PRIME™ 20LV

Epoxy Infusion System

- **Very low viscosity**
- **Variable infusion times**
- **Very low exotherm even in thick sections**
- **Suitable for infusing very large structures**
- **GL and Lloyds approved***

Introduction

PRIME™ 20LV is the next generation of PRIME™ 20 epoxy infusion system, which is specifically designed for use in a variety of resin infusion processes including RTM (resin transfer moulding), SCRIMP™ and RIFT (resin infusion under flexible tooling).

PRIME™ 20LV has a much reduced viscosity resin and longer working time, which makes it ideal for infusing very large parts with complex reinforcements in one operation. It maintains the exceptionally low exotherm characteristic, which allows thick sections to be manufactured without risk of premature gelation due to the heat of exothermic reaction. This low exotherm will also help to extend the life of mould tools.

PRIME™ 20LV has been used successfully for the single-operation moulding of components ranging from narrow carbon yacht masts, up to 80' yacht hulls and wind turbine blades. It achieves excellent mechanical and physical properties from a moderate (50°C) postcure, offering the finished laminate properties that lie between hand lamination and low-temperature cure prepreg processes.

The PRIME™ 20LV system is available with four hardeners, offering a range of working times and cure speeds. This enables the geltime of the resin to be more closely matched to the required infusion time for any particular size of moulded part. The high Tg hardener is ideal for applications requiring 100°C plus thermal capability, whilst maintaining all the other properties of the system.

Extensive tests at Gurit have shown that PRIME™ 20LV with Slow and Extra Slow Hardeners provide an excellent bond to certain types of vinylester resin. This permits production boat builders to use existing polyester gelcoat products with high performance epoxy infusion systems by using a vinylester tie-coat interface. This delivers significant benefits to the production boat builder, in terms of improved durability and performance of hulls/decks whilst retaining the high gloss and ease of gelcoat repair associated with polyester systems.

For further advice and comprehensive processing notes please contact Marine Technical Support.

*High Tg Hardener excluded

Table 1. Component Properties					
	LV Resin	Hardener			
		Fast	Slow	Extra Slow	High Tg
Mix Ratio by Weight	100	26	26	26	24
Mix Ratio by Volume	100	31.4	31.4	31.4	32.50
Viscosity @20°C (cP)	1010-1070	25-27	22-24	16-18	29-31
Viscosity @25°C (cP)	600-640	20-22	15-17	13-15	25-27
Viscosity @30°C (cP)	390-410	16-18	12-14	10-12	21-23
Shelf Life (months)	12	12	12	12	12
Colour (Gardener)	1	7	Clear	1	Clear
Mixed Colour (Gardener)	-	3	1	1	1
Density (g/cm^3)	1.123	0.983	0.936	0.931	0.926
Mixed Density	-	1.089	1.084	1.083	1.078

Mixing and Handling

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

PRIME™ 20LV resin: PRIME™ hardener (Fast, Slow or Extra Slow)
100 : 26 (by weight)
100 : 31.4 (by volume)

PRIME™ 20LV resin: PRIME™ High Tg Hardener
100 : 24 (by weight)
100 : 29.1 (by volume)

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™ 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 : 26 by weight. High Tg hardener should be used as a stand alone hardener

Accurate measurement and thorough mixing are essential when using this system, and any deviation from the prescribed mixing ratios will seriously degrade the physical properties of the cured system. The resin and hardener must be well stirred 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

Application

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

Cure Schedule

To generate optimum mechanical properties for this system an elevated temperature cure is required. The recommended minimum cure schedule is 7 hours at 65°C or 16 hours at 50°C. Ambient temperature (15-25°C) cure of this system will not generate adequate properties and is therefore not recommended.

Parts can be 'pre-cured' in the mould at temperatures just above ambient (e.g. 35-45°C) to give the part sufficient strength and stiffness to allow earlier demoulding. Such parts should still be post cured at the minimum recommended time/temperature indicated above. Contact Technical Services for 'pre-cure' time/temperature recommendations.

To get the maximum benefit from the High Tg hardener a further elevated post cure is required. For specific requirement contact Technical Services Department.

Table 2. Working Properties

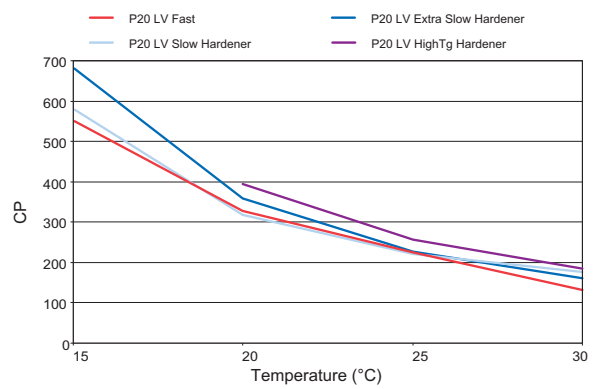
	Fast Hardener				Slow Hardener				Extra Slow Hardener				High Tg Hardener		
	15°C	20°C	25°C	30°C	15°C	20°C	25°C	30°C	15°C	20°C	25°C	30°C	20°C	25°C	30°C
Initial Mixed Viscosity (cP)	535-568	318-338	219-232	127-134	564-598	308-328	214-228	172-182	662-702	347-369	220-234	155-165	397	265	181
Geltime – Tecam 150g in water (hr : min)	1:30	1:09	0:30	0:17	6:20	5:00	3:20	2:20	13:30	10:20	8:00	6:15	7:45	6:30	4:08
Pot life 500g in air (hr : min)	0:35	0:28	0:23	0:16	1:30	1:15	1:00	0:45	7:55	6:00	4:05	2:10	3:20	2:10	1:10
Latest flow under vacuum (theoretical, thin film, hr : min)	3:50	3:10	2:40	1:50	6:00	5:20	4:50	4:10	13:00	10:50	8:50	6:40	8:25	6:30	4:40
Earliest vacuum off time (theoretical thin film) (hr : min)	5:10	4:15	3:20	2:15	8:20	7:30	6:30	5:50	18:10	15:10	11:30	8:50	12:30	9:00	6:30
Demould time (hr : min)	9:00	6:45	5:00	2:30	25:00*	21:00*	15:30*	11:50*	115:00*	88:00*	50:00*	28:00*	24:30*	18:45*	13:00*

Notes: For an explanation of test methods used see '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 website. www.gurit.com

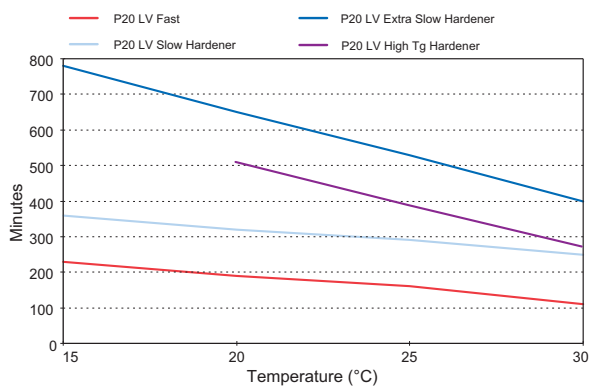
All figures quoted are indicative of the properties of the product concerned. Some batch to batch variation may occur.

*Demoulding components made with Slow, Extra Slow or High Tg Hardener should only be carried out after the part has received an elevated temperature cure in the mould.

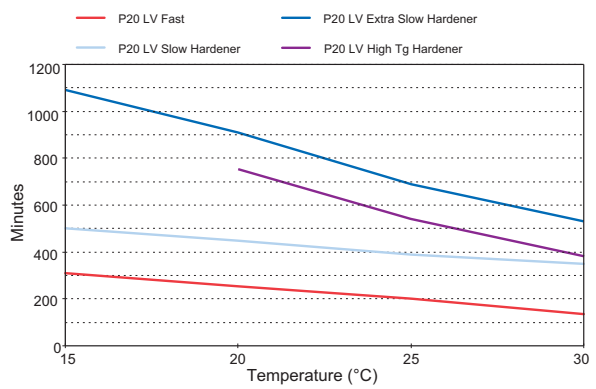
Initial Mixed Viscosity



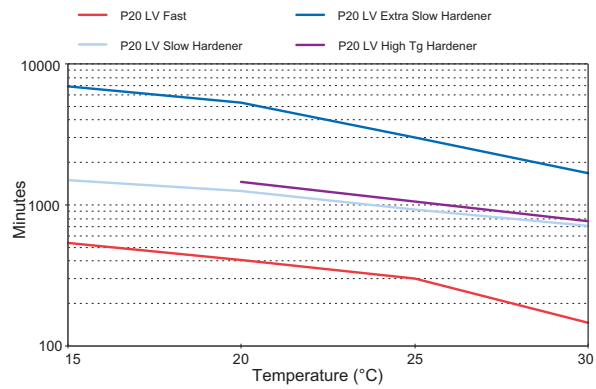
Latest Time for Flow Under Vacuum



Earliest Vacuum Off Time



Theoretical Demould Time for Thin Laminates



Cured Properties

Cured System Thermal Properties

The thermal properties of PRIME™ 20LV system, 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	High Tg
Cure Schedule	16hrs 50°C	16hrs 50°C	16hrs 50°C	16hrs 50°C
Tg (DMTA - peak tan δ)	82.8	82.6	82.9	87
TgUlt (DMTA)	74-76	87-89	90-92	112-115
Tg1 (DMTA)	68-70	68-70	69-71	72-74
∅H – DSC (J/g)	1.54	7.3	0.00	0.00
Estimated HDT	67	68	67	72

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	High Tg
Cure Schedule	16hrs 50°C	16hrs 50°C	16hrs 50°C	16hrs 50°C
Tensile Strength (MPa)	75	73	69	69.7
Tensile Modulus (GPa)	3.2	3.5	3.5	3.2
Strain to failure (%)	4.1	3.5	3.1	3
Moisture Absorption (%)	tba	tba	tba	tba
Cured density (g/cm^3)	1.153	1.144	1.132	1.13
Linear Shrinkage (%)	1.830	1.765	1.541	1.747
Barcol Hardness	21	27	25	34.1

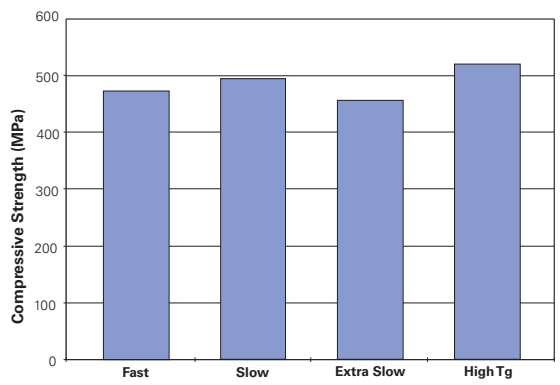
Cured Laminate Properties

The cured laminate properties are presented in Table 5. The laminate is constructed using RE301 8 harness satin weave glass and PRIME™ 20LV/Extra-Slow.

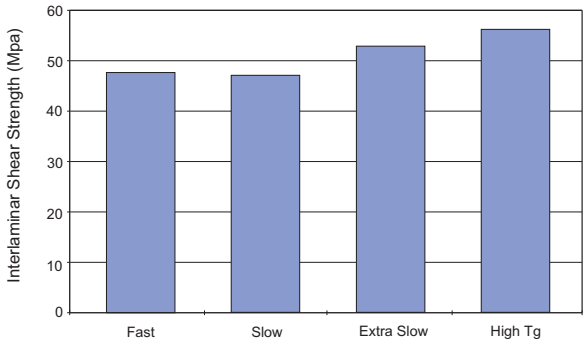
Table 5. Cured Laminate Properties

Hardener used	Fast	Slow	Extra Slow	High Tg
Cure Schedule	16hrs 50°C	16hrs 50°C	16hrs 50°C	16hrs 50°C
Compr. Strength (MPa)	473	492	456	519
ILSS (MPa)	47.6	47.0	52.8	56.9
ILSS wet retention (%)	tba	tba	85	tba

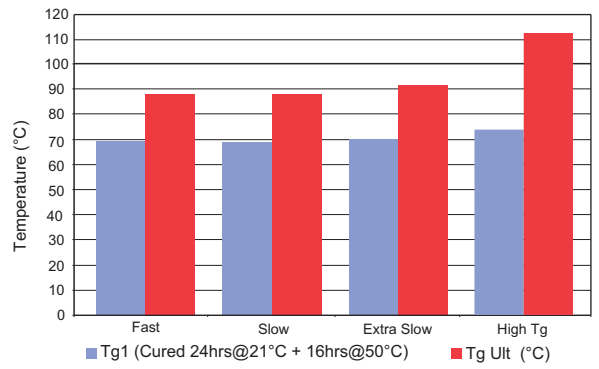
Compressive Strength of RE300 Glass Laminate Cured 24hrs @ 21°C + 16hrs @ 50°C



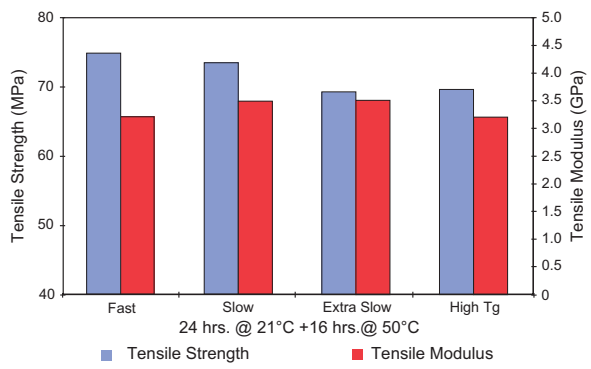
Interlaminar Shear Strength of RE300 Glass Laminate Cured 24hrs @ 21°C + 16hrs @ 50°C



Glass Transition Temperature



Tensile Properties of Castings



Health and Safety

PRIME™ 20LV system

PRIME™ 20LV resin and 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 MSDS is essential.

Users should ensure that some elevated temperature-cure is applied to the component before trying to machine it. In a component made from PRIME™ 20LV which has seen no heat, there will be only a partial cure. Therefore the sanding dust will be more irritating than dust from a laminate cured at elevated temperature, in which there will be more thorough cross linking.

Gurit produces a separate full Material Safety Data Sheet (MSDS) 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 Gurit resin systems is also available from Gurit, and can be found on our website at www.gurit.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

Refer to MSDS

General Health and Safety Points

The following points must be considered:

1. Skin contact must be avoided by wearing protective gloves. Gurit 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 one year for both the resin and hardeners.

Notice

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