



Hysol® PL 7000

Epoxy Film Adhesive

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Description

Hysol® PL 7000 is an epoxy film adhesive for composite bonding applications. Hysol® PL 7000 is formulated to provide excellent performance properties in composite bonding, and has excellent results on composite surfaces that have been exposed to bond shop environments and may have absorbed moisture. Hysol® PL 7000 may be cured at 250°F (120°C) or 350°F (180°C) with service temperatures up to 300°F (150°C). Hysol® PL 7000 also exhibits excellent fracture toughness (G_{IC}) over composite surfaces exhibiting cohesive failure patterns indicating superior adhesion characteristics.

Features

- Dual temperature cure capabilities 250°F (121°C) or 350°F (180°C)
- Excellent peel and -67°F (-55°C) properties
- Ideal for composite co-curing and secondary bonding applications
- Excellent hot-wet resistance
- Superior out-time characteristics - maintained after 30 days @ 90°F (32°C), 50% RH

Uses

- Composite repair
- Composite surfacing
- Bonding pre-cured composite
- Co-curing with composite prepregs

Typical Technical Data	Hysol® PL 7000
Type:	Modified epoxy film available supported or unsupported
Scrim:	Non-woven polyester-others available upon request
Weight:	.03 to .10 lbs/sf (146 to 488g/m ²)
Thickness:	.005 - .017" (.0127 - .043 cm)
Color:	Green
Width:	Std. 36" (Optional 48")
Volatiles:	< 1%
Out Time:	>30 days @ 90°F, 50% RH
Shelf Life:	>2 year @ 0°F(-18°C)
Gel Time (RDS):	~45 minutes when heated from 50°C at 2°C/minute, 2% strain, 10 rad/sec

Performance Properties

Typical technical data and performance properties given for reference only and not for specification purposes.

**TABLE 1:
 Composite Double Overlap Shear⁽¹⁾ For Hysol® PL 7000 .05 PSF (250 G/M²) with Matt Scrim –
 Typical Properties**

Test Temperature		Specimen Aging Prior to Test	PSI	MPa
°F	°C			
-65	-55	Tested Dry	3800	26.2
75	24	Tested Dry	4500	31.0
75	24	1000 hours @ 160°F (71°C), 95% RH	5300	36.6
160	71	Tested Dry	4800	33.1
160	71	14 days @ 160°F, 95% RH	4800	33.1
270 ⁽²⁾	132	Tested Dry	1300	9.0

1) Substrate consisted of W3T282-42-F263-8 precured for 2 hours @ 350°F (177°C), 85 psi (586 KPa) following a heat up from room temperature of 5°F/minute (2.8°C/minute). Precision Fabrics 60001 peel ply was used. Adhesive was cured as indicated except that the bonding pressure was 45 psi (300 KPa).

2) Substrates for 270°F (132°C) double lap shear were prebond conditioned 168±12 hours @ 75±5°F (23±2.8°C), 55±5% RH.

**TABLE 2:
 Honeycomb Flatwise Tensile⁽³⁾ for Hysol® PL 7000 .05 PSF (250 G/M²) with Matt Scrim –
 Typical Properties**

Test Temperature		Hexcel Prepreg ⁽⁴⁾		Cytac Prepreg ⁽⁵⁾	
°F	°C	PSI	MPa	PSI	MPa
-65	-54	1050	7.2	1020	7.0
75	23	1070	7.4	940	6.5
160	71	1010	7.0	1000	6.9

3) Adhesive and prepreg was co-cured for 2 hours @ 350°F (177°C), 45 psi (300 KPa) following a heat up from room temperature of 5°F/minute (2.8°F/minute). Three plies of prepreg were bonded to 8.0 3/16 HRP Core.

4) Hexcel W3T282(T)-42-F263-8HT/56

5) Cycom 970/PWC T300 3KUT(TY) 42

TABLE 3:
Double Cantilever Beam⁽⁶⁾ for Hysol® PL 7000 .05 PSF (250 G/M²) with Matt Scrim –
Typical Properties

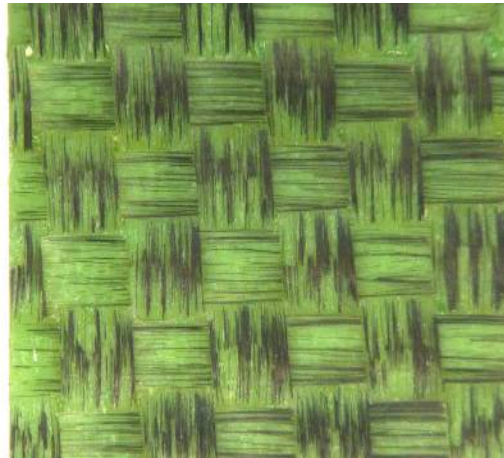
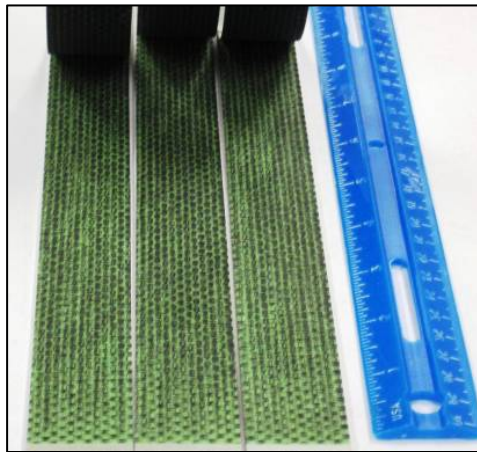
Adhesive Pre-Bond Conditioning	In-Lbs/In ²	J/M ²	Failure Pattern
None	4.3	758	Cohesive
30 Days @ 90°F (32°C), 50% RH	4.5	793	Cohesive

6) Toray P2352-19 pre-cured 2 hours @ 350°F (177°C), 85 psi (586 KPa) following a heat up from room temperature of 5°F/minute (2.8°C/minute). Precision Fabrics 60001 peel ply was used. Adhesive was cured as indicated except that the bonding pressure was 45 psi (300 KPa).

TABLE 4:

Test	Test Method	Film	Prepreg	Core	Peel Ply	Specimen Conditioning	Test Temperature	Average Test Results (MPa)	Average Test Results (Psi)
Single lap shear strength (composite/composite)	AITM 1-0019 S7 Co-bonded	Hysol® PL 7000 .050M (AT3122) Lot 6242	AS4/8552 FAW 196 g/m ² Lot 064034 (11 plies)	None	Precision Fabrics 60,001	None	-55°C (-67°F)	25	3625
							23°C (75°F)	28	4060
							80°C (176°F)	28	4060
							121°C (250°F)	23	3335
							132°C (270°F)	21	3045
						1000 hrs @ 70°C/85% RH	23°C (75°F)	31	4495
						80°C (176°F)	25	3625	
						2000 hrs @ 70°C DI Water	23°C (75°F)	25	3625
80°C (176°F)	15	2175							
Flatwise tensile strength (CF skin/HRP honeycomb)	AITM 1-0025	WST-282-42" F263-8HT/56 (2 plies)	HRP 8.0 pcf, 3/16" cell, 1/2" thick	None	Precision Fabrics 60,001 & Sand	None	23°C (75°F)	7	1015
							121°C (250°F)	4	580

**Rapid Adhesion Test
 PL7000**



PHOTOMICROSCOPY AT 20X MAGNIFICATION

EA9895WPP

Test	Composite Type	Pre-cured Laminate Conditioning	Specimen Conditioning	Test Temp.	EA 9895 WPP		
					EA 9695 .05K	PL795 .05S	PL7000 .05M
Wide Area Overlap Shear, psi Co-bonded	BMS 8-276	None	Dry	-67°F	3260	2918	3078
				73°F	4591	3674	5060
				270°F	3631	3434	2468
		Wet ¹	Dry	270°F	3719	3497	2699
		None	2000hrs at 160°F /85% RH	270°F	1486	1206	938
Double Cantilever Beam, in-lb/in ² Bonded	BMS 8-276	None	Dry	73°F	2.7	2.7	3.9
		Wet ¹			2.3	2.6	3.6
Honeycomb Climbing Drum Peel, in-lb/3in Bonded	BMS 8-212	None	Dry	73°F	24.3	24.2	26.5

Note 1: The pre-cured laminates were exposed with the peel ply attached for 24 hours at 160°F / 85% RH to achieve a bulk moisture gain of 0.60%.

Application Method

Allow adhesive film to reach room temperature before opening poly bag to prevent moisture contamination. Bonding surfaces should be clean, dry and free of contamination. Remove poly liner and apply adhesive to one surface to be bonded. Just prior to bonding, remove remaining liner. The bonded parts should be held in contact until the adhesive is cured.

Curing

- 60-120 Minutes @ 350°F(180 °C) and 25-100 psi(170 - 690 KPa)
- 90-120 Minutes @ 250°F(120 °C) and 25-100 psi(170 - 690 KPa)
- Other cure conditions are possible.

Clean-up

Uncured adhesive may be removed effectively with ketone solvents in well-ventilated areas. Avoid contaminating uncured parts. Consult solvent container label/MSDS for proper safety and handling procedures.

Storage

Hysol® PL 7000 has a shelf life of 2 years at 0°F(-18 °C)

The adhesive has an out time at 90°F (32°C), 50% RH of 30 days.

Handling Precautions

Do not handle or use until the Material Safety Data Sheet has been read and understood.

For industrial use only. See www.henkelna.com/aerospace for MSDS.

General:

As with most epoxy based systems, use this product with adequate ventilation. Do not get in eyes or on skin. Avoid breathing the vapors. Wash thoroughly with soap and water after handling. Empty containers retain product residue and vapors so obey all precautions when handling empty containers.

ONE PART

CAUTION! This material may cause eye and skin irritation or allergic dermatitis. It contains epoxy resins.

Hysol® is a registered trademark of Henkel Corporation.

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