



## Engineered Laminating Systems

**Endurance Technologies, Inc.**  
275 Bridge Point Drive  
South Saint Paul, MN 55075  
Phone: (800) 755-8568  
Fax: (651) 451-9728

## Standard Hand Lay-Up Laminating Systems

The laminating systems from Composite Polymer Design are designed for use in wet lay-up, filament winding, and RTM applications as well as cast parts. The systems exhibit excellent wet-out on all reinforcements such as fiber glass, carbon, and hybrid fibers and can be used with all types of cores. The adhesion capabilities of the systems provide excellent bonding to all surfaces. The systems can also be filled with standard glass balloons, flux, glass fibers, and other fillers for filleting and patching.

The systems consist of formulated epoxy resins and hardeners with varying cure speeds. The 9263B, 9283B, and 9287B hardeners are interchangeable and may be combined for custom property requirements. Many of the systems have been engineered to have convenient volumetric ratios so that they may be used on all types of metering and meter mix devices. While cure is complete after 7 days at room temperature, properties are increased with a moderate post cure. These formulations are NON BLUSHING, assuring maximum performance in the harsh environments present in the marine industry. The high crosslink density and the excellent heat deflection temperatures assure protection from print through problems, giving flexibility in color choices for parts made from these CPD systems. The 4227A resin may be substituted for 4217A resin where a medium viscosity thixotropic material is required to minimize drainage. The 4217A resin will alter the viscosity of the system to enhance performance on vertical surfaces.

**Table 1 – Standard Hand Lay-Up Laminating System Handling and Physical Properties**

System	4227A 9263B	4227A 9283B	4227A 9287B	4217A 9263B	4217A 9283B	4217A 9287B
<b>Handling Properties</b>						
Resin Viscosity, 77°F, cps	5,400	5,400	5,400	6,800	6,800	6,800
Hardener Viscosity 77°F, cps	60	30	15	60	30	15
Mixed Viscosity, 77°F, cps	950	630	400	2,100	1,400	1,100
Mix Ratio By Weight	100A:33B	100A:33B	100A:33B	100A:33B	100A:33B	100A:33B
Mix Ratio By Volume	2.5A:1B	2.5A:1B	2.5A:1B	2.5A:1B	2.5A:1B	2.5A:1B
Gel Time, 77°F, 150g, min.	38	140	600	38	140	600
<b>Physical Properties</b>						
Shore Hardness	86D	86D	86D	86D	86D	86D
Tensile Strength, psi	10,400	9,600	9,100	10,100	9,300	8,800
Tensile Elongation, %	9.6	9.0	8.4	9.3	8.7	8.1
Compressive Strength, psi	12,500	11,900	11,700	12,500	11,900	11,700
Flexural Strength, psi	16,100	15,200	14,000	15,100	14,300	13,100
Flexural Modulus, psi	461,000	450,000	453,000	479,000	467,000	470,000
HDT, Room Temp. Cure, °F	126	121	137	126	121	137
HDT, Post Cure, °F	168	164	165	168	164	165
Izod Impact, Notched, ft-lb/in	1.75	1.63	1.65	1.40	1.31	1.32
Shrinkage, in/in	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

## Hardener Blend Combinations

The hardeners can be used as they are packaged or in some combination to achieve a specific pot life. Some of the most common combinations are as follows:

**Table 2 – 4227A Resin with 9283B and 9287B Hardeners**

Hardener Blend Combination Chart		
% 9283B	% 9287B	Pot life, 77°F, min.
100	0	120
90	10	138
80	20	156
70	30	174
60	40	192
50	50	210
40	60	228
20	80	264
10	90	282
0	100	300
Mix Ratio By Weight 100A:33B		Mix Ratio By Volume 2.5A:1B
Pot Life: Time to 10,000 cps		

**Table 3 – 4227A Resin with 9263B and 9287B Hardeners**

Hardener Blend Combination Chart		
% 9263B	% 9287B	Pot life, 77°F, min.
100	0	30
90	10	57
80	20	84
70	30	111
60	40	138
50	50	165
40	60	192
30	70	219
20	80	246
10	90	273
0	100	300
Mix Ratio By Weight 100A:33B		Mix Ratio By Volume 2.5A:1B
Pot Life: Time to 10,000 cps		

**Table 4 – 4227A Resin with 9263B and 9283B Hardeners**

Hardener Blend Combination Chart		
% 9263B	% 9283B	Pot life, 77°F, min.
100	0	30
90	10	39
80	20	48
70	30	57
60	40	66
50	50	75
40	60	84
30	70	93
20	80	102
10	90	111
0	100	120
Mix Ratio By Weight 100A:33B		Mix Ratio By Volume 2.5A:1B
Pot Life: Time to 10,000 cps		

## Temperature and Pot Life

Desired pot life is dictated by both process requirements and temperature of the environment in which the laminate is being constructed. Environmental temperature has a significant impact

on the difference between the literature pot life value and the pot life that will actually be obtained. The pot life is measured according to SPIR-ERF 13-70 (METHOD A-1) measured at 77°F. The impact of temperature on pot life is charted in Figure 1.

**Table 5 - Pot Life Variation**

Pot Life Variation									
°C °F	20 min	30 min	60 min	80 min	120 min	160 min	200 min	240 min	300 min
35 95.0	10	15	30	40	60	80	100	120	150
34 93.2	11	16.5	33	44	66	88	110	132	165
33 91.4	12	18	36	48	72	96	120	144	180
32 89.6	13	19.5	39	52	78	104	130	156	195
31 87.8	14	21	42	56	84	112	140	168	210
30 86.0	15	22.5	45	60	90	120	150	180	225
29 84.2	16	24	48	64	96	128	160	192	240
28 82.4	17	25.5	51	68	102	136	170	204	255
27 80.6	18	27	54	72	108	144	180	216	270
26 78.8	19	28.5	57	76	114	152	190	228	285
25 77.0	20	30	60	80	120	160	200	240	300
24 75.2	21	33	66	88	132	176	220	264	330
23 73.4	22	36	72	96	144	192	240	288	360
22 71.6	23	39	78	104	156	208	260	312	390
21 69.8	24	42	84	112	168	224	280	336	420
20 68.0	25	45	90	120	180	240	300	360	450
19 66.2	26	48	96	128	192	256	320	384	480
18 64.4	27	51	102	136	204	272	340	408	510
17 62.6	28	54	108	144	216	288	360	432	540
16 60.8	29	57	114	152	228	304	380	456	570
15 59.0	30	60	120	160	240	320	400	480	600

## Processing Options

The laminating systems from CPD have been designed for use in all standard wet lay-up processes including roller applications, squeegee, impregnating equipment, both automatic metering and manual. The resin to reinforcement ratio can be controlled due to the excellent wetting characteristics of the system that does not require overcoat of the resin matrix.

## Advanced Hand Lay-Up Laminating Systems

The 9226B, 9227B and 9262B series of hardeners have been formulated to be used with the 4227A and 4217A resins for improved thermal properties. While a cure can be considered complete after 7 days at room temperature, a moderate post cure will expedite the cure and enhance the thermal and mechanical properties.

<b>Table 6 – Advanced Hand Lay-Up Laminating System Handling and Physical Properties</b>						
System	4227A 9262B	4227A 9227B	4227A 9226B	4217A 9262B	4217A 9227B	4217A 9226B
<b>Handling Properties</b>						
Resin Viscosity, 77°F, cps	5,400	5,400	5,400	6,800	6,800	6,800
Hardener Viscosity 77°F, cps	50	25	20	50	25	20
Mixed Viscosity, 77°F, cps	1,090	630	570	2,400	1,400	1,200
Mix Ratio By Weight	100A:28B	100A:28B	100A:27B	100A:28B	100A:28B	100A:27B
Mix Ratio By Volume	3A:1B	3A:1B	3A:1B	3A:1B	3A:1B	3A:1B
Gel Time, 77°F, 150g, min.	38	130	400	38	130	400
<b>Physical Properties</b>						
Shore Hardness	87D	87D	87D	87D	87D	87D
Tensile Strength, psi	10,400	10,700	10,900	10,100	10,400	10,600
Tensile Elongation, %	5.7	6.1	6.3	5.5	5.9	6.1
Compressive Strength, psi	13,600	14,300	14,600	13,600	14,300	11,700
Flexural Strength, psi	19,800	19,400	18,900	18,600	18,200	17,700
Flexural Modulus, psi	465,000	453,000	451,000	483,000	470,000	468,000
HDT, Room Temp. Cure, °F	124	125	134	124	125	134
HDT, Post Cure, °F	200	190	188	200	190	188
Izod Impact, Notched, ft-lb/in	1.43	1.38	1.39	1.29	1.24	1.25
Shrinkage, in/in	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

### Specialty Systems

- Core Bonding Systems
- Fairing compounds
- Custom formulated room temp curing laminating systems with varied post cure properties
- High peel strength bonding systems
- Epoxy and polyurethane casting systems
- High temp systems for applications up to 450°F
- Long pot life wet-preg systems
- Press molding systems
- RTM systems
- Specialty hardener bonding systems
- Other custom formulations

### ECONOMICAL SOLUTIONS

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