 4.7 and 4.8

Flat heat-cold-acid resistant rubber sheets (hereinafter referred to as: heat and cold resistant) are used for the on-site manufacture of front gaskets for flange connections and air barriers for the gas fillers of 9(10)GE exciter housings. The manufactured gaskets are used in mediums operating under pressure higher than 1kgf/cm^2 . The rubber material required to produce the rubber sheet should meet as a minimum the requirements of the Russian rubber compound type TMKIII in accordance with ГOCT 7338-90 on heat-cold-acid resistant rubber sheets of: Class 1 (thickness between 1 and 20 mm), type H (non-moulded - made by vulcanization in boilers and continuous vulcanization), type I (without internal textile reinforcement) operating under pressure $> 1\text{kgf/cm}^2$.

2.4.3.1. Required dimensions of heat and cold resistant rubber sheets.

2.4.3.1.1. "Rubber sheet – Heat/Cold Resistant $\delta=4\text{mm}$ "- item 4.7.

- sheet (roll) width range: $1000\div 1400\text{mm}$;
- sheet (roll) length range: $500 \div 10000\text{mm}$;
- sheet thickness: $\delta=4\text{mm}\pm 0.6\text{mm}$.

2.4.3.1.2. "Rubber sheet – Heat/Cold Resistant $\delta=5\text{mm}$ "- item 4.8.

- sheet (roll) width range: $1000\div 1400\text{mm}$;
- sheet (roll) length range: $500 \div 10000\text{mm}$;
- sheet thickness: $\delta=5\text{mm}\pm 0.7\text{mm}$.

2.4.3.2. Minimum requirements for the physico-mechanical parameters of vulcanized rubber compound for the manufacture of flat heat and cold resistant rubber sheets.

- conditional tensile strength: $\geq 5\text{MPa}$ (in accordance with ГOCT 269 and ГOCT 270-75);
- relative elongation at rupture: $\geq 250\%$ (in accordance with ГOCT 269 and ГOCT 270-75);
- Shore A hardness: from 50 to 65 units (in accordance with 20403-75 or ГOCT 263);
- change in the relative elongation of a rubber sheet specimen following impact of a 20% hydrochloric acid solution in accordance with ГOCT 3118 or ГOCT 857, or sulphuric acid in accordance with ГOCT 4204 or ГOCT 2184, or sodium hydroxide in accordance with ГOCT 4328 or ГOCT 11078 over the course of 24 hours at a temperature of 23°C : from - 20% to +20% (in accordance with ГOCT 9.030 method B);
- cold-resistance ratio based on snapback after shrinkage (pressure): ≥ 02 ;
- relative residual shrinkage deformation of the rubber sheet at $20\pm 5\%$ in air medium at a temperature of 70°C over a period of 24 hours: $\leq 50\%$ (in accordance with ГOCT 9.029 method B);
- rubber gasket working temperature range: -30°C to $+80^{\circ}\text{C}$ (broader temperature range is admissible, but at a temperature no lower than the indicated positive temperature).

2.5. Wedges and channel insulation for bus bar immobilization from the stator winding-item 5.

The channel insulation elements create a complex of a system used to fix (immobilise) and respectively keep the bus bars of the stator winding constantly pressed down to the stator pack channels.

2.5.1. Wedges under items 5.1 and 5.2. (Table II-1). General Technical Information

Item 5.1 and item 5.2 of the table outline the compliance of each of the wedge types with the markings of the original wedges and the outline drawings of some of the wedges available at Kozloduy NPP. The original wedges are made of mark STEF-U fiberglass, sort.1, type 221, 50 mm thickness, compliant under TY 16-89И79.0066.002TY.

When designing and selecting a material for the manufacture of the new type of alternative chocks, the technical requirement of the above-mentioned technical condition for the respective mark and type of fiberglass, aligned to equivalent European standards should be taken into account.

The wedges in item 5.2 come with rubber board installed on their upper side. They have two opposite channels (180°) of the stator package, and the purpose of the rubber board is to secure additional redistribution of the gas flows inside the stator. The alleged material used to manufacture the rubber board is heat and cold resistant rubber compound.

2.5.2. Horizontal flat groove insulation in item 5.3. (Table II-1). General Technical Information

The types of horizontal flat groove insulation in item 5.3 are installed between:

- the bottom parts of the stator grooves and the lower bus bars of the stator winding;
- lower and upper bus bars of the stator winding;
- upper bus bars and lower line of chock insulation.

2.5.2.1. Characteristics of the material.

The alleged material used to manufacture the original flat insulation gaskets is:

2.5.2.1.1. for item 5.3.1÷5.3.3 (in Table II-1) - fiberglass of a mark and type as those of the wedges in items 5.1 and 5.2 (in Table II-1).

2.5.2.1.2. for item 5.3.4 (in Table II-1) – flexible material with elasticity properties similar to those of teflon (PTFE).

2.5.2.2. Dimensions /length, width, thickness/:

2.5.2.2.1. “Sealant flat insulation type 1, $\delta=1\text{mm}$ ” (pos. 5.3.1), corresponding to original sealing 8BC.761.551-21 - 1300x38x1mm;

2.5.2.2.2. “Sealant flat insulation type 2, $\delta=0.5\text{mm}$ ” (pos. 5.3.2), corresponding to original sealing 8BC.761.551-22 - 1300x38x0.5mm;

2.5.2.2.3. “Sealant flat insulation type 3, $\delta=5\text{mm}$ ” (pos. 5.3.3), corresponding to original sealing 8BC.756.824-32 - 1300x38x5mm;

2.5.2.2.4. “Sealant flat insulation type 4, $\delta=1.5\text{mm}$ ” (pos. 5.3.4), corresponding to original sealing 8BC.761.551-63 - 800x38x1.5mm;

2.5.3. Corrugated gaskets in item 5.4 for side sealing of the bus bars from the stator winding in the stator grooves.

They are used for side sealing of the bus bars from the stator winding in the stator grooves.

2.5.3.1. Technical characteristics of the material.

The physico-mechanical parameters of the original gaskets, which should be taken into account when selecting their analogues, are the following:

- material: Fiberglass - semi-conductive, mark STEF-PV under TY 2296-188-05758799-2015;
- density: $1600\div 1900\text{kg/m}^3$;
- wave preservation: $\geq 60\%$;
- specific electrical resistance of the perpendicular layers: $1\cdot 10^3\div 3\cdot 10^5\Omega\text{cm}$;
- specific electrical resistance of the parallel layers: $1\cdot 10^1\div 9\cdot 10^4\Omega\text{cm}$;

2.5.3.2. Dimensions of the gaskets (in pos. 5.4.1 ÷ 5.4.3).

The dimensions of all three types of gaskets are in accordance with drawing No. 23.30.EO.GQ.PIIP.5633.00.20 (App. 1.24), where the only difference is in the thickness of the

sheet they are made of (respectively $\delta=0.4$; 0.6 and 0.8mm). The sheet thickness for the individual positions is as follows:

2.5.3.2.1. pos. 5.4.1. - “Corrugated gasket Type 1”, corresponding to the original gasket marked 8BC.769.448-08: $\delta=0.4+0.15/-0.05$ mm;

2.5.3.2.2. pos. 5.4.2. - “Corrugated gasket Type 2”, corresponding to the original gasket marked 8BC.769.448-19: $\delta=0.6$ mm;

2.5.3.2.3. pos. 5.4.3. - “Corrugated gasket Type 3”, corresponding to the original gaskets marked 8BC.769.448-20 (and 8BC.769.448-06): $\delta=0.8\pm 0.2$ mm.

2.6. Insulation boxes for the electrical connections of the stator winding - item 6

The insulation boxes in item 6 (Table II-1) are used:

2.6.1. In item 6.1 and item 6.2 - They consist of two parts that click together. They are used for electrical insulation inside the generator of the following connections: stator winding outlet - current conducting section of current terminal;

2.6.2. In item 6.3 and item 6.4 - They consist of two parts that click together. They are used for electrical insulation inside the generator of the visible metal parts of the following connections: Hydraulic I/O of the stator winding bus bar to a flexible water hose.

2.6.3. Box manufacturing material.

The approximate information available to Kozloduy NPP about the material used to make the original isolation boxes is the following: impregnated fiberglass cloth, moulded in the respective shapes of the isolation boxes. The dimensions, the type of the structure and the closing technology should be examined and recorded on-site.

2.7. Flexible plumbing hoses with electrical conduit for hydraulic connection of the stator winding branches - item 7

In the design, selection of materials and manufacturing of the flexible plumbing hoses, the following should be considered:

2.7.1. The available information and characteristics of the existing ones, in particular:

- dimensions of the electrical insulation pipe:
 - inner/outer diameter: 21.8x28.00mm;
 - length: to be measured on-site for the different types;
 - shape and curves: to be measured on-site for the different types;
- material of the electrical insulation pipe: PTFE (Chemours 62XT or Dupont T62);
- nipple connection to the electric insulation pipe: press connection or notching able to withstand hydraulic strength of water pressure 1.37MPa (14kfg/cm²) over a period of one hour.
- nipple connection screw pitch - to be calculated on-site;
- nipple connection conical surface shape: to be examined on-site;
- the shape, curves and lengths of the hose section made of copper pipe, should be examined on-site.

2.7.2. The maximum potential difference to which the electrical insulation pipe is subjected (between the stator winding bus bars and the water collectors of the winding cooling system) during tests of the stator winding dielectric strength.

2.8. Insulation components made of fibreglass - item 8.

The insulation components in item 8 are used for electrical insulation of flange connection threats of the oil pipelines of the main bearings.

2.8.1. Required technical characteristics of the pipes in item 8.1. (Table II-1).

The following specifics of the technical characteristics of the original insulation components should be considered in the design and consequent manufacture of the insulation components in item 8.1:

- the dimensions of the table descriptions are as follows: AxB-Cmm,
 - A - inner diameter;

- B - outer diameter;
- C - length.
- the original pipes are made using a mandrel in the respective size of the following material: impregnated fiberglass cloth mark: ПС-ЭП-46 900 in accordance with TY 3491-070-50157126-2007 and ДТ-277.

2.8.2. Required technical characteristics of the washers in item 8.2 (Table П1-1).

The following specifics of the technical characteristics of the original insulation components should be considered in the design and consequent manufacture of the insulation components in item 8.2:

- the dimensions of the table descriptions are as follows: AxB-Cmm,
 - A - inner diameter;
 - B - outer diameter;
 - C - thickness of the material.
- the original washers are made /cut out/ of the following material: fiberglass, EC grade, type: 221, mark: STEF-U (СТЕФ-У), 1sort in accordance with 16-89 И79.0066.002ТУ.

2.9. Outlets (terminals) - item 9.

The generator uses a total of four different types of outlets, and the differences between them have to do mainly with the lengths of their electrical conductor rods. Insulators are the same for each individual type of outlets and are made of porcelain. The overall dimensions of the porcelain insulator are shown in drawing No. 23.30.EO.GQ.ПІП.5633.00.32 - App. 1.29. Water chambers (Fig. П1-1.) are formed in the electrical conductor rods of all types of outlets, which are connected to the cooling circuit of the stator winding using flexible plumbing hoses.

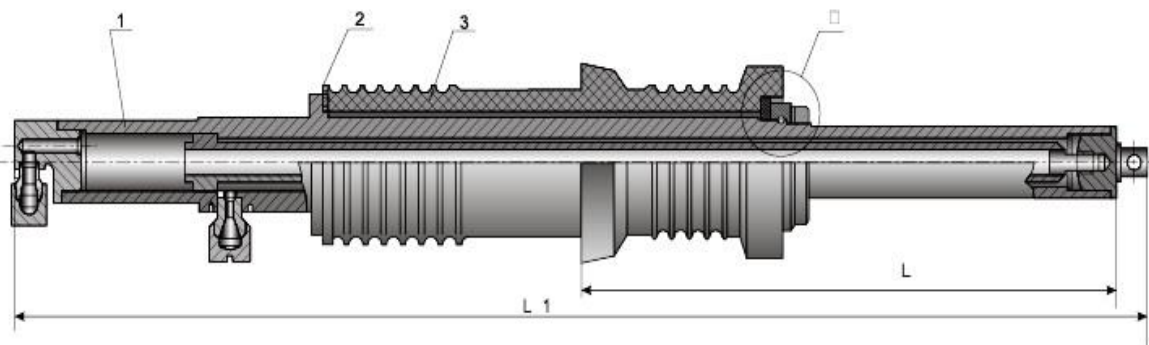


Fig. П1-1. General outlet view

The heat generated as a result of the transition resistance of the electro-mechanical connections to the electrical conductor rods of the outlets is removed via the circulation of cooling water.

In in-service state:

- the cooling chambers of the electrical conductor rod outlets are under $\sim 0.49\text{MPa}$ pressure;
- the outlets (that come with insulator and gaskets) are under $\sim 0.54\text{MPa}$ pressure.

The alternative outlet sets should be designed and manufactured to pass the following tests:

- electric strength test under 70kV pressure with AC line frequency of 50 Hz over a period of 60s;
- hydraulic test with water of the outlet electrical conductor rod under 2.45MPa (25kgf/cm^2) over a period of one hour;
- pneumatic test of the outlet (as part of the set) gas density under 0.59MPa (6.0kgf/cm^2) pressure over a period of one hour.

2.10. Rotor spare parts– item 10.

2.10.1. Gaskets for rotor current-carrying bolt (pos. 10.1 (Table П1-1)).

The rotor current-carrying bolts are used as a barrier ensuring the gas density of the rotor, making sure the exchange gas does not leak out of the stator internal part into the environment - through the rotor's current-conducting assembly.

The gaskets should be made of non-moulded flat rubber sheets, which as a minimum meet the physico-mechanical characteristics of the original rubber sheets used for their manufacture - Russian natural rubber mixture mark 7889 in accordance with ТУ 38 105116-81 (Вакуум Плате/Пластина вакуумная I-20x700x700). When selecting the rubber material for the gasket manufacturing, the maximum operating pressure of the medium they will be used in should also be considered. In this case, this is the generator - 6kgf/cm².

2.10.1.1. Dimensions.

The gaskets of the rotor current-conducting bolts correspond to the original gaskets marked 8БС.715.304-01. Their overall dimensions should meet the ones shown in drawing No.23.30.EO.GQ.ПІП.5633.00.10 (Appendix 1.26 to the ToR).

2.10.1.2. The minimum requirements for the physico-mechanical parameters of the vulcanized rubber compound that the gaskets should be made of are the following:

- conditional breaking strength: ≥ 16.7 MPa (in accordance with ГОСТ 270-75);
- relative elongation at rupture: $\geq 550\%$ (in accordance with ГОСТ 270-75);
- Shore A hardness: from 45 to 60 units (in compliance with ГОСТ 20403-75);
- relative residual shrinkage deformation at 40 % of the thickness size within 96 hours at a temperature of 70 °C/: $\geq 20\%$ (in accordance with ГОСТ 9.029-74 method Б);
- rubber gasket working temperature range: +8°C to +70 °C (broader temperature range is admissible, but at a temperature no lower than the indicated positive temperature).

2.10.1.3. Requirements for the composition of the chemical materials of the rubber sheet used to produce the gaskets.

According to item 4.3 of this Appendix.

2.10.2. Required technical parameters of the rotor current-carrying bolt bushing item 10.2 (Table П1-1).

The bushing is an element of the rotor current-carrying bolt sealing set.

- dimensions: in accordance with drawing No.23.30.EO.GQ.ПІП.5633.00.09 (Appendix.1.25).
- material: No information about the original material, it resembles bakelite.

2.10.3. General information on the nut in item 10.3 (Table П1-1).

The nut in pos. 10.3 is used to tighten the sealing set of elements in pos. 10.1 and pos. 10.2 in the rotor shaft installation groove, where the current-carrying rods are inserted. It is made of "black" steel and is cylinder-shaped. The M120x3 thread is cut on the outer periphery. The inner diameter of the nut is approximately $\Phi 92$ mm.

2.10.4. Banding insulation - pos. 10.4 and 10.5.

Banding insulation segments are installed under the rotor shroud ring to improve the electrical insulation of the rotor winding front parts. The original segments are made of fiberglass cloth sheets, moulded in the required shapes to produce the desired fibreglass segments.

There is an important requirement for the design, selection of materials and technology for the manufacture of the banding insulation segments - they should be able to withstand a temperature of up to 300°C without their varnish structure getting destroyed or melted (liquefied). This requirement is introduced as the removal of the shroud rings requires their heating to a temperature of 280°C using an electromagnetic inductor. The following dimensional drawings should be adhered to in the manufacturing of the segments:

2.10.4.1 Banding insulation dimensions - segment type 1 (pos. 10.4) - according to drawing No. 23.30.EO.GQ.ПІП.5633.00.21 – App.1.27;

2.10.4.2 Banding insulation dimensions - segment type 2 (pos. 10.5) - according to drawing No. 23.30.EO.GQ.ПІП.5633.00.22 – App.1.28.

2.10.5. Pin, calibration bolt - pos. 10.6

The pins in pos. 10.6 are used to transmit the drive from the generator rotor coupling half to the exciter rotor coupling half. A total of 12 pins are used in the generator rotor - exciter rotor connection. These are arranged down the base circle of the two coupling halves in a coupled state. Figure П1-2 shows a sketch of the dimensions of the original pin marked 8БС.934.766-02 where:

- $L=180_{-0.53}^{+0.53}\text{mm}$;
- $D=80_{-0.3}^{+0.3}\text{mm}$;
- Not specified limit deviation of the dimensions: $\pm 1T14/2$.

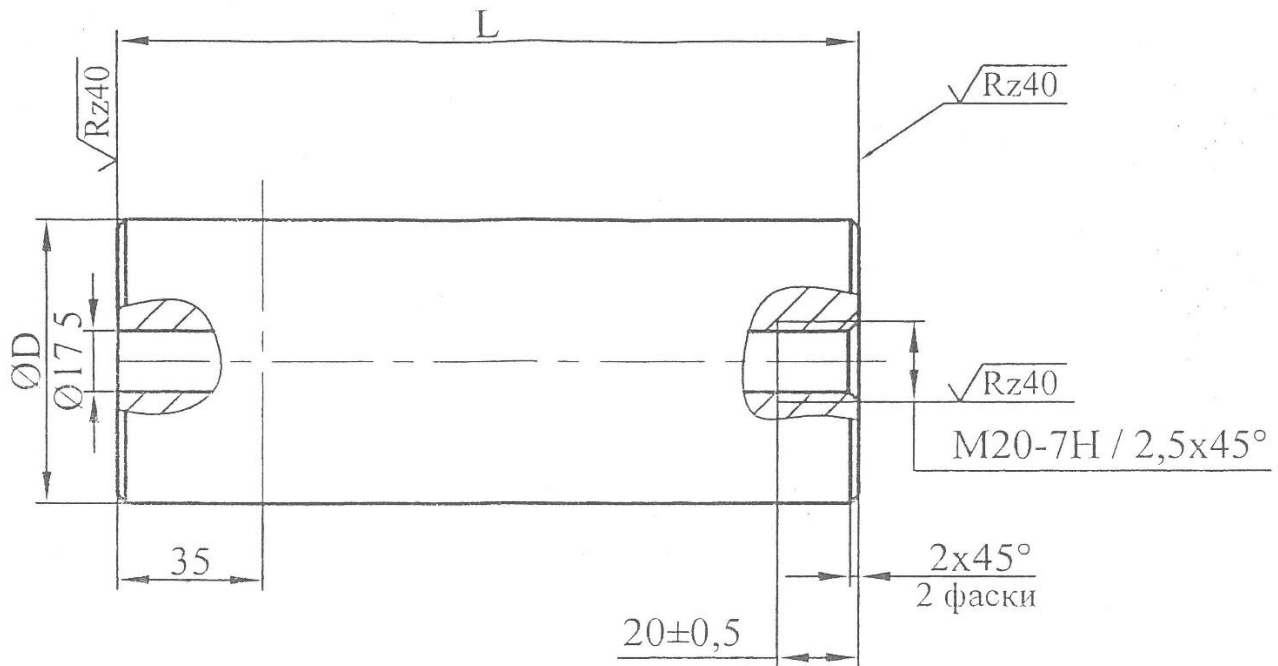


Figure П1-2; Sketch of overall pin dimensions

When selecting an alternative material (steel), its characteristics should be aligned with the characteristics of the Russian steel it is made of, namely:

- steel workpiece shape: Circle - 90-В ГОСТ 2590-2006;
- steel material: 38Х2Н2МА in accordance with ГОСТ 4543-71;
- mechanical properties of the material after heat treatment:
 - yield strength $\sigma_{0.2} > 785\text{MPa}$;
 - relative elongation $\delta_5 > 12\%$.

3. Summary of information on the use of the original maintenance materials in item 11 of Table П1-1, which should be considered in the selection of the alternative replacement materials for each position.

3.1. Rubber glue.

To be replaced with a rubber glue equivalent to the original rubber glue type: Adhesive 88-CA as per TY38.105-1760-89. Used to fix the 12x12 rubber cords in the installation grooves to the generator shell before the installation of shields and covers.

3.2. Silicone rubber Elastosil E43 Transparent /WACKER/. Moisture Curing Silicone Rubber (RTV-1) or similar.

Used to fix the 12x12 silicone rubber cords to the generator shell before the installation of shields and covers.

3.3. Electrical insulating epoxy varnish (two-component), drying without being heated

To replace and correspond to the original varnish type: Adhesive ЭК-4 as per ОБС.504.087ТУ. The electrical insulating epoxy varnish consists of two components and is used to impregnate straps, fix elements in the internal part of the stator, etc., as per the factory instructions. The necessary amount of varnish is prepared on-site by mixing the two liquid components. The resulting substance is coated by hand using a brush on the respective sections. Within 12 hours, without any need of any heat curing, it becomes monolithic and is characterized by high stiffness and hardness.

3.4. Rubber putty, component.

To replace and correspond to the original putty type: КЛСЕ-2 as per ОБС.504.011ТУ. The original putty is made on-site out of three components, mixed based on a formula in a given proportion. Within 24 hours, the resulting dough-like substance becomes highly stiff and hard rubbery material. It is used to fill in gaps in insulation boxes at the outlets of the bus bars of the stator winding, further sealing of opening to insulation boxes at outlets, etc. in accordance with the factory instructions.

3.5. Rubber compound (filler).

To replace and correspond to the KLSE-A (КЛСЕ-А) compound with catalytic material К/1 (K/1) as per ТУ 38.103.691-89. The original compound is made on-site out of two components, mixed based on a formula in a given proportion. Within 24 hours, the resulting liquid substance becomes rubbery and is characterized by low hardness (soft) and relative stiffness. It is used to fill in any gaps inside the generator to prevent the access of oil substances to the surface of rubber flange gaskets that are not made of oil-resistant rubber material.

3.6. Putty, fixing, types 1, 2 and 3

To replace and correspond to the original types of putty:

- type 1 - putty, component-based, ЭЗ-246 as per ОБС.504.062ТУ;
- type 2 - putty, component-based, ЭЗ-217, option 1 as per ОБС.504.062ТУ;
- type 3 - putty, component-based, ЭЗ-217, option 2 as per ОБС.504.062ТУ,

The original putties are made on-site of supplied components, mixed in given proportions. The result is a dough-like mixture, ready to mould and install to the designated assemblies. After the respective periods for drying, each of the putties becomes monolithic and is characterised by high hardness. In general, they are used to: fixate nuts to the flexible pipe unions inside the insulation boxes, stabilisation of the front parts of the stator winding and set, fixing of the insulation barriers, axial fixing of insulation boxes, etc. in accordance with the factory instructions.

3.7. Electrical insulating paint.

To replace and correspond to the ЭПИМАЛБ 9111 as per ТУ 2312-025-05758799. Used for surface painting (after maintenance) of the elements in the internal part of the stator.

3.8. Banding tape

To replace and correspond to the original ones:

- fiberglass banding tape 0.2x50 to replace: Tape ЛЭС 0.2x50 as per ГОСТ5937-81, dimension 0.2x50;
- electrical insulating banding tape to replace: Tape ЛСКН-160-ТТ 25 as per ТУ16-503.030-2007;
- elastic banding tape 0.5x26 to replace: Tape ЛЭТСАР, Кф. 0.5x26.2 group (группа), type (тип) X as per ТУ38.103.171-80.

The tapes in item 11.10 and 11.11 in Table П1-1 are non-elastic and are fiberglass-based. They are used for surface banding (in several layers) of the visible parts of the current-conducting elements to the internal part of the stator in accordance with the factory instructions. After the manufacturing of the banding, it is impregnated using electrical insulating epoxy varnish.

The tape in item 10 of Table П1-1 is elastic. It is layered to wrap and cover components inside the stator in accordance with the factory instructions.

3.9. Banding cord Ø3.0mm.

To replace and correspond to the original one: Tubular braid for technical use Ø3.0mm as per ТУ 6-13-05018335-73-98. Visually, it looks like a glass assembly and is used for:

- stitching or banding of insulating fixing or bracing elements, insulation boxes to the bus bars of the stator winding;
- banding of insulation boxes to connections: - stator end winding section - outlets;
- stator wedges fixing;
- banding the bus bars between the windings.

4. Chemical characteristics requirements for alternative spare parts.

4.1. Rubber cord 12x12mm (item 1.1, Table II-1).

The rubber material used to manufacture the cord should correspond to the chemical properties of Russian natural rubber compound mark 7889 as per TY 38.105.108-76. The main requirements for the properties of the rubber mixture during vulcanization in extruded condition in the shape of the cord are: improved resistance to high pressure and temperature; minimum residual deformation; good elasticity; high shrinkage (compression) resistance; minimum release of gases at high working temperatures; acid and base resistant.

When the cord is made of silicone compound (Eurosil 060 E 51 RAL 9010 or equivalent), it should be stable in chemical mediums:

- liquids:
 - water (boiling water is acceptable under normal conditions);
 - oils IRM OH.901, IRM OIL 903, Lubrizol OS 206 304;
- gases: ammonia, oxygen, hydrogen, ozone (non-concentrated), inert gases (helium, neon, argon, xenon);
- salts: sodium carbonate, copper sulphite, ferric chloride, sodium chloride (all sorts of salts that are not aqueous solutions oxidizers);
- solvents: hydrogen peroxide, ethylene glycol, ethyl alcohol, isopropyl alcohol;
- acids: non-organic (all dissolved non-organic acids, which are not water solutions oxidizers - for example, dilute hydrochloric acid), organic acids;
- alkalis: highly diluted alkalis (concentration $\leq 10\%$).

4.2. Silicone cords with round section: $\varnothing 5$, $\varnothing 5.4$, $\varnothing 5.5$, $\varnothing 5.6$ and $\varnothing 10$ as per TY38-105.1165-90 (items 1.2 ÷ 1.6, Table II-1).

The main requirements for the silicone compound during vulcanization, which should be used to manufacture the cords, are as follows:

- durability in electric field conditions during deformation of fixed rigid connections of up to 10%;
- increased resistance to high tension and temperature;
- minimum residual deformation;
- good elasticity;
- high shrinkage (compression) resistance;

Minimum release of gases at high operating temperatures; resistant to acid and base impact.

The silicone compound used to manufacture the cords should be stable in operations in chemical mediums:

- liquids: water and oils based on petrochemicals;
- gases: ammonia, oxygen, ozone, hydrogen;
- salts: sodium carbonate, copper sulphite, ferric chloride, sodium chloride;
- solvents: hydrogen peroxide, ethylene glycol, ethyl alcohol.

4.3. Specific requirements for the alternative rubber gaskets (sheet material used to manufacture the gaskets), which should correspond to those made of Russian natural rubber compound mark 7889 as per TY 38.105.108-76.

The approximate composition of Russian natural rubber compound mark 7889 as per TY 38.105.108-76, defined in a specialized polymer scientific research laboratory through IR spectroscopy, thermal gravitational analysis and X-ray structural analysis of a rubber specimen vulcanized from this compound shows main content of two types of synthetic rubber:

- fluorinated rubber (interpolymer of polyvinylidenefluoride with hexafluoropropylene);

- hydrogenated nitrile butadiene rubber (HNBR),

where the overall content of mineral filler is approximately 40% of the total mass of the rubber compound. Three types of fillers have been identified: lime carbonate, kaolin and fluoride-containing aluminosilicate (lepidolite).

When selecting an alternative rubber material to correspond to the one made of Russian natural rubber compound mark 7889 as per TY 38.105.108-76, the information from the above-mentioned analysis should be considered.

4.4 Specific requirements for the rubber sheets made of heat-cold-acid resistant rubber compound in compliance with the Russian rubber compound TMKIII as per ГОСТ 7338-90.

The approximate composition of Russian rubber compound TMKIII, as per ГОСТ 7338-90, specified in specialised laboratory for scientific studies of polymers, performing IR spectroscopy, thermogravimetry and x-ray structural analysis of the vulcanised rubber specimen from this compound shows the main content of one type of synthetic rubber: EPDM (ethylene-propylene-diene-monomer).

When selecting a rubber material to correspond to the one made of Russian natural rubber compound TMKIII as per ГОСТ 7338-90, information from the above mentioned analysis should be considered.

5. Additional characteristics

5.1. Additional characteristics and requirements required for manufacture and supply of sealing rubber cords of item 1 (of Table II-1);

minimum length for a piece of cord: $\geq 20\text{m.}$;

- cord appearance: The surface shall be: homogeneous, with correct profile (for the square cord - straight edges), smooth **without**:

- colour difference;
- mechanical defects;
- splits;
- cracks from shrinkage;
- presence of foreign materials, connections or contamination on the length of the profile;
- signs of dents, bumps or bubbles on the length of the profile larger than 0.2mm;
- pockets or pores in the interior when cut;

-the pieces are correctly rolled on round rolls, with the profile following the same line without being twisted or subjected to excessive stress;

- the rolls to be bandaged (tightened or tied) against self-unwinding, using soft ties, so that they do not cut into or deform the main profile of the rubber cord.

5.2. Additional requirements required for the rubber sheets in item 4 (Table II-1).

- regarding their resistance when operating in medium of a turbine oil type ТП 32/L-TSA 32 (only for oil resistant rubber sheets from item 4.1 to 4.6)

• change in rubber material specimen mass, after stay in turbine oil ТП 32/L-TSA 32, at a temperature of 100°C, over a period of 24 hours: $- 5 \div + 20 \%$.

- regarding the appearance:

- sheets to be without textile or other reinforcement;
- the surface to be smooth, homogeneous and without: pores, roughness, scratches, contamination, bubbles, dents, presence of foreign material and connections;
- inner layers of the rolls to be covered with light film of talcum not allowing sticking or this to be performed using thin polyethylene.