



PRIME™ 27

Epoxy Infusion System

Product Data Sheet

- **The lowest viscosity PRIME™ infusion resin**
- **Suitable for infusing structures that utilise carbon, aramid and glass fibres***
- **Good mechanical properties**
- **Very low exotherm in thick sections**

Purpose

As SP's premium infusion system, PRIME 27 is suitable for the female moulding of large, complex components incorporating advanced fibres such as carbon and aramid*. Typical projects include spars, hulls and reinforcing structures.

Introduction

PRIME™ 27 offers outstanding performance in a variety of liquid infusion processes including SCRIMP™, RIFT (resin infusion under flexible tooling), VARTM (vacuum assisted resin transfer moulding) and RTM (resin transfer moulding).

It is SP's premium infusion system, offering high mechanical and thermal properties, lower viscosity, improved wetting out and longer working time than PRIME™ 20LV. It achieves excellent mechanical and physical properties, including a high Tg from a moderate (50°C) postcure.

PRIME™ 27 resin uses PRIME™ 20 hardeners to give a range of working times and cure speeds. This enables the gel time of the resin to be closely matched to the required infusion time for any particular size of moulded part.

The system has an exceptionally low exotherm characteristic, which allows thick sections to be manufactured without risk of premature gelation due to exothermic heat build-up. This low exotherm will also extend the life of mould tools.

All the above properties make PRIME™ 27 a useful product for the infusion of large complex mouldings utilising "higher end" reinforcement fibres such as carbon.

*Unidirectional carbon fibre is acknowledged as difficult to infuse. Please contact a member of our technical team before attempting a carbon infusion with PRIME™ 27

Component Properties

Table 1. Component Properties				
	Resin	PRIME™ 20 Hardener		
		Fast	Slow	Extra Slow
Mix Ratio by Weight	100	28	28	28
Mix Ratio by Volume	100	34	34	34
Viscosity @15°C (cP)	1650 - 1670	300	280	230
Viscosity @20°C (cP)	815-865	260	230	170
Viscosity @25°C (cP)	480-510	210	160	140
Viscosity @30°C (cP)	310-330	170	130	110
Shelf Life (months)	12	12	12	12
Colour (Gardener)	1	7	Clear	1
Mixed Colour (Gardener)	-	3	1	1
Density (g/cm ³)	1.132	0.983	0.95	0.94
Mixed Density	-	1.086	1.0839	1.08
Hazard Category	Xi,N	C	C	C

Mixing and Handling

PRIME™ 27 resin must be mixed with PRIME™ 20 hardener in the following ratio:

PRIME™ 27 resin : PRIME™ 20 hardener (Fast, Slow or Extra Slow)
100 : 28 (by weight)

The fast hardener is not usually used alone with the resin - although it can be used in this way, it is more often premixed with another PRIME™ 20 hardener to achieve shorter gel times than would otherwise be obtained with the use of Slow or Extra Slow hardener alone. The premixed hardener combination (Fast + Slow, or Fast + Extra Slow) is still mixed with resin at 100 : 28 by weight.

Accurate measurement and thorough mixing are essential when using this system, and any deviation from the prescribed mix ratios will seriously degrade the physical properties of the cured system. The resin and hardener must be stirred well for two minutes or more, with particular attention being paid to the sides and bottom of the container. As soon as the material is mixed the reaction begins. This reaction produces heat (exothermic), which will in turn accelerate the reaction. If this mixed material is left in a confined mixing vessel the heat cannot disperse and the reaction will become uncontrollable. See "Working Properties" for details.

Instructions for use

PRIME™ 27 resin used with PRIME™ 20 hardeners is intended for use in any established resin infusion process. The information provided in the tables in this data sheet should allow the user to achieve a successful result with this system. However, if further information is required please contact SP Technical Services.

Cure Schedule

A post-cure is required to generate optimum mechanical properties for this system. The recommended minimum cure schedule is 7 hours at 65°C or 16 hours at 50°C. Ambient temperature cure of this system will not generate adequate mechanical properties and is therefore not recommended.

Infused parts can be pre-cured on the mould at temperatures just above ambient (eg 30-45°C) to give the part sufficient strength and stiffness to allow earlier demoulding. Such parts should still be post cured for the minimum recommended time/temperature indicated above, to obtain adequate in-service mechanical properties. Contact SP Technical Services for "pre-cure" time and temperature recommendations.

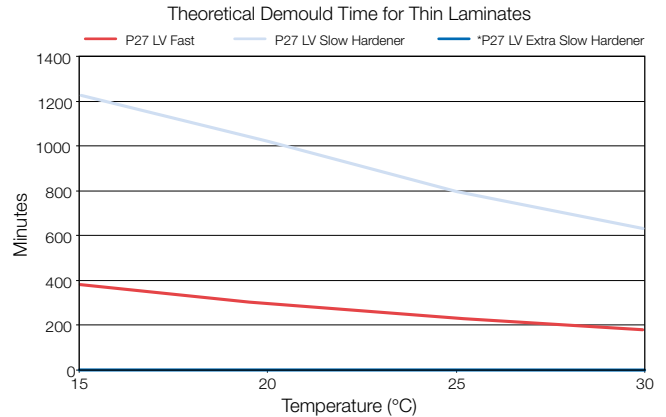
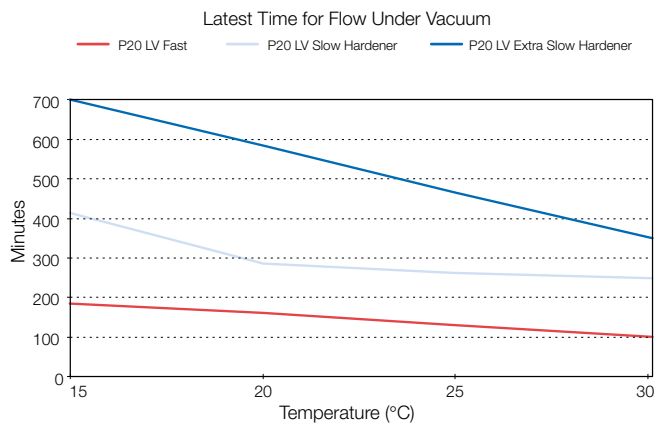
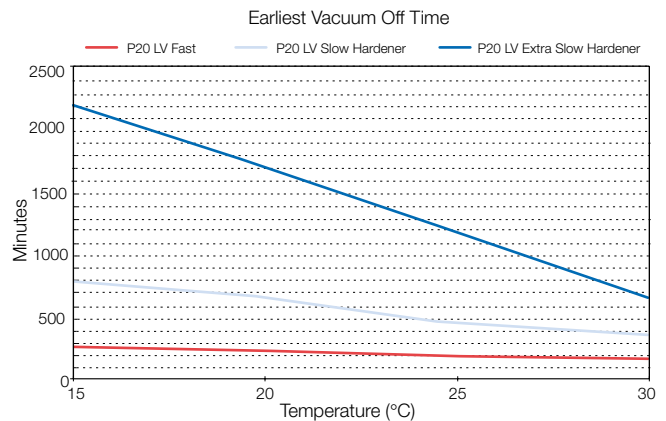
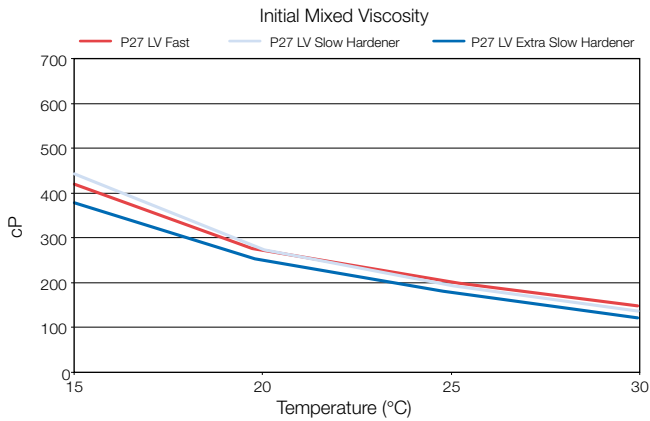
Working Properties

	PRIME™ 20 Fast Hardener				PRIME™ 20 Slow Hardener				PRIME™ 20 Extra Slow Hardener			
	15°C	20°C	25°C	30°C	15°C	20°C	25°C	30°C	15°C	20°C	25°C	30°C
Initial Mixed Viscosity (cP)	405 - 425	260 - 280	190 - 210	145 - 155	425 - 445	265 - 285	190 - 200	130 - 150	370 - 390	250 - 270	170 - 180	115 - 125
Geltime – Tecam 150g in water (hr : min)	2:00	00:50	00:25	00:13	7:40	4:45	2:40	2:15	14:50	10:40	7:20	5:30
Pot life 500g in air (hr : min)	00:28	00:20	00:14	00:07	1:12	1:00	00:46	00:35	4:45	4:00	3:50	3:40
Latest flow under vacuum (theoretical, thin film, hr : min)	3:05	2:40	2:15	1:40	6:50	4:50	4:15	4:00	11:40	9:40	7:40	5:45
Earliest vacuum off time (theoretical thin film) (hr : min)	4:40	4:00	3:20	2:40	13:00	11:00	7:15	6:00	37:00	28:40	19:50	11:10
Demould time (hr : min)	6:10	5:05	3:45	2: 50	20:15	17:00	13:15	10:25	*	*	*	*

Notes: For an explanation of test methods used see 'SP Formulated Products Technical Characteristics', which can be found in the 'Intro to Form Prods'.pdf. This can be found in the Formulated product section on the SP website. www.spsystems.com

All figures quoted are indicative of the properties of the product concerned. Some batch to batch variation may occur.

* This hardener requires an elevated temperature cure – demould times at temperatures of 15-30°C are not recommended. See "Cure Schedule" for further details.



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Cured Properties

Cured System Thermal Properties

The thermal properties of PRIME™ 27 with various PRIME™ 20 Hardeners, as determined by Differential Scanning Calorimeter (Mettler Toledo DSC821E), and Dynamic Mechanical Thermal Analysis (Rheodyne Thermal Analyser MkIII), are presented in Table 3.

Table 3. Cured System Thermal Properties			
Hardener used	Fast	Slow	Extra Slow
Cure Schedule	16hrs 50°C	16hrs 50°C	16hrs 50°C
Tg1 (DMTA)	69.4	68.7	70.0
Tg (DMTA - peak tan δ)	85	84	81
TgUlt (DMTA)	86	96	100
ΔH – DSC (J/g)	3.91	4.17	15.4
Estimated HDT	60-62	60-62	61-63

Cured System Mechanical Properties (Matrix Properties)

The mechanical properties of the matrix system are presented in Table 4.

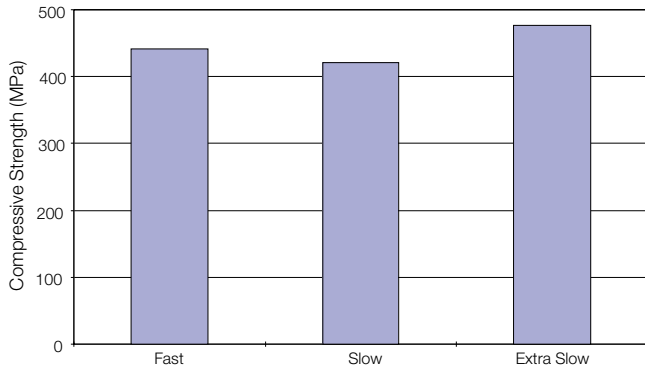
Table 4. Cured System Mechanical Properties			
Hardener used	Fast	Slow	Extra Slow
Cure Schedule	16hrs 50°C	16hrs 50°C	16hrs 50°C
Tensile Strength (MPa)	69.6	73.3	72.0
Tensile Modulus (GPa)	3.46	3.47	3.60
Strain to failure (%)	5.0	4.5	5.35
Moisture Absorption (%)	tba	tba	0.97
Cured density (g/cm ³)	1.133	1.139	1.140
Linear Shrinkage (%)	1.05	1.6	1.7
Barcol Hardness	18	28	38

Cured Laminate Properties

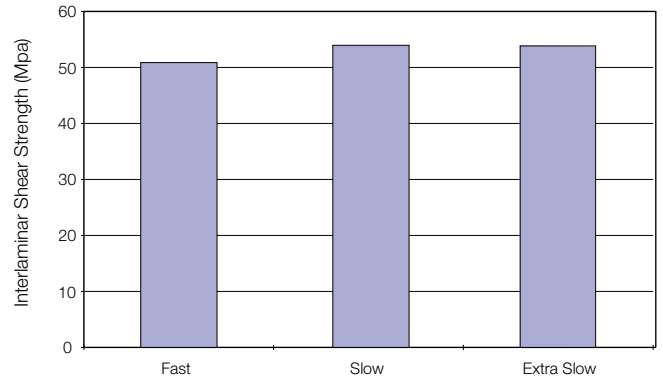
The cured laminate properties are presented in Table 5. The laminate is constructed using RE301 8 harness satin weave glass and PRIME™ 27 with various PRIME™ 20 Hardeners.

Table 5. Cured Laminate Properties			
Hardener used	Fast	Slow	Extra Slow
Cure Schedule	16hrs 50°C	16hrs 50°C	16hrs 50°C
Compr. Strength (MPa)	441.28	427.18	479.3
ILSS (MPa)	51.01	53.99	53.2
ILSS wet retention (%)	tba	tba	80

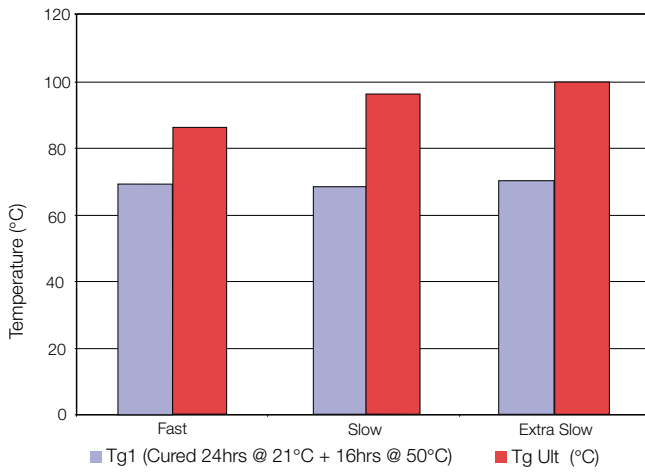
Compressive Strength of RE300 Glass Laminate
Cured 24hrs. @ 21°C + 16hrs. @ 50°C



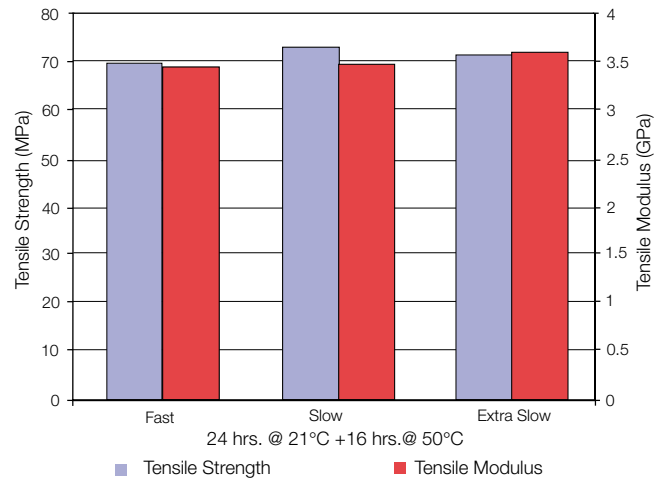
Interlaminar Shear Strength of RE300 Glass Laminate
Cured 24hrs. @ 21°C + 16hrs. @ 50°C



Glass Transition Temperature



Tensile Properties of Castings



Health & Safety

PRIME™ 27 system

PRIME™ 27 resin and PRIME™ 20 hardeners have been designed for use in entirely closed-mould processes. This includes the mixing phase, which should only be carried out by automated mixing machines. It is not suitable for open-mould processing and strict adherence to the health and safety procedures stated in the product MSDSs is essential (see below).

There should be some post-cure on the component before trying to machine cut it. If using 100% Slow or Extra Slow Hardener the user should give the part some heat even before de-mould, to stop it being fragile. When sanding or machining a component made from PRIME™ 27, which has seen no heat, there will be very low degree of cure, and the sanding dust will be more irritating than dust from a laminate, which has seen heat to effect more thorough cross linking.

SP produces a separate full Material Safety Data Sheet for each component of this system. Please ensure that you have the correct MSDS to hand for the materials you are using before commencing work. A more detailed guide for the safe use of SP resin systems is also available from SP, and can be found on our website at www.spsystems.com

Any accidental spillage should be soaked up with sand, sawdust, cotton waste or any other absorbent material. The area should then be washed clean (see appropriate Material Safety Data Sheet).

Applicable Risk & Safety Phrases

Resin	Fast Hardener
R 36/38, 43, 52	R 36/38, 43, 52 R 21/22, 34, 43
S 24, 26, 28, 37/39	S 24, 26, 28, 37/39 S 20, 26, 36/37/39, 45
	Slow Hardener
	R 21/22, 34, 43, 52/53
	S 20, 26, 28, 36/37/39, 45, 61
	Extra Slow Hardener
	R 21/22, 34, 43, 52/53
	S 26, 36/37/39, 45, 61

General Health and Safety

The following points must be considered:

1. Skin contact must be avoided by wearing protective gloves. SP recommends the use of disposable nitrile gloves for most applications. The use of barrier creams is not recommended, but to preserve skin condition a moisturising cream should be used after washing.
2. Overalls or other protective clothing should be worn when mixing, laminating or sanding. Contaminated work clothes should be thoroughly cleaned before re-use.
3. Eye protection should be worn if there is a risk of resin, hardener, solvent or dust entering the eyes. If this occurs flush the eye with water for 15 minutes, holding the eyelid open, and seek medical attention.
4. Ensure adequate ventilation in work areas. Respiratory protection should be worn if there is insufficient ventilation. Solvent vapours should not be inhaled as they can cause dizziness, headaches, loss of consciousness and can have long term health effects.
5. If the skin becomes contaminated, then the area must be immediately cleansed. The use of resin-removing cleansers is recommended. To finish, wash with soap and warm water. The use of solvents on the skin to remove resins etc must be avoided.

Washing should be part of routine practice:

- before eating or drinking
- before smoking
- before using the lavatory
- after finishing work

6. The inhalation of sanding dust should be avoided and if it settles on the skin then it should be washed off. After more extensive sanding operations a shower/bath and hair wash is advised.

Transport & Storage

The system should be kept in securely closed containers during transport and storage. Storage should be in a dry place out of direct sunlight. The temperature should be between 18°C and 25°C. Containers should be firmly closed. The hardeners, in particular, will suffer serious degradation if left exposed to air.

Shelf Life

Adequate long-term storage conditions for both materials will result in a shelf life of two years for both the resin and hardeners.

Notice

All advice, instruction or recommendation is given in good faith but the Company only warrants that advice in writing is given with reasonable skill and care. No further duty or responsibility is accepted by the Company. All advice is given subject to the terms and conditions of sale (the Conditions) which are available on request from the Company or may be viewed at the Company's Website: www.spsystems.com.

The Company strongly recommends that Customers make test panels and conduct appropriate testing of any goods or materials supplied by the Company to ensure that they are suitable for the Customer's planned application. Such testing should include testing under conditions as close as possible to those to which the final component may be subjected. The Company specifically excludes any warranty of fitness for purpose of the goods other than as set out in writing by the Company. The Company reserves the right to change specifications and prices without notice and Customers should satisfy themselves that information relied on by the Customer is that which is currently published by the Company on its website. Any queries may be addressed to the Technical Services Department.

SP data sheets are being continuously reviewed and updated. Please ensure that you have the current version before using the product, by contacting SP Marketing Communications and quoting the revision number in the bottom left-hand corner of the back cover page. Alternatively, the latest version can be downloaded from our web site: www.spsystems.com

Please Note:

*Unidirectional carbon fibre is acknowledged as difficult to infuse. Please contact a member of our technical team before attempting a carbon infusion with PRIME™ 27.

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