

KOBELITE LAMINATES

Table of article numbers

Part Number		KEL-GEF		KEL-9383NT	KEL-571	KEL-973
Division		—	(R)			
Item	Resin	Epoxy				
	Base material	Glass fabric	Glass fabric, Non-woven glass fabric	Non-woven aramid fabric	Non-woven aramid fabric, Polyester fabric	
	Color	Natural color				
	Grades	JIS	EL-GEF	—	—	—
		ANSI	FR-4.0	CEM-3 Equivalent	—	—
	UL	94V-0	94V-0	—	—	
	Features	Good insulation resistance Good strength High precision thickness	Good insulation resistance Good punching performance	Reduction scratch High precision thickness		
	Applications	Insulation spacer, FPC brace board, Retaining board for polishing	Insulation spacer, FPC brace board	Retaining board for polishing		
	Thickness (mm)	0.1~20.0	0.2~2.5	1.0~1.6	0.2~2.0	0.6~2.0
Size (mm)	1,020×1,020					

Actual thickness and tolerance

Actual thickness	JIS tolerance	KOBELITE tolerance				
		KEL-GEF	KEL-GEF (R)	KEL-9383NT	KEL-571	KEL-973
0.1	—	±0.02	—	—	—	—
0.2	—	±0.02	±0.02	—	±0.03	—
0.3	—	±0.10	±0.03	—	±0.03	—
0.4	—	±0.10	±0.03	—	±0.03	—
0.5	±0.12	±0.10	±0.03	—	±0.03	—
0.6	±0.13	±0.12	±0.03	—	±0.03	±0.03
0.7	±0.15	±0.15	±0.04	—	±0.04	—
0.8	±0.15	±0.15	±0.04	—	±0.04	±0.04
1.0	±0.15	±0.15	±0.05	±0.15	±0.05	±0.05
1.2	±0.20	±0.20	±0.20	±0.20	±0.06	±0.06
1.5	±0.20	±0.20	±0.20	—	±0.08	±0.08
1.6	±0.23	±0.23	±0.20	±0.22	±0.08	±0.08
2.0	±0.25	±0.25	±0.20	—	±0.14	±0.10
2.5	±0.30	±0.30	±0.20	—	—	—

Actual thickness	JIS tolerance	KEL-GEF
3.0	±0.35	±0.35
4.0	±0.40	±0.40
5.0	±0.55	±0.55
6.0	±0.60	±0.60
8.0	±0.70	±0.70
10.0	±0.80	±0.80
12.0	±0.90	±0.90
15.0	±1.10	±1.10
16.0	±1.10	±1.10
20.0	±1.30	±1.30

1. In case laminate thickness lies in between two thickness figures shown above, the tolerance of such laminate would be equal to the tolerance of the thicker one.
2. Thickness guarantee area is 920×920mm, center of 1020×1020mm (Only KEL-GEF (R), KEL-571, KEL-973)

Water absorption (JIS K 6912)

Condition: E-24/50+D-24/23

Unit (%)

Thickness (mm)	Part Number	KEL-GEF
	JIS	EL-GEF
0.5		1.00
0.8		0.80
1.6		0.35
2.0		0.30
2.5		0.25
3.0		0.20
5.0		0.15
6.0		0.13
12.0		0.10
20.0		0.10

Warp & Twist

Unit (%)

Standard Thickness (mm)	The ratio of the warp & twist against 1000mm	
	KOBELITE	JIS
0.8 ≤ 1.6 ≥	3.50 ≥	—
1.6 < 3.0 ≥	2.00 ≥	3.00 ≥
3.0 < 5.0 ≥	1.20 ≥	1.30 ≥
5.0 < 7.0 ≥	1.00 ≥	
7.0 < 10.0 ≥	0.60 ≥	0.65 ≥
10.0 < 15.0 ≥	0.50 ≥	
15.0 < 20.0 ≥	0.40 ≥	

■ Characteristics (t1.0mm)

Item	Condition	Unit	Actual Value				
			KEL-GEF /KEL-GEF(R)	KEL-9383NT	KEL-571	KEL-973	
Withstand Voltage Vertical To Layer	C-90/20/65	kV/mm	18~30	18~30	—	—	
Insulation Resistance	C-90/20/65	Ω	$1 \times 10^{14} \sim 1 \times 10^{15}$	$1 \times 10^{14} \sim 1 \times 10^{15}$	$1 \times 10^{14} \sim 1 \times 10^{15}$	—	
	C-90/20/65 +D-2/100		$1 \times 10^{14} \sim 5 \times 10^{14}$	$5 \times 10^{13} \sim 5 \times 10^{14}$	$5 \times 10^{13} \sim 5 \times 10^{14}$	—	
Dielectric Constant	(1MHz)	—	C-90/20/65	4.5~5.0	4.3~4.7	4.0~4.2	—
			C-90/20/65 +D-24/23	4.6~5.1	4.4~4.8	4.1~4.3	—
Dissipation Factor	(1MHz)	—	C-90/20/65	0.016~0.025	0.015~0.022	0.020~0.022	—
			C-90/20/65 +D-24/23	0.020~0.026	0.018~0.023	0.021~0.023	—
Flexural Strength	Length	A	N/mm ²	600~650	350~410	330~400	200~220
	Width			450~500	290~350	300~380	170~190
Flexural Modulus	Length	A	kN/mm ²	22~24	—	8.4~8.6	7.4~7.6
	Width			19~22	—	7.8~8.0	6.6~6.8
Compressive Strength	vertical	A	N/mm ²	400~550	—	—	—
	parallel			250~300	—	—	—
Izod Impact Strength	A	J/cm	5.00~6.50	—	—	—	
Cleavage Strength	A	kN	7.84~9.81	—	—	—	
Air Flammability	E-2/180	—	No abnormality	No abnormality	No abnormality	No abnormality	
Specific Gravity	A	—	1.7~1.9	1.5~1.7	1.4~1.5	1.5~1.6	
Chemical Resistance	HCl	(*1)	—	No abnormality	No abnormality	No abnormality	No abnormality
	NaOH			No abnormality	No abnormality	No abnormality	No abnormality
Flammability	(UL-94)	A	—	V-0	V-0	—	—
Aptitude Punching Temperature	A	°C	—	15~16	—	—	
CTE *2	X	(30~80°C)	ppm/°C	12~14	20~22	6~8	27~30
	Y			14~16	22~25	8~10	38~40
	Z			50~70	40~50	105~120	—

The contents of this report are based on the results of experiments conducted by HITACHI CHEMICAL and do not represent a guarantee of the values for each property. Before use, please study its properties, methods for using it, etc., using this data as a reference.

*1) Concentration: $3 \pm 0.2\%$, $20 \pm 2^\circ\text{C}$. Appearance checked with naked eyes after soaking for 24hrs.

*2) Heating Rate: $10^\circ\text{C}/\text{min}$.