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GOST : 5639-79

TITLE : PHENOLIC MOULDING RESINS

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DATE : MAY 1985

Phenolic resins (Platics). A large group of plastics made from a phenol (phenol, 3-cresol, 4-cresol, catechol, resorcinol, or quinol) and an aldehyde (methanal, ethanal, benzaldehyde, or furfuraldehyde). An acid catalyst produces a soluble and fusible resin (modified resin) used in varnishes and lacquers; while an alkaline catalyst results in the formation, after moulding, of an insoluble and infusible resin. Phenolics may be moulded, laminated, or cast.

Thermoreactive, more correctly, thermosetting compositions. Compositions in which a chemical reaction takes place while they are being moulded under heat and pressure; theappearance and chemical and physical properties are entirely changed, and the product is resistant to further applications of heat (up to charring point), e.g., phenol formaldehyde, urea formaldehyde, aniline formaldehyde, glycerol-phthalic anhydride.

Aldehyde resins (Plastics). Highly polymerized resinous condensation products of aldehydes, obtained by treatment of aldehydes with strong caustic soda.

C.D.S.N.T.

UDC 678.632.024:006.354 Group A 27 (L27)

USSR STATE STANDARD

Phenolic Moulding Resins Specifications	GOST 5689-79 This supersedes GOST 5.1958-76 and GOST 5689-73
Valid upto 01.01.1985	

The present standard relates to thermoreactive phenolic moulding resins (phenoplasts) obtained by comined processing of phenolaldehyde resins or their modifications, fillers, colouring substances and other additives.

Phenolic resins are intended for the manufacture of reinforced and unreinforced parts for engineering purposes, - parts which have to meet increased requirements as to mechanical strength; electrical insulating parts operating under conditions of elevated temperature, humidity, voltage, carrying high frequency currents; low-current and radio equipment, electrical parts for automobiles and tractors, items with increased resistance to humidity and chemical substances; electrical installation items which have to meet increased requirements of resistance to moisture and heat and for other purposes.

1. GRADES

1.1. Phenolic resins are divided into various types, groups and grades as in Table 1, depending on their composition, properties and purposes.

Table 1

Type	Group		Grade	Main filler	Recommended method of processing
General purpose O	Novolak without electrical parameters	02	02-010-02	Organic	Compression moulding and transfer moulding
	Novolak with improved mechanical and electrical parameters	03	03-010-02	Organic	Compression moulding and transfer moulding
	Novolak with high resistance to water	04	04-010-12	-do	-do-
	Novolak with improved mechanical parameters without electrical parameters	05	05-010-02	Organic	Compression moulding and transfer moulding
	Novolak, graphited	08	08-010-72	Organic	CM and TM
	Novolak with average impact strength and electrical parameters	09	09-200-07	Organic	Compression moulding and transfer moulding
	Novolak with average impact strength without electrical parameters	010	010-200-07	Organic	Compression moulding and transfer moulding
	Novolac with increased yield limit and impact strength	028	028-210-02	Organic	Compression moulding and transfer moulding
Special ammonia-free Sp	Resol with electrical parameters	Sp1	Sp1-342-02	Organic	Compression moulding and T.M.
	Resol with out electrical parameters	Sp2	Sp2-342-02	Organic	Compression moulding and T.M.
	Resol with increased mechanical parameters	Sp3	Sp3-342-02	Organic	Compression moulding and T.M.
Electrical Insulating type (E)	Resol with average dielectric strength	E1	E1-340-02	Organic	Compression moulding and T.M.

Table 1 Contd.

Type	Group		Grade	Main filler	Recommended Method of processing
E	Resol emulsion with increased electrical parameters	E2	E2-330-02	Organic	Compression moulding and transfer moulding
	Resol, high frequency with increased electrical parameters and high resistance to water	E3	E3-340-65 E3-340-61	Mineral	Compression moulding [illegible]
					Page 3
	Novolak, high frequency with increased ultimate bending stress, impact strength and high resistance to water	E4	E4-100-30	Mineral	Compression moulding and transfer moulding
	Novolak, high frequency with increased impact strength and high ultimate bending stress and resistance to water	E5	E5-101-30	Mineral	Compression moulding and transfer moulding
	Novolak, high frequency with high dielectric strength and resistance to heat	E6	E6-014-30	Mineral	Compression moulding and transfer moulding
	Resol with increased electrical parameters and high resistance to water	E8	E8-361-63	O & M	Compression moulding and transfer moulding
	Resol, Ammonia-free with improved electrical parameters and resistance to water	E9	E9-342-73	O & M	Compression moulding and transfer moulding

Table 1 Contd.

Type	Group		Grade	Main filler	Recommended Methods of processing
E	Resol, Ammonia-free with high resistant to water and increased electrical parameters	E10	E10-342-63	O & M	Compression moulding and transfer moulding
	Resol, Ammonia-free with high resistance to water and increased electrical parameters and resistance to heat	E11	E11-342-63	O & M	Compression moulding
	Novolak with improved electrical parameters	E15	E15-121-02	Organic	Compression moulding and T.M.
Moisture and Chemical resistante Type Bx (Vkh)	Novolak, acid resistant, without electrical parameters	Vkh1	Vkh1-090-34	Mineral	Compression moulding
	Novolak, acid resistant, without electrical parameters	Vkh2	Vkh2-090-68	O & M	Compression moulding
	Novolak, acid resistant, without electrical parameters	Vkh2	Vkh2-090-69	O & M	Compression moulding
Moisture and chemical resistant Type Bx (Vkh)	Novolak water-resistant, with increased mechanical parameters	Vkh3	Vkh3-090-14	Organic	Compression moulding

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Table 1 Contd.

Type	Group		Grade	Main filter	Recommended Methods of processing
	Novolak, water resistant, with high impact strength	VKh4	VKh4-080-34	Mineral	Compression moulding
	Novalak, water resistant, with increased resistant heat and dielectric strength	VKh5	VKh5-010-73	O & M	Compression moulding
	Resol, water and acid resistant without electrical parameters	VKh6	VKh6-342-70	O	Compression moulding
Shock proof Y (U)	Resol with electrical parameters	U1	U1-301-07	O	Compression moulding and transfer moulding
	Resol without electrical parameters	U2	U2-301-07	O	Compression moulding and transfer moulding
	Novolak with high electrical parameters	U4	U4-080-02	O	Compression moulding
+	Resol with high resistance heat and impact strength	U5	U5-301-41	M	Compression moulding
	Resol with high mechanical parameters, increased resistance to heat and water	U5	U5-301-41	M	Compression moulding

Table 1 Contd.

Type	Group		Grade	Main filler	Recommended Methods of processing
Heat resistant ✻ (Zh)	Novolak with increased electrical parameters	Zh1	Zh1-010-40	M	Compression moulding
	Novolak with increased impact strength	Zh2	Zh2-010-60	O & M	Compression moulding
	Novolak with high yield limit and water resistance	Zh3	Zh3-010-62	M	Compression moulding and transfer moulding
	Novolak with high yield parameters and resistance to water	Zh4	Zh4-010-62	O & M	Compression moulding and transfer moulding

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	Novolak with increased mechanical and electrical parameters	Zh5	Zh5-010-78	O & M	Compression moulding and transfer moulding
	Novolak with electrical parameters	Zh6	Zh6-010-60	O & M	Compression moulding

1.2. GOST 15963-70 specifies the grade of phenolic resins which are intended for operation in regions with tropical climate.

1.3. Designation of the grade for phenolic resins consists of the nomenclature of the material "Phenoplast" (Phenolic resin) designation of the group, the resin, the filler and colour (if necessary), in accordance with the All Union Classification of Industrial Products (OKP).

EXAMPLE OF CONVENTIONAL DESIGNATION of phenolic resin group Zh1, black, made out of phenol novolak resin 010, with asbestos as filler 40:

Phenoplast Zh1-010-40- black GOST 5689-79.

(✻)

2. TECHNICAL REQUIREMENTS

2.1. Phenolic resins must be manufactured in conformity with the requirements of this standard and to production regulations approved in the established manner.

2.2. Phenolic resins are produced in the form of non-compacting powders. Phenolic resins of groups U1, U2, U3 and U6 are produced in the form of fibrous masses.

2.3. Phenolic resins must conform to the requirements and norms set out in Table 2.

2.4. Quality parameters of phenolic resins useful as reference data are listed in the annexure to this standard.

2.5. Phenolic resins of the ypes O (groups 02 to 05, 08 and 028), Sp, E, Vkh, Zh and group U4 must lend themselves to preforming on standard preforming machines whereas those of groups 09, 010, U1, U2, U5 and U6 are to be preformed on hydraulic presses.

2.6. When phenolic resins are processed into various articles, they must not adhere to the forming surfaces of the die which are chromium plated and polished to a surface finish Ra ranging from 0.160 to 0.125 micron as per GOST 2789-73.

Table 2

Parameter	Norm for grades						
	02-010-02	03-010-02	04-010-12	05-010-02	08-010-72	09-200-07	010-200-07
1	2	3	4	5	6	7	8
1. Colour	Coloured, single-tone, (red, green, yellow etc.) or multi-coloured	Black	Black	Coloured, single-tone, (red, green, yellow etc.) or multi-coloured	Black	Black or other colour with different shades	
2. Yield, mm	120-190	110-190	100-180	90-190	120-190	120-200	140-200
3. Impact strength measured on unnotched specimens, kJ/m^2 ($kgf.cm/cm^2$), minimum	4.9(5.0)	5.9(6.0)	5.9(6.0)	5.9(6.0)	5.9(6.0)	4.9(5.0)	4.9(5.0)
4. Ultimate bending stress, MPa (kgf/cm^2), minimum	63.7(650)	69.0(700)	69.0(700)	69.0(700)	69.0(700)	58.8(600)	62.7(640)
5. Marters heat stability, °C, minimum	125	130	140	130	135	130	130
6. Water absorption, mg, maximum	55	55	30	55	45	40	40

Table 2 Contd.

Parameter	Norm for grades						
	02-010-02	03-010-02	04-010-12	05-010-02	08-010-72	09-200-07	010-200-07
7. Surface resistivity, ohm, minimum	--	1.10^{12}	5.10^{12}	--	--	1.10^{12}	--
8. Volume resistivity, ohm. cm, minimum	--	1.10^{11}	5.10^{11}	--	--	1.10^{11}	--
9. Diclectric strength, kV/mm,	--	13.0	14.5	--	--	13.0	--
10. Dissipation factor at 50 Hz, maximum	--	--	--	--	--	--	--
11. Dissipation factor at 10^6 Hz, maximum	--	--	--	--	--	--	--
12. Moisture and volatile substances content by weight, %, maximum	--	--	--	--	--	3.0-6.0	3.0-6.5
13. Retention time, seconds, maximum	80	70	--	80	--	--	--

Table 2 Contd.

Parameter	Norm for grades						
	02-010-02	03-010-02	04-010-12	05-010-02	08-010-72	09-200-07	010-200-07
14. Residue after filtering, %, maximum, in a sieve with mesh size ...,							
No. 1.25K	--	--	--	--	5.0	--	--
No. 1K	--	--	--	--	--	--	--
No. 08K	--	--	--	--	--	--	--
15. Shrinkage, %	0.4-0.8	0.4-0.8	0.4-0.8	0.4-0.8	0.5-0.7	0.5-0.8	0.5-0.8
16. Density, g/c.c., minimum	1.45	1.40	1.40	1.40	1.40	1.40	1.40
17. Bulk density, g/c.c., minimum	0.50	0.50-0.80	0.50	0.50	0.50	0.50	0.50

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Parameters	Norm for grades						
	028-210-02	Sp1-342-02	Sp2-342-02	Sp3-342-02	E1-340-02	E2-330-02	E3-340-65 E2-340-61
1. Colour	Black	Brown or other colour with different shades					from yellow to dark green with different shade
2. Yield, mm	150-190	100-190	100-190	90-190	100-180	100-180	100-190
3. Impact strength measured on unnotched specimens, kJ/m^2 ($kgf.cm/cm^2$), minimum	6.4(6.5)	4.9(5.0)	4.9(5.0)	5.4(5.5)	4.9(5.0)	4.9(5.0)	3.4(3.5)
4. Ultimate bending stress, MPa (kgf/cm^2), minimum	69.0(700)	58.8(600)	58.8(600)	58.8(600)	58.8(600)	63.7(650)	49.0(500)
5. Martens heat stability, °C minimum	--	130	130	130	125	125	150
6. Water absorption, mg, maximum	--	55	55	55	55	45	9
7. Surface resistivity, ohm, minimum	--	1.10^{13}	--	5.10^{13}	5.10^{13}	5.10^{13}	1.10^{14}

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Table 2 Contd.

Parameter	Norm for grades						
	028-210-02	Sp 1-342-02	Sp 2-342-02	Sp 3-342-02	E1-340-02	E2-330-02	E3-340-65 E3-340-61
8. Volume resistivity, ohm. cm, minimum	—	5.10^{12}	—	5.10^{12}	5.10^{12}	5.10^{12}	1.10^{14}
9. Dielectric strength, kV/mm, minimum	—	12.5	—	13.0	13.0	16.0	15.0
10. Dissipation factor at 50 Hz, maximum	—	—	—	0.08	0.08	0.08	—
11. Dissipation Factor at 10^5 Hz, maximum	—	—	—	—	—	—	0.010
12. Moisture and volatile substances content by weight, %, maximum	3.5-5.5	45	—	—	—	8.0	—
13. Rentention time, seconds, maximum	80	—	—	—	—	—	—

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Table 2 Contd.

Parameter	Norm for grades						
	C28-210-02	Sp 1-342-02	Sp 2-342-02	Sp 3-342-02	E1-340-02	E2-330-02	E3-340-65 E3-340-61
14. Residue after filtering, %, maximum in a sieve with mesh size ...,							
No. 1.25K	3.0	--	--	--	--	--	--
No. 1K	--	--	--	--	--	--	--
No. 08K	--	--	--	--	--	--	--
15. Shrinkage, %	0.5-0.7	0.4-0.8	0.4-0.8	0.5-0.9	0.5-0.9	0.4-0.8	0.4-0.7
16. Density, g/c.c. minimum	1.40	1.40	1.40	1.40	1.40	1.40	1.95
17. Bulk density, g/c.c., minimum	0.50	0.50	0.50	0.50	0.50	0.30	0.90

Table 2 Contd.

Parameter	Norm for grades						
	E4-100-30	E5-101-30	E6-014-30	E8-361-63	E9-342-73	E10-342-63	E11-342-63
1. Colour	from yellow to dark green with different shades		from yellow to dark green or any other colour with different shades	from yellow to dark green with different shades	from yellow to dark green or any other colour with different shades		Black with different shades
2. Yield, mm	120-190	120-190	130-200	120-180	100-180	100-180	100-180
3. Impact strength measured on unnotched specimens, kJ/m^2 ($kgf.cm/cm^2$) minimum	5.4(5.5)	5.9(6.0)	5.4(5.5)	4.4(4.5)	4.4(4.5)	4.4(4.5)	4.9(5.0)
4. Ultimate bending stress MPa(kgf/cm^2), minimum	88.2(900)	95.1(970)	93.1(950)	53.9(550)	53.9(550)	53.9(550)	53.9(550)
5. Martens heat stability, °C minimum	125	140	250	140	135	135	140
6. Water absorption, mg, maximum	10	10	25	20	35	20	20

Table 2 Contd.

Parameter	Norm for grades						
	E4-100-30	E5-101-30	E6-014-30	E8-361-63	E9-342-73	E10-342-63	E11-342-63
7. Surface resistivity, ohm, minimum	2.10^{14}	1.10^{14}	1.10^{14}	5.10^{13}	1.10^{13}	1.10^{13}	1.10^{13}
8. Volume resistivity, ohm. cm, minimum	1.10^{14}	1.10^{13}	1.10^{13}	1.10^{13}	5.10^{12}	5.10^{12}	5.10^{12}
9. Dielectric strength, kV/mm, minimum	16.0	16.0	18.0	15.0	14.0	14.0	14.0
10. Dissipation factor at 50 Hz, maximum	--	--	--	0.09	0.08	0.09	0.08
11. Dissipation factor at 10^6 Hz, maximum	0.010	0.010	0.012	--	--	--	--
12. Moisture and volatile substances content by weight, %, maximum	--	--	--	--	--	--	--

Table 2 Contd.

Parameter	Norm for grades						
	E4-100-30	E5-101-30	E6-014-30	E8-361-63	E9-342-73	E10-342-63	E11-342-63
13. Rentention time, seconds, maximum	--	--	--	--	--	--	--
14. Residue after filtering,%, maximum, in a sieve with mesh size ...,							
No. 1.25K	--	--	--	--	--	--	--
No. 1K	0.5	--	5.0	--	--	--	--
No. 08K	--	Absent	--	--	--	--	--
15. Shrinkage,%	0.4-0.7	0.6-0.6	0.4-0.6	0.4-0.7	0.4-0.6	0.4-0.6	0.6-0.7
16. Density, g/c.c. minimum	1.90	2.00	1.85	1.85	1.85	1.85	1.85
17. Bulk density, g/c.c. minimum	0.50	0.50	--	0.80	0.80	0.80	0.80

Table 2 Contd.

Parameter	Norm for grades						
	E15-121-02	Vkh1-090-34	Vkh2-090-69 Vkh2-090-68	Vkh3-090-14	Vkh4-080-34	Vkh5-010-73	Vkh6-342-70
1. Colour	Black	from yellow to brown, single shade	Black with different shades	from dark green to black with different shades	Black with different shades		from light brown to brown with different shades
2. Yield, mm	120-195	100-190	100-190	90-180	130-195	110-190	100-190
3. Impact strength measured on unnotched specimens, kJ/m^2 (kgf/cm^2), minimum	5.4(5.5)	4.4(4.5)	4.4(4.5)	5.9(6.0)	7.8(8.0)	4.4(4.5)	4.9(5.0)
4. Ultimate bending stress, MPa (kgf/cm^2), minimum	63.7(650)	58.8(600)	53.9(550)	58.8(600)	34.3(350)	53.9(550)	54.9(560)
5. Martens heat stability, °C, minimum	140	125	125	125	120	140	130
6. Water absorption, mg, maximum	45	15	20	15	20	25	20

Table 2 Contd.

Parameter	Norm for grades						
	E15-121-02	Vkh1-090-34	Vkh2-090-69 Vkh2-090-68	Vkh3-090-14	Vkh4-080-34	Vkh5-010-73	Vkh6-342-70
7. Surface resistivity, ohm, minimum	5.10^{13}	--	--	--	1.10^{12}	1.10^{12}	--
8. Volume resistivity, ohm. cm, minimum	2.10^{12}	--	--	--	1.10^{11}	1.10^{11}	--
9. Dielectric strength, kV/mm,	15.0	--	--	--	13.0	15.0	--
10. Dissipation factor at 50 Hz, maximum	0.08	--	--	--	--	--	--
11. Dissipation factor at 10^6 Hz, maximum	--	--	--	--	--	--	--
12. Moisture and volatile substances content by weight, %, maximum	--	--	--	--	--	--	--
13. Retention time, seconds, maximum	--	--	--	--	--	--	--

Table 2 Contd.

Parameter	Norm for grades						
	B15-121-02	Vkh1-090-34	Vkh2-090-69 Vkh2-090-68	Vkh3-090-14	Vkh4-080-34	Vkh5-110-73	Vkh6-342-70
14. Residue after filtering %, maximum in a sieve with mesh size ..,							
No. 1.25K	--	--	--	--	--	--	--
No. 1K	--	--	--	--	--	--	--
No. 08K	--	--	--	--	--	--	--
15. Shrinkage,%	0.4-0.8	0.4-0.8	0.4-0.8	0.4-0.8	0.3-0.9	0.3-0.7	0.6-1.0
16. Density, g/c.c., minimum	1.40	1.60	1.60	1.60	1.70	1.70	1.40
17. Bulk density g/c.c., minimum	--	0.75	0.65	0.75	0.80	0.80	0.30

Table 2

Parameter	Norm for grades						
	U1-301-07	U2-301-07	U4-080-02	U5-301-41	U6-301-41	Zh1-010-40	Zh2-010-60
1	2	3	4	5	6	7	8
1. Colour	From light brown to dark brown with different shades		Black with different shades	From light brown to dark brown with different shades		Black with different shades	
2. Yield, mm	40-140	40-140	130-190	not less than 100	110-200	100-100	130-200
3. Impact strength measured on unnotched specimens, kJ/m^2 ($kgf.cm/cm^2$) minimum	8.8(9,0)	8.8(9.0)	8.8(9,0)	19,6(20.0)	21.6(22.0)	2,9(3.0)	3.9(4.0)
4. Ultimate bending strees, MPa (kgf/cm^2), minimum	78.4(800)	78.4(800)	39.2(400)	83.4(850)	83.4(850)	44.1(450)	53.9(550)
5. Martens heat stability, C, minimum	160	140	130	200	200	145	150
6. Water absorption mg, maximum	70	70	65	200	150	20	25

Parameter	Norm for grades						
	U1-301-07	U2-301-07	U4-080-02	U5-301-41	U6-301-41	Zh1-010-40	Zh2-010-60
7. Surface resistivity, ohm, minimum	1.10^{10}	--	1.10^{12}	1.10^{10}	1.10^{10}	1.10^{12}	--
8. Volume resistivity, ohm, cm, minimum	1.10^{9}	--	1.10^{11}	1.10^{10}	1.10^{10}	5.10^{11}	1.10^{11}
9. Dielectric strength, KV/mm,	5.0	--	10.0	2.0	2.5	--	--
10. Dissipation factor at 50 Hz, maximum	--	--	--	--	--	--	--
11. Dissipation factor at 10^{6} Hz, maximum	--	--	--	--	--	--	--
12. Moisture and volatile substances content by weight, %, maximum	9.0	--	--	--	--	--	--
13. Retention time, seconds, maximum	--	--	--	--	--	--	--

Table 2 Contd.

Parameter	Norm for grades						
	U1-301-07	U2-301-07	U4-080-02	U5-301-41	U6-301-41	Zh1-010-40	Zh2-010-60
14. Residue after filtering, %, maximum, in a sieve with mesh size ....,							
No. 1.25K	--	--	--	--	--	--	--
No. 1K	--	--	--	--	--	--	--
No. 08K	--	--	--	--	--	--	--
15. Shrinkage, %	0,3-0,5	0.3-0.6	0.4-08	0.1-03	0.1-03	0.2-0.8	0.2-0.5
16. Density, g/c.c., minimum	1.45	1.45	1.50	1.95	1.95	1.90	1.70
17. Bulk density, g/c.c., minimum	0.16	0.60	0.60	--	--	0.80	0.70-1.00

Parameter	Norm for grades				Method of testing
	Zh3-010-62	Zh4-010-62	Zh5-010-78	Zh6-010-60	
1. Colour	Black with different shades		Black	Black with different shades	As per clause 5.5
2. Yield, mm	160-200	160-200	150-195	130-200	As per clause 5.6
3. Impact strength measured on unnotched specimens, kJ/m^2 (kgf/cm^2), minimum	3.4(3.5)	3.4(3.5)	3.9(4.0)	3.4(3.5)	As per GOST 4647-69 and clause 5.7 of this standard.
4. Ultimate bending stress, MPa (kgf/cm^2), minimum	53.9(550)	53.9(550)	58.8(600)	49.0(500)	As per GOST 4648-71 and clause 5.8 of this standard.
5. Martens heat stability °C, minimum	140	140	150	140	As per GOST 21341-75
6. Water absorption, mg, maximum	10	10	22	35	As per GOST 4650-73 and clause 5.9 of this standard.
7. Surface resistivity, ohm, minimum	--	--	1.10^{12}	1.10^{12}	As per GOST 6433.2-71 and clause 5.10 of this standard.
8. Volume resistivity, ohm. cm, minimum	--	--	1.10^{11}	1.10^{11}	- Do -

Table 2 Contd.

Parameter	Norm for grades				Method of testing
	Zh3-010-62	Zh4-010-62	Zh5-010-78	Zh6-010-60	
9. Dielectric strength, kV/mm, minimum	11.0	11.0	13.0	12.0	As per GOST 6433.3-71 and clause 5.10 of this standard.
10. Dissipation factor at 50 Hz, maximum	--	--	--	--	As per GOST 6433.4-71 and clause 5.10 of this standard.
11. Dissipation factor at 10^6 Hz, maximum	--	--	--	--	As per GOST 22372-77 and clause 5.10 of this standard.
12. Moisture and volatile substances content by weight, %, maximum	--	--	--	--	As per clause 5.11
13. Retention time, seconds, maximum	--	--	--	--	As per clause 5.12
14. Residue after filtering %, maximum in a sieve with mesh size ...					As per clause 5.13
No. 1.25K	--	5.0	--	--	
No. 1K	--	--	--	--	
No. 08K	--	--	--	--	
15. Shrinkage, %	0.2-0.7	0.3-0.7	0.3-0.5	0.2-0.7	As per GOST 18616-73 and clause 5.14 of this standard.
16. Density, g/c.c. minimum	1.85	1.85	1.70	1.75	As per GOST 15139-69 and clause 5.15 of this standard.

Table 2 Contd.

Parameter	Norm for grades				Method of testing
	Zh3-010-62	Zh4-010-62	Zh5-010-78	Zh6-010-60	
17. Bulk density g/c.c., minimum	0.80	0.80	0.70	0.70	As per GOST 11035-64

Note :

1. Phenolic resins are supplied at customer's request, with yield parameters specified within the norms indicated in the Table with a tolerance of ± 20 mm.
2. Phenolic resins may be manufactured with the following yield parameters for different groups with the customer's concurrence:

groups E1, E9, E10, E11, Vkh1, Vkh2, Vkh6 and Zh1 - yield 90 to 100 mm;

groups 03-90-110 ; 02-90-120 mm and 010 - yield 90 to 140 mm;

3. Phenolic resins may be made to the following colours with customer's concurrence :

grade Vkh1-090-34 - black with different shades;

grade Vkh5-010-73 - red.

2.7. Phenolic resins must be free from extraneous impurities and contaminations. Impurities, permitted in the raw materials by the corresponding standards and technica documentation are ignored.

2.8. Test specimens must have bright, smooth surface free from bulgings, cracks, peeling, cavities and filler projections. The test specimens must correspond to master specimens approved in the established manner, in respect of external appearance and colour.

3. SAFETY REQUIREMENTS

3.1. Phenolic resins belong to class 2 hazared judging by the extent of effect of harmful substances.

3.2. Phenolic resins of all grades are toxic. Free phenol, formaldehyde and dust are liberated when they are processed. Phenol is a strong poison. Inhaling of phenol vapour causes irritation of the upper respiratory tract and prolonged exposure causes general poisoning, weakness and dyspnnea.

Flash point of phenol is 75°C. Its temperature of spontaneous combustion is 595°C. Its explosive limits of temperature are: lower 48°C and upper 83°C. Its combustion range is 0.3 to 2.4% (by volume)

Maximum permissible concentration of phenol vapour in air in the working zone of production premises is 0.3 mg/m^3.

Formaldehyde is a protoplasmic pison. It causes acute and chronic poisoning and has a strongly irritating action on the mucous membranes of the eyes and the repiratory tract.

Formaldehyde has a flash point of 4°C, a temperature of spontaneous combustion of 430°C and a combustion range of 7 to 73% (by volume).

Maximum permissible concentration of formaldehyde in air in the working zone of production premises is 0.5 mg/m^3.

Phenolic resin dust causes catarrh of the respiratory tracts and asthma if inhaled.

Maximum permissible concentration of phenolic resin dust in air in the working zone of production premises is 6 mg/m^3.

Production premises must be equipped with technical means for monitoring the condition of the surrounding medium.

The proportion of harmful substances present in air in the working zone of production premises must be monitored.

3.3. Phenolic resins are inflammable materials. The lower limit of combustion of pehnolic resin dust (LLC) (НПВ) (NPV) is 12.6 g/m^3.

Minimum energy for ignition W_{min} for phenolic resins in suspension (aerosol) is 10 mJ; it is 40 mJ for precipitated dust.

The most effective fire-fighting aids are atomized water with a wetting agent, and air-cum-mechanical foam. Page 19.

Compact jets of water must not be used for extinguishing fires. Glowing embers are extinguished with atomized water containing a wetting agent.

3.4. Phenolic resins are handled in premises with effective air changes brought about by plenum and exhaust vetilation systems. Work - places must be equipped with local exhaust devices capable of ensuring that the proportion of vapours of phenolic resins, formaldehye and phenolic resin dust does not exceed the maximum permissible concentration.

3.5. Operators handling phenolic resins must have special dress, special footwear and individual means of protection for the respiratory organs.

4. ACCEPTANCE RULES

4.1. Phenolic resins are accepted in batches. Any quantity of phenolic resin of a single grade and colour accompanied by a single quality certificate constitutes a batch.

4.2. The weight of a batch must conform to the value shown Table 3.

Table 3

Type and group	Batch weight kg, not less than
02, 03, 04, 05	2500
U1, U2	1000
3p, Vkh1, Vkh2, Vkh3, Vkh4, Vkh5	700
08, 09, 010, 028, E, U4, U5, U6, Zh	500
Vkh6,	250

Other batch weights may be adopted with the customer's consent.

4.3. Ten percent of the units of the product, subject to a minimum of three units, are selected from a batch for quality check of phenolic resin.

4.4. Acceptance tests, periodic tests and type tests are carried out in order to check the conformity of phenolic resins with the requirements of this standard.

4.5. Every single batch is subjected to acceptance tests for conformity with the requirements of clauses 2.3 (Table 2, items 1 and 2) and 2.8 and in the case of E11 - 342-63 grade, items 7 to 10 Table 2, in addition, if the customer so desires.

4.6. Periodic tests of phenolic resins are conducted at least once a month for conformity with the requirements of clause 2.3 (Table 2, items 3 to 17).

4.7. If unsatisfactory test results are obtained against even a single parameter, the particular test is repeated on twice the units of the product.

Results of the repeat test are applicable to the whole batch.

4.8. Type tests for conformity with the requirements of clauses

2.2 to 2.8 whenever there has been a change in the technological process of manufacturing phenolic resins or in the constituent components.

5. METHODS OF TESTING

5.1. Samples of phenolic resins in powder from are drawn with a sampler or otherwise and samples of phenolic resins in fibre form are drawn by hand.

5.2. Individual samples, drawn from production units as per clause 4.3 are combined and thoroughly mixed. An average sample weighing not less than 1 kg is taken out of the mixture. This average sample is placed in a clean, dry can with a well-fitting cover or in a packet made of moisture-proof material. A label containing the designations of the manufacturing concern, the grade, the batch number and the date of drawing of the sample is pasted on the can. If a packet is used, the lable is placed inside the packet.

5.3. Test specimens are prepared in accordance with GOST 12015-66 by compression moulding. Phenolic resins are pressed with or without preforming.

The preforms are made under a pressure of 24.4 to 49.0 MPa (250 to 500 kgf/cm^2) so as to eliminate damage while loading them into the moulds. The corresponding pressure for E6-014-30 grade is 19.6 to 24.4 MPa (200 to 250 kgf/cm^2). Recommended shape of preforms is a cylinder of 50 $\pm$ 1 mm diameter.

The press and moulds used, must ensure fluctuation of pressure on the press charge with an error of $\pm$ 10%. The force must be applied at right angles to the wide portion of the specimen.

Moulds must be of the single cavity type. Mutli-cavity dies may be used if they ensure comparable results.

Specimens in the form of bars are formed by pressing out of fibre masses only on single-cavity, collapsible moulds.

The forming surface of the moulds must be chromium plated and polished to a surface finish of Ra from 0.160 to 0.125 micron. The moulds for determining flow must have Ra from 0.080 to 0.063 micron as per GOST 2789-73.

The mould must be equipped with a thermostat for maintaining the moulding temperature within the limits shown in Tables 4 to 7. The temperature of the forming surface of the mould is taken as the moulding temperature.

4. Specimens of particular shapes and sizes must be used for different tests as below. Table 4 lists the parameters of the operating mode in moulding these specimens.

A bar of size (120 ± 2) x (15 ± 0.5) x (10 ± 0.5) mm is used for determining impact strength, specific heat and shrinkage.

A bar of size 80 x (10 ± 0.5) x (4 ± 0.2) mm is used for determining density and ultimate bending strength.

A disc of diameter 50 ± 1 mm and thickness 3 ± 0.2 mm is used for determining water absorption.

Discs of diameter 100 ± 1 mm and thickness 2.8 ± 0.2 mm and diameter 100 ± 1 mm and thickness 3.0 ± 0.2 mm are used for determining colour and external appearance, shrinkage and electrical parameters.

Premoulding before regular compression moulding is permissible.

Table 4.

Group	Grade	Preheating temperature in the thermal chamber, °C	Duration of heating in minutes	Moulding temperature, °C	Moulding time minutes			
					Bars 120x15x10	Bars 80x10x4	Disc 50x3	Discs 100x2.8 and 100x2.0
1	2	3	4	5	6	7	8	9
02	02-010-02	130-150	4-15	185±5	6	6	4	4
03	03-010-02	130-150	4-15	185±5	6	6	4	4
04	04-010-12	130-150	4-15	185±5	6	6	4	4
05	05-010-02	130-150	4-15	185±5	6	6	4	4
08	08-010-72	130-150	4-15	185±5	6	6	4	4
09	09-200-07	130-150	4-15	185±5	6	6	4	4
010	010-200-07	130-150	4-15	185±5	6	6	4	4
020	020-210-02	130-150	4-15	185±5	6	6	-	6
Sp1	Sp1-342-02	130-150	4-15	155±5	10	6	4	4
Sp2	Sp2-342-02	130-150	4-15	155±5	10	6	4	4
Sp3	Sp3-342-02	130-150	4-15	155±5	10	6	4	4
E1	E1-340-02	130-150	4-15	155±5	10	6	4	4
E2	E2-330-02	130-150	4-15	155±5	10	6	4	4
E3	E3-340-65	110-150	4-15	185±5	15	15	7	7
	E3-340-61	110-150	4-15	185±5	15	15	7	7
E4	E4-100-30	130-150	to 20	170±5	20	10	7	7
E5	E5-101-30	130-150	to 20	165±5	20	10	7	7
E6	E6-014-30	150-170	10-18	160±10	10	10	10	10

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Table 4 Contd.

1	2	3	4	5	6	7	8	9
E8	E8-361-63	110-150	4-15	165±5	10	10	7	7
E9	E9-342-73	110-150	4-15	165±5	10	10	7	7
E10	E10-342-63	110-150	4-15	165±5	10	10	7	7
E11	E11-342-63	110-150	4-15	165±5	10	10	7	7
E15	E15-121-02	130-140	4-15	155±5	10	6	4	4
Vkh1	Vkh1-090-34	130-150	4-15	165±5	10	6	4	4
Vkh2	Vkh2-090-69	130-150	4-15	165±5	10	6	4	4
	Vkh2-090-68	130-150	4-15	165±5	10	6	4	4
Vkh3	Vkh3-090-14	130-150	4-15	165±5	10	6	4	4
Vkh4	Vkh4-080-34	120-150	3-20	175±5	10	10	4	4
Vkh5	Vkh5-010-73	110-150	4-15	165±5	10	10	7	7
Vkh6	Vkh6-342-70	130-150	4-15	155±5	10	6	4	4
U1	U1-301-07	60-100	4-20	155±5	6	6	5	5
U2	U2-301-07	60-100	4-20	155±5	6	6	5	5
U4	U4-080-02	120-150	3-20	175±5	10	10	4	4
U5	U5-301-41	80-100	4-20	175±5	15	15	11	11
U6	U6-301-41	80-100	2-20	175±5	15	15	11	11
Zh1	Zh1-010-40	130-150	4-15	155±5	10	10	7	7
Zh2	Zh2-010-60	130-150	4-15	170±5	6	6	4	4
Zh3	Zh3-010-62	110-150	4-15	165±5	20	10	7	7
Zh4	Zh4-010-62	110-150	4-15	165±5	20	10	7	7
Zh5	Zh5-010-78	130-140	4-15	155±5	6	6	4	6
Zh6	Zh6-010-60	130-150	4-15	170±5	6	6	4	4

Note:

The preheating temperature in the thermal chamber must be as follows

for different groups of phenolic resins while preparing discs of diameter 100 ± 1 mm:

110 to 150°C for groups Sp1, Sp2, Vch4 and U4;

130 to 150°C for groups E8, E9, E10, E11, Vkh5, Zh3 and Zh4.

Duration of preheating in the thermal chamber must be 6 to 8 minutes for group E15 and 3 to 4 minutes for Vkh4 and U4.

2. Moulding pressure must be

44.0 ± 4.9 MPa (450 ± 50 kgf/cm^2) - for phenolic resins of groups U1, U2, U5 and U6

29.5 ± 4.9 MPa (300 ± 50 kgf/cm^2) - for all other groups.

3. Phenolic resins of all groups may be preheated in a high frequency installation (B4 Y) (VchU) (HFI) till they become soft. The exceptions are groups E3, E6, Vkh1, Vkh2, Vkh3, U5, U6 and Zh1 in the preparation of discs of diameter 100 ± 1 mm and groups E6, U5 and U6 in the preparation of other specimens.

4. The maximum duration of preheating till specimens free from greyness (raw quality) and inadequate compression are obtained, is determined by trial mouldings. Except for discs for determining colour, external appearance and shrinkage, compression moulded specimens must be heat treated to the following schedule:

Heating upto	180 ± 5°C	.. .. ..6 hours
Holding time at	180 ± 5°C	.. .. ..4 hours
Heating upto	250 ± 5°C	.. .. ..4 hours
Holding time at	250 ± 5°C	.. .. ..10 hours
Cooling in a closed thermal chamber		.. not less than 2 hours

5. Phenolic resins may be moulded with preheating in a thermal chamber for 20 minutes for the purpose of determining electrical parameters.

5.4. The specimens are conditioned for not less than 3 hours at 23 ± 2°C as per GOST 12423-66 before the tests. The interval of time between moulding of the specimens and their testing must be at least 16 hours including conditioning time.

5.5. DETERMINATION OF COLOUR AND EXTERNAL APPEARANCE

Specimens for determining colour and external appearance of phenolic are moulded in the form of

disc of diameter 100 ± 1 mm and thickness 2.0 ± 0.2 mm for group E6 and disc of diameter 100 ± 1 mm and thickness 2.8 ± 0.2 mm for all other groups.

except 02, 03, 05 and 028. Table 4 tests moulding parameters.

Taper cups (drg. 1), are pressed for groups 02, 03, 05 and 028. Table 5 lists moulding parameters. for these cups

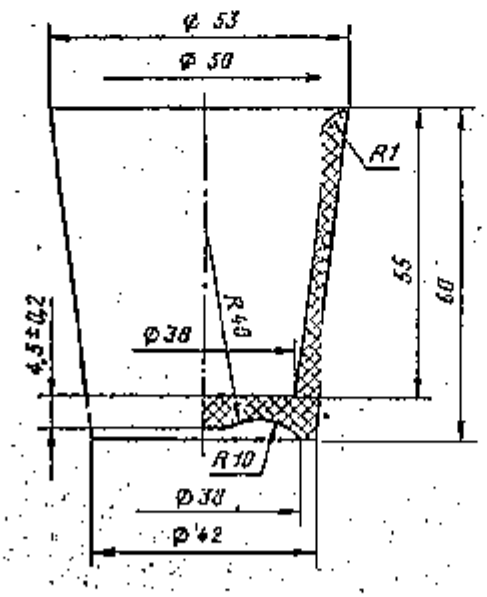


Table 5.

MOULDING PARAMETERS FOR MAKING TAPER CUPS

Moulding parameter	Groups		
	02, 05	03	028
Temperature, °C	185±2	185±2	185±2
Pressure, MPa (kgf/cm^2)	29.5±2.4 (300±25)	29.5±2,4 (300±25)	29.5±2.4 (300±25)
Time, seconds, not more than	60	50	80

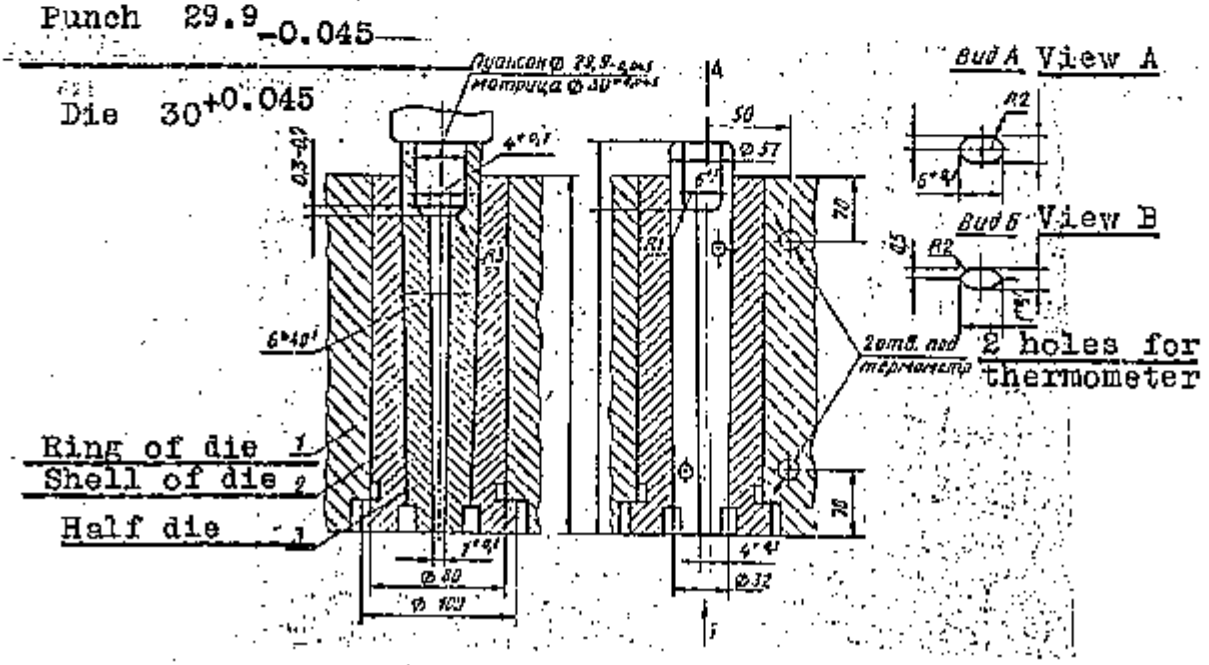
Note : Phenolic resins are subjected to preliminary preheating in a high frequency intallation till they become soft.

The mould specimen is placed under an electrical lamp of 100 W power with an opaque shade. External inspection is carried out visually by comparison with the specimen approved in the established manner.

5.6. FLOW DETERMINATION

5.6.1. PREPARATION FOR THE TEST

Before commencing the test, the mould is first checked to see that there is no misalignment (Drg. 2) by slowly lowering the punch till it takes its final seating. If the mould is properly installed the pressure gauge should indicate no pressure when the punch is lowered.



Drg. 1

The effective power of the press and the required working pressure by pressure gauge are verified on a model dynamometer, at least once in six months or whenever a new pressure gauge is fixed in the hydraulic line.

Flow characteristics of phenolic resins are determined by arranging moulding of a control sample of moulding material whenever a new mould is commissioned or when a mold remains idle for more than 3 hours in the press. It is recommended that 03 group phenolic resin be used for this purpose. Control sample of phenolic resin is prepared by sifting it through a sieve with No. 1.6K or No. 2K mesh as defined in GOST 3584-73 and determining its flow till the length of the moulded rods becomes constant. The arithmetic mean of five parallel determinations, differing from one another by not more than ± 5 mm is taken as the flow parameter of the control sample.

The quantity of control sample is prepared such that it can be used for six months and it is stored in a hermetically sealed container.

5.6.2. TEST PROCEDURE

The mould is loaded with 7.5 g of moulding material (10 g in the case of groups U5 and U6). The rod is moulded in accordance with the parameters shown in Table 6. The moulding material may be preformed. The time interval from the moment of loading phenolic resin into the die till the required peressure reached should not be more than 15 seconds.

Table 6

MOULDING PARAMETERS FOR PREPARING RODS

Moulding Parameter	Group	
	02 to 05; 08 to 0.10; 028; Sp1 to Sp3, E1 to E6; E8 to E11; E15; Vkh1 to Vkh6; U1, J2, U4, Zh1 to Zh6	U5 and U6
Temperature, °C	150±2	170±2
Pressure, MPa (kgf/cm^2)	29.5±2.4 (300±25)	44.0±2.4 (450±25)
Time minutes	3	3

5.6.3. PROCESSING OF RESULTS

The length of the moulded rod upto the boundary of the dense layer of moulding material, expressed in millimeters is taken as the flow.

The arithmetic mean of three parallel determinations, the result of each of which must be within the limits indicated in Table 2 is taken as the test result. Page 27

5.7. Impact strength is determined in accordance with GOST 4647-69 on No.1 type specimens, with a pendulum striking speed of $2.9^{+0.1}_{-0.0}$ metres/second. The speed should be $3.8^{+0.2}_{-0.0}$ m/sec for phenolic resins of groups U5 and J6. Parameters for the preparation of the specimens have been shown in Table 6.

5.8. Ultimate bending stress is determined in accordance with GOST 4648-77 on bars of size $80\times(10\pm0.5)\times(4\pm0.2)$ mm, prepared according to the parameters set out in Table 4.

5.9. Water absorption is determined in accordance with GOST 4650-73 in cold water. Before the test, the specimens may be dried in a drying cabinet at 105 ± 3°C for one hour. The parameters for

the preparation of the specimens are set out in Table 4.

5.10. Surface and volume resistivity, dielectric strength and dissipation factor at 50 Hz are determined in accordance with GOST 6433.2-71 to GOST 6433.4-71 and dissipation factor at 10^6 Hz, in accordance with GOST 22372-77. Discs of diameter 100 ± 1 mm and thickness 2.8 ± 0.2 mm are used for these tests. The thickness of the discs is 2.0 ± 0.2 mm for group E6 phenolic resins. The specimens are conditioned to the 2 hours (20) 65 schedule which is modified to 48 hours (20) 95 for phenolic resins of groups E4 and E5, in accordance with GOST 6433.1-71.

Table 4 shows the operating parameters for moulding the discs. Discs made out of U5 and U6 groups of phenolic resins must be heat treated at 120 to 130°C for 6 hours.

Dielectric permeability is determined by the resonance method in accordance with GOST 22372-77. Capacitance of the specimen is calculated using the formula

$$C_x = (C_2 - C_1 + 0.0695 \frac{d^2}{h},$$

where C_1 and C_2 are the values of capacitance of the measuring condenser with and without the specimen, pf;

d is the diameter of the electrode, cm;

h is the thickness of the specimen, cm.

Surface resistivity and volume resistivity are determined at 1000 V (250 V for groups U5 and U6) Dc. Dissipation factor at 50 Hz is measured at 1000 V AC using electrodes made of aluminium foil:

measuring electrode - of diameter 50 ± 0.2 mm;

high voltage electrode - of diameter not less than 75 mm;

protective ring - of width not less than 10 mm.

The electrodes are pressed to the specimens through a piece of rubber.

Dielectric strength of phenolic resins is determined in transformer oil (GOST 982-68) at 20 ± 5°C using cylinderical brass electrodes. The lower and upper electrodes are of diameter 25 mm in the case of groups E6 and U4. For all other groups the lower electrode is of diameter 75 mm and the upper electrode of diameter 25 mm with 3 mm rounding off radius. Page 28.

The pressure must be increased smoothly.

Surface and volume resistivity and dissipation factor are determined on three specimens and dielectric strength on five specimens.

5.11. DETERMINATION OF PROPORTION OF MOISTURE AND VOLATILE SUBSTANCES BY WEIGHT

5.11.1. APPARATUS AND LABORATORY WARE

Drying cabinet with temperature control, but without forced circulation of air, capable of maintaining 150 ± 5°C.

Glass weighing bottles CH45/13 (SN45/13) to GOST 7148-70 or aluminium ones of the same sizes.

Desiccator to GOST 6371-73.

5.11.2. PREPARATION FOR THE TEST

The drying cabinet is set for a temperature of 150 ± 5°C. The weighing bottles are first washed and dried at this temperature for 15 minutes before samples of phenolic resins are collected in them for tests.

5.11.3. TEST PROCEDURE

About 2 g of phenolic resin is weighed in a weighing bottle with error not exceeding 0.0002 g and is spread uniformly along the bottom of the weighing bottle by shaking it (if fibrous material is used, it is arranged uniformly by hand).

The open weighing bottles and their covers are placed on the shelf of the drying cabinet covered with an asbestos board, no closer than 25 mm to the walls of the cabinet.

The thermometer must be arranged in the cabinet such that its mercury bulb is in contact with the asbestos board.

After 15 minutes (30 minutes for group E2) the weighing bottles are closed with their covers and cooled for 25 to 30 minutes in a desiccator with anhydrous calcium chloride or silicagel and weighed with the same error.

5.11.4. PROCESSING OF RESULTS

The proportion of moisture and volatile substances by weight (X) as a percentage is calculated using the formula

$$X = \frac{(m_1 - m_2)\ 100}{m_1 - m}$$

where m is the weight of the weighing bottle, g;

m_1 is the weight of the weighing bottle with the specimen before drying, g and

m_2 is the weight of the weighing bottle with the specimen after drying, g.

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The arithmetic mean of three parallel determinations, the permissible differences between which should not exceed 0.3%, is taken as the test result.

5.12. DETERMINATION OF HOLDING TIME

In the case of groups 02, 03, 05 and 028, tapered cups (Drg. 1) are moulded without preheating but to the moulding parameters shown in Table 7.

Table 7.

MOULDING PARAMETERS FOR PREPARATION OF TAPER CUPS

Moulding parameter	Groups	
	02, 05 and 028	03
Temperature, °C	163±2	163±2
Pressure, MPa (kgf/cm^2)	29.5±2.4 (300±25)	29.5±2.4 (300±25)
Time, minutes	80	70

A block of phenolic resin weighing 28 to 32 g is moulded in the form of a cylinder of diameter 50 mm at a moulding pressure of 24.4 to 39.2 MPa (250 to 400 kgf/cm^2).

The time interval from the completion of loading the phenolic resin into the mould to complete closing of the die is 10 ± 5 seconds.

The minimum time in seconds, required for obtaining three successively moulded specimens without bulging at the bottom of the of the taper cup, is taken as the test result.

5.13. DETERMINATION OF RESIDUE LEFT AFTER SIFTING ON A SIEVE WITH MESH No. 1.25K, 1K and 08K.

5.13.1. APPARATUS

Sieve analyser with electric motor and reduction gear, with sifting speed of 300 rpm, and 180 strokes per minute on the cover.

Sieves with metallic meshes No. 1.25K, 1K and 08K conforming to GOST 3584-73.

5.13.2. TEST PROCEDURE

One hundred grams of phenolic resin are weighed with error not exceeding 0.1 g and sifted for 30 minutes through sieves with meshes No. 1.25K, 1K and 08K. The residue on each mesh is weighed with the same accuracy.

5.14. Shrinkage is determined in accordance with GOST 18616-73, upto 01.01.1982, on discs of diameter 100 ± 1 mm, thickness 2.8 ± 0.2 mm (thickness 4.0 ± 0.2 mm for E6 group with the same diameter). Beyond 01.01.1982 the specimens for this test must be bars of size (120 ± 2) x (15 ± 0.5) x (10 ± 0.5) mm. Table 4 shows the moulding parameters for the preparation of specimens.

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5.15. Density is determined in accordance with GOST 15139-69 by hydrostatically weighing bars of size 80x(10 ± 0.5) x (4 ± 0.2) mm. Table 4 shows the mouding parmeters for the preparation of these specimens.

6. PACKING, MARKING, TRANSPORT AND STORAGE

6.1. Phenolic resins of groups Sp1, Sp2, Sp3, E2, E3, E4, E5, E6, E8, E10, E11, Vkh4, Vkh5 and U4 are packed in four-ply paper bags to GOST 2226-75 with polyethylene or other moisture-proof coating or in three-ply paper bags inserted into bags made of moisture-proof material and in polyethylene bags to GOST 17811-72.

Phenolic resins of groups U1, U2, U5 and U6 are packed in bags made out of moisture-proof material.

Phenolic resins of the remaining groups are packed in four-ply or five-ply paper bags to GOST 2226-75.

Phenolic resins may be packed in soft containers to GOST 21045-75.

Net weight must not exceed 30 kg when packed in a bag. Net weight when packed in containers depends on the type of container.

6.2. Bags are marked in accordance with GOST 14192-77 indicating the following particulars:

manufacturer's name and trade mark;

designation of group of phenolic resin;

net weight;

batch weight;

date of manufacture and

designation of the present standard.

6.3. Each batch of phenolic resin is registered in a document attesting its quality and containing the following particulars:

manufacturer's name and trade mark;

designation of group of phenolic resin;

batch number;

net weight;

date of manufacture;

results of tests conducted and attestation of conformity with the requirements of the present standard and

designation of the present standard.

6.4. Phenolic resins, packed in bags, may be transported by all means of covered transport and those packed in soft containers - in semicovered wagons in accordance with the rules of carriage in force for the particular form of transport.

6.5. Containers and packing for phenolic resins being sent to the Far North must conform to GOST 15846-70.

Phenolic resins packed in bags may be carried by river transport only if the bags are further packed in containers. Phenol resins in the form of briquettes may be carried by river transport.

6.6. Phenolic resins are stored in dry, enclosed premises at temperatures not exceeding 25°C, separated at least one metre away from heating devices.

7. MANUFACTURER'S GUARANTEE

7.1. The manufacturer must guarantee conformity of phenolic resins with the requirements of the present standard provided the storage and transport conditions specified by this standard are observed.

7.2. Guaranteed shelf life for phenolic resins is 8 months from date of manufacture, except for those of groups U1 and U2 for which it is 6 months and for those groups U5 and U6 for which it is 3 months.

After the lapse of the guaranteed shelf life and before use, phenolic resin must be checked for conformity with the requirements of the present standard.

ANNEXURE

For reference

Parameters	Norm for grades			
	02-010-02	03-010-02	08-010-72	09-200-07 010-200-07
1. Compacting factor	2.8	2.8	2.8	--
2. Specific volume, ml/g, maximum	2.2	2.2	--	--
3. Impact strength on notched specimens, kJ/m^2 (kgf, cm/cm^2)	2.16 (2.2)	1.96 (2.0)	1.7 (1.8)	2.45 (2.5)
4. Ultimate compression stress, MPa (kgf/cm^2)	157 (1600)	157 (1600)	235-255 (2400-2600)	186-196 (1900-2000)
5. Ultimate tensile stress, MPa (kgf/cm^2)	34.3 (350)	36.8 (375)	46.1-51.0 (470-520)	24.5-33.3 (250-340)
6. Ultimate bending stress after exposure to sulphuric acid, MPa, (kgf/cm^2)	--	--	--	--
7. Relative elongation at rupture, %	0.6-0.8	0.6-0.8	2.0-2.6	0.5-0.9
8. Modulus of elasticity on bending, MPa (kgf/cm^2)	$(6,9\text{-}7.8).10^3$ $(70\text{-}80).10^3$	$(7.4\text{-}7.8).10^3$ $(75\text{-}80).10^3$	$5.9.10^3$ 60.10^3	$(5.9\text{-}6.9).10^3$ $(60\text{-}70).10^3$
9. Hardness, MPa (kgf/cm^2)	245-294 (2500-3000)	245-294 (2500-3000)	294 (3000)	294 (3000)
10. Coefficient of friction	-	0.410-0.420	0.330-0.340	0.390-0.400

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ANNEXURE
For reference

Parameters	Norm for grades			
	02-010-02	03-010-02	08-010-72	09-200-07 010-200-07
11. Wear (against steel)	-	5-6	1-5	2-5
12. Surface resistivity, ohms	1.10^{12}	-	$(4-15).10^{13}$	-
13. Volume resistivity, ohm. cm	1.10^{11}	-	$(7-13).10^{12}$	-
14. Dielectric strength, kV/mm	10	-	11-13	-
15. Dissipation factor at 50 Hz	0.1-0.7	0.1-0.7	0.01-0.07	0.1-0.5
16. Dissipation factor at 10^6 Hz	0.03-0.05	0.2-0.3	0.03-0.04	0.05-0.06
17. Dielectric permeability at 50 Hz	6.0-9.0	6.0-9.0	6.0-7.0	7.0-9.0
18. Dielectric permeability at 10^6 Hz	5.0-6.0	4.5-8.0	4.0-5.0	4.0-5.0
19. Resistance to intense heating	3	3	3	3
20. Resistance to oil after 24 hours, %	0.03	0.03	-	0.03
21. Resistance to benzine after 24 hours, %	0.05	0.05	-	0.02
22. Acid resistance, %	-	-	-	-
23. Brittle point in bending, °C	-60	-60	-	-
24. Specific heat, J/kg.K (kcal/kg.degree) at 20 to 30°C	1340-1382 (0.32-0.33)	1340-1382 (0.32-0.33)	-	1465-1500 (0.35-0.36)
25. Thermal conductivity W/m.K (kcal/m.h. degree) at 20 to 30°C	0.21-0.23 (0.18-0.20)	0.21-0.23 (0.18-0.20)	-	0.23 (0.20)

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ANNEXURE
For reference

Parameters	Norm for grades			
	02-010-02	03-010-02	08-010-72	09-200-07 010-200-07
26. Coefficient of linear thermal expansion, 1/degree., at 30 to 150°C	$(4.5-5.3).10^{-5}$	$(4.6-5.3).10^{-5}$	-	$(2.3-3.1).10^{-5}$
27. Thermal diffusivity, at 20 to 25°C, m^2/s	-	$0.20.10^{-6}$	-	$0.20.10^{-6}$
28. Operating temperature, °C	-	From -50 to +110	-	-
29. Duration of viscous-flow state, seconds				
at 120°C	-	250-450	250-360	250
at 170°C	-	25-40	30-40	30
30. Coefficient of viscosity at 120°C, Pa.s (P)		$(8-20).10^6$ $(80-200).10^6$	$(6-15).10^6$ $(60-150).10^6$	12.10^6 120.10^6
31. Solidification time at 170°C and shear stress of 5.9 MPa (60 Kgf/cm^2)	-	50-80	-	-

Table Contd.

Parameters	Norm for grades			
	028-210-02	Sp1-342-02	Sp2-342-02	Sp3-342-02
1. Compacting factor	2.8	2.6	2.6	2.6
2. Specific volume, ml/g, maximum	-	2.2	2.2	2.2
3. Impact strength on notched specimens, kJ/m^2 ($kgf \cdot cm/cm^2$)	1.96 (2.0)	1.86 (1.9)	1.86 (1.9)	2.84 (2.9)
4. Ultimate compression stress, MPa (kgf/cm^2)	-	137 (1400)	137 (1400)	157 (1600)
5. Ultimate tensile stress, MPa (kgf/cm^2)	22.5-39.2 (230-400)	27.4 (280)	27.4 (280)	25.5-44.1 (260-450)
6. Ultimate bending stress after exposure to sulphuric acid, MPa, (kgf/cm^2)	-	-	-	-
7. Relative elongation at rupture, %	2.0-3.0	-	-	1.4-2.1
8. Modulus of elasticity on bending, MPa (kgf/cm^2)	$(6.9-9.8) \cdot 10^3$ $(70-100) \cdot 10^3$	$(6.9-8.8) \cdot 10^3$ $(70-90) \cdot 10^3$	- -	$(5.9-7.4) \cdot 10^3$ $(60-75) \cdot 10^3$
9. Hardness, MPa (kgf/cm^2)	-	196 (2000)	196 (2000)	304-343 (3100-3500)
10. Coefficient of friction	-	0.495-0.500	-	0.300-0.325

Table Contd.

Parameters	Norm for grades			
	028-210-02	Sp1-342-02	Sp2-342-02	Sp3-342-02
11. Wear (against steel)	-	9-10	-	26-27
12. Surface resistivity, ohms	1.10^{13}-1.10^{14}	-	-	-
13. Volume resistivity, ohm. cm	1.10^{12}-1.10^{13}	-	-	-
14. Dielectric strength, kV/mm	16-20	-	-	-
15. Dissipation factor at 50 Hz	0.05-0.07	0.01-0.03	-	-
16. Dissipation factor at 10^6 Hz	0.02-0.04	0.06	-	0.04-0.05
17. Dielectric permeability at 50 Hz	5.0-6.0	10.2-10.8	-	5.0-6.0
18. Dielectric permeability at 10^6 Hz	4.0-5.0	5.0-6.0	-	4.0-5.0
19. Resistance to intense heating	3	3	-	4
20. Resistance to oil after 24 hours, %	0.05	0.03	0.03	0.03
21. Resistance to benzine after 24 hours, %	0.03	0.05	0.05	0.05
22. Acid resistance, %	-	-	-	-
23. Brittle point in bending, °C	-	-	-	-
24. Specific heat, J/kg.K (kcal/kg.degree) at 20 to 30°C	- -	2345 (0.56)	-	1160 (0.28)

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Table Contd.

Parameters	Norm for grades			
	028-210-02	Sp1-342-02	Sp2-342-02	Sp3-342-02
25. Thermal conductivity W/m.K (kcal/m.h. degree) at 20 to 30°C	-	0.16 (0.14)	-	0.21 (0.18)
26. Coefficient of linear thermal expansion, 1/degree, at 30 to 150°C	-	$(3.5-4.0).10^{-5}$	$(5.0-7.0).10^{-5}$	-
27. Thermal diffusivity, at 20 to 25°C, m^2/s	-	$0.18.10^{-6}$	-	$0.13.10^{-6}$
28. Operating temperature, °C	-	From -60 to +115	From -60 to +115	From -50 to +110
29. Duration of viscous-flow state, seconds				
at 120°C	-	300-450	300-450	420
at 170°C	-	60-80	60-80	65
30. Coefficient of viscosity at 120°C, Pa.s (2)	-	$(14-20).10^6$ $(140-200).10^6$	$(14-20).10^6$ $(140-200).10^6$	14.10^6 140.10^6
31. Solidification time at 170°C and shear stress of 5.9 MPa (60 kgf/cm^2)	-	120-150	120-150	115

Table Contd.

Parameters	Norm for grades			
	E1-340-02	E2-330-02	E3-340-65	E3-340-61
1. Compacting factor	2.6	4.0	2.1	2.1
2. Specific volume, ml/g, maximum	2.2	2.8	2.2	2.2
3. Impact strength on notched specimens, kJ/m^2 ($kgf, cm/cm^2$)	2.84 (2.9)	1.76 (1.8)	2.45 (2.5)	1.67 (1.7)
4. Ultimate compression stress, MPa (kgf/cm^2)	147 (1500)	147 (1500)	113 (1150)	109 (1100)
5. Ultimate tensile stress, MPa (kgf/cm^2)	27.4 (280)	29.4-51.9 (300-530)	23.3 (238)	23.5-47.0 (240-480)
6. Ultimate bending stress after exposure to sulphuric acid, MPa (kgf/cm^2)	-	-	-	-
7. Relative elongation at rupture, %	0.6-0.7	0.6-0.7	1.3-1.4	1.7-2.1
8. Modulus of elasticity on bending, MPa (kgf/cm^2)	$(6.2-8.6).10^3$ $(63-88).10^3$	$(8.1-8.6).10^3$ $(83-88).10^3$	$(15.7-16.7).10^3$ $(160-170).10^3$	$(7.8-9.8).10^3$ $(80-100).10^3$
9. Hardness, MPa (kgf/cm^2)	196 (2000)	294-343 (3000-3500)	480-549 (4900-5600)	392-121 (400-4300)
10. Coefficient of friction	0.340-0.380	0.450-0.460	0.450-0.470	0.450-0.465

Table Contd.

Parameters	Norm for grades			
	E1-340-02	E2-330-02	E3-340-65	E3-340-61
11. Wear (against steel)	28-40	-	5-6	5-6
12. Surface resistivity, ohms	-	-	-	-
13. Volume resistivity, ohm, cm	-	-	-	-
14. Dielectric strength, kV/mm	-	-	-	-
15. Dissipation factor at 50 Hz	-	-	0.015	0.01-0.03
16. Dissipation factor at 10^6 Hz	-	0.04	-	-
17. Dielectric permeability at 50 Hz	7.5-9.5	7.5-9.6	7.0	5.0-8.0
18. Dielectric permeability at 10^6 Hz	4.6-5.6	5.4	4.0	4.0
19. Resistance to intense heating	3	3	5	5
20. Resistance to oil after 24 hours, %	0.03	0.03	0.02	0.01
21. Resistance to benzine after 24 hours, %	0.05	0.05	0.01-0.03	0.01-0.02
22. Acid resistance, %	-	-	-	-
23. Brittle point in bending, °C	-	-	-	-
24. Specific heat, J/kg.K (kcal/kg.degree) at 20 to 30°C	-	1465 - 1507 (0.35-0.36)	-	-

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Table Contd.

Parameters	Norm for grades			
	E1-340-02	E2-330-02	E3-340-65	E3-340-61
25. Thermal conductivity W/m.K (kcal/m.h. degree) at 20 to 30°C	-	0.21-0.23 (0.18-0.20)	0.19-0.26 (0.16-0.22)	0.19-0.26 (0.16-0.22)
26. Coefficient of linear thermal expansion 1/degress at 30 to 150°C	$(4.3-5.3).10^{-5}$	$(4.5-5.3).10^{-5}$	$(2.0-5.0).10^{-5}$	$(2.0-5.0).10^{-5}$
27. Thermal diffusivity, at 20 to 25°C, m^2/s	-	$0.18.10^{-6}$	-	-
28. Operating temperature, °C	From -60 to +110	From -60 to +110	From -60 to +115	From -60 to +115
29. Duration of viscous-flow state, seconds				
at 120°C	-	500-900	140	120-350
at 170°C	-	50-80	40	40-80
30. Coefficient of viscosity at 120°C, Pa.s (P)	-	$(20-40).10^6$ ($200-400).10^6$	23.10^6 230.10^6	$(1-60).10^6$ $(10-600).10^6$
31. Solidification time at 170°C and shear stress of 5.9 MPa (60 kgf/cm^2)	-	120-140	-	-

Table Contd.

Parameters	Norm for grades			
	E4-100-30	E5-101-30	E6-014-30	E8-361-63
1. Compacting factor	3.8	4.0	2.5	2.3
2. Specific volume, ml/g maximum	2.2	1.45	-	2.2
3. Impact strength on notched specimens, kJ/m^2 ($kgf, cm/cm^2$)	-	1.67 (1.7)	2.30 (2.4)	1.76 (1.8)
4. Ultimate compression stress, MPa (kgf/cm^2)	176-196 (1800-2000)	167-196 (1700-2000)	176-284 (1800-2900)	147-167 (1500-1700)
5. Ultimate tensile stress, MPa (kgf/cm^2)	39.2-44.1 (400-450)	39.2-44.1 (400-450)	58.9 (550)	29.4 (300)
6. Ultimate bending stress after exposure to sulphuric acid, MPa, (kgf/cm^2)	-	-	-	-
7. Relative elongation at rupture, %	-	2.0-3.0	1.6-1.9	1.7-2.3
8. Modulus of elasticity on bending, MPa (kgf/cm^2)	-	-	$(10.8-12.7).10^3$ $(110-130).10^3$	$(6.9-7.8).10^3$ $(70-80).10^3$
9. Hardness, MPa (kgf/cm^2)	441-549 (4500-5600)	490-637 (5000-6500)	539-588 (5500-6000)	304-333 (3100-3400)
10. Coefficient of friction	-	-	0.550-0.565	0.465-0.480
11. Wear (against steel)	-	-	6-8	4-7

Table Contd.

Parameters	Norm for grades			
	E1-100-30	E2-101-30	E6-014-30	E8-361-63
12. Surface resistivity, ohms	-	-	-	-
13. Volume resistivity, ohm. cm	-	-	-	-
14. Dielectric strength, kV/mm	-	-	-	-
15. Dissipation factor at 50 Hz	0.03	0.02	0.03 -0.05	-
16. Dissipation factor at 10^6 Hz	-	-	-	0.01-0.03
17. Dielectric permeability at 50 Hz	4.0-8.0	6.0-7.0	4.0-5.0	5.0-6.0
18. Dielectric permeability at 10^6 Hz	4.8	5.0	3.0-4.0	4.0-5.0
19. Resistance to intense heating	-	-	4	3
20. Resistance to oil after 24 hours, %	0.01-0.02	0.005-0.05	0.01-0.02	0.03
21. Resistance to benzine after 24 hours, %	0.015-0.016	0.003	0.005-0.01	0.01
22. Acid resistance, %	-	-	-	-
23. Brittle point in bending, °C	-50	-	-60	-60
24. Specific heat, J/kg.K (kcal/kg.degree) at 20 to 30°C	978 (0.22)	-	-	1040 (0.25)

Table Contd.

Parameters	Norm for grades			
	E1-100-30	E2-101-30	E6-014-30	E8-361-63
25. Thermal conductivity W/m.K (kcal/m.h. degree) at 20 to 30°C	0.19-0.26 (0.16-0.22)	-	0.31-0.38 (0.27-0.33)	0.22-0.27 (0.19-0.23)
26. Coefficient of linear thermal expansion, 1/degree at 30 to 150°C	$(0.18-0.2).10^{-5}$	$(2.0-5.0).10^{-5}$	$(1.9-3.6).10^{-5}$	$3.8.10^{-5}$
27. Thermal diffusivity, at 20 to 25°C, m^2/S	$0.21.10^{-6}$	-	-	$0.13.10^{-6}$
28. Operation temperature, °C	From -50 to +115	From -50 to +110	From -60*** to +250	-
29. Duration of viscous-flow state, seconds				
at 120°C	-	215	260	90-200
at 170°C	-	30	30	40-80
30. Coefficient of viscosity at 120°C, Pa.s (P)	-	$6.7.10^6$ (67.10^6)	6.10^6 (60.10^6)	$(15-70).10^6$ $(150-700).10^6$
31. Solidification time at 170°C and shear stress of 5.9 MPa (60 kgf/cm^2)	-	65	-	-

Table Contd.

Parameters	Norm for grades			
	E9-342-73	E10-342-63 E11-342-63	E15-121-02	Vkh 1-090-34
1. Compacting factor	2.3	2.1	2.8	2.1
2. Specific volume, ml/g maximum	2.2	2.2	2.8	2.2
3. Impact strength on notched specimens, kJ/m^2 (kgf_o cm/cm^2)	2.41 (2.5)	1.96 (2.0)	-	1.96 (2.0)
4. Ultimate compression stress, MPa (kgf/cm^2)	147 (1500)	147 (1500)	-	147 (1500)
5. Ultimate tensile stress, MPa (kgf/cm^2)	29.4 (300)	29.4 (300)	-	27.4 (280)
6. Ultimate bending stress after exposure to sulphuric acid, MPa, (kgf/cm^2)	-	-	-	-
7. Relative elongation at rupture, %	2.2-2.5	2.0-2.7	-	1.7-2.2
8. Modulus of elasticity on bending, MPa (kgf/cm^2)	$(8.8-9.8).10^3$ $(90-100).10^3$	$(7.8-8.8).10^3$ $(80-90).10^3$	-	$(6.9-8.8).10^3$ $(70-90).10^3$
9. Hardness, MPa (kgf/cm^2)	363-392 (3700-4000)	294 (3000)	-	294-392 (3000-4000)
10. Coefficient of friction	0.340-0.365	0.340-0.370	-	0.470-0.485
11. Wear (against steel)	4-5	2-3	-	14-15

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Table Contd.

Parameters	Norm for grades			
	E9-342-73	E10-342-63 E11-342-63	E15-121-02	Vkh1-090-34
12. Surface resistivity, ohms	-	-	-	Minimum 1.10^{13}
13. Volume resistivity, ohm.cm	-	-	-	Minimum 1.10^{12}
14. Dielectric strength, kV/mm	-	-	-	Minimum 13
15. Dissipation factor at 50 Hz	-	-	-	0.01
16. Dissipation factor at 10^6 Hz	0.02-0.03	0.02-0.03	-	0.01-0.03
17. Dielectric permeability at 50 Hz	8.2-8.9	8.0-8.9	-	6.0
18. Dielectric permeability at 10^6 Hz	5.4-5.5	5.4-5.5	-	5.0
19. Resistance to intense heating	3	3	-	4
20. Resistance to oil after 24 hours, %	0.03	0.03	-	0.03
21. Resistance to benzine after 24 hours, %	0.04	0.04	-	0.03
22. Acid resistance, %	-	-	-	0.20*
23. Brittle point in bending, °C	-60	-	-	-50
24. Specific heat, J/kg.K (kcal/kg.degree) at 20 to 30°C	1285 (0.31)	-	-	1172-1591 (0.28-0.38)

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Table Contd.

Parameters	Norm for grades			
	E9-342-73	E10-342-63 E11-342-63	E15-121-02	Vkh1-090-34
25. Thermal conductivity W/m.K (kcal/m.h. degree) at 20 to 30°C	0.42 (0.36)	0.41 (0.35)	-	0.29 (0.25)
26. Coefficient of linear thermal expansion, 1/degree at 30 to 150°C	$(5.0-7.0).10^{-5}$	$2.5.10^{-5}$	-	$(2.0-3.4).10^{-5}$
27. Thermal diffusivity, at 20 to 25°C, m^2/s	$0.19.10^{-6}$	-	-	$0.22.10^{-6}$
28. Operation temperature, °C	From -50 to +125	From -50 to +125	From -60 to +110	From -40 to +110
29. Duration of viscous-flow state, seconds				
at 120°C	160-300	220-300	-	200-250
at 170°C	60-80	70-90	-	30-40
30. Coefficient of viscosity at 120°C, Pa.s (P)	$(10-15).10^6$ $(100-150).10^6$	$(4-8).10^6$ $(40-80).10^6$	-	$(3-6).10^6$ $(30-60).10^6$
31. Solidification time at 170°C and shear stress of 5.9 MPa (60 kgf/cm^2)	120-140	110-140	-	-

Table Contd.

Parameters	Norm for grades			
	Vkh2-090-69	Vkh2-090-68	Vkh3-090-14	Vkh4-090-34
1. Compacting factor	2.5	2.5	2.0	2.2
2. Specific volume, ml/g maximum	2.2	2.2	1.3	-
3. Impact strength on notched specimens, kJ/m^2 ($kgf, cm/cm^2$)	2.38 (2.4)	1.59 (1.6)	2.35 (2.4)	3.60 (3.7)
4. Ultimate compression stress, MPa (kgf/cm^2)	147-157 (1500-1600)	118-147 (1200-1500)	108-167 (1100-1700)	118-147 (1200-1500)
5. Ultimate tensile stress, MPa (kgf/cm^2)	27.4 (280)	33.3-39.2 (340-400)	34.3-40.2 (350-410)	19.6-24.5 (200-250)
6. Ultimate bending stress after exposure to sulphuric acid, MPa, (kgf/cm^2)	-	-	-	-
7. Relative elongation at rupture, %	2.0	-	2.0-2.7	-
8. Modulus of elasticity on bending, MPa (kgf/cm^2)	$(6.9-8.8).10^3$ $(70-90).10^3$	$5.4.10^3$ (55.10^3)	$(5.5-18.0).10^3$ $(56-184).10^3$	$3.3.10^3$ (34.10^3)
9. Hardness, MPa (kgf/cm^2)	294-372 (3000-3800)	235-274 (2400-2800)	265-304 (2700-3100)	147-157 (1500-1600)
10. Coefficient of friction	0.430-0.435	0.435-0.450	0.150-0.310	0.435-0.450
11. Wear (against steel)	5-8	5-11	1-2	5-11

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Table Contd.

Parameters	Norm for grades			
	Vkh2-090-69	Vkh2-090-68	Vkh3-090-14	Vkh4-080-34
12. Surface resistivity, ohms	2.10^{12}	1.10^{12}	-	-
13. Volume resistivity, ohm.cm	1.10^{12}	1.10^{12}	-	-
14. Dielectric strength, kV/mm	13-17	12	-	-
15. Dissipation factor at 50 Hz	0.07-0.10	0.04	-	0.05-0.07
16. Dissipation factor at 10^6 Hz	0.02-0.04	0.01-0.02	-	0.09-0.10
17. Dielectric permeability at 50 Hz	5.0-6.0	5.0-6.0	-	6.0-8.0
18. Dielectric permeability at 10^6 Hz	3.0-5.0	4.0-5.0	-	5.0-6.0
19. Resistance to intense heating	4	3	4	4
20. Resistance to oil after 24 hours, %	0.03	0.02	0.03	0.012
21. Resistance to benzine after 24 hours, %	0.02	0.01	0.03	0.05
22. Acid resistance, %	1.75**	1.75**	-	-
23. Brittle point in bending, °C	-50	-50	-50	-60
24. Specific heat, J/kg.K (kcal/kg.degree) at 20 to 30°C	-	1100-1200 (0.26-0.29)	-	1300 (0.31)

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Table Contd.

Parameters	Norm for grades			
	Vkh2-090-69	Vkh2-090-68	Vkh3-090-14	Vkh4-080-34
25. Thermal conductivity W/m.K (kcal/m.h. degree) at 20 to 30°C	0.29 (0.25)	0.24 (0.21)	-	0.29-0.35 (0.25-0.30)
26. Coefficient of linear thermal expansion, 1/degree at 30 to 150°C	$(3.1-3.6).10^{-5}$	$(3.3-5.8).10^{-5}$	$1.7.10^{-5}$	$(3.0-6.0).10^{-5}$
27. Thermal diffusivity, at 20 to 25°C, m^2/s	-	$0.29.10^{-6}$	-	$0.29.10^{-6}$
28. Operation temperature, °C	From -40 to +110	From -40 to +110	-	-
29. Duration of viscous-flow state, seconds				
at 120°C	200-318	25-200	140-200	200-300
at 170°C	30-40	30-50	30-40	70-80
30. Coefficient of viscosity at 120°C, Pa.s (P)	3.10^6 (30.10^6)	$(5-10).10^6$ $(50-100).10^6$	$(8-15).10^6$ $(80-150).10^6$	15.10^6 (150.10^6)
31. Solidification time at 170°C and shear stress of 5.9 MPa (60 kgf/cm^2)	-	-	-	180-200

Table Contd.

Parameters	Norm for grades			
	Vkh5-010-73	Vkh6-342-70	U1-301-07 U2-301-07	U4-080-02
1. Compacting factor	1.9	-	-	2.5
2. Specific volume, ml/g, maximum	2.2	-	-	1.7
3. Impact strength on notched specimens, kJ/m^2 ($kgf, cm/cm^2$)	1.76 (1.8)	2.16 (2.2)	3.92 (4.0)	2.45 (2.5)
4. Ultimate compression stress, MPa (kgf/cm^2)	147 (1500)	196-216 (2000-2200)	98 (1000)	157 (1600)
5. Ultimate tensile stress, MPa (kgf/cm^2)	33.3-42.1 (340-430)	24.5-39.2 (250-400)	29.4 (300)	23.5 (240)
6. Ultimate bending stress after exposure to sulphuric acid, MPa, (kgf/cm^2)	-	42 (425)	-	-
7. Relative elongation at rupture, %	2.2-2.8	1.6-2.4	0.4	1.7-2.3
8. Modulus of elasticity on bending, MPa (kgf/cm^2)	$(6.9-7.8).10^3$ $(70-80).10^3$	$(6.9-8.3).10^3$ $(70-85).10^3$	Minimum $5.9.10^3$ (60.10^3)	$(5.9-8.2).10^3$ $(60-84).10^3$
9. Hardness, MPa (kgf/cm^2)	343-392 (3500-4000)	294-314 (3000-3200)	245 (2500)	196-441 (2000-4500)
10. Coefficient of friction	0.460-0.480	0.300-0.320	0.325-0.335	0.410-0.415
11. Wear (against steel)	3-9	4-5	14-15	6-15

Table Contd.

Parameters	Norm for grades			
	Vkh5-010-73	Vkh6-342-70	U1-301-07 U2-301-07	U4-080-02
12. Surface resistivity, ohms	-	1.10^{14}-1.10^{15}	-	-
13. Volume resistivity, ohm.cm	-	1.10^{13}-1.10^{14}	-	-
14. Dielectric strength, kV/mm	-	13-16	-	-
15. Dissipation factor at 50 Hz	0.04-0.06	0.01-0.02	0.88	0.20-0.30
16. Dissipation factor at 10^6 Hz	0.008-0.02	0.02-0.03	1.0	0.2-0.3
17. Dielectric permeability at 50 Hz	5.0-6.0	5.0-6.0	8.0-10.0	7.5-9.0
18. Dielectric permeability at 10^6 Hz	4.0-5.0	4.0-5.0	-	4.0-7.0
19. Resistance to intense heating	4	3	-	4
20. Resistance to oil after 24 hours, %	0.02	-	0.03	0.03-0.07
21. Resistance to benzine after 24 hours, %	0.05	-	0.03	0.05-0.10
22. Acid resistance, %	-	-	-	-
23. Brittle point in bending, °C	-	-	-	-50
24. Specific heat, J/kg.K (kcal/kg.degree) at 20 to 30°C	1040 (0.25)	-	1256-1424 (0.30-0.34)	-

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Table Contd.

Parameters	Norm for grades			
	Vkh5-010-73	Vkh6-342-70	U1-301-07 U2-301-07	U4-080-02
25. Thermal conductivity W/m.K (kcal/m.h. degree) at 20 to 30°C	0.36 (0.31)	-	0.21-0.23 (0.18-0.20)	0.19-0.22 (0.16-0.19)
26. Coefficient of linear thermal expansion 1/degree at 30 to 150°C	-	-	$(3.0-3.5).10^{-5}$	$3.3.10^{-5}$
27. Thermal diffusivity, at 20 to 25°C, m^2/s	$(0.18-0.20).10^{-6}$	-	-	-
28. Operation temperature, °C	From -40 to +120	-	From -40 to +110	-
29. Duration of viscous-flow state, seconds				
at 120°C	150-180	140-170	-	450
at 170°C	29-35	60-100	-	40-60
30. Coefficient of viscosity at 120°C, Pa.s (P)	$(4-7).10^6$ $(40-70).10^6$	$(7-21).10^6$ $(70-210).10^6$	-	$(13-60).10^6$ $(130-600).10^6$
31. Solidification time at 170°C and shear stress of 5.9 MPa (60 kgf/cm^2)	100	120-160	-	-

Table Contd.

Parameters	Norm for grades			
	J5-301-41 U6-301-41	Zh1-010-40	Zh2-010-60 Zh6-010-60	Zh3-010-62 Zh4-010-62
1. Compacting factor	-	2.3	2.5	2.2
2. Specific volume, ml/g maximum	-	-	1.35	1.35
3. Impact strength on notched specimens, kJ/m^2 ($kgf, cm/cm^2$)	14.70 (15.0)	2.38 (2.4)	1.86 (1.9)	2.23 (2.3)
4. Ultimate compression stress, MPa (kgf/cm^2)	78 (800)	147-196 (1500-2000)	103 (1050)	103 (1050)
5. Ultimate tensile stress, MPa (kgf/cm^2)	24.5 (250)	22.5-29.4 (230-300)	27.4 (280)	27.4 (280)
6. Ultimate bending stress after exposure to sulphuric acid, MPa, (kgf/cm^2)	-	-	-	-
7. Relative elongation at rupture, %	0.1-0.13	0.8-0.9	-	1.4-1.8
8. Modulus of elasticity on bending, MPa (kgf/cm^2)	Minimum $6.9.10^3$ (70.10^3)	$(6.9-8.8).10^3$ $(70-90).10^3$	$(6.9-8.8).10^3$ $(70-90).10^3$	$(6.9-8.8).10^3$ $(70-90).10^3$
9. Hardness, MPa (kgf/cm^2)	294 (3000)	294-490 (3000-5000)	294-392 (3000-4000)	294-490 (3000-5000)
10. Coefficient of friction	-	0.450-0.460	0.450-0.460	-
11. Wear (against steel)	-	5-6	4-5	-

Table Contd.

Parameters	Norm for grades			
	U5-301-41 U6-301-41	Zh1-010-40	Zh2-010-60 Zh6-010-60	Zh3-010-62 Zh4-010-62
12. Surface resistivity, ohms	-	-	1.10^{11}	1.10^{12}
13. Volume resistivity, ohm.cm	-	-	-	1.10^{11}
14. Dielectric strength, kV/mm	-	13	10	-
15. Dissipation factor at 50 Hz	0.08	0.10-0.20	0.24	0.20-0.25
16. Dissipation factor at 10^6 Hz	-	0.05-0.06	0.08-0.10	0.05
17. Dielectric permeability at 50 Hz	10.0-15.0	8.0-9.0	10.0-11.0	5.5-5.7
18. Dielectric permeability at 10^6 Hz	-	4.0-5.0	6.6	2.0
19. Resistance to intense heating	-	4	4	4
20. Resistance to oil after 24 hours, %	-	0.015-0.03	0.02	0.01
21. Resistance to benzine after 24 hours, %	-	0.02-0.04	0.02	0.007-0.01
22. Acid resistance, %	-	-	-	-
23. Brittle point in bending, °C	-	-50	-50	-50
24. Specific heat, J/kg.K (kcal/kg.degree) at 20 to 30°C	1172 (0.28)	-	-	-

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Table Contd.

Parameters	Norm for grades			
	U5-301-41 U6-301-41	Zh1-010-40	Zh2-010-60 Zh6-010-60	Zh3-010-62 Zh4-010-62
25. Thermal conductivity W/m.K (kcal/m.h. degree) at 20 to 30°C	0.52 (0.45)	-	-	-
26. Coefficient of linear thermal expansion, 1/degree at 30 to 150°C	$(2.5-2.8).10^{-5}$	$(2.5-4.0).10^{-5}$	$(1.5-4.0).10^{-5}$	$(1.5-4.0).10^{-5}$
27. Thermal diffusivity, at 20 to 25°C, m^2/s	$0.33.10^{-6}$	-	-	-
28. Operation temperature, °C	From -40 to +130	From -40 to +120	From -40 to +130	From -40 to +120
29. Duration of viscous-flow state, seconds				
at 120°C	-	220-250	200-400	200-300
at 170°C	-	25-30	23-30	25-35
30. Coefficient of viscosity at 120°C, Pa.s(P)	-	$(7-9).10^6$ $(70-90).10^6$	$(13-35).10^6$ $(130-350).10^6$	$(3-5).10^6$ $(30-50).10^6$
31. Solidification time at 170°C and shear stress of 5.9 KPa (60 kgf/cm^2)	-	49-70	45-70	80-120

Table Contd.

Parameters	Norm for grades 2h5-010-78
1. Compacting factor	2.4
2. Specific volume, ml/g maximum	-
3. Impact strength on notched specimens, kJ/m^2 (kgf, cm/cm^2)	-
4. Ultimate compression stress, MPa (kgf/cm^2)	-
5. Ultimate tensile stress, MPa (kgf/cm^2)	-
6. Ultimate bending sress after exposure to sulphuric acid, MPa, (kgf/cm^2)	-
7. Relative elongation at rupture, %	-
8. Modulus of elasticity on bending, MPa (kgf/cm^2)	-
9. Hardness, MPa (kgf/cm^2)	-
10. Coefficient of friction	-
11. Waar (against steel)	-
12. Surface resistivity, ohms	-
13. Volume resistivity, ohm.cm	-
14. Dielectric strength, kV/mm	-
15. Dissipation factor at 50 Hz	-
16. Disaipation factor at 10^6 Hz	-
17. Dielectric permeability at 50 Hz	-
18. Dielectric permeability at 10^6 Hz	-
19. Resistance to intense heating	4
20. Resistance to oil after 24 hours, %	-
21. Resistance to benzine after 24 hours, %	-
22. Acid resistnace, %	-
23. Brittle point in bending, °C	-
24. Specific heat, J/kg.K (kcal/kg.degree) at 20 to 30°C	-

Table Contd.

Parameters	Norm for grades
	Zh5-010-78
25. Thermal conductivity W/m.K (kcal/m.h.degree) at 20 to 30°C	-
26. Coefficient of linear thermal expansion, 1/degree at 30 to 150°C	-
27. Thermal diffusivity, at 20 to 25°C, m^2/s	-
28. Operation temperature, °C	-
29. Duration of viscous-flow state, seconds	
at 120°C	-
at 170°C	-
30. Coefficient of viscosity at 120°C, Pa.s (P)	-
31. Solidification time at 170°C and shear stress of 5.9 MPa (60 kgf/cm^2)	-

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* Holding time for 120 x 15 x 10 mm bars is 24 hours in sulphuric acid with 1.08 g/cm^3 specific gravity.

** Holding time for 120 x 15 x 10 mm bars is 48 hours in sulphuric acid with 1.32 g/cm^3 specific gravity.

*** Duration of exposure to operating temperature not more than 5000 hours.

BASE SI UNITS

Quantity	Unit		
	Name	Russian symbol	International symbol
Length	metre	м	m
Weight (Mass)	Kilogram	кг	kg
Time	second	с	s
Current	ampere	А	A
Thermodynamic temperature	kelvin	К	K
Amount of substance	mole	моль	mol
Intensity of light	candela	кд	cd
SUPPLEMENTARY SI UNITS			
Plane angle	radian	рад	rad
solid angle	steradian	ср	sr

DERIVED SI UNITS WITH PROPRIETORY NAMES

Quantity	Unit		Expression for derived unit	
	Name	Symbol	using other units	using base SI units
Frequency	hertz	Hz	-	s^{-1}
Force	newton	N		$m, kg. s^{-2}$
Pressure	pascal	Pa	N/m^2	$m^{-1}, kg. s^{-2}$
Energy, work, heat	joule	J	N.m	$m^2, kg. s^{-2}$
Power, energy, flow	watt	W	J/c	$m^2, kg. s^{-3}$
Quantity of electricity, electric charge	coulomb	C	A.s	S.A
Electric potential	volt	V	W/A	$m^2, kg. s^{-3}.A^{-1}$
Electric capacitance	farad	F	c/V	$m^{-2}, kg^{-1}. s^4.A^2$
Electric resistance	ohm	Ω	V/A	$m^2, kg. s^{-3}.A^2$
Conductance	siemens	S	A/V	$m^{-2}, kg^{-1}. s^3.A^2$
Magnetic flux	weber	Wb	V.s	$m^2, kg. s^{-2}.A^{-1}$
Magnetic induction	tesla	T	Wb/m^2	$kg. s^{-2}.A^{-1}$
Inductance	henry	H	Wb/A	$m^2, kg. s^{-2}.A^{-2}$
Luminous flux	lumen	lm	-	cd.sr. *
Illumination	lux	lx	-	m^{-2}.cd.sr.*
Nucleid activity	beckerel	bk	-	s^{-1}
Radiation dosage	grey	gr	-	m^2, s^{-2}

* The supplementary unit steradian figures along with base SI units in these two expressions.