Report # 37199ES

TEST REPORT SUMMARY

(Short Report)

CLIENT:	IPC INTERNATIONAL INC 3000 Lakeside Drive Suite 105N Bannockburn, IL 60015 Attention: Glenna Carrell Phone: /
REFERENCE:	IPC-4101E-WAM1/40, IPC-TM-650 2.4.8C, 2.4.8.3A, 2.5.17.1A, 2.6.2.1A, 2.5.6B, 2.5.5.9, 2.4.4B, 2.4.4.1A, 2.5.1B, 2.4.13.1, 2.5.6.2A, 2.4.24C, 2.3.4.2A, 2.4.39A, 2.3.1.1, 2.6.16, IPC J-STD-003C, UL94
TEST ITEM:	Peel Strength, Volume Resistivity and Surface Resistivity, Moisture Absorption, Dielectric Breakdown , Permittivity and Loss Tangent at 1 MHz, Flexural Strength, Arc Resistance, Thermal Stress, Electric Strength, Horizontal Burning Test, Glass Transition Temperature (TMA), Dimensional Stability, Solderability, Chemical Resistance , Metal Surface Cleanability, Pressure Cooker Test
SAMPLE:	CCL
TEST MATERIAL:	85N 0400C H1/H1, 85N 0080C H1/H1
SPECIFICATION:	IPC-4101E-WAM1/40
TEST RESULTS:	The specimens were tested by the indicated test methods within this report. The actual detailed test results are enclosed.
DATE OF REPORT:	21 March 2023
REPORT No.:	37199E

"INTEGRITY, HONESTY AND KNOWLEDGE"

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SUMMARIZED TEST RESULTS:

Test Item	Thin	Thick
Peel Strength	Pass	Pass
Volume Resistivity	Pass	Pass
Surface Resistivity	Pass	Pass
Moisture Absorption	/	Pass
Dielectric Breakdown	/	Pass
Permittivity at 1 MHz	Pass	Pass
Loss Tangent at 1 MHz	Pass	Pass
Flexural Strength	/	Pass
Arc Resistance	Pass	Pass
Thermal Stress	Pass	Pass
Electric Strength	Pass	/
Horizontal Burning Test	Pass	Pass
Glass Transition Temperature (TMA)	/	Pass
Dimensional Stability	Pass	Pass
Solderability	Pass	Pass
Chemical Resistance	See test page	See test page
Metal Surface Cleanability	/	See test page
Pressure Cooker Test	/	See test page

Peel Strength

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards
IPC-TM-650 2.4.8C Peel Strength of Matallic Clad Laminates
IPC-TM-650 2.4.8.3A Peel Strength of Matallic Clad Laminates at Elevated

RESULTS

Table 1 Peel Strength After Thermal Stress Thin

Sample Designation	CCL		Sample Identification	85N 0080C H1/H1
Test Date	2023-03-02		Ambient	22°C, 49%RH
Sample No.	Peel Strength (N/mm)			
	Top Lengthwise	Top Crosswise	Bottom Lengthwise	Bottom Crosswise
37199-21-1	1.03			
37199-21-2	1.06			
37199-21-3		1.04		
37199-21-4		1.03		
37199-21-5			1.02	
37199-21-6			1.05	
37199-21-7				1.02
37199-21-8				1.01
Average	1.05	1.03	1.04	1.01
Requirement	⩾0.90			

Table 2 Peel Strength After Thermal Stress Thick

Sample Designation	CCL		Sample Identification	85N 0400C H1/H1
Test Date	2023-03-02		Ambient	22°C, 49%RH
Sample No.	Peel Strength (N/mm)			
	Top Lengthwise	Top Crosswise	Bottom Lengthwise	Bottom Crosswise
37199-4-1	1.08			
37199-4-2	1.09			
37199-4-3		1.08		
37199-4-4		1.07		
37199-4-5			1.09	
37199-4-6			1.10	
37199-4-7				1.10
37199-4-8				1.10
Average	1.08	1.07	1.10	1.10
Requirement	⩾0.90			

Table 3 Peel Strength At Elevated Temperature Thin

Sample Designation	CCL		Sample Identification	85N 0080C H1/H1
Test Date	2023-03-09		Ambient	22°C, 46%RH
Sample No.	Peel Strength (N/mm)			
	Top Lengthwise	Top Crosswise	Bottom Lengthwise	Bottom Crosswise
37199-21-9	1.02			
37199-21-10	1.04			
37199-21-11		0.98		
37199-21-12		0.96		
37199-21-13			1.01	
37199-21-14			1.04	
37199-21-15				0.96
37199-21-16				0.97
Average	1.03	0.97	1.02	0.96
Requirement	⩾0.70			

Table 4 Peel Strength At Elevated Temperature Thick

Sample Designation	CCL		Sample Identification	85N 0400C H1/H1
Test Date	2023-03-09		Ambient	22°C, 46%RH
Sample No.	Peel Strength (N/mm)			
	Top Lengthwise	Top Crosswise	Bottom Lengthwise	Bottom Crosswise
37199-4-9	1.02			
37199-4-10	1.01			
37199-4-11		1.01		
37199-4-12		0.99		
37199-4-13			1.01	
37199-4-14			0.99	
37199-4-15				1.04
37199-4-16				1.05
Average	1.02	1.00	1.00	1.05
Requirement	⩾0.70			

Table 5 Peel Strength After Process Solutions Thin

Sample Designation	CCL		Sample Identification	85N 0080C H1/H1
Test Date	2023-03-04		Ambient	20°C, 47%RH
Sample No.	Peel Strength (N/mm)			
	Top Lengthwise	Top Crosswise	Bottom Lengthwise	Bottom Crosswise
37199-20-1	1.08			
37199-20-2	1.11			
37199-20-3		1.19		
37199-20-4		1.09		
37199-20-5			1.12	
37199-20-6			1.11	
37199-20-7				1.10
37199-20-8				1.10
Average	1.10	1.14	1.11	1.10
Requirement	≥0.80			

Table 6 Peel Strength After Process Solutions Thick

Sample Designation	CCL		Sample Identification	85N 0400C H1/H1
Test Date	2023-03-04		Ambient	20°C, 47%RH
Sample No.	Peel Strength (N/mm)			
	Top Lengthwise	Top Crosswise	Bottom Lengthwise	Bottom Crosswise
37199-5-1	1.11			
37199-5-2	1.11			
37199-5-3		1.13		
37199-5-4		1.13		
37199-5-5			1.12	
37199-5-6			1.12	
37199-5-7				1.08
37199-5-8				1.12
Average	1.11	1.13	1.12	1.10
Requirement	⩾0.95			

Table 7 Peel Strength Thin (Low Profile Copper Foil)

Sample Designation	/	Sample Identification	/	
Test Date	/	Ambient	/	
Sample No.	Peel Strength (N/mm)			
	Top Crosswise	Top Lengthwise	Bottom Crosswise	Bottom Lengthwise
No Requirement for IPC-4101E-WAM1/40				

Table 8 Peel Strength Thick (Low Profile Copper Foil)

Sample Designation	/	Sample Identification	/	
Test Date	/	Ambient	/	
Sample No.	Peel Strength (N/mm)			
	Top Crosswise	Top Lengthwise	Bottom Crosswise	Bottom Lengthwise
No Requirement for IPC-4101E-WAM1/40				

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Volume and Surface Resistivity

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards
IPC-TM-650 2.5.17.1A Volume and Surface Resistivity of Dielectric Materials

RESULTS

Table 9 Volume and Surface Resistivity Thin (Humidity Conditioning)

Sample Designation	CCL		Sample Identification	85N 0080C H1/H1	
Test Date	2023-02-27～2023-03-06		Ambient	22 °C, 50% RH	
Sample No.	Average Thickness T	Surface Resistance R'	Surface Resistivity $r'=R'P/D_4$	Volume Resistance R	Volume Resistivity r=RA/T
	(cm)	(MΩ)	(MΩ)	(MΩ)	(MΩ·cm)
37199-22-1	0.0219	7.5E+04	2.4E+07	4.2E+05	9.9E+07
37199-22-2	0.0217	3.4E+05	1.1E+08	4.0E+05	9.5E+07
37199-22-3	0.0219	2.0E+05	6.4E+07	4.6E+05	1.1E+08
Average		/	6.6E+07	/	1.0E+08
Requirement		/	$\geqslant 10^4$	/	$\geqslant 6.0\times 10^4$

Table 10 Volume and Surface Resistivity Thin (At Elevated Temperature)

Sample Designation	CCL		Sample Identification	85N 0080C H1/H1	
Test Date	2023-03-08～2023-03-09		Ambient	24 °C, 50% RH	
Sample No.	Average Thickness T	Surface Resistance R'	Surface Resistivity $r'=R'P/D_4$	Volume Resistance R	Volume Resistivity r=RA/T
	(cm)	(MΩ)	(MΩ)	(MΩ)	(MΩ·cm)
37199-23-1	0.0219	3.4E+05	1.1E+08	7.0E+04	1.7E+07
37199-23-2	0.0217	6.0E+05	1.9E+08	9.0E+04	2.1E+07
37199-23-3	0.0218	3.2E+05	1.0E+08	8.0E+04	1.9E+07
Average		/	1.4E+08	/	1.9E+07
Requirement		/	$\geqslant 10^4$	/	$\geqslant 6.0\times 10^4$

Table 11 Volume and Surface resistivity Thick (Humidity Conditioning)

Sample Designation	CCL		Sample Identification	85N 0400C H1/H1	
Test Date	2023-02-27～2023-03-06		Ambient	22 °C, 50% RH	
Sample No.	Average Thickness T	Surface Resistance R'	Surface Resistivity $r'=R'P/D_4$	Volume Resistance R	Volume Resistivity r=RA/T
	(cm)	(MΩ)	(MΩ)	(MΩ)	(MΩ-cm)
37199-7-1	0.1059	4.2E+06	1.4E+09	1.2E+06	5.9E+07
37199-7-2	0.1062	2.0E+06	6.4E+08	1.0E+06	4.9E+07
37199-7-3	0.1064	2.5E+06	8.1E+08	6.0E+05	2.9E+07
Average		/	9.3E+08	/	4.5E+07
Requirement		/	$\geqslant 10^6$	/	$\geqslant 10^6$

Table 12 Volume and Surface resistivity Thick (At Elevated Temperature)

Sample Designation	CCL		Sample Identification	85N 0400C H1/H1	
Test Date	2023-03-08～2023-03-09		Ambient	24 °C, 50% RH	
Sample No.	Average Thickness T	Surface Resistance R'	Surface Resistivity $r'=R'P/D_4$	Volume Resistance R	Volume Resistivity r=RA/T
	(cm)	(MΩ)	(MΩ)	(MΩ)	(MΩ-cm)
37199-8-1	0.1037	1.6E+05	4.5E+06	4.6E+04	1.1E+07
37199-8-2	0.1039	1.6E+05	4.5E+06	5.0E+04	1.2E+07
37199-8-3	0.1027	1.2E+05	3.4E+06	3.2E+04	8.0E+06
Average		/	4.1E+06	/	1.1E+07
Requirement		/	$\geqslant 10^6$	/	$\geqslant 10^6$

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Moisture Absorption

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards
IPC-TM-650 2.6.2.1A Water Absorption, Metal Clad Plastic Laminates

RESULTS

Table 13 Moisture Absorption

Sample Designation	CCL		Sample Identification	85N 0400C H1/H1
Test Date	2023-02-27~2023-02-28		Ambient	(20~22) °C, (50~52)% RH
Sample No.	mass(g)		increasing weight percent of mass(%)	
	m_1	m_2		
37199-15-1	4.6516	4.6710	0.42	
37199-15-2	4.7065	4.7265	0.42	
37199-15-3	4.5871	4.6067	0.43	
Average			0.42	
Requirement			⩽1.0	

Dielectric Breakdown

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards
IPC-TM-650 2.5.6B Dielectric Breakdown of Rigid Printed Wiring Material

RESULTS

Table 14 Dielectric Breakdown Thick

Sample Designation		CCL	Sample Identification	85N 0400C H1/H1
Test Date		2023-03-04~2023-03-06	Ambient	23 °C, 50% RH
Sample No.		Thickness (mm)	Breakdown Voltage (kV)	Minimum Voltage (kV)
37199-9-1	Machine direction	1.012	44.2+N.B	44+N.B
37199-9-2		1.013	43.7+N.B	
37199-9-3	Transverse direction	1.012	44.7+N.B	
37199-9-4		1.010	44.6+N.B	
Requirement				⩾40

Permittivity and Loss Tangent

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards
IPC-TM-650 2.5.5.9 Permittivity and Loss Tangent, Parallel Plate, 1MHz to 1.5 GHz

RESULTS

Table 15 Permittivity and Loss Tangent

Sample Designation	CCL		Sample Identification	see table below	
Test Date	2023-02-27~2023-02-28		Ambient	20 °C, 50% RH	
Sample No.	Sample Identification	test frequency	thickness(mm)	permittivity	loss tangent
37199-29-1	85N 0080C H1/H1	1 MHz	0.221	3.9	0.010
37199-29-2			0.224	3.8	0.010
37199-29-3			0.223	3.8	0.010
Average				3.8	0.010
Requirement				≤5.4	≤0.035
37199-15-4	85N 0400C H1/H1	1 MHz	1.024	4.4	0.006
37199-15-5			1.016	4.4	0.006
37199-15-6			1.013	4.4	0.006
Average				4.4	0.006
Requirement				≤5.4	≤0.035

Flexural Strength

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards
IPC-TM-650 2.4.4B Flexural Strength of Laminates (at Ambient Temperature)
IPC-TM-650 2.4.4.1A Flexural Strength of Laminates (at Elevated Temperature)

RESULTS

Table 16 Flexural Strength (At Ambient Temperature)

Sample Designation	CCL		Sample Identification		85N 0400C H1/H1		
Test Date	2023-03-07		Ambient		21°C, 46%RH		
Sample No.	Span	Load	Width	Thickness	Flexural Strength S	Average	Requirement
	L	P	b	d			
	(mm)	(N)	(mm)	(mm)	(N/mm^2)	(N/mm^2)	(N/mm^2)
37199-6-1 (Length Direction)	25.40	467.357	25.49	1.067	614	621	⩾415
37199-6-2 (Length Direction)		477.579	25.49	1.065	629		
37199-6-3 (Cross Direction)		321.643	25.49	1.060	428	425	⩾325
37199-6-4 (Cross Direction)		317.468	25.49	1.060	422		

Table 17 Flexural Strength (At Elevated Temperature)

Sample Designation	CCL		Sample Identification		85N 0400C H1/H1		
Test Date	2023-03-07		Ambient		21°C, 46%RH		
Sample No.	Span	Load	Width	Thickness	Flexural Strength S	Average	Requirement
	L	P	b	d			
	(mm)	(N)	(mm)	(mm)	(N/mm^2)	(N/mm^2)	(N/mm^2)
37199-6-5 (Length Direction)	25.40	296.373	25.49	1.066	390	401	≥311
37199-6-6 (Length Direction)		305.710	25.49	1.063	404		
37199-6-7 (Length Direction)		312.579	25.49	1.063	413		
37199-6-8 (Length Direction)		300.164	25.49	1.063	397		

Arc Resistance

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards
IPC-TM-650 2.5.1B Arc Resistance of Printed Wiring Material

RESULTS

Table 18 Arc Resistance

Sample Designation	CCL		Sample Identification	See the table below	
Test Date	2023-03-04~2023-03-06		Ambient	23 °C, 50% RH	
Sample No.	Sample Identification	Thickness (mm)	Times (s)	Average (s)	Requirement (s)
37199-9-5	85N 0400C H1/H1	1.013	161	158	⩾120
37199-9-6		1.012	158		
37199-9-7		1.010	155		
37199-25-4	85N 0080C H1/H1	0.220	139	141	
37199-25-5		0.218	150		
37199-25-6		0.219	134		

Thermal Stress

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards
IPC-TM-650 2.4.13.1 Thermal Stress of Laminates

RESULTS

Table 19 Thermal Stress

Sample Designation	CCL		Sample Identification	See the table below
Test Date	2023-03-08		Ambient	22°C, 48% RH
Sample No.			Sample Identification	Test result
37199-25-13	Etched	Top	85N 0080C H1/H1 (Thin)	No obvious blister, delamination, wrinkling or cracking.
37199-25-14				No obvious blister, delamination, wrinkling or cracking.
37199-25-15				No obvious blister, delamination, wrinkling or cracking.
37199-25-16		Bottom		No obvious blister, delamination, wrinkling or cracking.
37199-25-17				No obvious blister, delamination, wrinkling or cracking.
37199-25-18				No obvious blister, delamination, wrinkling or cracking.
37199-27-1	Unetched	Top		No obvious blister, delamination, wrinkling or cracking.
37199-27-2				No obvious blister, delamination, wrinkling or cracking.
37199-27-3				No obvious blister, delamination, wrinkling or cracking.
37199-27-4		Bottom		No obvious blister, delamination, wrinkling or cracking.
37199-27-5				No obvious blister, delamination, wrinkling or cracking.
37199-27-6				No obvious blister, delamination, wrinkling or cracking.
37199-9-9	Etched	Top	85N 0400C H1/H1 (Thick)	No obvious blister, delamination, wrinkling or cracking.
37199-9-10				No obvious blister, delamination, wrinkling or cracking.
37199-9-11				No obvious blister, delamination, wrinkling or cracking.
37199-9-12		Bottom		No obvious blister, delamination, wrinkling or cracking.
37199-9-13				No obvious blister, delamination, wrinkling or cracking.
37199-9-14				No obvious blister, delamination, wrinkling or cracking.
37199-12-1	Unetched	Top		No obvious blister, delamination, wrinkling or cracking.
37199-12-2				No obvious blister, delamination, wrinkling or cracking.
37199-12-3				No obvious blister, delamination, wrinkling or cracking.
37199-12-4		Bottom		No obvious blister, delamination, wrinkling or cracking.
37199-12-5				No obvious blister, delamination, wrinkling or cracking.
37199-12-6				No obvious blister, delamination, wrinkling or cracking.

Electric Strength

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards

IPC-TM-650 2.5.6.2A Electric Strength of Printed Wiring Material

RESULTS

Table 20 Electric Strength Thin

Sample Designation	CCL	Sample Identification	85N 0080C H1/H1
Test Date	2023-03-04~2023-03-06	Ambient	23 °C, 50% RH
Sample No.	Average Thickness (mm)	Voltage (kV)	Electric Strength (kV/mm)
37199-25-1	0.219	10.6	48.40
37199-25-2	0.219	11.7	53.42
37199-25-3	0.220	11.0	50.00
Average			51
Requirement			⩾30

Horizontal Burning Test

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards

UL94 STANDARD FOR SAFETY Tests for Flammability of Plastic Materials for Parts in Devices and Appliances Section 7 Horizontal Burning Test; HB

RESULTS

Table 21 Horizontal Burning Test Thin

Sample Designation	CCL		Sample Identification	85N 0080C H1/H1		
Test Date	2023-03-04~2023-03-10		Ambient	23 °C, 49% RH		
Sample No.	Sample Thk	Flame time Te	Burning time Tb	Combustion length L	Burning rate v	Note
	(mm)	(s)	(s)	(mm)	(mm/min)	
37199-24-1	0.222	30	0	0	/	1
37199-24-2	0.224	30	0	0	/	1
37199-24-3	0.224	30	0	0	/	1
Avg:	0.223	Flammability classification				HB
Requirement						HB
Note:	1.The test specimen did not burn more than 25mm mark line.					
	2.The sample was burned more than 25mm mark line, and no more than 100mm mark line.					
	3.Sample burning more than 100mm mark line.					
	4.Samples have any burning particles drop.					

Table 22 Horizontal Burning Test Thick

Sample Designation	CCL		Sample Identification	85N 0400C H1/H1		
Test Date	2023-03-04~2023-03-10		Ambient	23 °C, 49% RH		
Sample No.	Sample Thk	Flame time Te	Burning time Tb	Combustion length L	Burning rate v	Note
	(mm)	(s)	(s)	(mm)	(mm/min)	
37199-9-15	1.034	30	0	0	/	1
37199-9-16	1.040	30	0	0	/	1
37199-9-17	1.041	30	0	0	/	1
Avg:	1.038	Flammability classification				HB
Requirement						HB
Note:	1.The test specimen did not burn more than 25mm mark line.					
	2.The sample was burned more than 25mm mark line, and no more than 100mm mark line.					
	3.Sample burning more than 100mm mark line.					
	4.Samples have any burning particles drop.					

Glass Transition Temperature (TMA)

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards

IPC-TM-650 2.4.24C Glass Transition Temperature and Z-Axis Thermal Expansion by TMA

RESULTS

Table 23 Glass Transition Temperature （TMA）

Sample Designation	CCL	**Sample Identification**	85N 0400C H1/H1
Test Date	2023-02-24~2023-02-27	**Ambient**	22 ℃, 50% RH
Sample No.	**Tg(℃)**		
37199-15-7	252.42		
37199-15-8	252.84		
Requirement	⩾200		

Dimensional Stability

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards

IPC-TM-650 2.4.39A Dimensional Stability, Glass Reinforced Thin Laminates

RESULTS

Table 24 Dimensional Stability Thin

Sample Designation	CCL		Sample Identification		85N 0080C H1/H1			
Test Date	2023-02-17~2023-02-28		Ambient		(20~22)°C,(48~50)% RH			
Sample No.	After Bake Process (ppm)				After Thermal Stress Process (ppm)			
	MD		TD		MD		TD	
37199-17	-149	-141	-189	-209	-213	-205	-401	-387
37199-18	-101	-153	-169	-205	-370	-415	-306	-367
37199-19	-169	-117	-157	-150	-238	-323	-299	-382
Average	-138		-180		-294		-357	
Requirement	-450~150							

Table 25 Dimensional Stability Thick

Sample Designation	CCL		Sample Identification		85N 0400C H1/H1			
Test Date	2023-02-17~2023-02-28		Ambient		(20~22)°C,(48~50)% RH			
Sample No.	After Bake Process (ppm)				After Thermal Stress Process (ppm)			
	MD		TD		MD		TD	
37199-1	-56	12	-90	-39	-125	-40	-157	-103
37199-2	-28	-64	-71	-28	-52	-93	-173	-83
37199-3	-68	-56	-98	-12	-97	-36	-169	-71
Average	-44		-56		-74		-126	
Requirement	-300~300							

Solderability（Edge Dip Test）

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards

IPC J-STD-003C Solderability Tests for Printed Boards 4.2.1 Edge Dip Test

RESULTS

Table 26 Solderability (Edge Dip Test)

Sample Designation	CCL	**Sample Identification**	See the table below
Test Date	2023-03-09	**Ambient**	23 °C, 51% RH
Sample No.	**Sample Identification**	**Test result**	
37199-27-7	85N 0080C H1/H1(Thin)	Sample surface exhibit good wetting	
37199-12-7	85N 0400C H1/H1(Thick)	Sample surface exhibit good wetting	

Chemical Resistance

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards

IPC-TM-650 2.3.4.2A Chemical Resistance of Laminates, Prepreg, and Coated Foil Products, by Solvent Exposure

RESULTS

Table 27 Chemical Resistance

Sample Designation	CCL				Sample Identification	See table below	
Test Date	2023-03-07				Ambient	25℃, 48% RH	
Sample No.	Sample Identification	Thickness（mm）	Weight (mg)		Increase Weight (mg)	Appearance Inspection	
			W_1	W_2	W_2-W_1	After Bake	After Immerse in the Solvent
37199-29-4	85N 0080C H1/H1	0.220	942.8	947.4	4.6	no any change	no any change
37199-29-5		0.219	950.7	957.2	6.5	no any change	no any change
37199-29-6		0.222	960.1	965.7	5.6	no any change	no any change
Average					5.6	/	
37199-15-9	85N 0400C H1/H1	1.010	4719.2	4724.9	5.7	no any change	no any change
37199-15-10		1.020	4725.1	4731.4	6.3	no any change	no any change
37199-15-11		1.022	4713.0	4718.7	5.7	no any change	no any change
Average					5.9	/	

Metal Surface Cleanablility

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards

IPC-TM-650 2.3.1.1 Chemical Cleaning of Metal-Clad Laminate

RESULTS

Table 28 Metal Surface Cleanablility

Sample Designation	CCL	**Sample Identification**	See table below
Test Date	2023-03-07	**Ambient**	25 °C, 48% RH
Sample No.	**Sample Identification**	**Test Result**	
37199-16-1	85N 0400C H1/H1	A uniform matte finish formed on the metal cladding of the test specimen. No bead or puddles formed on the metal surface after pouring deionized water on it	
37199-16-2		A uniform matte finish formed on the metal cladding of the test specimen. No bead or puddles formed on the metal surface after pouring deionized water on it	
37199-16-3		A uniform matte finish formed on the metal cladding of the test specimen. No bead or puddles formed on the metal surface after pouring deionized water on it	
37199-30-1	85N 0080C H1/H1	A uniform matte finish formed on the metal cladding of the test specimen. No bead or puddles formed on the metal surface after pouring deionized water on it	
37199-30-2		A uniform matte finish formed on the metal cladding of the test specimen. No bead or puddles formed on the metal surface after pouring deionized water on it	
37199-30-3		A uniform matte finish formed on the metal cladding of the test specimen. No bead or puddles formed on the metal surface after pouring deionized water on it	
Requirements		A uniform matte finish formed on the metal cladding of the test specimen. No bead or puddles formed on the metal surface after pouring deionized water on it	

Pressure Cooker Test

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards
IPC-TM 650 2.6.16 Pressure Vessel Method for Glass Epoxy Laminate Integrity

RESULTS

Table 32 Pressure Cooker Test Thick

Sample Designation	CCL	Sample Identification	85N 0400C H1/H1
Test Date	2023-03-10	Ambient	24 °C, 50% RH
Sample No.	Test result		
37199-11-1	Grade 5: No measles, blisters and surface erosion.		
37199-11-2	Grade 5: No measles, blisters and surface erosion.		
37199-11-3	Grade 5: No measles, blisters and surface erosion.		
37199-11-4	Grade 5: No measles, blisters and surface erosion.		
37199-11-5	Grade 5: No measles, blisters and surface erosion.		

Report # 37199ES

CERTIFICATE OF CONFORMANCE

Microtek (Changzhou) Laboratories certifies that the test equipment used complies with the calibration requirements of correlation criterion and that the data contained in this report is accurate within the tolerance limitation of this equipment.

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