Gurit EPOXY

PRODUCT DATASHEET

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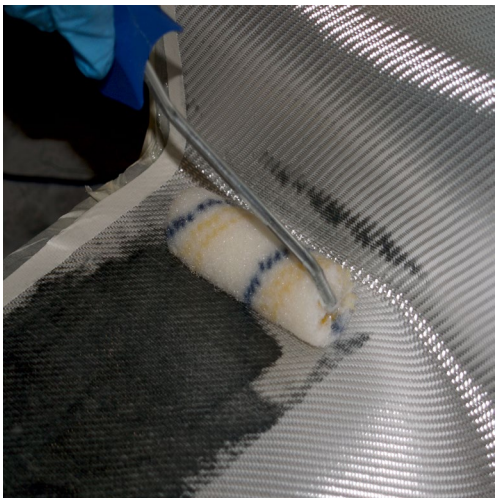

AMPREG™ F230-2

FOAMING EPOXY SYSTEM

The Ampreg 3X laminating range of products has been optimized for the manufacture of large composite structures using hand layup and vacuum bagging techniques whilst offering improved health and safety through the careful selection of low toxicity raw materials.

Ampreg F230-2 is a three part foaming epoxy system using Ampreg 3X hardeners. The final density of the cured product can be controlled by the careful addition of the Foaming Agent, although the product is optimized to the 150 – 300kg/m³ range.

Ampreg F230-2 is ideal for foaming within closed mouldings. In this type of application best results are achieved by applying the F230-2 wet-on-wet to both halves of the moulding, pouring carefully to prevent large bubble entrapment. The mould should then be closed as soon as possible and the F230-2 allowed to expand without further handling. Aim to keep molds level if possible to reduce the vertical expansion distance.

- Uses Ampreg 3X Slow low toxicity hardener
- Expanding epoxy system
- Density 150 – 300kg/m^3
- Good mechanical and thermal properties
- Excellent adhesion to substrates
- Three components for flexibility and storage stability
- Mix ratio by weight 100:22

INSTRUCTIONS FOR USE

APPLICATION

The product is optimized 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

Ampreg F230-2 is a three component system of Resin, Hardener and Foaming Agent. The Resin and Hardener are mixed at a ratio of 100:22 parts by weight and then the required amount of Foaming Agent is mixed into the resin/hardener mix to initiate the foaming process.

For control of the cured foam density, the addition of the foaming agent needs to be accurately controlled. The recommended cured density of 230kg/m³ is obtained by the addition of 1.3 parts Foaming Agent for every 100g of Resin (122g mixed resin/hardener). Having a density of 1, the Foaming Agent can be added by weight or volume (with the 10cc syringe provided). 1.3 cc per 100g resin.

100 grams Resin + 22 grams Hardener + 1.3 grams Foaming agent = 3.5x expansion and cured foam of approximately 230kg/m³

The resin and hardener components should be weighed accurately and mixed together thoroughly for at least two minutes paying particular attention to the sides and bottom of the mixing pot. The Foaming Agent is then added and the product is mixed again expansion of foam starts as soon as the mixing process starts, therefore the product should be applied to the mould or cavity immediately mixing is complete.

Varying the amount of Foaming Agent will affect the cured density and overall expansion rate as detailed in the charts below. The addition of more than 2 parts of foaming agent will result in a low density of foam of variable quality and is therefore not recommended.

EXAMPLE OF USE – TO PREPARE 230KG/M³ CURED FOAM WITH A 3.5X EXPANSION

When using the product to fill a mould or cavity, the volume of the mould needs to be calculated, then the quantities of resin, hardener and foaming agent calculated accordingly. The weight of mixed system is calculated using the following formula:

$$\text{Weight of Mixed Product Required } = \frac{Volume\ of\ Cavity\ (cm^3)}{Expansion\ Coefficient} \times Mixed\ Density \quad (1.1)$$

- A cavity of 2.5 litres (2500cm³) will require (2500/ 3.5) x 1.1 = 786g mixed product.
- The mix ratio of F230-2 is 100 parts resin to 22 parts hardener / foaming agent.
- 786g mixed product equates to (786/122)x100 = 644g resin plus (786/122)x22 =142g hardener
- Foaming agent is then added at the ratio of 1.3g per 100g resin (6.44/100)x1.3 = 8.4g

Other examples are shown in the table below showing how the amount of foaming agent can be tailored to produce different cured densities. Examples are approximate only and will vary slightly according to the temperature and hardener speed used.

PROPERTY	CURE DENSITY OF F230-2 AT DIFFERENT FOAMING AGENT RATIOS					
Foaming agent (parts by weight)	0	1	1.2	1.3	1.5	2
Approx. cured density (kg/m^3)	1100	280	250	230	200	170
Foamed volume of 122g mixed resin / hardener (cm^3)	110	300	360	385	420	500

EXPANSION

Time to full expansion will vary according to the hardener used and the temperature, slow hardeners take longer to reach full expansion. Note – the expansion of the foam is independent to the polymerisation, full cross-linking and hardening of the epoxy will take several hours depending on the temperature and the volume of foam being cast. The foam and moulding cannot be handled until the resin has hardened sufficiently.

CURE

It is recommended that the foam is allowed to cure at ambient temperature for 24hours before post curing. A full post cure of 16hours at 50°C (122°F) will give the properties outlined in the table in the Cured Properties Section. 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.

In order to shorten the curing time the post cure can be started after 1 hour when the foam is fully expanded. A minimum of 6 hours at 50°C (122°F) should be given before the foam is handled. The foam structure can be damaged if the mould is handled before the foam has hardened sufficiently.

EXOTHERM

As with all epoxy systems the cross-linking reaction is exothermic, as this system foams, the self insulating effect means that high temperatures can be expected if large volumes are being cast in confined moldings.

The actual temperature reached will depend on the speed of hardener used, the volume of material being cast, the ambient temperature, the thermal conductivity of the mould and whether the mold is open or confined. Standard hardener is only really suitable for thin and low volume castings up to 30mm thickness due to the heat created.

When curing thick sections, it is clear that the mixture becomes quite hot in the middle, this has the effect of reducing slightly the density of the foam as the cells expand more. This can be up to 15% less depending on the mold geometry.

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 F230-2 Resin	Months	24
Ampreg 3X Hardeners	Months	36
Ampreg Foaming Agent	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 color change if very old and new hardeners are used on the same project.

AMPREG F230-2 RESIN & AMPREG 3X SLOW HARDENER (AT A DENSITY OF 250 KG/M^3)

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 F230-2 RESIN	3X SLOW HARDENER	FOAMING AGENT	MIXED SYSTEM	TEST METHOD
Color	-	White	Dark Orange	Colorless	Orange	-
Mix ratio by weight	Parts by weight	100	22	0 – 2	-	-
Mix ratio by volume	Parts by volume	100	26	0 - 2	-	-
Density at 21°C	g/cm^3	1.12	0.94	1.12	1.09	ISO 1183-1B

COMPONENT PROPERTIES*

PROPERTY	UNITS	25°C	TEST METHOD
Ampreg F230-2 Resin viscosity	cP	8,900 – 10,900	-
Ampreg 3X Slow Hardener viscosity	cP	20 - 30	-

EXPANSION PROPERTIES

PROPERTY	UNITS	20°C	TEST METHOD
Time to 100% expansion	hrs:min	01:10	Internal Gurit Method
Peak exotherm temperature (150g in air)	°C	32	Internal Gurit Method
Peak exotherm time (150g in air)	hrs:min	01:00	Internal Gurit Method
Cured density	g/cm3	0.24	ISO 1183-1A
Expansion ratio	-	3.7	ISO 1183-1A

CURED MECHANICAL PROPERTIES

PROPERTY	SYMBOL	UNITS	16 HOURS @ 50°C**	TEST METHOD
Cured density	ρ_{CURED}	g/cm3	248	ISO 1183-1A
Core shear strength MPa	σ_{Shear}	MPa	1.65	ASTM C273
Core shear modulus MPa	E_{Shear}	GPa	51	ASTM C273
Core shear elongation	ε_{Shear}	%	22	ASTM C273
Glass transition	Tg_2	°C	60	-
Ultimate glass transition	Utg_2	°C	80	-

**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*

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

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:

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