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1.The statments are requirements to Norm 60893-3-4 IEC:2003; (German version EN 60893-3-4:2004)

2. A dash "–" signifies that there is no requirement.

3. All statements are not binding. No liability is accepted for any injury, loss, damage arising from the use of this information.

4. The following abbreviations are used at this pages.

Resin	
PF	Phenolic resin

Reinforcement	
CC	Woven cotton cloth
CP	Cellulosic paper
GC	Woven glass cloth

5. Similar norms:

	PF CC 201	PF CC 202	PF CC 203	PF CC 204	PF CC 305	PF CP 201	PF CP 202	PF CP 203	PF CP 204	PF CP 205	PF CP 206	PF CP 207	PF CP 308	PF GC 201
DIN 7735	Hgw 2082	Hgw 2082.5	Hgw 2083	Hgw 2083.5		Hp 2061	Hp 2061.5	Hp 2061.6	Hp 2063	Hp 2062.9	Hp 2062.8			Hgw 2072
Nema	CC 201	CE	L	LE		X; XP	XX		XXXPC					G 3

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Table 1; Typs of sheets; Norm 60893-3-4©IEC:2003 (German version: EN 60893-3-4:2004)			
Typen			Applications and distinguishing characteristics (note 1)
Resind	Reinforcement	Serial number	
PF	CC	201	Mechanical applications. Better mechanical properties and poorer electrical properties than type PF CC 202 (coarse weave; note 2)
		202	Mechanical and electrical applications. (coarse weave; note 2)
		203	Mechanical applications. Recommended for small parts. Better mechanical properties and poorer electrical properties than type PF CC 204. (fine weave; note 2)
		204	Mechanical and electrical applications. Recommended for small parts (fine weave; note 2)
		305	Mechanical and electrical applications. For close tolerance machining applications. (very fine weave; note 2)
	CP	201	Mechanical applications. Mechanical properties better than other PF CP types. Poor electrical properties under normal humidtiy. Also available in hot-punching versions.
		202	High voltage applications at power frequencies. High electrical stregth in oil. Good electrical strength in air under normal humidity.
		203	Mechanical and electrical applications. Good electrical properties under normal humidity. Also available in hot -punching versions.
		204	Electrical and electronic applications. Good stability of electrical properties in high humidity. Also available in cold or hot-punching versions.
		205	Similar to type PF CP 204, but low flammability.
		206	Mechanical and electrical applications. Good electrical properties in high humidity. Also available in hot-punching versions.
		207	Similar to type PF CP 201, but with improved punching characteristics at lower temperature.
		308	Similar to type PF CP 206, but low flammibility.
	GC	201	Mechanical and electrical applications. High mechanical strength and good electrical properties under normal humidity. Heat resistence.

Note 1: It should not be inferred from the contens of Table 1 that laminates of any particular type are necessarily unsuitable for applications other than those listed for them, or that specific laminates will be suitable for all applications within in the wide description given.

Note 2: Fabric weaves of type PC and CC reinforcements: These values are only for information. They are not to be considered as specification values. In general, the finer weave materials have better machining characteristics.

Coarse weave	> 130	≤ 30
Fine weave	≤ 130	> 30
Very fine weave	≤ 125	> 38

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Table 2; Tolerances on thickness (test method: see IEC 60893-2, 4.1), Norm 60893-3-4 IEC:2003 (German version: EN 60893-3-4:2004)

Nominal thickness mm	Tolerance +- mm (all types)			
	PF CP all types	PF CC 202 PF CC 201	PF CC 204 PF CC 203 PF CC 305	PF GC 201
0,40	0,07	–	–	0,10
0,50	0,08	–	0,13	0,12
0,60	0,09	–	0,14	0,13
0,80	0,10	0,19	0,15	0,16
1,00	0,12	0,20	0,16	0,18
1,20	0,14	0,22	0,17	0,21
1,50	0,15	0,24	0,19	0,24
2,00	0,19	0,26	0,21	0,28
2,50	0,22	0,29	0,24	0,33
3,00	0,25	0,31	0,26	0,37
4,00	0,30	0,36	0,32	0,45
5,00	0,34	0,42	0,36	0,52
6,00	0,37	0,46	0,40	0,60
8,00	0,47	0,55	0,49	0,72
10,00	0,55	0,63	0,56	0,82
12,00	0,62	0,70	0,64	0,94
14,00	0,69	0,78	0,70	1,02
16,00	0,75	0,85	0,76	1,12
20,00	0,86	0,95	0,87	1,30
25,00	1,00	1,10	1,02	1,50
30,00	1,15	1,22	1,12	1,70
35,00	1,25	1,34	1,24	1,95
40,00	1,35	1,45	1,35	2,10
45,00	1,45	1,55	1,45	2,30
50,00	1,55	1,65	1,55	2,45
60,00	–	–	–	–
70,00	–	–	–	–
80,00	–	–	–	–
90,00	–	–	–	–
100,00	–	–	–	–

Where the nominal thickness is not one of the preferred thicknesses listed, then the tolerance for the next higher preferred nominal thickness shall apply.

Other tolerances may be agreed between the supplier and the purchaser.

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Table 3; flatness (test method: see 4.2 of IEC 60893-2); Norm 60893-3-4 IEC:2003 (German version: EN 60893-3-4:2004)			
Material	Thickness d mm	Lenght of straight edge mm	
		1000	500
All types	6 < d ≤ 8	8	2
	8 < d	6	1,5

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Table 4; Tolerances on width of cut strips; (minus tolerance only); Norm 60893-3-4 IEC:2003 (German version: EN 60893-3-4:2004)						
Nominal thickness	Nominal width in mm, all types					
d in mm	3 < b ≤ 50	50 < b ≤ 100	100 < b ≤ 160	160 < b ≤ 300	300 < b ≤ 500	500 < b ≤ 600
0,40	0,50	0,50	0,50	0,60	1,00	1,50
0,50	0,50	0,50	0,50	0,60	1,00	1,50
0,60	0,50	0,50	0,50	0,60	1,00	1,50
0,80	0,50	0,50	0,50	0,60	1,00	1,00
1,00	0,50	0,50	0,50	0,60	1,00	1,00
1,20	0,50	0,50	0,50	1,00	1,20	1,20
1,50	0,50	0,50	0,50	1,00	1,20	1,20
2,00	0,50	0,50	0,50	1,00	1,20	1,50
2,50	0,50	1,00	1,00	1,50	2,00	2,50
3,00	0,50	1,00	1,00	1,50	2,00	2,50
4,00	0,50	2,00	2,00	3,00	4,00	5,00
5,00	0,50	2,00	2,00	3,00	4,00	5,00

Unilatral, all - negative tolerances are normally applied to the width of the cut strips, and are given in the above table. Other tolerances may be agreed between purchaser and supplier.

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Table 5; Property requirements; Norm 60893-3-4 IEC:2003 (German version: EN 60893-3-4:2004)												
Property	IEC 60893-2 Subclause	Unit	Min. oder Max.	Thickness of sheet to which test is applicable mm	Type							
					PF CP 201	PF CP 202	PF CP 203	PF CP 204	PF CP 205	PF CP 206	PF CP 207	PF CP 308
Flexural strength	5.1	Mpa	Min.	≥ 1,5	135	120	120	75	75	85	80	85
Electric strength at 90 °C in oil ⊥ to laminations	6.1	kV/mm	Min.	≤ 3	–	table 6	table 6	table 6	table 6	table 6	table 6	table 6
Breakdown voltage at 90 °C in oil ‖ to laminations	6.1	kV	Min.	> 3	–	60 (note 1)	15	25	20	25	–	25
Insulation resistance after immersion in water	6.3	M Ω	Min.	All	–	–	$5x10^{1}$	$1x10^{4}$	$1x10^{3}$	$1x10^{3}$	–	$1x10^{3}$
Flammibility (note 2)	7.2	Kategorie		3	–	–	–	–	FV 1	–	–	FV 1
Water absorption	8.2	mg	Max.	All	table 7	table 7	table 7	table 7	table 7	table 7	table 7	table 7

Note 1: After preconditioning in air at 105 °C +- 5 K for 96 h immediatly before test and transferring immediatly into hot oil.

Note 2: The small-scale laboratory test used in this standard for assingning a flammability category is primarily for monitoring consistency of prodoction of laminates. The results so obtained should not in any circumstances be considered as an overall indication of the potential fire hazards presented by these laminates under actual conditions of use.

Table 5; Property requirements; Norm 60893-3-4©IEC:2003 (German version: EN 60893-3-4:2004)										
Property	IEC 60893-2 Subclause	Unit	Min. oder Max.	Thickness of sheet to which test is applicable mm	Type					
					PF CC 201	PF CC 202	PF CC 203	PF CC 204	PF CC 305	PF GC 201
Flexural strength	5.1	Mpa	Min.	≥ 1,6	100	90	110	100	125	140
Charpy impact strength ‖to lamination (note 3)	5.4.2	kJ/m²	Min.	≥ 5	8,8	7,8	7	6	6	25
Izod impact strength ‖to lamination (note 3)	5.4.3	kJ/m²	Min.	≥ 5	5,4	5,9	5,9	4,9	4,9	29
Electrical strength at 90 °C in oil ⊥ to lamination	6.1.1	kV/mm	Min.	≤ 3	table 6	table 6	table 6	table 6	table 6	table 6
Breakdown voltage at 90 °C in oil ‖to lamination	6.1.1	kV	Min.	> 3	1	20	1	20	1	20
Insulation resistance after immersion in water	6.3	M Ω	Min.	All	1	$5x10^{1}$	1	$5x10^{1}$	1	$1x10^{2}$
Water absorption	8.2	mg	Max.	All	table 7	table 7	table 7	table 7	table 7	table 7

Note 3: Conformance with the requirements for either Charpy or Izod test constitutes conformance with the specification in this respect.

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Table 6; electric strenght at °90 in oil, ⊥ to lamination (1-min-proof test or 20 -s- step-by-step test) (kV/mm) (note 1); Norm 60893-3-4 IEC:2003 (German version: EN 60893-3-4:2004)																
	Mean measured thickness of test specimens mm (note 2)															
Type	0,40	0,50	0,60	0,70	0,80	0,90	1,00	1,20	1,50	1,80	2,00	2,20	2,40	2,60	2,80	3,00
PF CC 201	–	–	–	–	0,98	0,84	0,82	0,80	0,74	0,69	0,65	0,61	0,58	0,56	0,53	0,50
PF CC 202	–	–	–	–	5,60	5,30	5,10	4,60	4,00	3,60	3,40	3,30	3,20	3,10	3,00	3,00
PF CC 203	–	0,98	0,95	0,92	0,89	0,84	0,82	0,80	0,74	0,69	0,65	0,61	0,58	0,56	0,53	0,50
PF CC 204	–	8,10	7,70	7,30	7,00	6,60	6,30	5,80	5,25	4,80	4,60	4,40	4,20	4,10	4,10	4,00
PF CC 305	2,72	2,50	2,30	2,15	1,97	1,89	1,72	1,52	1,21	1,10	1,03	1,00	0,90	0,85	0,83	0,80
PF CP 202 (note 3)	19,00	18,20	17,60	17,10	16,60	16,20	15,80	15,20	14,50	13,90	13,60	13,40	13,30	13,20	13,00	13,00
PF CP 203	15,70	14,70	14,00	13,40	12,90	12,50	12,10	11,40	10,40	9,60	9,30	9,00	8,80	8,60	8,50	8,40
PF CP 204	15,70	14,70	14,00	13,40	12,90	12,50	12,10	11,40	10,40	9,60	9,30	9,00	8,80	8,60	8,50	8,40
PF CP 205	15,70	14,70	14,00	13,40	12,90	12,50	12,10	11,40	10,40	9,60	9,30	9,00	8,80	8,60	8,50	8,40
PF CP 206	17,50	16,00	15,00	14,10	13,40	12,80	12,30	11,40	10,35	9,50	9,10	8,70	8,40	8,20	7,90	7,70
PF CP 308	17,50	16,00	15,00	14,10	13,40	12,80	12,30	11,40	10,35	9,50	9,10	8,70	8,40	8,20	7,90	7,70
PF GC 201	10,80	10,20	9,70	9,30	9,00	8,70	8,40	8,00	7,45	7,00	6,80	6,50	6,30	6,10	5,90	5,70

Note 1: The two test are alternatives. A material meeting either requirements shall be deemed to comply with the specification to electric strenght at 90 °C in oil, ⊥ to laminations.

Note 2: If the arithmetic mean of the measured values of thickness of the test specimen lies between two values of thickness shown in the aboce table, the limit shall be obtained by interpolation. If the arithmetic mean of the measured values of thickness is below the minimum thickness for which a limit is given, the electric strenght limit appropriate to the minimum thickness shall apply. If the nominal thickness is 3 mm and the arithmetic mean measured thickness exceeds 3 mm, the limit for 3 mm shall apply.

Note 3: Type PF CP 202 shall be preconditioned in air for 96 h at 105 °C +- 5 K before this test and transferred immediatly to the hot oil.

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Table 7; Limits for water absorption (mg) ; Norm 60893-3-4 IEC:2003 (German version: EN 60893-3-4:2004)																					
	Mean measured thickness of test specimens mm (note 1)																				
Type	0,4	0,5	0,6	0,8	1	1,2	1,5	2	2,5	3	4	5	6	8	10	12	14	16	20	25	22,5 (note 2)
PF CC 201	–	–	–	201	206	211	218	229	239	249	262	275	284	301	319	336	354	371	406	450	540
PF CC 202	–	–	–	133	136	139	144	151	157	162	169	175	182	195	209	223	236	250	277	311	373
PF CC 203	–	190	194	201	206	211	218	229	239	249	262	275	284	301	319	336	354	371	406	450	540
PF CC 204	–	127	129	133	136	139	144	151	157	162	169	175	182	195	209	223	236	250	277	311	373
PF CC 305	–	190	194	201	206	211	218	229	239	249	262	275	284	301	319	336	354	371	406	450	540
PF CP 201	410	417	423	437	450	460	475	500	525	550	600	650	700	810	920	1020	1130	1230	1440	1700	2040
PF CP 202	165	167	168	173	180	188	200	220	240	260	300	342	382	447	550	630	720	800	970	1150	1380
PF CP 203	160	162	163	167	170	174	180	190	195	200	220	235	250	285	320	340	390	420	490	570	684
PF CP 204	44	45	46	47	48	50	52	56	58	63	70	77	84	99	113	128	142	157	196	222	266
PF CP 205	44	45	46	47	48	50	52	56	58	63	70	77	84	99	113	128	142	157	196	222	266
PF CP 206	62	63	65	67	69	71	75	80	85	90	100	110	118	135	149	162	175	175	202	219	263
PF CP 207	410	417	423	437	450	460	475	500	525	550	600	650	700	810	920	1020	1130	1230	1440	1700	2040
PF CP 308	62	63	65	67	69	71	75	80	85	90	100	110	118	135	149	162	175	175	202	219	263
PF GC 201	80	85	89	95	100	105	115	127	140	153	178	202	226	270	310	347	380	410	465	525	630

Note 1:If the arithmetic mean of measured values of thickness of the test specimen lies between two values of thickness shown in the above table, the limit shall be be obtained by interpolation. If the arithmetic mean of the measured values of thickness is below the minimum thickness for which a limit is given, the water absorption limit appropriate to the minimum thickness shall apply. If the nominal thickness is 25 mm and the arithmetic mean measured thickness exceeds 25 mm, the limit for 25 mm shall apply.

Note 2: Sheets of nominal thickness greater than 25 mm shall be machined to a relatively smooth surface on one face to a thickness of 22,5 +-0,3 mm

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