

AMPREG™ 21FR / 3X HARDENERS

FIRE RETARDANT EPOXY WET LAMINATING SYSTEM



Ampreg™ 21FR resin / Ampreg™ 3X Hardeners has been optimised for the manufacture of large composite structures using hand layup, and vacuum bagging techniques, whilst offering improved health & safety through the careful selection of low toxicity raw materials.

Ampreg™ 21FR resin / Ampreg™ 3X Hardeners has been designed to give excellent mechanical and thermal properties from both ambient temperature cures, and moderate temperature postcures (50°C / 122°F).

This system is available with the full range of Ampreg™ 3X Hardener speeds, from Fast to Extra Slow and in a wide range of formats from small pack sizes to drums and IBCs.

- Uses Ampreg™ 3X low toxicity hardeners
- Indicative FST performance evaluated FAR Part 25 (60s flame applied)
- Range of working times using blendable hardeners
- Ideal for wet laminating large composite structures
- Good cure progression from ambient only cures
- Speciality hardener available
- Mix Ratio by Weight 100:17

INSTRUCTIONS FOR USE

The product is optimised for use between 18 - 25°C (64 – 77°F). At lower temperatures the product thickens and may become unworkable. At higher temperatures working times will be significantly reduced. Maximum relative humidity for use is 70%.

MIXING AND HANDLING

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. Ampreg™ 3X Fast and Extra-slow hardeners can be blended in order to achieve intermediate speeds as indicated in the table.

HARDENER	FAST	STANDARD	SLOW	EXTRA-SLOW
Ampreg 3X Fast	100%	67%	25%	0%
Ampreg 3X Extra-slow	0%	33%	75%	100%

When blending hardeners, it is recommended that the hardener components are dispensed and mixed together for approximately 2 minutes before the addition to the resin.

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. Gurit produces a separate full Safety Data Sheet for each component of this system. Please ensure that you have the correct SDS 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 Safety Data Sheet).

APPLICATION

Ampreg™ 21FR resin used with Ampreg 3X hardeners is usually applied by foam roller from a roller tray or brush. Accurate fibre volume fractions can be obtained by applying a known weight of mixed resin / hardener to each fabric / fibre layer. If the laminate is particularly thick, it is recommended that slower hardeners are used for laminating the first layers and faster hardeners in the later layers. In this way the whole thickness laid down remains workable for approximately the same time. For further advice, please contact Gurit Technical Support.

CURE SCHEDULE

The system has been developed to provide good mechanical properties after an ambient only cure. The minimum recommended cure temperature is 18°C (64°F). Excellent mechanical/thermal properties can be achieved after a slightly elevated temperature post-cure. An initial cure of at least 48 hours (with slow hardener) or 16 hours (with fast hardener) at 18°C (64°F) is recommended before demoulding. When using the Slow, Extra Slow or High Tg Hardeners exclusively, an elevated temperature postcure is strongly recommended

Post curing the laminate will greatly increase mechanical/thermal properties. The system will achieve similar properties with a cure of 5 hours at 70°C (158°F) or 16 hours at 50°C (122°F). The latter temperature is easily achievable with low cost heating and insulation techniques.

The post cure need not be carried out immediately after laminating. It is possible to assemble several composite components and post-cure the entire assembly together. It is recommended, however, that elevated temperature curing should be completed before any further painting / finishing operations. Furthermore, care should be taken to adequately support the laminate if it is to be post cured after demoulding, and the laminate must be allowed to cool before the support is removed.

When postcuring it is recommended to use a ramp rate of 10°C (18°F) / hour when heating from ambient to the postcure temperature, to ensure that the thermal performance of the laminate stays ahead of the oven temperature. Higher ramp rates may result in the resin softening and distortion of the part.

TRANSPORT & STORAGE

The resin and hardener should be kept in securely closed containers during transport and storage. 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 Safety Data Sheet). Adequate long term storage conditions will result in a shelf life, as per table, from the date of manufacture for both the resin and hardeners, see product container label for expiry date.

COMPONENT	UNITS	10 – 25°C (50 – 77°F)
Ampreg™ 21FR Resin	months	12
Ampreg 3X Fast, Std. Slow, Extra Slow Hardeners	months	36
Ampreg 21FR /30 /31 Hardener Ultra Slow	months	24

Storage should be in a warm dry place out of direct sunlight and protected from frost. The storage temperature should be kept constant between 10 - 25°C (50 – 77°F), cyclic fluctuations in temperature can cause crystallization. Containers should be firmly closed. Hardener, in particular, will suffer serious degradation if left exposed to air. Hardeners may darken over time, however the physical properties are not affected. Be aware of a possible mixed system colour change if very old and new hardeners are used on the same project.

AMPREG™ 21FR RESIN & AMPREG 3X FAST HARDENER

PROPERTY	UNITS	AMPREG™ 21FR RESIN	FAST HARDENER	MIXED SYSTEM	TEST METHOD
Colour	-	White	Very Dark Orange	Cream	-
Mix Ratio by Weight	Parts by weight	100	17	-	-
Mix Ratio by Volume	Parts by volume	100	TBC	-	-
Density at 21°C	g/cm3	1.34	0.90 – 1.10	1.29	ISO 1183-1B

COMPONENT & MIXED SYSTEM PROPERTIES

PROPERTY	UNITS	15°C	20°C	25°C	30°C	40°C	TEST METHOD
Ampreg™ 21FR Resin Viscosity	cP	23,300	11,600	5,500	3,800	2,000	-
Ampreg™ 3X Fast Hardener Viscosity	cP	900 - 1000	500 - 600	300 - 500	150 - 250	90 - 130	-
Initial Mixed System Viscosity	cP	-	-	TBC	-	-	-
Pot Life (150 g, mixed in water)*	hrs:min	-	-	00:30	-	-	Tecam Gel Time

CURED RESIN AND LAMINATE MECHANICAL PROPERTIES

PROPERTY	SYMBOL	UNITS	16 HOURS AT 50°C**	TEST METHOD
Tensile Strength	σ_T	MPa	39.7	ISO 527-2
Tensile Modulus	E_T	GPa	4.77	ISO 527-2
Tensile Strain	ε_T	%	0.97	ISO 527-2
ILSS***	X_{ILSS}	MPa	28.0	ISO 14130

CURED FST PROPERTIES

PROPERTY	REPORT	UNITS	16 HOURS AT 50°C**	SAMPLE DESCRIPTION	TEST STANDARD
Extinguish Time	Indicative result	s	Coupon 1 = 53 Coupon 2 = 33	A21FR / A3X Ultra-Slow / 8 x WRE581T / 40% RC	FAR Part 25 (60s flame applied)
Burn Length	Indicative result	mm	Coupon 1 = 33 Coupon 2 = 32	A21FR / A3X Ultra-Slow / 8 x WRE581T / 40% RC	FAR Part 25 (60s flame applied)

*working time properties are highly subjective to ambient conditions and should be used as an approximate guideline. It is recommended to postcure laminates for 16 hours at 40°C, when using Extra Slow or Ultra Slow Hardeners

**initial cure of 24 hours at 21°C

***laminare construction: 8 plies of WRE581T, 40% resin content by weight

AMPREG™ 21FR RESIN & AMPREG 3X STANDARD HARDENER

PROPERTY	UNITS	AMPREG™ 21FR RESIN	STANDARD HARDENER	MIXED SYSTEM	TEST METHOD
Colour	-	White	Very Dark Orange	Cream	-
Mix Ratio by Weight	Parts by weight	100	17	-	-
Mix Ratio by Volume	Parts by volume	100	TBC	-	-
Density at 21°C	g/cm3	1.34	0.90 – 1.10	1.29	ISO 1183-1B

COMPONENT & MIXED SYSTEM PROPERTIES

PROPERTY	UNITS	15°C	20°C	25°C	30°C	40°C	TEST METHOD
Ampreg™ 21FR Resin Viscosity	cP	23,300	11,600	5,500	3,800	2,000	-
Ampreg™ 3X Standard Hardener Viscosity	cP	200 - 300	150 - 200	100 – 150	50 – 100	30 - 60	-
Initial Mixed System Viscosity	cP	-	-	TBC	-	-	-
Pot Life (150 g, mixed in water)*	hrs:min	-	-	01:16	-	-	Tecam Gel Time

CURED RESIN AND LAMINATE MECHANICAL PROPERTIES

PROPERTY	SYMBOL	UNITS	16 HOURS AT 50°C**	TEST METHOD
Tensile Strength	σ_T	MPa	49.2	ISO 527-2
Tensile Modulus	E_T	GPa	4.69	ISO 527-2
Tensile Strain	ε_T	%	1.40	ISO 527-2
ILSS***	X_{ILSS}	MPa	26.9	ISO 14130

CURED FST PROPERTIES

PROPERTY	REPORT	UNITS	16 HOURS AT 50°C**	SAMPLE DESCRIPTION	TEST STANDARD
Extinguish Time	Indicative result	s	Coupon 1 = 5 Coupon 2 = 5	A21FR / A3X Ultra-Slow / 8 x WRE581T / 40% RC	FAR Part 25 (60s flame applied)
Burn Length	Indicative result	mm	Coupon 1 = 29 Coupon 2 = 53	A21FR / A3X Ultra-Slow / 8 x WRE581T / 40% RC	FAR Part 25 (60s flame applied)

*working time properties are highly subjective to ambient conditions and should be used as an approximate guideline. It is recommended to postcure laminates for 16 hours at 40°C, when using Extra Slow or Ultra Slow Hardeners

**initial cure of 24 hours at 21°C

***laminare construction: 8 plies of WRE581T, 40% resin content by weight

AMPREG™ 21FR RESIN & AMPREG 3X SLOW HARDENER

PROPERTY	UNITS	AMPREG™ 21FR RESIN	SLOW HARDENER	MIXED SYSTEM	TEST METHOD
Colour	-	White	Burnt Orange	Pale Yellow	-
Mix Ratio by Weight	Parts by weight	100	17	-	-
Mix Ratio by Volume	Parts by volume	100	TBC	-	-
Density at 21°C	g/cm3	1.34	0.90 – 1.10	1.29	ISO 1183-1B

COMPONENT & MIXED SYSTEM PROPERTIES

PROPERTY	UNITS	15°C	20°C	25°C	30°C	40°C	TEST METHOD
Ampreg™ 21FR Resin Viscosity	cP	23,300	11,600	5,500	3,800	2,000	-
Ampreg™ 3X Slow Hardener Viscosity	cP	34 - 42	24 - 34	20 - 30	14 - 20	8 - 16	-
Initial Mixed System Viscosity	cP	-	-	TBC	-	-	-
Pot Life (150 g, mixed in water)*	hrs:min	-	-	02:48	-	-	Tecam Gel Time

CURED RESIN AND LAMINATE MECHANICAL PROPERTIES

PROPERTY	SYMBOL	UNITS	16 HOURS AT 50°C**	TEST METHOD
Tensile Strength	σ_T	MPa	43.0	ISO 527-2
Tensile Modulus	E_T	GPa	4.66	ISO 527-2
Tensile Strain	ε_T	%	1.10	ISO 527-2
ILSS***	X_{ILSS}	MPa	30.2	ISO 14130

CURED FST PROPERTIES

PROPERTY	REPORT	UNITS	16 HOURS AT 50°C**	SAMPLE DESCRIPTION	TEST STANDARD
Extinguish Time	Indicative result	s	Coupon 1 = 40 Coupon 2 = 14	A21FR / A3X Ultra-Slow / 8 x WRE581T / 40% RC	FAR Part 25 (60s flame applied)
Burn Length	Indicative result	mm	Coupon 1 = 37 Coupon 2 = 31	A21FR / A3X Ultra-Slow / 8 x WRE581T / 40% RC	FAR Part 25 (60s flame applied)

*working time properties are highly subjective to ambient conditions and should be used as an approximate guideline. It is recommended to postcure laminates for 16 hours at 40°C, when using Extra Slow or Ultra Slow Hardeners

**initial cure of 24 hours at 21°C

***laminare construction: 8 plies of WRE581T, 40% resin content by weight

AMPREG™ 21FR RESIN & AMPREG 3X EXTRA-SLOW HARDENER

PROPERTY	UNITS	AMPREG™ 21FR RESIN	EXTRA-SLOW HARDENER	MIXED SYSTEM	TEST METHOD
Colour	-	White	Colourless / Very Pale Yellow	Cream	-
Mix Ratio by Weight	Parts by weight	100	17	-	-
Mix Ratio by Volume	Parts by volume	100	TBC	-	-
Density at 21°C	g/cm3	1.34	0.85 – 1.05	1.28	ISO 1183-1B

COMPONENT & MIXED SYSTEM PROPERTIES

PROPERTY	UNITS	15°C	20°C	25°C	30°C	40°C	TEST METHOD
Ampreg™ 21FR Resin Viscosity	cP	23,300	11,600	5,500	3,800	2,000	-
Ampreg™ 3X Extra-Slow Hardener Viscosity	cP	18 - 28	15 - 20	5 - 15	5 – 10	4 - 8	-
Initial Mixed System Viscosity	cP	-	-	TBC	-	-	-
Pot Life (150 g, mixed in water)*	hrs:min	-	-	06:15	-	-	Tecam Gel Time

CURED RESIN AND LAMINATE MECHANICAL PROPERTIES

PROPERTY	SYMBOL	UNITS	16 HOURS AT 50°C**	TEST METHOD
Tensile Strength	σ_T	MPa	45.7	ISO 527-2
Tensile Modulus	E_T	GPa	4.55	ISO 527-2
Tensile Strain	ε_T	%	1.21	ISO 527-2
ILSS***	X_{ILSS}	MPa	29.6	ISO 14130

CURED FST PROPERTIES

PROPERTY	REPORT	UNITS	16 HOURS AT 50°C**	SAMPLE DESCRIPTION	TEST STANDARD
Extinguish Time	Indicative result	s	Coupon 1 = 13 Coupon 2 = 30	A21FR / A3X Ultra-Slow / 8 x WRE581T / 40% RC	FAR Part 25 (60s flame applied)
Burn Length	Indicative result	mm	Coupon 1 = 44 Coupon 2 = 45	A21FR / A3X Ultra-Slow / 8 x WRE581T / 40% RC	FAR Part 25 (60s flame applied)

*working time properties are highly subjective to ambient conditions and should be used as an approximate guideline. It is recommended to postcure laminates for 16 hours at 40°C, when using Extra Slow or Ultra Slow Hardeners

**initial cure of 24 hours at 21°C

***laminare construction: 8 plies of WRE581T, 40% resin content by weight

AMPREG™ 21FR RESIN & AMPREG ULTRA-SLOW HARDENER

SPECIALITY HARDENER

This hardener does not fall within our low toxicity and common mix ratio range of the standard 3X range of hardeners, see MSDS for details. This product summary is intended for use in conjunction with further advice provided under the Instructions for Use section. All data has been generated from typical production material and does not constitute a product specification.

PROPERTY	UNITS	AMPREG™ 21FR RESIN	ULTRA-SLOW HARDENER	MIXED SYSTEM	TEST METHOD
Colour	-	White	Blue	Pale Blue	-
Mix Ratio by Weight	Parts by weight	100	18	-	-
Mix Ratio by Volume	Parts by volume	100	26	-	-
Density at 21°C	g/cm ³	1.34	0.94	1.28	ISO 1183-1B

COMPONENT & MIXED SYSTEM PROPERTIES*

PROPERTY	UNITS	20°C	25°C	30°C	TEST METHOD
Ampreg™ 21FR Resin Viscosity	cP	11,600	5,500	3,800	-
Ampreg™ Ultra-Slow Hardener Viscosity	cP	22	14	9	-
Initial Mixed System Viscosity	cP	-	700	530	-
Pot Life (150 g, mixed in water)*	hrs:min	-	06:55	-	Tecam Gel Time
Earliest time to apply Vacuum	hrs:min	-	07:40	-	Internal Gurit Method
Latest time to apply Vacuum	hrs:min	-	10:00	-	Internal Gurit Method
Earliest demould time	hrs:min	It is recommended to postcure laminates for 16 hours at 40°C, when manufactured using Extra Slow or Ultra Slow Hardeners.			Internal Gurit Method

CURED RESIN AND LAMINATE MECHANICAL AND THERMAL PROPERTIES

PROPERTY	SYMBOL	UNITS	4 Hours @ 70°C**	TEST METHOD
Glass Transition Temperature	T _{g2}	°C	75.5	ISO 11357 (DSC)
Glass Transition Temperature	T _{g1}	°C	75.6	ISO 6721 (DMA)
Cured Density	ρ _{CURED}	g/cm ³	1.28	ISO 1183-1A
Tensile Strength	σ _T	MPa	47.2	ISO 527-2
Tensile Modulus	E _T	GPa	4.57	ISO 527-2
Tensile Strain	ε _T	%	1.38	ISO 527-2
ILSS***	X _{ILSS}	MPa	24.5	ISO 14130

CURED FST PROPERTIES

PROPERTY	REPORT	UNITS	16 HOURS AT 50°C**	SAMPLE DESCRIPTION	TEST STANDARD
Extinguish Time	Indicative result	s	Coupon 1 = 10 Coupon 2 = 9	A21FR / Ultra-Slow / 8 x WRE581T / 40% RC	FAR Part 25 (60s flame applied)
Burn Length	Indicative result	mm	Coupon 1 = 26 Coupon 2 = 24	A21FR / Ultra-Slow / 8 x WRE581T / 40% RC	FAR Part 25 (60s flame applied)

*working time properties are highly subjective to ambient conditions and should be used as an approximate guideline. It is recommended to postcure laminates for 16 hours at 40°C, when using Extra Slow or Ultra Slow Hardeners

initial cure of 24 hours at 21°C *laminare construction: 8 plies of WRE581T, 40% resin content by weight

HEALTH AND SAFETY

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. 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 & vaping
- 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.

Gurit produces a separate full Safety Data Sheet for all hazardous products. Please ensure that you have the correct SDS to hand for the materials you are using before commencing work.

NOTICE

All advice, instruction or recommendation is given in good faith but the selling Gurit entity (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 Gurit's Website: www.gurit.com/terms-and-conditions.aspx

The Company strongly recommends that Customers make test panels in the final process conditions and conduct appropriate testing of any goods or materials supplied by the Company prior to final use 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. Due to the varied nature of end-use applications, the Company does, in particular, not warrant that the test panels in the final process conditions and/or the final component pass any fire standards.

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.

Gurit is continuously reviewing and updating literature. Please ensure that you have the current version by contacting your sales contact and quoting the revision number in the bottom left-hand corner of this page.

CONTACT INFORMATION

Please see local contact information at www.gurit.com

24-HOUR CHEMICAL EMERGENCY NUMBER

For advice on chemical emergencies, spillages, fires or exposures:

Europe	+44 1273 289451
Americas	+1 646 844 7309
APAC	+65 3158 1412

customer.support@gurit.com