

I 688	NUMBER...GOST 2214-78
	SHEET.....1.....OF.....35
	SUPERSEDES..

ELECTROINSULATING VARNISHED CLOTH

SPECIFICATIONS

GOST 2214-78

TRANSLATED	S. SUMAN			Ordnance Factory Project Hyderabad.
AUTHENTICATED	A. K. KUNDU	<i>[Signature]</i>	2.3.82	
TYPED	n. BaLA	<i>[Signature]</i>	25-3-82	
EDITED		<i>[Signature]</i>		
	NAME	SIGN.	DATE	APPROV. D A. K. KUNDU <i>[Signature]</i> 2.5.82

GOST 2214-78

Electroinsulating varnished cloth. Specifications instead of GOST 2214-70

~~Nonobservation of standard is punishable by law.~~

The present standard refers to electroinsulating varnished cloth (cotton, silk and kapron), used as electroinsulating material for long time working at a temperature upto + 10°C.

The standard specifies the requirements for varnished cloth made for (the need of) national economy and export.

The standard conforms to the recommendations of M 3 K (publication 394-2, 1972) with the exception of methods of determining the thickness, hydrolytic stability, internal resistance to tearing and resistance to surface tearing of the edge.

1. GRADES AND DIMENSIONS

1.1 Varnished cloth of grades specified in Table 1 is made, depending on the properties and the main purpose.

Table 1.

Grade of varnished cloth	Characteristic properties and the main purpose
XM-105	For working in air*.
XMC-105	With increased dielectric properties for working in air*. It may work (be used) in transformer oil also.
AXMM-105	For working in hot transformer oil (with a temperature upto + 105°C).
AXE-105	For working in air*.
AMM-105	With slight shrinkage and resistance to short-duration increase in temperature, which is possible during soldering of wires (during assembly of) of electric motors, apparatus and transformers for working in air*.
AMMC-105	Also, with increased dielectric properties for working in air*. Working in transformer oil is allowed.
AKM-105	With increased elasticity, for working in air*.
AKMC-105	Also, with increased dielectric properties. For working in air*. Working in transfer oil is allowed.

* Under normal relative humidity of environment (relative humidity 45-75% at 15-35°C).

In the description of grades, the following letters and figures mean as follows:

letter A(L) first in order - varnished cloth;
letters X^(L), U and K, second in order

X - cotton, U - silk, K - caprone;
third in order, letters: M - oleoresinous (oil)
varnish as base, B - bituminous (asphalt) oleoresinous
varnish;
fourth in order, letters: C^(L) - special, M - oil resistant;
105 - Temperature, characteristic heat resistance of
varnish cloth as per GOST 8865-70.

Average weight of 1 m² of varnished cloth is given
in the reference appendix.

- 1.2 The varnished cloth should be made (manufactured)
into rolls with a width of 320 to 880mm - for varnished
cloth, made with cotton percale B - 3 as a base;
from 800 to 850mm - for varnished cloth, manufactured
with cotton percale F as a base;
From 830 upto 920mm - for varnished cloth; manufactured
with cotton cloth BV-1;
From 700 upto 740mm or 870 to 930mm for varnished cloth,
manufactured with cotton manufactured with silk cloth as
a base;
From 800 to 900 or from 950 to 1050mm - for varnished
cloth, manufactured with caprone cloth as a base.

In a roll, a minimum of 40m of varnished cloth
should be there where, length of each individual piece
should be at least 5m. For every 40m of varnished cloth
in a roll, not more than two pieces should be present.

As per the agreement of the manufacturer with the consumer, it is allowed to

- a) manufacture varnished clothes into rolls having other width;
- b) manufacture small pieces of any length.

1.3 Nominal thickness of varnished cloth and limit deviations from it should correspond to those given in Table 2.

Table 2.

Grade of varnished cloth	Nominal thickness	Limit deviation	
		Mean	at individual points
1	2	3	4
AXM - 105	0.15; 0.17; 0.20; 0.24;	± 0.02	± 0.03
	0.30	± 0.02 - 0.03	± 0.04
AXM-105 with quality mark	0.15; 0.17	+ 0.02 - 0.01	± 0.03
	0.20; 0.24	± 0.02	
	0.30	+ 0.02 - 0.03	± 0.04
AXMC-105	0.17; 0.20;	± 0.02	
AXMM-105; AXE -105	0.17; 0.20 0.24		± 0.03
AXMM-105 with quality mark	0.17	+ 0.02 - 0.01	
	0.20; 0.24	± 0.02	

Continuation of Table 2.

1	2	3	4
AWM - 105	0.08; 0.10	± 0.01	± 0.02
	0.12; 0.15	+ 0.01 - 0.02	+ 0.02 - 0.03
AWM-105 with quality mark	0.08; 0.10	± 0.01	± 0.02
	0.12; 0.15	+ 0.01 - 0.02	+ 0.02 - 0.03
AWMC-105	0.04; 0.05		± 0.01
	0.06	± 0.01	+ 0.02 - 0.01
	0.10		± 0.02
	0.12	+ 0.02 - 0.01	+ 0.03 - 0.02
AWMC-105 with quality mark	0.06	± 0.01	+ 0.02 - 0.01
	0.10		± 0.02
	0.12	+ 0.02 - 0.01	+ 0.03 - 0.02
	0.15	+ 0.01 - 0.02	+ 0.02 - 0.03
AKM-105	0.10	± 0.01	± 0.02
	0.12; 0.15	+ 0.01 - 0.02	+ 0.02 - 0.03
AKM-105 with quality mark	0.10	± 0.01	± 0.02
	0.12		+ 0.02 - 0.03
	0.15	+ 0.01 - 0.02	+ 0.02 - 0.03

Contd./-

Continuation of Table 2.

1	2	3	4
AKMC-105	0.10	± 0.01	± 0.02
	0.12	+ 0.02 - 0.01	+ 0.03 - 0.02
	0.15	+ 0.01 - 0.02	+ 0.02 - 0.03
AKMC-105 with quality mark	0.10	± 0.01	± 0.02
	0.12	+ 0.02 - 0.01	+ 0.03 - 0.02
	0.15	+ 0.01 - 0.02	+ 0.02 - 0.03

It is allowed if one out of ten values, leads the thickness beyond the limit deviations at various points specified in Table 2.

1.4 Conventional designation of varnished cloth should consist of grade of varnished cloth, nominal thickness and designation of present standard.

Example of conventional designation of varnished cloth of grade AKMM-105 with a nominal thickness of 0.17mm: varnished cloth AKMM-105-0.17 GOST 2214-78

2. TECHNICAL REQUIREMENTS

2.1 Varnished insulating fabric should be manufactured in compliance with the requirements of present standard.

2.2 The varnished cloth should be uniformly coated, should have even and smooth surface without the leakages of varnish base, leading the thickness of varnished cloth beyond limit deviations and should not have visible pores and foreign inclusions. While unwinding from the roll, the surface of varnished cloth should remain intact and smooth.

Aberrations on the surface of varnished cloth, caused by defects may be present, fabrics with permissible standards and technical documents for clothes.

2.3 Shrinkage of varnished cloth along the base, after heat treatment at $105 \pm 2^{\circ}\text{C}$ for 6 hours, should not exceed 1% for grades AKM-105 and AKMC-105 and should not exceed 5% - for grades AKM-105 and AKMC-105

2.4 Unit breaking load of varnished cloth at $15 - 35^{\circ}\text{C}$ and under relative humidity of air of 45-75%, should correspond to the values given in Table 3.

Table 3.

Grade of varnished cloth	Nominal thick- ness, mm	Unit breaking load, N/cm					
		Along the base		Transverse to (at right angles to) the base		At an angle of 45-45° to the base	
		Mean	Minimal	Mean	Minimal	Mean	Minimal
AKM-105	0.15	45	38	35	28	30	22
AKMC-105	0.17	51	44	36	30	32	25
AKMM-105	0.20	64	50	40	35	36	30
AKB-105	0.24	75	58	52	40	45	36
	0.30	80	60	60	48	55	45
AKM-105	0.04	10	7	7	5	7	5
	0.05	14	9	9	7	9	7
AKMC-105	0.06	18	11	11	9	11	9
	0.08	22	16	15	10	15	10
AKH-105	0.10	24	18	17	12	17	12
AKMC-105	0.12	25	20	18	14	18	14
AKM-105	0.15	30	24	22	18	22	18
AKMC-105							

2.5 The varnished cloth should be thermoplastic. After heat treatment at $70 \pm 2^\circ\text{C}$ for 24 hours, the layers of varnished clothes of all grades should not adhere to each other and the varnish layer (coating) should not peel from the cloth.

2.6 Varnished cloth of grades AXMM-105, AXMC-105, AXMC-105 and AKMC-105 (having a thickness of 0.12mm) should be oil resistant.

After keeping the varnished cloth of grades AXMM-105 for 72 hours and varnished cloth of grades AXMC-105, AXMC-105 and AKMC-105 (with thickness of 0.12mm) for 18 hours in transformer oil at a temperature of $105^{\circ} \pm 2^{\circ}\text{C}$, the layers should not stick together and the varnish coating should not peel from the cloth. Insignificant peeling of the layer near the edges of the sample is allowed.

2.7 The varnished cloth of grade AXMM-105 should not increase the acid number of transformer oil by not more than 0.3 mg of KOH per 1gm of oil after keeping it in the transformer oil at $105 \pm 2^{\circ}$ for 72 hours.

During guaranteed storage life of varnished cloth, the acid number of the oil may increase upto 0.4 mg KOH per 1gm. of oil.

2.8 Varnished cloth of grade AXMC-105 with a thickness of 0.12mm should be benzine resistant. After keeping the varnished cloth in aviation petrol for 18 hours at a temperature of $15-35^{\circ}\text{C}$, the varnish coating should not peel from the cloth.

2.9 Electric volume resistivity (ohm.cm) of the varnished cloth should not be less than:

1.10¹³ - at 15-35°C and under relative humidity of air of 45-75%;

1.10⁹ - at 105 ± 2°C;

1.10¹⁰ - after 24 hours of holding in a medium having a temperature of 20 ± 2°C and relative humidity of air of 95 ± 2%*

Electric, volume resistance of varnished cloth of grade MWC-105 with a thickness of 0.04 and 0.05mm is not standardized (see).

2.10 Break down voltage of varnished cloth should correspond to that specified in Table 4.

2.11 Elasticity of the varnished cloth (load for obtaining normalized elongation) and break down voltage, in the state of this elongation, should conform to that specified in Table 5.

For obtaining standardized elongation for separate (individual) samples of varnished cloth, load may (be) pass beyond the limits of mean values of norms specified in Table 5, to any one side; either below the lower limit or above the upper limit.

* While testing the varnished cloth, to be supplied to the COMECON countries, relative humidity of air of 95 ± 2% is accepted at a temperature of 23 ± 2°C

Table 4. Break down voltage at the electrodes having a diameter of 6mm.; K V effective, minimum

Grade of varnished	Nominal thickness, mm	Before bending		at various points		at a temperature of 15-35°C and relative humidity of air of 45-75%		at a temperature of 105 ± 2°C		after 25 hrs. after treatment for 18 hrs. at 100 ± 2°C and subsequent bending		at various points	
		Mean	at various points	Mean	at various points	Mean	at various points	Mean	at various points	Mean	at various points	Mean	at various points
AXM -105	0.15	6.9	4.9	3.6	2.9	4.0	2.5	2.2(2.4)	1.5(1.6)	3.9(3.3)	3.0	1.6	
	0.17	6.5	4.3	3.2	2.0	4.0	2.0	2.8(3.0)	1.8(1.9)	3.6(3.0)	3.0	1.6	
	0.20	7.2	4.6	4.2	3.0	4.5	2.0	3.1(3.4)	2.0(2.1)	3.7(3.1)	3.0	2.0	
AXM -105 with quality mark	0.24	9.1	5.0	4.3	3.3	5.2	3.3	3.5(3.8)	2.2(2.3)	4.2(4.6)	4.2	2.1	
	0.28	10.5	5.2	5.2	4.0	6.5	4.0	4.0(4.4)	2.5(2.7)	4.8(5.2)	4.2	2.9	
	0.30	9.5	5.5	5.5	4.0	6.5	4.0	3.2	3.0	4.1	4.1	2.1	
AXMC - 105	0.17	7.0	4.5	4.8	3.3	5.0	3.2	3.0	1.9	4.0	3.0	1.6	
	0.20	7.4	4.8	5.0	3.5	5.4	3.4	3.5	2.2	4.1	4.1	2.1	
AXMM - 105	0.17	7.5	4.8	4.8	3.2	5.0	3.2	3.2	1.9	4.1	4.1	2.1	
	0.20	8.3	5.0	5.0	3.5	5.5	3.4	3.6	2.0	4.2	4.2	2.1	
AXMM - 105 with quality mark	0.24	9.2	5.4	5.4	3.9	6.0	4.0	4.0	2.5	4.2	4.2	2.1	
	0.28	10.5	5.6	5.6	3.9	6.0	4.0	4.0	2.5	4.2	4.2	2.1	

Break down voltage at the electrodes having a diameter of 6 mm., K Veffective, minimum

Grade of Varnished	at a temperature of 15-35°C and relative humidity of air of 45-75%		at a temperature of 105 ± 2°C		after 24 hrs. of keeping (holding) in a medium with a temperature of 20 ± 2°C and relative humidity of 95 ± 2%*		after heat treatment for 18 hours at 100 ± 2°C and subsequent bending.	
	Before bending		After bending		at various points		at various points	
	Mean	at various points	Mean	at various points	Mean	at various points	Mean	at various points
AX 5 - 105	0.17	45	3.0	3.0	2.5	2.0	3.9	2.8
	0.20	48	4.2	3.3	2.7	2.2	4.2	2.8
	0.24	53	6.0	3.0	3.6	2.8	4.8	3.3
AUM - 105	0.08	32	1.6	1.8	1.8	1.4	2.5	1.4
	0.10	35	2.1	2.1	2.8	2.0	3.7	1.7
	0.12	45	3.8	2.5	3.5	2.5	4.0	2.1
AUM - 105 with quality mark	0.15	50	3.6	3.0	3.8	2.8	4.2	2.7
	0.08	24	3.0	1.8	1.8(1.6)	1.4(1.5)	2.5(2.0)	1.4(1.5)
	0.10	38	4.2	2.1	2.6(1.9)	2.0(2.0)	3.7(4.0)	1.7(1.8)
AUMC-105	0.12	48	6.0	3.5	5.5(3.7)	3.5(3.7)	10(10)	2.1(2.2)
	0.15	54	6.6	3.6	6.6(4.1)	3.6(4.1)	12(10)	2.7(2.8)
	0.03	0.1	—	—	—	—	—	—
AUMC-105	0.06	10	—	—	—	—	—	—
	0.10	65	4.0	2.6	2.8	2.0	4.2	2.3
	0.12	90	6.0	3.3	5.7	2.6	5.4	2.6
AUMC-105	0.15	65	7.5	3.9	7.2	3.7	5.8	3.2
	0.03	0.1	—	—	—	—	—	—
	0.06	10	—	—	—	—	—	—

Normal thickness, mm

Grade of Varnished

Contn. Table.4

Table.4 Contd.

Break down voltage at the electrodes having a diameter of 6mm., K V effective, minimum

Grade of varnished	Nominal thickness, mm	at a temperature of 15-35°C and relative humidity of air of 45-75%		Before bending		After bending		at a temperature of 105 ± 2° C		After 24 hrs of keeping (holding) in a medium with a temperature of 20 ± 2°C and subsequent relative humidity of 95 ± 2%*		After heat treatment for 18 hrs. at 100 ± 2°C and subsequent relative humidity of air bending	
		Mean		Mean		Mean		Mean		Mean		Mean	
		at various points	at various points	at various points	at various points	at various points	at various points	at various points	at various points	at various points	at various points	at various points	at various points
AKMC - 105 with quality mark	0.09	3.2	1.0	1.0	1.0	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
	0.10	7.0	4.0	4.0	4.0	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
	0.12	9.0	6.0	6.0	6.0	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
AKM - 105	0.10	5.0	3.8	4.2	4.2	2.1	2.1	1.9	1.9	2.4	2.4	2.4	2.4
	0.12	6.0	4.2	3.4	3.4	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
	0.15	7.8	4.5	3.5	3.5	3.3	3.3	3.1	3.1	3.4	3.4	3.4	3.4
AKM - 105 with quality mark	0.10	6.0	3.5	4.2	4.2	2.1	2.1	1.9	1.9	2.4	2.4	2.4	2.4
	0.12	7.5	4.5	3.7	3.7	3.3	3.3	3.0	3.0	3.6	3.6	3.6	3.6
	0.15	8.5	5.0	3.8	3.8	3.8	3.8	3.1	3.1	3.4	3.4	3.4	3.4
AKMC - 105	0.10	6.0	3.5	3.7	3.7	2.1	2.1	1.9	1.9	2.4	2.4	2.4	2.4
	0.12	9.0	6.0	5.0	5.0	3.0	3.0	3.0	3.0	3.6	3.6	3.6	3.6
	0.15	9.3	6.0	7.5	7.5	3.9	3.9	3.2	3.2	4.2	4.2	4.2	4.2
AKCM - 105 with quality mark	0.10	6.5	3.8	5.0	5.0	3.7	3.7	4.4	4.4	2.4	2.4	2.4	2.4
	0.12	9.0	6.0	6.6	6.6	3.2	3.2	5.0	5.0	3.0	3.0	3.0	3.0
	0.15	9.8	6.0	7.5	7.5	3.9	3.9	6.0	6.0	4.0	4.0	4.0	4.0

* While testing the varnished cloth, to be supplied to the COMECON countries, relative humidity of air of 95 ± 2% is accepted at a temperature 23 ± 2°C

Remarks: Values given in brackets are introduced from 01.01.1982.

Table 5.

Grade of varnished cloth	Nominal thickness, mm.	Elasticity			Mean value of break down values of voltage in the elongation state, KV, minimum.
		Standard (ized) elongation at rupture, %	Permissible limits of mean values of loads for obtaining standard (ized) elongation, N.	Maximum values of loads for obtaining standard (ized) elongation, N	
1	2	3	4	5	6
AXM-105	0.15	6	6-30	35	3.5
	0.17		6-30	35	4.0
	0.20		6-30	35	4.8
	0.24		6-40	45	5.2
	0.30		12-48	52	5.5
AXMC-105	0.17	6	9-35	38	4.3
	0.20		10-42	45	5.0
AXMM-105	0.17	6	9-35	38	4.5
	0.20		10-42	45	5.2
	0.24		10-45	47	5.6
AXS-105	0.17	6	6-30	33	4.2
	0.20		6-30	33	5.0
	0.24		6-35	38	5.2
AXM-105	0.08	6	2-10	11	2.7
	0.10		2-12	14	3.0
	0.12		3-12	14	3.5
	0.15		3-14	17	4.0
AXMC-105	0.05	6	1-19	11	-
	0.06		2-10	12	-
	0.10		3-12	14	3.0
	0.12		3-14	15	3.6
	0.15		3-15	18	4.5
AKM-105	0.10	10	1-9	12	3.0
	0.12		2-10	12	4.0
	0.15		2-16	19	4.6
AKMC-105	0.10	10	2-10	12	3.7
	0.12		2-10	12	4.5
	0.15		2-16	19	5.0

2.12 While manufacturing the varnished cloth, fabrics specified in Table 6, insulating, oleoresinous and bituminous varnish

as per technical document approved in the specified order should be used.

Table 6.

Grade of varnished cloth	Nominal thickness, mm	Fabrics used
AXM-105	0.15; 0.17	Cotton, commercial percale B-3 as per GOST 9821-71.
AXMM-105; AXMC-105; AXB-105	0.17	
AXM-105; AXMM-105; AXMC-105; AXB-105	0.20	Cotton, commercial 3U-1 and percale B-3 as per GOST 9821-71.
AXM-105; AXMM-105; AXB-105	0.24	Cotton, commercial 3U-1 and percale B as per GOST 9821-71.
AXM-105	0.31	Cotton, commercial percale B as per GOST 9821-71.
AXM-105	0.08-C.15	Silk "Excelsior 1" as per GOST 20023-74.
AXMC-105	0.04-C.15	
AKM-105; AKMC-105	0.10-C.15	Caprone "Excelsior 2" and "Excelsior 3" as per GOST 20023-74; caprone cloth as per technical paper, approved in the set (specified) order.

For varnished cloth of all grades, other fabrics may be used, provided that the quality of varnished cloth is not below the requirements specified in the present standard.

These materials should be used by the agreement between the manufacturer and the chief consumer.

3. ACCEPTANCE RULES

3.1 For checking the conformity of varnished cloth to the requirements of present standard, approval tests, periodical tests and type tests are conducted by the manufacturer.

The varnished cloth is accepted in batches. For a batch daily output of varnished cloth of the same grade and thickness, but not more than ten rolls is accepted.

Every batch is subjected to approval tests in the scope of:

- every roll of varnished cloth - as per sub item 1.2; 1.3 and 2.2
- 10% of rolls from a batch but as per sub item 2.6;
- not less than one roll - 2.8 and 2.10 (in the place of break down stress before and after bending).

On obtaining unsatisfactory results for approval tests of the varnished cloth even by one of the properties of sub item 2.6; 2.8 and 2.10 retests are conducted on (double number of) samples, selected from the same batch for those properties for which unsatisfactory results are obtained.

As per the agreement with the consumer during retesting each roll may be tested instead of double number of samples.

Results of retastings extend to the whole batch.

3.3 Periodic tests of varnished cloth should be conducted at least once in 3 months as per sub item 2.3-2.5; 2.7; 2.9; 2.10 (in the place of breakdown voltage under all conditions specified in Table 4, except the break down voltage (stress) before and after bending at a temperature of 15-35°C and relative humidity of air of 45-75%) and 2.11.

Periodic tests of the varnished cloth are conducted on one roll selected from a batch which has passed the approval tests on obtaining unsatisfactory results for tests, re-testings are conducted on double number of samples, selected from that batch, for those properties (indices) for which unsatisfactory results are obtained. On obtaining unsatisfactory results for retests, varnished cloth should not be supplied to the consumer till the cause for non-conformity to the requirements of present standard is detected and rectified and till satisfactory results are obtained for the new tests.

3.4 While changing the manufacturing method and also while substituting the raw materials, type tests of varnished cloth for conformity to the requirements of present standard are conducted.

3.5 On demand by the consumer, the manufacturer should present the record of periodic and type tests.

3.6 While checking the quality of varnished cloth for conformity to the requirements of present standard, number of samples for the batch to be supplied is set in compliance with the requirements for approval and periodic tests. In this case varnished cloth of same grade and same thickness, received by same accompanying document is accepted in a batch.

On obtaining unsatisfactory results for tests, retests are conducted on double number of samples for those properties (indices), for which unsatisfactory results are obtained.

Results of retests extend to the whole batch.

4 TEST METHODS

4.1 Before the tests the varnished cloth should be standardized for 24 hours at temperature of 15-35°C and relative humidity of 45-75%.

If tests are conducted within 24 hours after the manufacture of varnished cloth and when it is stored under indoor conditions as per GOST 6433.1-71, then the samples may not be normalized before the test.

Samples for tests are cut along the entire width of the varnished cloth at a distance of not less than 1m

from the end of the roll. In order to avoid distortion (damage or peeling) of varnish coating, the selected sample is placed on a sheet of thick paper and is rolled up in a tube with a diameter of 100-150mm.

4.2 The width of the varnished cloth (point 1.2) should be checked with help of measuring tool having a measurement error not exceeding ± 3 mm. Length of the varnished fabric is checked during rewinding of the roll.

4.3 Thickness of varnished cloth (item 1.3) should be checked with the help of micrometer MK as per GOST 6507-78 having an error not exceeding ± 0.01 mm, at ten equidistant points along the width of the roll.

If necessary, the thickness of varnished cloth is checked with the help of a micrometer equipped with counting device having a division of not more than 0.002mm, as per GOST 4381-68.

For measuring the thickness of varnished cloth, points without protuberances are selected.

Arithmetical mean of results of ten measurements is taken as the thickness of varnished cloth.

4.4 Appearance of the varnished cloth (item 2.2) is checked by visual inspection without using magnifying instruments.

4.5 Shrinkage of varnished cloth (item 2.3) is determined on three samples having a dimension of 40 x 250mm, cut with large side along the base at a

distance of not less than 25mm from the edge of the roll.
On the cut samples a section with a length of 200mm
is marked with an error not exceeding ± 1 mm.

Samples in free state (without stretching) are kept
in thermostat at $105 \pm 2^\circ\text{C}$ for 6 hours. After this
(holding), the samples are placed on an even surface and
length of the marked section is measured with an error of
not more than ± 1 mm.

Shrinkage of varnished cloth X in percentage is
calculated by the formula:

$$X = \frac{l_1 - l_2}{l_1} \cdot 100,$$

where l_1 - length of the section of varnished cloth
before keeping (holding) it in the thermostat,
mm;

l_2 - length of the section of varnished cloth
after keeping in the thermostat, mm.

4.6 Breaking load of varnished cloth (item 2.4) is
determined on tearing machine providing measurement of
load with an error of not more than $\pm 1\%$ from the
measured value when the speed of movable clamp is 50-100
mm/min.

For testing, three samples with a width of 15mm and
length of not less than 200mm are cut in each direction
(along the base, transverse to the base).

Distance between clamps of tearing machine should be 200mm.

Arithmetic mean of three determinations is taken as the result. In this case, minimum value is fixed.

Unit breaking load is determined by dividing the breaking load in newtons by width of the sample in cms.

4.7 Thermoplasticity (item 2.5) is determined on two samples with width of 40 ± 1 mm, which are cut transverse to the base along the entire (whole) width of the roll. Samples are tightly wound on a metal rod with an overlap of not more than 20mm along the length, and tied together with a thin strip of the same varnished cloth.

Diameter of the rod should be 12 ± 1 mm, length should not be less than 120mm. The rod with the samples is placed in vertical position in thermostat with temperature of $70 \pm 2^{\circ}\text{C}$ for 24 hours. After 24 hours (on the lapse of this time) the rod is taken out of the thermostat and immediately, the samples are unwound and change in the surface of varnished cloth is observed. Unwinding should be completed within 1 minute after removing the samples from the thermostat. During unwinding of varnished cloth from the rod, slight adhesion of the layers without any damage of the varnish coating is allowed.

Completeness of varnish coating may be damaged at the place of joining to the metal rod.

4.8 For determining oil resistance of varnished cloth (item 2.6) samples are prepared as per item 4.7. Prepared samples are placed in transformer oil as per GOST 982-68 at $105 \pm 2^\circ$ for 72 hours for varnished cloth of grade AXMM-105 and for 18 hours for varnished cloth of grades AXMC-105, AMMC-105 and AKMC-105. After the specified time, samples are taken out of the oil and immediately they are unwound and change in the surface of varnished cloth is observed. Unwinding should be completed within 1min after the samples are taken out of the oil. Completeness of varnish coating of the sample may be damaged at the place of its joining to metal rod.

4.9 For determining the effect of varnished cloth on transformer oil (item 2.7) a strip is cut along the entire width of the varnished cloth and it (the strip) is cut into pieces with an area approximately equal to 50mm^2 and 10gms is weighed with an error not exceeding $\pm 0.01\text{gms}$. The sample is placed in a 150-250ml glass beaker, and then 100gms of transformer oil is added as per GOST 982-68.

The beaker with the sample and oil is placed in thermostat and is kept at a temperature of $105 \pm 2^\circ\text{C}$ for 72 hours. At the same time a similar beaker with 100gms of transformer oil without varnished cloth, is placed in the thermostat. After 72 hrs. the beakers are taken out of the thermostat and acid numbers of the oils are determined as per GOST 5985-59 using yellow nitrazine

(delta). Weight of the oil should be around 10gms.

Effect of varnished cloth on transformer oil K is expressed in mg of KOH per 1gm of oil and is calculated by the formula.

$$K = K_1 - K_2,$$

K_1 - acid number of oil in which varnish cloth is kept, mg of KOH per 1gm of oil;

K_2 - acid number of oil without varnished cloth, mg of KOH per 1gm of oil.

4.10 For determining benzine resistance (item 2.8), three samples with a length of 100mm each are cut from the strip of varnished cloth with a width of 80 ± 20 mm and a length equal to the width of the roll.

Samples of varnished cloth are rolled up into two layers, tied together by a thin strip of the same varnished cloth and they are placed in vertical position in a vessel containing aviation petrol of grade 5-70 as per GOST 1012-72, where they are held at a temperature of $15-35^\circ\text{C}$ for 18 hours.

After removing from the vessel containing benzine, the samples to be tested are cut and dried between the sheets of filter paper (to remove traces of benzine) and then are tested with the help of special equipment used for determining oil resistance of insulating varishes and enamels as per GOST 13526-79. Samples are

placed on movable plate of the instrument (device) below the base and the folds are straightened here the base should be covered with a gauze in four layers. Weight of the base should be 0.47 ± 0.01 kg and its cross-sectional area should be 1 ± 0.1 cm².

The plate is moved along the sleds completely with the help of handle. Here varnished cloth should be moved (slided) along with the plate. If under the action of the heel there is no damage of completeness of varnish coating visible to the naked eye, then the given sample is considered to have passed the test. Time from the moment the sample is taken out of benzine to the completion of test, should not exceed 5 minutes.

4.11 Electric, volume resistance of varnished cloth (item 2.9) is determined on six samples with a dimension of not less than 100x100mm, and which are cut along the width of roll of varnished cloth, during which three samples are subjected to each one of the tests specified in item 2.9. Samples are tested at increased temperature having passed the tests at a temperature of 15-35°C and relative humidity of 45-75%.

Resistance is measured as per GOST 6433.2-71 under constant voltage of 100-500 V (voltage of 500 V is preferable).

Electrodes of annealed aluminium or tin foil are used for the test. Diameter of the measuring electrode should be 50mm.

Contact of the electrode with the sample is obtained by a pressure of 0.9810^4 Pa (0.1 kgf/cm^2) through rubber or by rubbing the foils against the sample surface with the help of vasoline or other lubricants specified in GOST 6433.2-71.

For determining the electric volume resistance at increased temperature, thermostat along with the electrodes is heated upto temperature of $105 \pm 2^\circ\text{C}$. Then sample of varnished cloth to be tested is placed in thermostat and is held at a temperature of $105 \pm 2^\circ\text{C}$ for 10-20 minutes after which determination is carried out.

For determining electric volume resistance after the action (off-set) of humid atmosphere, samples of varnished cloth without electrodes are placed for 24 hours in a chamber with $95 \pm 2\%$ relative humidity of air at $20 \pm 2^\circ\text{C}$. While keeping samples in the moist chamber, dew should not fall on the samples. Samples taken out of the chamber are tested under room conditions as per GOST 6433.1-71. Here, the time from the moment the sample is taken out of the chamber to the completion of test should not exceed 5 minutes.

Antilogarithmic mean of decimal log arithms of results of three readings is taken as (the value of) resistance.

4.12 Break down voltage (stress) (item 2.10) is determined on samples with width of 100-150mm and which are cut in compliance with item 4.1, at ten points during gradual increase of alternating voltage of frequency 50 Hz as per GOST 6433.3-71 using cylindrical electrodes with a height

of not less than 25 and a diameter of 6mm.

Weight of the upper electrode should be 50 ± 2 gms.

For determining the breakdown ~~shown in 2000x2000~~
voltage after folding the sample is folded transverse to
the base at 180° around the lining of the same varnished
cloth being tested. Edge of the lining should not be
more than 2.1mm away from the folding (bending). Place
of folding (bending) is rolled once with steel roller with
a diameter of 55 ± 5 mm, a length of not more than 100mm
and mass of 2 ± 0.05 kg. Roller should be moved without
pressure.

Rolling is carried out on smooth surface in such a
way, that the axis of the roller is perpendicular to the
line of folding (bending) and the line of bending passes
approximately the middle of the length of the roller.
Lined samples are carefully straightened out and tested,
here line of folding (bending) of varnished cloth should
be below the middle electrode.

For determining breakdown voltage at increased
temperature, the thermostat along with the electrodes is
heated upto (a temperature of) $105 \pm 2^\circ\text{C}$, after which
test sample of varnished cloth is placed in the thermostat
and it is held at $105 \pm 1^\circ\text{C}$ for 10-20 minutes, after
which reading is taken.

To avoid damage of varnish coating of varnished cloth due to its hanging on edges of lower electrode, around which a support made of insulating material is erected at working surface; besides this, the test sample may be cut into 2 or 3 parts.

For determining the breakdown voltage after the effect of humid atmosphere, samples of varnished cloth are placed for 24 hours in a chamber with $95 \pm 2\%$ relative humidity at a temperature of $20 \pm 2^{\circ}\text{C}$. While holding the samples of varnished cloth in the humid chamber due should not fall on the samples. Samples taken out of the humid chamber are tested under room conditions as per GOST 6433.1-71. The time from the moment the sample is taken out of the humid chamber till the completion of the test, should not exceed 5 minutes.

For determining the breakdown voltage after heat treatment with subsequent bending samples of varnished cloth are held for 18 hours at $100 \pm 2^{\circ}\text{C}$ in the thermostat in such a way, that they are not in contact with each other and with the walls of thermostat. Distance between the samples should not be less than 2cm. After heat treatment, samples are removed from the thermostat, cooled down to a temperature of $15-35^{\circ}\text{C}$; rolled with a roller and tested for any rupturing at places of folding (bending). Test should be carried within 2 hours after removing the samples from the thermostat.

Arithmetic mean of ten readings is taken as (the result of) break down voltage. Here, minimum value of

breakdown voltage is fixed at various points.

4.13 Determination of elasticity and breakdown voltage in the state of tension.

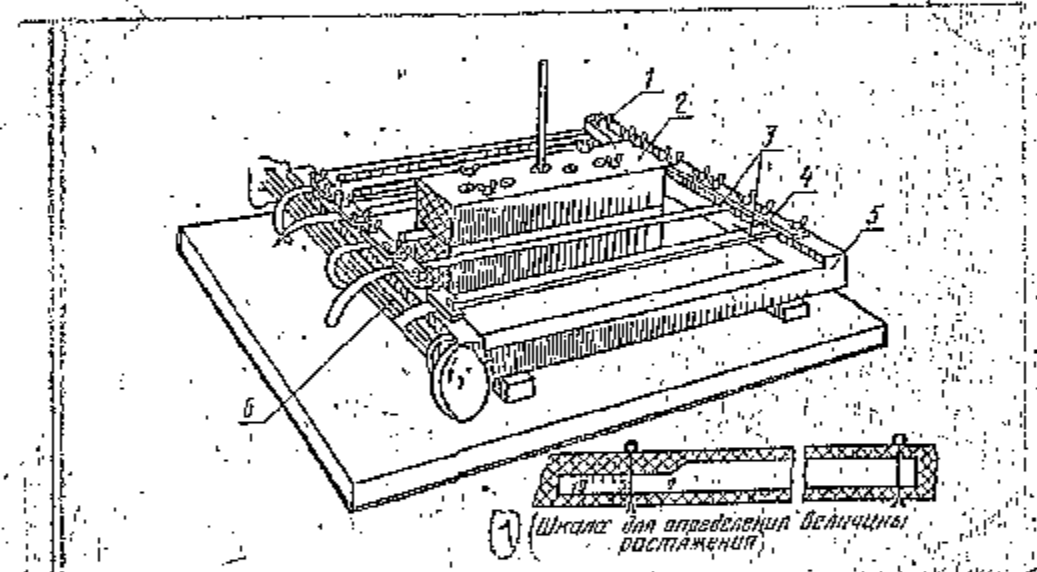
4.13.1 Elasticity (item 2.11) is determined on ten samples of varnished cloth with a width of 20 ± 1 mm and a length of not less than 260 mm, which (samples) are cut at an angle of $43-45^\circ$ to the base in two mutually perpendicular directions (with five samples in every direction). Elasticity is determined on testing machine providing measurement of load with an error not exceeding 1% from the measured value when the speed of movable clamp is 50-100 mm/min.

At a temperature of $20 \pm 2^\circ\text{C}$, samples are stretched till the elongation is 6 or 10% (in compliance with Table 5). Here, value of tensile force is fixed in newtons.

Distance between clamps of tearing machine should be 200 mm.

Mean of ten values of load for obtaining fixed (normalized) elongation of varnished cloth and maximum value of load for any sample should be within the limits of norms specified in item 2.11.

4.13.2 Breakdown voltage in state of tension (item 2.11) is determined on two samples with a width of 40 ± 5 and a length of 400 ± 1 mm which are cut at an angle of $43-45^\circ$ to the base in two mutually perpendicular directions (with one sample in every direction).



Scale for determining the
(value of) tension.

- 1. Clamp
- 2. Electrode device (device with electrode)
- 3. Test samples
- 4. Fixture for measuring tension (scale)
- 5. Frame of the instrument
- 6. Tension rod.

Samples are placed in a special device (see the drawing) and straightened out at a temperature of $20^{\circ} \pm 2^{\circ}\text{C}$ upto 6 or 10% (in compliance with Table 5).

For samples in stretched state device with electrode is placed as per GOST 433.3-71 and breakdown voltage is determined at the electrodes with a diameter of 6mm in compliance with the method of item 4.2 at five points on every sample.

Mean of item readings of breakdown voltage of varnished cloth in state of tension or two samples should conform to that specified in Table 5.

5. MARKING, PACKING, TRANSPORTATION AND STORAGE

5.1 On every roll, on the cover of packaging paper a certificate on which the following are specified is pasted:

Trade mark of the manufacturer;

Roll number;

Date of manufacture;

Nominal thickness of varnished cloth in mm;

Width of the roll and roller in mm;

Number of meters of varnished cloth in a roll or weight of varnished cloth in kgs. when supplied to rollers;

Designation of present standard;

Stamp of technical control of the manufacturer;

Batch No.;

Imprint of quality mark as per GOST 1.9-67 for

varnished cloth to which the quality mark is attributed in the specified order;

- 5.2 Marking of the boxes should be carried out as per GOST 14192-77 with application of following additional designations:

Conventional designation of varnished cloth;

Gross weight and net weight in kgs;

Box number;

Imprint of quality mark as per GOST 1,9-67 for x varnished cloth; to which the quality mark is attributed in the specified order.

- 5.3 Varnished cloth of all grades should be supplied in rolls coiled on hard sleeve with internal diameter of 42-50mm.

Every roll of varnished cloth should be wrapped in a moisture resistant paper as per GOST 515-77, GOST 9569-79 or as per GOST 8828-75 on top with a paper as per GOST 645-79 or as per GOST 8273-75.

Varnished cloth may be packed by other method not decreasing its preservation during transportation.

As per agreement of the manufacturer with the customer it is allowed to supply varnished cloth of all grades to the rollers, cut in the direction of main threads, in this case, width, external and internal diameters of the roller, and also the length and number of pieces of varnished cloth in the roller are specified in the order.

5.4 Varnished cloth should be transported by any type of transport under conditions providing its protection against the effects of atmospheric precipitation.

Rolls of varnished cloth are transported in containers or per two in plywood as per GOST 5959-71 or plank boxes as per GOST 2991-76 or lathwork as per GOST 12082-77. In this case, the rolls should be fastened in such a way that friction between one and another and against the wall of the container box or lath work.

Depending on the dimensions of rolls of varnished cloth, dimensions of boxes or lath work are set (fixed).

Gross weight of the box should not exceed 80kg, other type of containers which do not lower (affect) the preservation of varnished cloth may be used.

5.5 Varnished cloth packed into rolls should be stored in closed heated chamber on shelves, racks or stands which are at least 10cm, above the floor, not touching the heating system. Rolls are stacked, not more than five rows, one above the other.

During storage of varnished cloth, relative humidity should not exceed 80%.

6 . MANUFACTURER'S GUARANTY

6.1 Manufacturer guarantees the compliance of varnished cloth with the requirements of present standard while

the storage conditions are observed by the consumer

6.2 Guaranteed storage life of varnished cloth is 6 months from the day of manufacture.

If varnished cloth is not used during the guaranty period, it may used only after it is tested for its compliance to with the requirements of present standard.

Reference appendix

Mean weight of 1m² of varnished cloth

Grade of varnished cloth	Nominal thickness mm	Weight of 1m ² , kg.
AUMC-105	0.04	0.040
	0.05	0.050
	0.06	0.070
AXM-105	0.08	0.090
AXM-105; AUMC-105; AKM-105; AKMC-105	0.10	0.115
	0.12	0.130
AXM-105; AUMC-105; AKM-105; AKMC-105	0.15	0.160
	AXM-105	0.15
AXM-105; AXMC-105; AXMM-105; AXB-105	0.17	0.195
	0.20	0.250
AXM-105; AXMM-105 AXB-105	0.24	0.285
	AXM-105	0.30