

# 3240 Epoxy Phenolic Resin Glass Cloth Rigid Laminated Sheet

Standard No.: Q/DJ<sub>10</sub>-143-2000

3240 is made from alkali-free glass fabric impregnated with epoxy phenolic resin . It is made at high temperature and high pressure. It has high mechanical strength and excellent electric properties, suitable for making insulating structural parts and components in electric motor and electric apparatus. It can also be used in condition of humidity and in transformer oil.



## 1 Technical requirements

### 1.1 Appearance

Its surface should be flat and smooth, free of bubbles, wrinkles and crackles and other defects. If dent and uneven color exist, little stain is allowed. Edges should show net cut and be free of delamination and crackles.

### 1.2 Dimensions and tolerance

1.2.1 Length and width are as shown in Form 1.

Form 1		mm
Length and Width	Tolerance	
450~970	±15	
>970~1970	±25	

1.2.2 Nominal thickness and tolerance are are shown in Form 2

Form 2				mm
Nominal Thickness	Tolerance	Nominal Thickness	Tolerance	
	±0.12			±0.82
0.5	±0.13	10		±0.94
0.6	±0.16	12		±1.02
0.8	±0.18	14		±1.12
1.0	±0.20	16		±1.30
1.2	±0.24	20		±1.50
1.6	±0.28	25		±1.70
2.0	±0.33	30		±1.95
2.5	±0.37	35		±2.10
3.0	±0.45	40		±2.30
4.0	±0.52	45		±2.45
5.0	±0.60	50		±2.50
6.0	±0.72	60		±2.80
8.0		80		

Note: The product of non-nominal thickness is settled upon negotiation between sellers and buyers, its deviation adopts the value of next bigger nominal thickness.

1.3 Bending deflection: shown in Form 3

Form 3			mm
Thickness	Bending deflection		
	1000 (Ruler length)	1000 (Ruler length)	
3.0~6.0	≤10	≤2.5	
>6.0~8.0	≤8	≤2.0	
>8.0	≤6	≤1.5	

### 1.4 Machining

The laminated sheets should be free from crackles and scraps after being machined such as sawing, drilling, lathing and milling.

1.5 The mechanical, physical and dielectric properties of the laminated sheets are as shown in Form 4.

Form 4

No.	Properties		Units	Values
1	Density		g/cm <sup>3</sup>	1.7~1.9
2	Martens temperature	MD	°C	≥200
3	Thermal stability		°C	200
4	Oil resistance in transformer oil	4h	°C	130
5	Water absorption		%	≤0.8
6	Bending strength perpendicular to the laminations	MD	MPa	≥350
		TD		≥290
7	Tensile strength	MD	MPa	≥300
		TD		≥220
8	Charpy impact strength No gap	3mm~9.5mm	kJ/m <sup>2</sup>	MD
				TD
	>9.5mm	MD		
		TD		
9	Bond strength		N	≥5600
10	Surface resistivity	At room temp.	Ω	≥1.0×10 <sup>13</sup>
		After 24h submerged in water		≥1.0×10 <sup>11</sup>
11	Volume resistivity	At room temp.	Ω•m	≥1.0×10 <sup>11</sup>
		After 24h submerged in water		≥1.0×10 <sup>9</sup>
12	Insulation resistance parallel to the laminations	At room temp.	Ω	≥1.0×10 <sup>10</sup>
		After 24h submerged in water		≥1.0×10 <sup>8</sup>
13	Dielectric strength perpendicular to the laminations in transformer oil at 90°C±2°C	0.5 mm~1mm	MV/m	≥22
		1.1 mm~3mm		≥20
14	Dissipation factor	50Hz	—	≤0.030
15	Breakdown voltage parallel to the laminations in transformer oil at 90°C±2°C		kV	≥30

## 2 Testing methods

### 2.1 : Appearance

Visual observation

### 2.2 Machining

As per *Machining Methods for Insulating Laminated Products*, Standard No.JB/Z141-79.

### 2.3 Specimen treatment before test

As per Chapter 2 of GB5130-1985. The specimen should be treated in an oven at 105°C circular sirocco for one hour.

### 2.4 Density

As per Method A of GB1033-1985. Weight of specimen: 28-50g

### 2.5 Martens temperature

As per GB1035. Test is unnecessary for the nominal thickness less than 10mm.

### 2.6 Thermal stability and oil resistance

#### 2.6.1 Specimen: Three specimens for each group; Dimension: 100mm × 100mm;

Thickness: Nominal

2.6.2 Heat resistance: Hang the specimens in the oven with thin metal thread, avoid touch between specimen and specimen or between specimens and wall of the oven. Increase the temperature to 200°C within 30min-60min and then keep stable for 24 hours. After that, decrease the temperature to room temperature. Take out the specimens, then observe its appearance. Delamination and crack are not allowed, small cracks (like hair diameter) are allowed.

2.6.3 Oil resistance: Put specimens into 70°C±2°C container filled with transformer oil, avoid touches between specimen and specimen and between specimens and container. Increase the temperature to 130°C±2°C within 40min~90min and keep stable for four hours. Take out the

specimens and check immediately. Bubbles and tympanites are not allowed, small cracks on the edges are allowed.

## 2.7 Charpy impact strength

No less than 5 specimens for each group, if the nominal thickness of the specimen is more than 10mm, they should be processed to  $10\text{mm}\pm 0.2\text{mm}$  on one side. Measure 3 places to get their arithmetic average value as its testing result, the precision for testing the dimension should be 0.1mm. The span should be adjusted according to the thickness of the specimen. If the nominal thickness is no more than 5mm, the span should be  $40\text{mm}\pm 0.2\text{mm}$ ; if the nominal thickness is more than 5mm, the span should be  $70\text{mm}\pm 2\text{mm}$ . The test should be parallel to the lamination, the specimen processed from one side should face to bob. Impact speed of bob is  $3.5\text{m/s}\pm 0.5\text{m/s}$ . If the specimen does not break or does not break in the middle part of trisection, the testing result is invalid. Rare values of testing results can have the deviation of less than  $\pm 15\%$  compared with the average value.

$$\text{Impact strength } (\sigma_n) = \frac{A_n}{b_n \cdot h_n}$$

$\sigma_n$  — Impact strength kJ/m;

$A_n$  — kJ

$b_n$  — Width of specimen; m

$h_n$  — Thickness of specimen; m

## 2.8 Surface resistivity & Volume resistivity

The distance between the testing electrode and the protecting electrode is 2mm. The diameter of the testing electrode is  $50\text{mm}\pm 0.1\text{mm}$ . The inner diameter of protecting electrode is  $54\text{mm}\pm 0.1\text{mm}$  and its outer diameter is  $74\text{mm}\pm 0.1\text{mm}$ .

## 2.9 Breakdown voltage parallel to the laminations

The dimension of the specimen:  $60\text{mm}\times 30\text{mm}$ .

Drill hole in the middle of the thickness of the specimen, the depth of the hole is 20mm, and the testing distance is  $10\text{mm}\pm 0.2\text{mm}$ . Use the high speed step-up method to test. Use the average value of the breakdown voltage of 5 specimens as the testing result. If rare values have the deviation of 15% compared with the average value, another 5 specimens should be tested, and use the average value of the breakdown voltage of 10 specimens as the testing result.

The others are as per GB5130-1985.

## 3 Inspection, marks, package, transportation and storage

3.1 The inspection items are as per Clause 1.1,1.2,1.3 and Item 13 of Form 3 in Clause 1.5, the items in Clause 1.1,1.2,1.3 should be checked one by one.

Under the conditions stipulated, the storage life is 18 months after leaving factory. If the storage life is over 18 months, the product can still be used only when being tested to be qualified.

The other items are as per GB1305-1985.

## 4 Remarks

The laminated sheets have different properties compared with the metal. The methods of JB/Z141-79 must be adopted to avoid damage when the product is machined.

Thermal conductivity of the laminated sheets is small, so high cutting speed and small depth of cut should be adopted when the product is machined.

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福州佳为事进出口有限公司

FUZHOU CANWELL IMPORT & EXPORT CO., LTD.



Rm.No.J,21/F.,Huakaifugui Building A,No.36, Dongda Road,

Fuzhou,China. Postal code:350001

Tel:0086-591-87610093, 87614264, 87279367

Fax:0086-591-83640189,87279269

E-mail:qqmd@fcanwell.com