

Ampreg F230-1

FOAMING EPOXY SYSTEM

- **Expanding Epoxy System**
- **Density 150 – 300kg/m³**
- **Uses Ampreg 21 hardeners**
- **Good mechanical and thermal properties**
- **Excellent adhesion to substrates**
- **Three components for flexibility and storage stability**

INTRODUCTION

Three part foaming epoxy system using Ampreg 21 hardeners. The final density of the cured product can be controlled by the careful addition of the Foaming Agent, although the product is optimised to the 150 – 300kg/m³ range.

INSTRUCTIONS FOR USE

Ampreg F230-1 is a three component system of Resin, Hardener and Foaming Agent. The Resin and Hardener are mixed at a ratio of 100:23 parts by weight and then the required amount of Foaming Agent is mixed into the resin/hardener mix to initiate the foaming process.

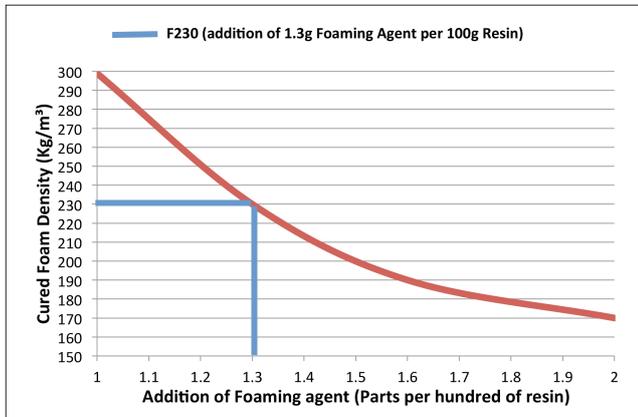
For control of the cured foam density, the addition of the foaming agent needs to be accurately controlled. The recommended cured density of 230kg/m³ is obtained by the addition of 1.3 parts Foaming Agent for every 100g of Resin (123g mixed resin/hardener).

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.**

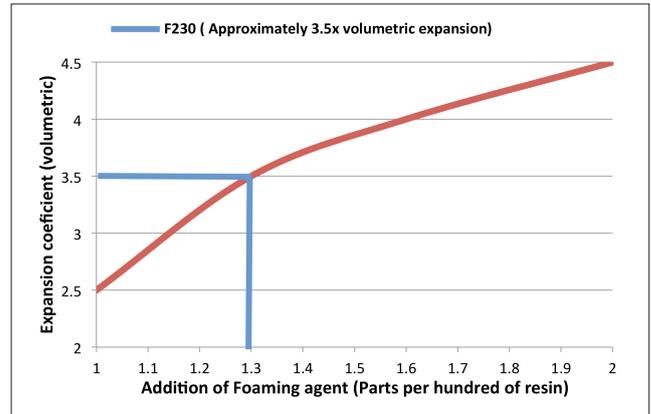
100 grams Resin + 23 grams Hardener + 1.3 grams Foaming agent = 3.5x expansion and cured foam of approximately 230Kg/m³

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;

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

A cavity of 2.5 litres (2500cm³) will require (2500/ 3.5) x 1.1 = 786g mixed product.

Mix Ratio of F230 is 100 parts resin to 23 parts hardener (For simplicity the volume of the foaming agent can be ignored in this calculation).

786g mixed product equates to (786/123)x100 = 639g resin plus (786/123)x23 =147g hardener

Foaming agent is then added at the ratio of 1.3g per 100g resin (6.39/100)x1.3 = 8.3g

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.

	123g Mixed Ampreg F230					
Foaming Agent (parts by weight)	0	1	1.2	1.3	1.5	2
Approximate cured density (Kg/m ³)	1100	280	250	230	200	170
Foamed Volume (cm ³)	110	300	360	385	420	500

Ampreg F230-1 is ideal for foaming closed mouldings such as rudder foils. In this type of application best results are achieved by applying the F230-1 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 F230-1 allowed to expand without further handling. Aim to keep moulds level if possible to reduce the vertical expansion distance.

COMPONENT PROPERTIES

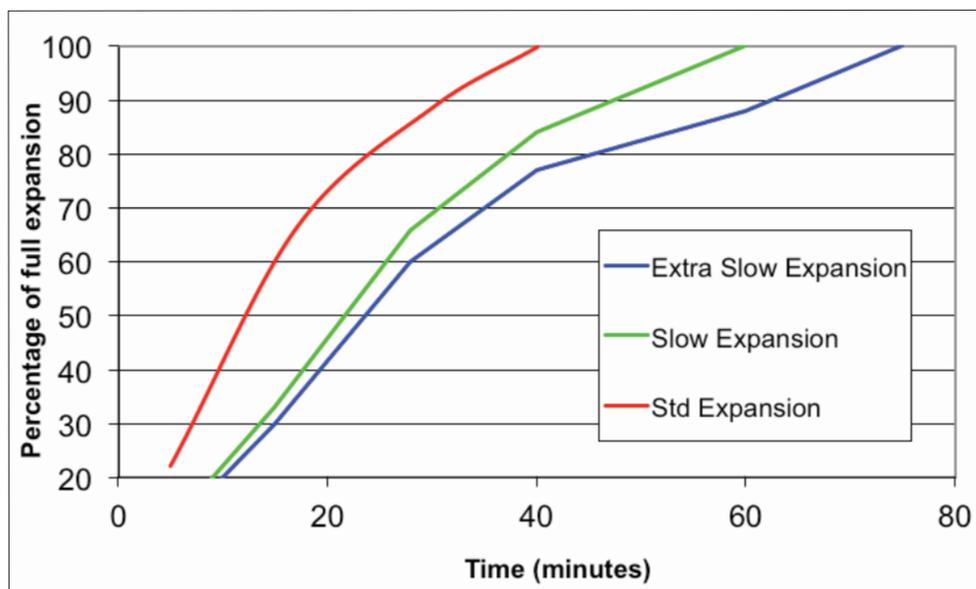
	Resin	Standard Hardener	Slow Hardener	Extra Slow Hardener	Foaming Agent
Mix Ratio (By Weight)	100	23	23	23	1.3
Mix Ratio (By Volume)	100	26	27	27	1.3
Viscosity at 25°C(cP)	10500	90	63	60	10
Shelf Life (months)	12	24	24	24	24
Colour	White	Pale amber	Pale amber	Pale amber	Clear
Mixed Colour		Off white	Off white	Off white	Off white
Component Density (g/cc)	1.132	1.0	0.985	0.974	1.01

WORKING PROPERTIES

EXPANSION

Time to full expansion will vary according to the hardener used and the temperature, slow hardeners take longer to reach full expansion as shown in the chart below.

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



CURING

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

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 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.

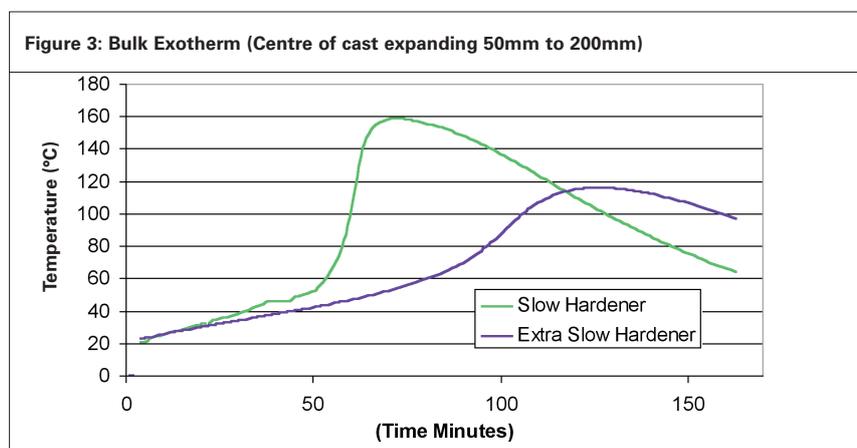
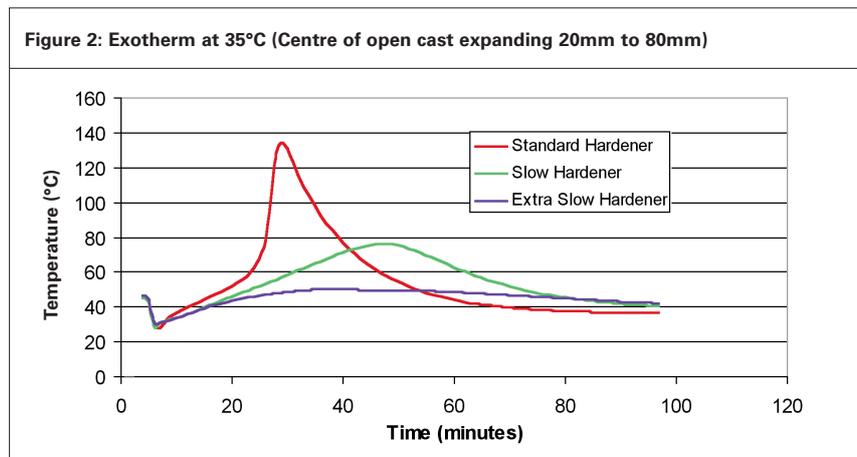
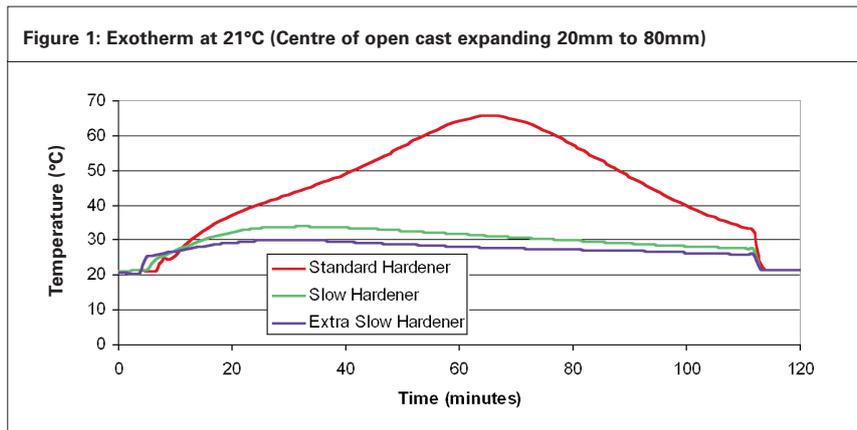
EXOTHERM

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 mouldings.

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 mould 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 mould geometry.

The charts below show some typical temperatures experienced at the centre of castings in various situations.



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CURED SYSTEM PROPERTIES

The table below shows mechanical and thermal properties of the system at a density of 230Kg/m³. Samples cured 24 hrs at 21°C followed by 16hrs @ 50°C.

Property	Standard Hardener	Slow Hardener	Extra Slow Hardener
Tg DMTA (Peak Tan d) (°C)	82.9	77.8	81.8
Tg2 Ult – DSC (°C)	84.8	77.7	79.5
Tg2 – DSC (°C)	66	69	70
Tg1 – DMA (°C)	64	66	69
Compressive Strength (kPa)	TBA	2660	2408
Compressive Modulus (MPa)	TBA	90	89.9
Shear Strength (MPa)	TBA	1.49	1.54
Shear Modulus (MPa)	TBA	TBA	36.97
Shear Elongation %	TBA	16.7	15.4
Tensile Strength (MPa)	TBA	2.0	2.2
Tensile Modulus (GPa)	TBA	TBA	TBA
Foamed laminate adhesion(Ampreg 21 skins cast wet on wet)	TBA	695J/m ² peel strength	TBA

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. 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.

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. A more detailed guide for the safe use of Gurit resin systems is also available from Gurit, and can be found at www.gurit.com

APPLICABLE RISK & SAFETY PHRASES

Please refer to product SDS for up to date information specific to this product.

TRANSPORT & STORAGE

The resin and hardeners 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).

Storage should be in a cool, dry place out of direct sunlight. Temperatures should not exceed 20°C. High storage temperatures may cause premature expansion of the Foaming Agent. Containers should be firmly closed. Hardeners, in particular, will suffer serious degradation if left exposed to air.

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.

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