

I-2458

State standard of U.S.S.R.

Electro technical flat-sheet

laminated

COST 2910-74.

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I. 2458

Name of the standard should be added with the words "Technical specifications."

Code: OKП 349112 should be entered below the name of the standard.

Item 1.1.

The new column (after column "Grades") should be added to table 1

Table 1

Grades	Code OKП
A	34 9112 0100
B	34 9112 0200
Г	34 9112 0300
В4	34 9112 0400
AT	34 9112 0500

Item 2.1. Reference GOST 9310-59 should be replaced by GOST 9310-75.

New item 2.6 should be added to section 2. "2.6. The textolite should be permitted to machining: turning, milling, filing, drilling without the formation of cracks, and chips while observing the machining parameters, set as per the agreement of manufacturer with consumer."

Item 4.11. Reference GOST 11262-61 should be replaced by GOST 11262-76.

Item 4.14. Reference GOST 15089-61 should be replaced by GOST 21341-75.

Item 4.18_4.20. Reference GOST 10315-62 should be replaced by GOST 10315-75.

Item 4.21. Reference GOST 9141-61 should be replaced by GOST 22372-77.

F. 2458

Item 5.1. The second paragraph should be stated in new edition:

"Packing is allowed in wooden boxes as per GOST 2991-76 or crates as per GOST 12082-77 or in boxes as per standard technical documentation. The dimensions of the boxes should be set depending upon the dimensions of sheets".

Reference GOST 645-67 should be replaced by GOST 23436-79;
The last paragraph should be stated in new edition:

"The boxes should be lined inside with paper as per GOST 515-77 or as per GOST 2228-75 or as per GOST 8828-75, or as per GOST 9569-79. While using paper as per GOST 515-77, the boxes should be additionally lined with paper as per GOST 8273-75 or as per GOST 23436-79."

Item 5.2 should be stated in new edition:

"5.2. Marking of boxes should be carried out as per GOST 14192-77 with the inscription of manipulation sign "Keep in a dry place" and following additional designations:

- a) conventional designation of laminate,
- b) Batch No. or box no.,
- c) Weight of box with laminate in kilograms."

The present standard refers to electro-technical flat sheet laminate, used as electric insulation material.

1. Grades and dimensions

1.1. The laminate should be made in grades, specified in table 1 depending on the properties, main purpose and permissible temperatures for continuous operation.

Table 1

Grades	Nominal thickness, mm.	Characteristic properties and main purpose	Prolonged permissible working temperatures, °C.
A	0.5-50.0	For working in transformer oil and in air in normal relative humidity conditions of surrounding medium (relative humidity 45 to 75% at temperature 15 to 35°C) at current frequency 50Hz with increased electrical properties.	From minus 65 to plus 105.
B	0.5-50.0	For working in air in normal relative humidity conditions of surrounding medium (relative humidity 45 to 75% at temperature 15 to 35°C) at current frequency 50Hz, with increased mechanical properties.	From minus 65 to plus 105.
Γ	0.5-50.0	Same as for grade A, but with extended tolerances for thickness and buckling.	From minus 65 to plus 105.

Grades	Nominal thickness, mm	Characteristic properties and main purpose	Prolonged permissible working temperatures, °C.
<i>S₄</i>	0,5-0,8	For working in air in normal relative humidity conditions of surrounding medium (relative humidity 45 to 75% at temperature 15 to 35°C) at current frequency 1.10 ⁶ Hz	From minus 65 to plus 105.
<i>AT</i>	0,3-3,0	For working in air in increased relative humidity conditions of surrounding medium (relative humidity 95±2% at temperature 35°C) at current frequency 5 Hz	
		<p>a) While using in the form of articles carrying mechanical load.</p> <p>b) While using in the form of articles without mechanical load.</p>	<p>From minus 65 to plus 85</p> <p>From minus 65 to plus 120</p>

1.2. Laminate should be made in sheets with width from 450 to 980mm and length from 600 to 1480mm. Limit deviations of dimensions should not exceed: when the side length of sheet is less than 930mm - ± 35 mm, when the side length of sheet is 930mm and more - ± 50 mm. As per the agreement between the sides, laminate may be made of other dimensions. Laminate may be supplied in sheets with notches (for tests) from one side of sheet, in this case the number sheets with notches may not exceed:

- 12 - in one container,
- 2 - in one box.

1.3. Nominal thickness of laminates should meet its limit deviation and also permissible buckling should comply with values, specified in table 2.

C.C.

1.4. Conventional designation should include laminate grade,
its thickness and designation of present standard.

Example of conventional designation of laminate of grade A
with thickness 10.0MM:

Laminate A - 10.0 COST 2910-74.

Nominal thickness	Laminate grade									
	A		B		F		B4		AT	
	Limit deviations for thickness	Permissible buckling, max	Limit deviations for thickness	Permissible buckling, max	Limit deviations for thickness	Permissible buckling, max	Limit deviations for thickness	Permissible buckling, max	Limit deviations for thickness	Permissible buckling, max
0,3	-	-	-	-	-	-	-	-	+0,12 -0,6	-
0,5	-	-	-	-	-	-	-	-	-	-
0,6	±0,15	-	±0,15	-	±0,20	-	±0,15	-	±0,15	-
0,7	-	-	-	-	-	-	-	-	-	-
0,8	-	-	-	-	-	-	-	-	-	-
0,9	-	-	-	-	-	-	-	-	-	-
1,0	±0,15	-	±0,15	-	±0,25	-	±0,15	-	±0,15	-
1,2	-	-	-	-	-	-	-	-	-	-
1,4	±0,16	not standardized	±0,18	not standardized	±0,25	not standardized	±0,18	not standardized	±0,18	not standardized
1,5	-	-	-	-	-	-	-	-	-	-
1,6	-	-	-	-	-	-	-	-	-	-
1,8	±0,23	-	±0,23	-	±0,30	-	±0,23	-	±0,23	-
2,0	-	-	-	-	-	-	-	-	-	-
2,2	-	-	-	-	-	-	-	-	-	-
2,5	±0,33	-	±0,33	-	±0,40	-	±0,33	-	±0,33	-
2,8	-	-	-	-	-	-	-	-	-	-
3,0	-	-	-	-	-	-	-	-	-	-
3,5	±0,35	40	±0,35	40	±0,40	-	±0,35	40	±0,35	-
3,8	-	-	-	-	-	-	-	-	-	-
4,0	-	-	-	-	-	-	-	-	-	-
4,5	±0,40	35	±0,40	35	±0,50	-	±0,40	35	-	-
4,8	-	-	-	-	-	-	-	-	-	-
5,0	-	-	-	-	-	-	-	-	-	-
5,5	±0,53	14	±0,57	14	±0,60	-	±0,53	14	-	-

Nominal thickness	Indicate grade									
	A		B		F		BY		AT	
	Limit deviations for thickness	Permissible buckling, max	Limit deviations for thickness	Permissible buckling, max	Limit deviations for thickness	Permissible buckling, max	Limit deviations for thickness	Permissible buckling, max	Limit deviations for thickness	Permissible buckling, max
6,0 6,5	±0,63	10	±0,63	10	±0,70		±0,63	10	-	-
7,0 7,5	±0,68	10	±0,68	10	±0,80		±0,68	10	-	-
8,0	±0,68	10	±0,68	10	±0,80		±0,68	10	-	-
8,5 9,0 9,5	±0,80	10	±0,80	10	±0,80		-	-	-	-
10,0 10,5	±0,90	7	±0,90	7	±1,00	not standardized	-	-	-	-
11,0 11,5 12,0 12,5 13,0 13,5 14,0 14,5	±1,10	7	±1,10	7	±1,50		-	-	-	-
15,0 16,0 17,0 18,0 19,0	±1,50	5	±1,50	5	±2,00		-	-	-	-
20,0 21,0 22,0 24,0 25,0 26,0 28,0	±2,00	5	±2,00	5	±2,50	-	-	-	-	

Nominal
thick-
ness

Laminate grade

	A		B		Г		B4		AT	
	Limit deviations for thickness	Permissible buckling, max	Limit deviations for thickness	Permissible buckling, max	Limit deviations for thickness	Permissible buckling, max	Limit deviations for thickness	Permissible buckling, max	Limit deviations for thickness	Permissible buckling, max
30,0										
32,0										
33,0										
35,0	±3,00	5	±3,00	5	±3,50	<i>not standardized</i>				
36,0										
38,0										
40,0										
42,0										
45,0	±3,30	5	±3,30	5	±4,00					
48,0										
50,0										

Remarks:

1. Dash (-) denotes that laminate of given thickness is not made.
2. Norms of permissible buckling are given for the length of sheet 1000 mm.
3. Thickness values, in bold letters are preferable.
4. As per the agreement between the sides, laminate of grade B4 with thickness above 0,0mm, grade AT with thickness above 3,0mm, grades A, B, Г with thickness above 50mm, may be made.

2. Technical requirements

2.1. Electro technical flat sheet laminate is pressed material, consisting of two or more layers of cotton fabric or synthetic fibre, impregnated in thermoreactive resin.

The following materials should be used while making the laminate:

a) cotton fabrics as per GOST 9821-71 for laminate of grades A, B, Г and as per GOST 910-59 * for laminate of grade ВУ;

Grade pocket fabric for grades A, B and Г and industrial polyester fabric for electro-technical purpose for laminate of grade АТ;

b) Thermoreactive phenolformaldehyde and electric insulative aniline phenol formaldehyde ~~resin~~ resin of resol type for laminate of grades A, B, Г and ВУ; epoxy resin, hardened with resin of resol type for laminate of grade АТ.

Other binders and fabrics may be used for every grade of laminate provided that the quality of laminate made on their basis should not be less than the requirements, specified in present standard. The use of these materials should be agreed to between the concerning ministries under which function the manufacturer and consumer.

2.2. The surface of laminate sheets should be smooth, without gas bubbles and foreign inclusions. Separate marks, pitted surface, nicks, bulges, scratch marks (like indentations of flitch steel plates) and variations in shade are allowed. The surface of sheets should comply with test samples, approved in set order. For every grade, the test samples are subjected to approval with permissible deviations of surface conditions. Copies of test samples should be sent by the consumers as per their requirement.

Note: The presence of deviations on surfaces of laminate, caused by fabric defects and permissible by standards and technical documentation, is not a cause for rejection.

2.3. The laminate sheets of all grades and thicknesses should have notches from all the sides. Sheets with thickness 1mm and more should have edges ^{with} notches at right angles with deviations not exceeding $\pm 1^\circ$. Delamination and cracks from butt ends are not allowed.

Note: As per the requirement of consumers, the laminate with thickness 10mm and more may be supplied ^{with} notches from one side.

2.4. Laminate of all grades with thickness upto 2.0mm should be pressable and when thickness is 1.5mm the extent of pressing should not be less than 6 for grades A, B, C, AT and not less than 5 for grade B4.

2.5. Physico-mechanical and electrical properties should comply with the requirements, specified in table 3.

*From 1/VII 1976, GCST9310-75 is brought into force instead of GOST 9310-59.

Table 3

Parameters	Standards for laminate of grades				
	A	B	Г	B4	AT
1. Density, gm/cm ³ .	1.30-1.45	1.30-1.45	1.30-1.45	1.30-1.45	1.25-1.35
2. Breaking stress during static bending perpendicular to the layers for sheets with thickness 10mm and more, MPa (kgf/cm ²), minimum:			88.2 (900)	-	107.8 (1100)
for fabric base	88.2 (900)	107.8 (1100)			
for fabric weft	78.5 (800)	88.2 (900)	78.5 (800)	-	107.8 (1100)
3. Tensile stress at rupture for sheets with thickness 1mm and more, MPa (kgf/cm ²), minimum:			49.0 (500)	88.2 (900)	98.0 (1000)
for fabric base	49.0 (500)	54.0 (550)	49.0 (500)		
for fabric weft	37.3 (350)	44.0 (450)	37.3 (350)	44.0 (450)	49.0 (500)
4. Impact strength perpendicular to the layers, KJ/m ² (kgf.cm/cm ²), minimum:					
a) for sheets with thickness from 1.2 to 5.0mm:					
for fabric base	11.8 (12.0)	14.7 (15.0)	11.0 (12.0)	-	21.5 (25.0)
for fabric weft	9.8 (10.0)	12.7 (13.0)	9.8 (10.0)	-	19.6 (20.0)
b) for sheets with thickness above 5 to 9.5mm:					
for fabric base	16.7 (17.0)	19.6 (20.0)	16.7 (17.0)	-	-
for fabric weft	16.7 (17.0)	19.6 (20.0)	16.7 (17.0)	-	-
c) for sheets with thickness above 9.5mm:					
for fabric base	14.7 (15.0)	16.7 (17.0)	14.7 (15.0)	-	-
for fabric weft	27.4 (28.0)	31.4 (32.0)	27.4 (28.0)	-	-
	21.8 (22.0)	24.5 (25.0)	21.8 (22.0)	-	-
5. Splitting resistance for sheets with thickness 10mm and more, KN/M (kgf/cm), minimum:	225 (230)	235 (240)	225 (230)	-	-
6. Martens yield temperature for sheets with thickness 10mm and more, °C, minimum:	135	135	135	-	-
7. Stability towards instant heating, °C, minimum:	-	-	-	-	150
8. Oil-resistance in transformer oil for a period of 1/2 hours at temperature, °C, minimum:	30	-	30	-	130
9. Water absorption, %, maximum for sheets with thickness:					
upto 1mm					
above 1 upto 2mm	9.0	9.0	9.0	7.5	0.90
above 2 upto 5mm	6.0	6.0	6.0	6.0	0.90
above 5 upto 10mm	4.5	4.5	4.5	4.5	0.45
above 10mm	3.0	3.0	3.0	3.0	-
	2.0	2.0	2.0	-	-

Parameters	Standards for luminance of grades				
	A	B	Г	B4	AT
10. Electrical surface resistivity, ohm, minimum:					
a) in initial state*					
for sheets with thickness:					
upto 3mm. -----	1.10^{11}	1.10^{10}	1.10^{11}	1.10^{11}	1.10^{13}
above 3mm. -----	1.10^{10}	1.10^{10}	1.10^{10}	1.10^{11}	-
b) after keeping for a period of 24 hours in the moist chamber**					
for sheets with thickness:					
upto 3mm. -----	1.10^8	1.10^8	1.10^8	1.10^9	-
above 3mm -----	1.10^8	1.10^8	1.10^8	1.10^8	-
c) after keeping for a period of 4 days in moist chamber***					
-----	-	-	-	-	5.10^{11}
11. Electrical volume resistivity ohm.cm, minimum:					
a) in initial state*	1.10^{10}	1.10^9	1.10^{10}	1.10^{10}	1.10^{13}
b) after keeping for a period of 24 hours in moist chamber**					
for sheets with thickness:					
from 0.8 to 3.0mm. -----	1.10^8	1.10^8	1.10^8	1.10^8	-
above 3.0mm. -----	1.10^8	1.10^8	1.10^8	1.10^8	-
c) after keeping for a period of 4 days in moist chamber***					
-----	-	-	-	-	5.10^{12}
12. Internal electrical resistance for sheets with thickness 8mm and more, ohm, minimum:					
a) initial state*	1.10^{10}	1.10^9	1.10^{10}	-	-
b) after keeping for a period of 24 hours in moist chamber**	1.10^7	1.10^7	1.10^7	-	-
13. Insulation resistance for sheets with thickness/MM and more, ohm, minimum:					
a) in initial state	-	-	-	-	1.10^{12}
b) after keeping for a period of 4 days in moist chamber***	-	-	-	-	1.10^{11}
14. Co-efficient of dielectric losses at frequency 10 ⁶ Hz in initial state, maximum				0.07	
15. Co-efficient of dielectric losses at frequency 50Hz in initial state, maximum.					0.01
16. Breakdown voltage parallel to the layers (for sheets with thickness 8MM and more) at alternating voltage frequency 50Hz in transformer oil at temperature of 90±2°C (kVrms), minimum	10	8	10	10	-
17. Electric strength perpendicular to the layers (for samples with thickness upto 8MM) at alternating voltage frequency of 50Hz in transformer oil at temperature of 90±2°C, kVrms/MM, minimum ¹⁾ for samples with thickness:					
upto 0.8MM. -----	6	4.5	6	6	1
above 0.8 to 1MM. -----	8	6	8	8	25
above 1 to 2MM. -----	6	4	6	6	20
above 2 to 3MM. -----	6	3	5	5	17

* In atmospheric relative humidity conditions 45 to 75% at temperature 15 to 35°C.

** After holding in relative humidity conditions 95±2% at temperature 20±2°C.

*** After holding in relative humidity conditions 95±2% at temperature 40±2°C.

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3. Acceptance rules

3.1. For checking the compliance of laminate with the requirements of present standard, the manufacturer should conduct approval, periodic and type tests.

3.2. Approval tests for laminate should be carried out for compliance with requirements of items 1.2, 1.3, 2.2, 2.3, 2.5 (table 3, items 16 and 17), moreover for laminate of grade AT as per table 3, item 9; for laminate of grade BU as per table 3, item 14. Atleast 10% of sheets from every batch should be subjected to approval tests for compliance with requirements of items 1.2, 1.3, 2.3; every sheet of the batch for compliance with requirements of item 2.2; and one sheet from every batch for compliance with requirements of item 2.5 (table 3, items 9, 14, 16, 17).

Laminate of the same grade, pressed simultaneously in one press and having the serial no. of this pressing is taken as a batch.

3.3. Every sheet should be subjected to check, in case unsatisfactory results of tests for compliance with requirements of items 1.2, 1.3 and 2.3 are obtained. In case unsatisfactory results are obtained even for one of the parameters of item 2.5, the tests should be repeated for those parameters which gave unsatisfactory results, on double the number of samples taken from different sheet of the same batch. The results of repeated tests are considered final and valid for the whole batch.

3.4. Periodic tests for laminate should be carried out atleast once in six months for compliance with requirements of table 3, items 1 to 8, 10 to 13, 15. Periodic tests should be conducted on two sheets with thickness 2 and 10mm. (one sheet each) from the batch, undergoing approval tests.

In case of absence of sheets with thickness 2 and 10mm in the batch, sheets with thickness 3 to 8 and exceeding 10mm respectively should be selected.

In this case, the samples should be brought to the thickness, by machining, envisaged by test methods. Results of periodic tests conducted, extend to laminate of all thicknesses of the same grade. In case unsatisfactory results of periodic tests are obtained, the tests should be repeated for those parameters, which gave unsatisfactory results on double the number of samples, taken from different sheets of the same thickness, of the same batch.

Results of repeated tests are considered final.

3.5. Type tests should be carried out for compliance with all requirements of present standard while changing the technological process for its manufacture and also while substituting the raw materials.

Number of samples should be set in compliance with requirements of approval and periodic tests.

As per the requirements of consumers, the manufacturer should submit the protocols of periodic and type tests.

3.6. When the consumer checks the quality of laminate, its marking and packing for compliance with the requirements of present standard, the number of samples for batch to be supplied should be set in compliance with the requirements of approval and periodic tests. In this case, laminate of the same grade, obtained under one accompanying document, certifying the quality of the product, is taken for a batch.

In case unsatisfactory results of tests are obtained, tests should be repeated for those parameters, which gave unsatisfactory results on doubled number of samples.

Results of repeated tests are considered final and valid for the whole batch.

4. Test Methods

4.1. Before the tests for compliance with requirements of item 1.3 after long storage in conditions, specified in item 5.6, the laminate should be held for a period of 48 hours at a temperature 15 to 35°C and relative humidity of 45 to 75%.

4.2. Before every type of test for compliance with requirements of item 2.5, the samples of laminate should be conditioned at temperature of $10 \pm 2^\circ\text{C}$ for a period of 4 hours with subsequent holding at temperature of 15 to 35°C and relative humidity of air at 45 to 75% for a period of at least 6 hours, but not exceeding 24 hours, and after storing in conditions, specified in item 5.6., the laminate should at first be maintained for 48 hours at temperature of 15 to 35°C and relative humidity of air at 45 to 75% and then conditioned as specified above.

If the manufacturer conducts the testing of samples for a period of 24 hours from the moment of pressing and in this case observes the room conditions for storage as per GOST 64331-71; then the samples may not be conditioned before testing.

4.3. Length and width of laminate sheets *(item 1.2)* should be checked by measuring tool, enduring measuring error upto 1mm.

4.4. The thickness of laminate (item 1.3) should be checked by micrometer or other measuring tool with error 0.01mm and 0.1mm for thickness upto 1mm and above 15mm respectively at 10 points along perimeter of sheet at a distance of minimum 15mm from its edge. None of the values of measured thickness should go beyond the limits, specified in table 2. While checking thickness with the aid of automatic devices, *may be measured, at more than 10 points* thickness. In this case thickness at one point for every 10 measured points may exceed the limit ~~deviations of thickness specified in table 2.~~

4.5. Checking the value of buckling of laminate (item 1.3) should be carried out on whole sheets. For sheets with thickness from 3 to 4.5mm, measuring should be carried out by metallic scale or vernier calipers, and for sheets with thickness from 5mm and more - by depth gauge and by scale with length of 1 M.

For measuring the value of ~~warping~~^{buckling}, the sheet should be placed on even horizontal plate with the concave surface upwards.

While measuring the value of ~~warping~~^{buckling} of ~~material~~^{laminates} with thickness from 3 to 4.5mm, that corner of sheet should be tightly pressed to plate, in which maximum ~~warping~~^{buckling} is observed. After this, the distance between the surface of plate and lower side of sheet at the point of maximum deviation and also the distance between the point of measurement and pressed corner of sheet should be measured.

While measuring the ~~warping~~^{buckling} of sheets with thickness from 5mm and more, measuring should be carried out by depth gauge, placing the scale lengthwise, crosswise and along the diagonal of the sheet.

In those cases, when the ~~max~~^{max} length of side or diagonal of sheet is more than 1000mm, measuring of ~~warping~~^{buckling} may be carried out on section of 1000mm length.

In both cases, measured value of buckling of laminate sheet to be tested (K_1), in mm, should not exceed the value, calculated as per formula.

$$K_1 = \frac{K_A \cdot L}{1000}$$

where,

K_A is permissible value of ~~warping~~^{buckling} according to table n 2, MM.

L is distance between measuring point and pressed corner of sheets with thickness from 3 to 4.5mm and length or width, or diagonal for laminate with thickness from 5mm and more, mm.

Note: Value K_1 for laminate with thickness from 5mm and more should be calculated for all three measurements; measured values of ~~warping~~ ^{buckling} correspondingly should not exceed the calculated values of K_1 .

4.6. Surface condition of laminate sheets (item 2.2) should be checked visually by comparing with test samples.

4.7. Checking the accurate cutting of edges (item 2.3) should be carried out for the whole length of sides, forming an angle, by measuring tool, ensuring the measuring accuracy upto 1° .

4.8. Test for pressing (item 2.4) should be carried out as per technical documentation, approved in set order. 3 samples each should be cut in two directions for tests: along the length and width of sleet. Before testing, the samples should be placed in thermostat, heated upto temperature $65 \pm 2^\circ\text{C}$ in such a way, that they do not touch each other. Holding time of samples in thermostat should be 4 min. for sample of thickness 1mm for laminate of grades A, B, B₂ and 5 min for laminate of grade AT. Tests should be conducted within 5 sec after removal of sample from thermostat.

4.9. Density of laminate (table 3 item 1) should be checked by the hydrostatic weighing method as per GOST 15139-69 on three samples with dimension $(50 \pm 1) \times (50 \pm 1) \times$ (thickness of sample) MM for laminate with thickness upto 2mm and dimension $(20 \pm 1) \times (20 \pm 1) \times$ (thickness of sample) MM for laminate with thickness above 2MM. The samples should have the thickness equal to the thickness of sheet. The arithmetic mean of three readings is taken as the test result.

4.10. Breaking stress during static bending (table 3, item 2) should be checked as per GOST 4648-71. Five samples each should be cut in two directions for tests:

along length and width of sheet. Dimensions of sample:
length 200mm minimum, width 15 ± 0.5 MM, thickness 10 ± 0.5 MM.
Distance between the supports should be

$$160 \pm 0.5 \text{MM.}$$

The arithmetic mean of five readings along each direction should be taken for test results and the same time breaking stress for any test sample should not be less than 80% of the value, specified in table 3.

4.11. Tensile stress at rupture (table 3, item 3) should be checked as per GOST 11262-68 on samples of type 2 with length of atleast 235MM. Five samples each ~~in two~~ should be cut in two directions for test:
along length and width of sheet, the parting speed of clamps of testing machine should be 5MM/min.

The arithmetic mean of five readings along each direction should be taken for test results, at the same time the stress at rupture for any test sample should not be less than 80% of the value, specified in table 3.

4.12. Impact strength (table 3, item 4) should be checked as per GOST 4647-69 on samples without notch. The speed of pendulum at the moment of impact should be selected in such a way, that the work done for breaking the sample should be minimum 10 and maximum 80% of maximum impact energy carried by the pendulum is used. Five samples each should be cut in two directions for tests: along the length and width of sheet. The arithmetic mean of five readings along each direction should be taken as test results, at the same time the impact strength for any test sample should not be less than 80% of the value, specified in table 3.

4.13. Splitting resistance (table 3, item 5) should be checked as per GOST 13537-68 on five samples without notch. Splitting time of sample should be within the limits of 20 to 70 secs.

The arithmetic mean of five readings should be taken as test results, at the same time splitting resistance of any test sample should not be less than 80% of the value, specified in table 3.

4.14. Yield temperature (table 3, item 6) should be checked as per GOST 15089-69.

4.15. Stability towards instant heating (table 3, item 7) should be checked on three samples with dimension of not less than 100 x 100 x (thickness of sample), mm, thickness of sample should be equal to thickness of sheet. The samples should be placed in thermostat at room temperature in suspended position. The temperature in thermostat should be increased upto the value, specified in table 3, for a period of 30 to 60 min. The samples should be held at the given temperature for a period of 24 hours.

On the expiry of this period, the temperature in thermostat should be reduced upto room temperature, after which the samples should be removed from the thermostat. After the test, the samples should not split and not swell up;

the presence of hair ~~mm~~ cracks are allowed from butt ends.

4.16. Oil resistance (table 3, item 8) should be checked on three samples with dimension of not less than $100 \times 100 \times$ (thickness of sample) MM. Thickness of sample should be equal to thickness of sheet. Samples should be immersed in transformer oil heated upto temperature $70 \pm 2^{\circ}\text{C}$ in such a way that they do not touch each other, the walls and the bottom of the container. Then the temperature of oil should be increased upto $130 \pm 2^{\circ}\text{C}$ for a period of 40 to 90 min and the samples should be held at this temperature for a period of 4 hours. On expiry of the specified period the samples should be removed from oil. After the test, bubbles and swellings should not be on the surface of samples; presence of hair cracks are allowed from butt ends.

4.17. Water absorption (table 3, item 9) should be checked as per GOST 4650-73 in water at temperature $20 \pm 2^{\circ}\text{C}$ on three samples with dimension $(50 \pm 10) \times (50 \pm 1) \times$ (thickness of sample) MM without protective varnish coating of machined surfaces. The thickness of sample should be equal to the thickness of sheet. The arithmetic mean of three readings should be taken as test results. Water absorption should be calculated with accuracy of upto 0.1%.

4.18. Electrical surface resistivity (table 3, item 10) and electrical volume resistivity (table 3, item 11) should be checked as per GOST 6433.1-71, GOST 6433.2-71 and GOST 10315-62 at voltage 100 to 1000V (voltage of 1000v is preferable) on three samples with dimension not less than $100 \times 100 \times$ (thickness of sample) MM. The thickness of sample should be equal to the thickness of sheet.

Electrodes made of annealed aluminium or tin foil should be used for measuring. Diameter of measuring electrode should be 50 ± 2 MM. Contact of electrodes with sample should be carried out at pressure 1 N/cm^2 (100 gi/cm^2) through rubber or by rubbing the foil to the surface of sample while using vaseline or other lubricants, specified in GOST 6433.2-71 (table 2). Electrodes made of other materials may be used, as specified in GOST 6433.2-71 (table 2).

Before testing in initial state and before placing in humidity chamber, the surface of samples should be wiped with clean cloth, ^{wetted} in benzine. Measuring as per items 10b, 11b, table 3, may be conducted at room conditions (at temperature 15 to 35° and relative humidity of air 45 to 75%); in this case, the time taken from the moment the sample is removed from humidity chamber till the completion of measurement should not exceed 3 min. Measuring may not be carried out during deposit of dew on samples. The average antilog of logarithms of three measurement results should be taken as resistance value.

4.19. Internal electric resistance (table 3, item 12) for sheets with thickness 8MM and more should be checked as per GOST 6433.1-71, GOST 6433.2-71 and GOST 10315-62 at voltage 100 to 1000V (voltage 100v is preferable) on three samples with dimension $50 \times 75 \times$ (thickness of sample) MM minimum the thickness of sample should be equal to thickness of sheet. Two holes should be drilled on every sample for electrodes.

The dimensions of holes and their position on sample should comply with drawing 3 GOST 6433.2-71.

Copper or brass electrodes, the form and dimensions of which should comply with drawing 12 GOST 6433.2-71, should be used for measuring. Before measuring in initial state and before placing in moist chamber, the surface of samples should be cleaned with clean cloth, wetted in benzine.

While testing as per item 12b table 3, the samples should be held in humidity chamber with electrodes, inserted in holes. Measuring may be carried out at room conditions (at temperature of 15 to 35°C and relative humidity of air of 45 to 75%), in this case the time taken from the moment the samples are removed from moist chamber till completion of measurement should not exceed 3 min.

The average antilog of logarithms of measurement results should be taken as resistance value.

4.20. Insulation resistance (table 3, item 13) for sheets with thickness of δ mm and more should be checked as per GOST 6433.1-71, GOST 6433.2-71 and GOST 10315-62 at voltage 100 to 1000v (voltage 1000v is preferable) on three samples with dimension not less than $35 \times 50 \times$ (thickness of sample) ^{minimum} the thickness of sample should be equal to thickness of sheet.

Two through holes should be drilled on every sample for electrodes. The position of the holes on sample should comply with drawing 1 GOST 6433.2-71, the distance between the centres of holes should be 15 ± 1 mm. Pin-type copper or brass electrodes should be used while measuring. Dimensions of electrodes and their position on sample should comply with drawing 7 GOST 6433.2-71. Before measuring the samples in initial state and before placing them in humidity chamber, the surface of samples should be wiped with clean cloth wetted in benzine. While testing as per item 13b the samples should be held in humidity chamber with electrodes, inserted in holes. The average antilog of logarithms of measurement results should be taken as resistance value.

4.21.

Co-efficient of dielectric losses (table 3, item 14) should be checked as per GOST 9141-65 at frequency $1 \cdot 10^6$ Hz on three samples with dimension $(50 \pm 1) \times (50 \pm 1) \times$ (thickness of sample) mm. When the thickness of sheets is upto 3mm, the thickness of samples is equal to thickness of sheets; when the thickness of sheets is more than 3mm, the samples should be brought down to thickness of 3mm by machining from one side. The arithmetic mean of three measurements should be taken as result.

4.22. Co-efficient of dielectric losses (table 3, item 15) should be checked as per GOST 6433.1-71 and GOST 6433.4-71 at voltage 1000v, on three samples with dimension $100 \times 100 \times$ (thickness of sample) ^{mm} minimum. When the thickness of sheets is upto 3mm, the thickness of samples is equal to thickness of sheet. When the thickness of sheets is more than 3mm, the samples should be brought down to 3mm ^{mm} thickness by machining from outside.

Electrodes made of annealed aluminium or tin foil should be used for measuring. Diameter of measuring electrode should be 50 ± 0.2 mm. Contact of electrode with sample should be carried out at pressure 1 N/cm^2 (100 gf/cm^2) through rubber or by rubbing the foil to surface of samples while using vaseline or other lubricants, specified in GOST 6433.4-71, table 2.

Electrodes made of other materials specified in GOST 6433.4-71, table 2 may be used.

The arithmetic mean of three measurements should be taken as result.

4.23. Break down voltage parallel to the layers (table 3, item 16) for sheets with thickness 8MM and more should be checked as per GOST 6433.3-71 in transformer oil at temperature $90 \pm 2^{\circ}\text{C}$ on five samples with dimension 60 x 65 x (thickness of sample) MM, minimum, thickness of sample should be equal to thickness of sheet.

Two holes should be drilled on every sample for electrodes. Dimensions of holes and their position on sample should comply with drawing 2 GOST 6433.3-71.

Copper or brass electrodes, the form and dimensions of which should comply with specifications to drawing 13 GOST 6433.3-71, should be used for test. The samples should be immersed in transformer oil, heated upto a temperature $90 \pm 2^{\circ}\text{C}$, and should be held for a period of 30 min, after which the voltage on sample should be increased gradually until breaking.

The arithmetic mean of five measurements should be taken as test result, at the same time the value of electric strength for any test sample should not be less than 80% of the value, specified in table 3.

4.24. Electric strength perpendicular to the layers (table 3, item 17) should be checked as per GOST 6433.3-71 in transformer oil at temperature $90 \pm 2^{\circ}\text{C}$ on fine samples with dimension $100 \times 100 \times$ (thickness of sample) MM minimum, when the thickness of sheets is upto 3mm, the thickness of sample is equal to thickness of sheet. When the thickness of sheets is more than 3mm, the samples should be brought down to 3mm thickness by machining from one side.

Copper and brass electrodes should be used for test as per GOST 6433.3-71, the diameter of the upper electrode should be $25 \pm 0.2\text{MM}$, the diameter of lower electrode should be $75 \pm 0.2\text{mm}$. The position of electrodes on sample should be according to drawing 6 GOST 6433.3-71. For testing, the samples should be immersed in transformer oil, heated upto a temperature $90 \pm 2^{\circ}\text{C}$ and held for a period of 30min., after which the voltage on the sample should be increased gradually until breaking.

The arithmetic mean of fine measurements should be taken as test result, at the same time the value of electric strength for any test sample should not be less than 80% of the value, specified in table 3.

5. Packing, Marking, transportation and storage

5.1. Laminate should be packed in plywood boxes as per GOST 5959-71. Packing is allowed in wooden boxes as per GOST 2991-69 or in crates as per GOST 12082-66. The dimensions of boxes should be set depending on the dimensions of laminate sheets.

Before packing, the surface of laminate sheets should be cleaned from dust and resin particles. While packing, paper should be put between the adjacent laminate sheets as per GOST 8273-75 and GOST 145-67.

Note: As per the agreement with the consumer, laminate of all grades, except B7, may be packed ~~in boxes~~ in boxes ^{without} ~~without~~ putting paper between the adjacent sheets.

Weight of box with laminate should not exceed 80kg. In case the mass of laminate sheet exceeds 80kg, then only one sheet should be packed in box, and the gross ~~mass~~ ^{weight} of box is not standardized.

The boxes should be lined inside with water-proof paper as per GOST 515-56, GOST 2228-62 or paraffin paper as per GOST 8273-75 and GOST 145-67.

5.2. Marking of boxes should be carried out as per GOST 14192-71 by inscribing the following additional designations:

- a) Conventional designation of laminate;
- b) batch no;
- c) weight of box with laminate in kilograms;
- d) box No.

5.3. Tag with dimension of not more than 40 x 65mm, on which the following should be marked legibly with non-conducting paint, one on each of the corners of each laminate sheet at a distance of not more than 4cm from adjacent sides:

- a) trade mark of manufacturing plant;
- b) batch No (pressing);
- c) date of manufacturing;
- d) Conventional index.

Acceptance stamp of manufacturer should be put on every sheet.

5.4. Every batch of laminate, dispatched to the same address, should be accompanied by quality document, containing:

- a) trade mark of manufacturing plant,
- b) laminate grade;
- c) thickness in milli meters;
- d) gross and nett weight in kilograms;
- e) designation of present standard.

5.5. The laminate in the package supplied by manufacturer should be transported by any means of transport ensuring its protection from the effects of atmospheric precipitation.

During transportation, the laminate should be safeguarded from impacts and mechanical damages.

The laminate may be transported in containers, without packing in boxes, in this case sheets with thickness 0.5mm should be tied up in bundles. The packs, and also the separate laminate sheets should be fastened in containers so as that the possibility of their displacement with respect to each other during transportation is ruled out.

5.6. The laminate should be stored in horizontal position in covered dry godowns on shelves leaving atleast 5cm gap from the ground.

Air temperature in the godowns should be from minus 10 to plus 35°C., relative humidity of air should not exceed 90%.

6. Manufacturer's guarantee

6.1. The laminate should be approved by Inspection department of manufacturer.

The manufacturer should guarantee the compliance of the delivered laminate to the present standard, provided that the storage conditions, set by the standard are observed.

6.2. Guaranteed shelf life of laminate is 18 months from the date of manufacture.

On the expiry of the specified guaranteed shelf life, the laminate should be checked for compliance with requirements of present standard, before using.