

# AMPREG™ 33

## EPOXY LAMINATING SYSTEM

**Ampreg 33 has been optimized for the manufacture of large composite structures using hand layup and vacuum bagging techniques whilst offering improved health and safety with CMR free hazard labeling.**

The viscosity of Ampreg 33 has been optimized for good fabric wet-out whilst maintaining drainage resistance for application on vertical surfaces. Ampreg 33 has been designed to give excellent mechanical and thermal properties from both ambient temperature cures and moderate temperature postcures.

The unique formulation offers improved health & safety through the careful selection of low toxicity raw materials as well as Light Reflective Technology which in conjunction with a UV light-source can detect droplets as small as 1mm for easy identification of contamination to improve industrial hygiene.

Ampreg 33 can contain BIO sourced materials with a BIO content up to 26.5%.

This system is available with Ampreg 32/33 hardener with speeds ranging from Fast to Slow and in a wide range of formats from small pack sizes to drums and IBCs. For further advice please contact Gurit Technical Support.



- Uses Ampreg 32/33 low toxicity hardeners
- CMR free hazard labeling
- Up to 26.5% BIO carbon content in resin
- Viscosity optimized for good fabric wet-out and drainage resistance
- Tough resin matrix giving good laminate mechanical properties
- Formulated with Gurit LRT (Light Reflective Technology)
- Mix ratio by weight 100:25



## INSTRUCTIONS FOR USE

### APPLICATION

The product is optimized for use between 18 - 25°C (64 – 77°F), mixing is recommended at minimum 15°C. The mixed system will cure at lower temperatures on substrates down to 5°C. Lower application temperatures will progressively increase the viscosity of the resin and hardeners making it difficult to mix and wet out the reinforcement. The preferred level of humidity for use is 45-70%, however the product can be used at lower and higher levels.

### 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 32/33 Fast and Slow hardeners can be blended in order to achieve intermediate speed as indicated in the table.

HARDENER	FAST	STANDARD	SLOW
Ampreg 32/33 Fast	100%	37%	0%
Ampreg 32/33 Slow	0%	63%	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](http://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 33 resin used with Ampreg 32/33 hardeners is usually applied by foam roller from a roller tray or brush. Accurate fiber volume fractions can be obtained by applying a known weight of mixed resin / hardener to each fabric / fiber 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. 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 demolding. 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 postcure 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 demolding, 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.

### HIGH HUMIDITY DURING LAMINATION

Although the recommended ambient relative humidity remains <70%, Gurit has successfully carried out testing at 90% relative humidity using the Fast Hardener which showed no significant drop in ILSS. For the testing carried out by Gurit, subsequent plies were applied within 5 mins of each other and vacuum & heat was applied directly following full lamination. As mechanical properties are highly dependent on the processing method, Gurit recommends that a test laminate is manufactured and evaluated in representative conditions in order to ensure that the required performance is achieved.

### LIGHT REFLECTIVE TECHNOLOGY (LRT)

Ampreg 33 is formulated with Gurit's Light Reflective Technology included as standard, which causes the resin or mixed system to fluoresce under UV light and can assist in developing best practice post work. This ensures minimum exposure and no transfer of epoxy outside the workshop, significantly reducing the risks of sensitization and other conditions associated with contact with uncured resins. Contact Gurit Technical Support for further information.

## 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 33 Resin	Months	36
Ampreg 32 / 33 Fast, Std. Slow Hardeners	Months	36

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 color change if very old and new hardeners are used on the same project.

## AMPREG 33 RESIN & AMPREG 32/33 FAST HARDENER

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	RESIN	HARDENER	MIXED SYSTEM	TEST METHOD
Color	-	Colorless / Yellow	Dark Orange	Pale Orange	-
Mix ratio by weight	Parts by weight	100	25	-	-
Mix ratio by volume	Parts by volume	100	29	-	-
Density at 21°C	g/cm3	1.16	0.95 - 1.15	-	ISO 1183-1B

## COMPONENT & MIXED SYSTEM PROPERTIES

PROPERTY	UNITS	25°C	TEST METHOD
Ampreg 33 Resin viscosity	cP	2470	-
Ampreg 32/33 Fast Hardener viscosity	cP	100 - 150	-
Pot life (150 g, mixed in water)*	hrs:min	00:30	Tecam Gel Time
Thin film gelation	hrs:min	01:25	Gurit VI

## CURED RESIN PROPERTIES

PROPERTY	SYMBOL	UNITS	28 DAYS @ 23°C	5 HOURS @ 70°C**	TEST METHOD
Glass transition temp.	T <sub>g2</sub>	°C	54.25	92.7	ISO 11357 (DSC)
Ultimate glass transition temp.	UT <sub>g2</sub>	°C	96.55	-	ISO 11357 (DSC)
Tensile strength	σ <sub>T</sub>	MPa	-	72.48	ISO 527-2
Tensile modulus	E <sub>T</sub>	GPa	-	3.13	ISO 527-2
Tensile strain	ε <sub>T</sub>	%	-	7.84	ISO 527-2
Flexural strength	σ <sub>F</sub>	N/mm <sup>2</sup>	-	120.81	ISO 178
Flexural modulus	E <sub>F</sub>	GPa	-	3.22	ISO 178
Flexural strain	ε <sub>F</sub>	%	-	7.10	ISO 178

## CURED LAMINATE MECHANICAL PROPERTIES

PROPERTY	SYMBOL	UNITS	16 HOURS @ 50°C**	TEST METHOD
Fiber volume fraction	V <sub>FVF</sub>	%	36.6	-
ILSS***	X <sub>ILSS</sub>	MPa	49.97	ISO 14130
ILSS (after 7 days in water)***	X <sub>ILSS</sub>	MPa	50.18	ISO 14130

\*working time properties are highly subjective to ambient conditions and should be used as an approximate guideline

\*\*initial cure of 24 hours at 21°C      \*\*\* 4 plies XE603

## AMPREG 33 RESIN & AMPREG 32/33 STANDARD HARDENER

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	RESIN	HARDENER	MIXED SYSTEM	TEST METHOD
Color	-	Colorless / Yellow	Dark Orange	Pale Orange	-
Mix ratio by weight	Parts by weight	100	25	-	-
Mix ratio by volume	Parts by volume	100	29	-	-
Density at 21°C	g/cm <sup>3</sup>	1.16	0.95 - 1.15	-	ISO 1183-1B

## COMPONENT & MIXED SYSTEM PROPERTIES

PROPERTY	UNITS	25°C	TEST METHOD
Ampreg 33 Resin viscosity	cP	2470	-
Ampreg 32/33 Standard Hardener viscosity	cP	100 - 150	-
Pot life (150 g, mixed in water)*	hrs:min	01:31	Tecam Gel Time
Thin film gelation	hrs:min	02.23	Gurit WI

## CURED RESIN PROPERTIES

PROPERTY	SYMBOL	UNITS	28 DAYS @ 23°C	5 HOURS @ 70°C**	TEST METHOD
Glass transition temp.	T <sub>g2</sub>	°C	53.24	86.0	ISO 11357 (DSC)
Ultimate glass transition temp.	UT <sub>g2</sub>	°C	97.2	-	ISO 11357 (DSC)
Tensile strength	σ <sub>T</sub>	MPa	-	72.74	ISO 527-2
Tensile modulus	E <sub>T</sub>	GPa	-	3.10	ISO 527-2
Tensile strain	ε <sub>T</sub>	%	-	8.56	ISO 527-2
Flexural strength	σ <sub>F</sub>	N/mm <sup>2</sup>	-	120.39	ISO 178
Flexural modulus	E <sub>F</sub>	GPa	-	3.20	ISO 178
Flexural strain	ε <sub>F</sub>	%	-	8.64	ISO 178

## CURED LAMINATE MECHANICAL PROPERTIES

PROPERTY	SYMBOL	UNITS	16 HOURS @ 50°C**	TEST METHOD
Fiber volume fraction	V <sub>FVF</sub>	%	39.5	-
ILSS***	X <sub>ILSS</sub>	MPa	48.11	ISO 14130
ILSS (after 7 days in water)***	X <sub>ILSS</sub>	MPa	46.88	ISO 14130

\*working time properties are highly subjective to ambient conditions and should be used as an approximate guideline

\*\*initial cure of 24 hours at 21°C      \*\*\* 4 plies XE603

## AMPREG 33 RESIN & AMPREG 32/33 SLOW HARDENER

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	RESIN	HARDENER	MIXED SYSTEM	TEST METHOD
Color	-	Colorless / Yellow	Colorless / Pale Yellow	Pale Yellow	-
Mix ratio by weight	Parts by weight	100	25	-	-
Mix ratio by volume	Parts by volume	100	29	-	-
Density at 21°C	g/cm <sup>3</sup>	1.16	0.95 - 1.15	-	ISO 1183-1B

## COMPONENT & MIXED SYSTEM PROPERTIES

PROPERTY	UNITS	25°C	TEST METHOD
Ampreg 33 Resin viscosity	cP	2470	-
Ampreg 32/33 Slow Hardener viscosity	cP	100 - 150	-
Pot Life (150 g, mixed in water)*	hrs:min	03:25	Tecam Gel Time
Thin film gelation	hrs:min	01:27	Gurit WI

## CURED RESIN PROPERTIES

PROPERTY	SYMBOL	UNITS	28 DAYS @ 23°C	5 HOURS @ 70°C**	TEST METHOD
Glass transition temp.	T <sub>g2</sub>	°C	55.04	87.0	ISO 11357 (DSC)
Ultimate glass transition temp.	UT <sub>g2</sub>	°C	95.58	-	ISO 11357 (DSC)
Tensile strength	σ <sub>T</sub>	MPa	-	68.0	ISO 527-2
Tensile modulus	E <sub>T</sub>	GPa	-	3.1	ISO 527-2
Tensile strain	ε <sub>T</sub>	%	-	7.99	ISO 527-2
Flexural strength	σ <sub>F</sub>	N/mm <sup>2</sup>	-	119.47	ISO 178
Flexural modulus	E <sub>F</sub>	GPa	-	2.99	ISO 178
Flexural strain	ε <sub>F</sub>	%	-	8.94	ISO 178

## CURED LAMINATE MECHANICAL PROPERTIES

PROPERTY	SYMBOL	UNITS	16 HOURS @ 50°C**	TEST METHOD
Fiber volume fraction	V <sub>FVF</sub>	%	37.5	-
ILSS***	X <sub>ILSS</sub>	MPa	50.64	ISO 14130
ILSS (after 7 days in water)***	X <sub>ILSS</sub>	MPa	49.23	ISO 14130

\*working time properties are highly subjective to ambient conditions and should be used as an approximate guideline

\*\*initial cure of 24 hours at 21°C      \*\*\* 4 plies XE603

## 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 moisturizing 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 vapors 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

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## CONTACT INFORMATION

Please see local contact information at [www.gurit.com](http://www.gurit.com)

## 24-HOUR CHEMICAL EMERGENCY NUMBER

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

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