PRO-SET INFUSION EPOXY IN ACTION

Leading boat builders from around the world use PRO-SET epoxy systems to build lighter, stronger boats. In the table below, we show who's using our products and how:

Infusion application	Boat builders	Product range
Large motor boat construction	Solution Motor Cruisers	PRO-SET INF and LAM epoxies
Sailing dinghy construction	Winder Boats	PRO-SET LAM epoxy
Kayak construction	Rockpool Kayaks	PRO-SET INF epoxy
Racing power boat construction	Bernico International	PRO-SET INF epoxy
Large catamaran construction	Ocean Quality Systems	PRO-SET INF epoxy
Foiling catamaran construction	Graham Eeles Composites	PRO-SET INF epoxy
Sailing dinghy construction	White Formula Ltd	PRO-SET INF epoxy

For more information about our PRO-SET® Infusion epoxies and how they help fabricators eliminate mess and waste and build lighter, stronger boats, please contact our technical team.

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CASE STUDY:

SOLUTION60: EPOXY INFUSION ON A GRAND SCALE

David Skene, Production Director of Solution Motor Cruisers, is currently building a 60ft powerboat, known as the Solution60, conceived by Ray Davis and world-leading yacht designer Bill Dixon. Modern composite production techniques – including constructing the hull using epoxy infusion methods – have shaped his whole approach to this substantial project.

Although David is a veteran of epoxy construction, he is using epoxy infusion for the first time on Solution60. Specifically, he is using the vacuum infusion technique in conjunction with PRO-SET® INF-114 Resin and PRO-SET® INF-210/213 Hardeners.

For David and his team, the process has been a revelation. "Now, instead of becoming a messy laminating workshop, you can become a clean workshop," he says. "It's better for people's welfare. It's better for the environment. There's no waste. It saves time labour-wise. It creates a lighter boat, because you only use the exact amount of resin you need (and no more) and you get exactly the result you want."

The current plan is for the first Solution60 motor cruiser to take to the water in 2015. One of the first boats will be available for charter – and while many early passengers may be unaware of the role epoxy has played in their voyage, David considers it central to his team's work.

"Epoxy is one of the best products you can get for marine construction," he says. "It saves weight. It prevents water ingress. It has a huge range of uses. I think some boat builders can be a bit short-sighted and they use other materials to save costs. However, using epoxy means our boats will last longer than theirs and will have a lot less problems. We don't want any warranty issues. These are luxury boats, built to last – and PRO-SET epoxy is a big part of that."

Application Brochure
INFUSION

BUILDING LIGHTER, STRONGER BOATS WITH PRO-SET INFUSION EPOXY

How builders can construct lighter, more durable boats with PRO-SET® Infusion epoxy and optimise laminate consolidation

Photo: Ocean Quality Systems

PRO-SET INF EPOXY: THE IDEAL CHOICE FOR INFUSION

Photo: Tuco Marine Group

Building lighter, stronger boats with epoxy infusion
Whilst it is possible to build strong hulls using polyester or vinyl-ester resins, they are invariably heavy. To create components that are both strong and light, boat builders require low-viscosity epoxy systems that have been specially formulated for infusion.

This type of specialist epoxy was developed in the 1970s by Gougeon Brothers, Inc., (GBI), an organisation founded by three brothers from Bay City, Michigan. Over decades of development and testing, GBI now provides a range of epoxy laminating and infusion systems which are manufactured by West System International under the PRO-SET® brand.

With PRO-SET® Infusion epoxy, manufacturers can build boats that are both light and strong. With a polyester or vinyl-ester resin system, it might be possible to engineer only one of these qualities.

Optimising infusion with PRO-SET INF epoxy
PRO-SET INF epoxy has a number of physical characteristics that help boat builders optimise their infusion processes. It offers unparalleled strength and its low viscosity speeds up the infusion process.

Post-cure times are typically shorter than competing epoxy products, significantly reducing production costs and speeding up production timelines. Also, post-cure temperatures are achievable with minimal expense to the builder – typically 50°C will yield outstanding physical properties from the epoxy system.

In addition, PRO-SET INF epoxy can be used to replace traditional open mould/vacuum bagging wet laminating techniques, reducing the mess and waste associated with 'wet lay-up' using brushes or rollers. Also, infusing in a mould virtually eliminates contact with wet epoxy, helping boat builders create a far cleaner, safer working environment.

THE EVOLUTION OF IN-MOULD INFUSION

The delivery of epoxy within a mould via vacuum or pressure has developed from 50 years of experimentation – since the advent of polyester resin and glass laminates. The idea is to control hazardous volatile organic compounds (VOCs) associated with open mould hand lay-up techniques, when using either polyester or vinyl-ester resins.

Both Colin Chapman, with the Moonraker design, and Jeremy Rodgers, with the Contessa range, can be credited with some of this early experimentation.

The infusion with epoxy method was developed many years ago and is quality and process driven, whilst also being mindful of operator contact with the mixed epoxy. Where a boat builder wishes to produce aesthetically exquisite, lightweight, durable and void-free process-controlled parts, large or small, then vacuum infusion utilising PRO-SET INF epoxy is the first choice.

PRO-SET®

Photo: Tim Bees. Failing Vampire catamaran, development by Graham Eeles Composites.

Photo: Rockpool Kayaks, Rockpool Taran 16 Sea Kayak

THE BENEFITS OF PRO-SET INF EPOXY

PRO-SET® INF epoxy helps fabricators build boats that are stronger and lighter. Formulated specifically for infusion, PRO-SET INF epoxies have the ideal viscosity for any project. They also offer a range of cure times, making them suitable for projects of all sizes. Critically, PRO-SET INF epoxies also require a far shorter post-cure period than many competing epoxy products, which helps substantially reduce boat builders' heating bills.

Key benefits of PRO-SET epoxies for boat builders include:

- **Superior strength**
  PRO-SET epoxies are among the strongest available, ensuring that well engineered hulls are suitable for the complicated stress and loading on a marine structure and are protected against impacts and abrasion for longer.

- **Lighter, stronger and more durable composite laminates**
  Replacing polyester and vinyl-ester infusion with PRO-SET INF epoxy and using appropriate composite engineering can significantly reduce the weight of hulls and improve the performance of boats. In addition, boat builders who use PRO-SET INF epoxy can reduce the weight of a superstructure above the working deck to minimise pitching, rolling and other performance issues.

- **The right viscosity for infusion**
  PRO-SET INF epoxy has the perfect viscosity for infusion, allowing rapid processing. All four low-viscosity hardeners in the range are optimised for infusion and the characteristics of mixed epoxy are always consistent. This ensures that technicians can achieve excellent, repeatable results, whichever hardener is used.

- **The correct gel and working times for successful infusion of the largest projects**
  Unlike polyester and vinyl-ester resins that require more catalyst to speed up the process, PRO-SET INF epoxy resin can be combined with a range of different PRO-SET INF Hardeners to optimise the pot life and working times for successful infusion. Cure times can also be adjusted by blending the four available INF Hardeners. This makes PRO-SET INF epoxy suitable for even the largest, most complex infusion projects, as well as for intricate, irregularly shaped components.

- **Improved operator health and safety**
  PRO-SET INF epoxy systems have a very low hazard rating, an important factor when considering the health and safety of a labour force.

- **Lower energy costs**
  Most competing epoxy resins require a post-cure period of up to 24 hours at 50°C or 80°C. By contrast, PRO-SET INF epoxy reaches full strength after post curing for just 8 hours at 50°C, significantly reducing energy used for heating and helping to streamline the production process.

- **Valuable technical support**
  Unlike some epoxy companies, West System International provides a range of technical support to help boat builders optimise their infusion processes. As well as offering on-site support for large projects where appropriate, we can provide training on the latest infusion techniques and advice for using PRO-SET INF epoxy, which can help teams of fabricators reduce mess, improve health and safety in the workshop and achieve an exquisite finish for infused components.

PRO-SET INF EPOXY AND VACUUM BAGGING: AN INFUSION REVOLUTION

PRO-SET®

PRO-SET® INF epoxy is used by boat builders who want to achieve the best results when adopting 'in-mould' infusion techniques.

In-mould infusion is achieved by placing composite materials in the mould and sealing with an impermeable bag. This creates a vacuum, removing the air from under the bag, prior to drawing the epoxy into and through the laminate using a distribution network of transport mesh, channelled core, pipes and manifolds. The pressure differential that the vacuum creates allows atmospheric air pressure to propel the epoxy under the vacuum bag and infuse the dry composite stack with minimal air voids.

This produces better quality epoxy composite laminates than the traditional 'wet lay-up' techniques such as brushing or rolling.

Infusion with PRO-SET epoxy
Here are some of the key steps which boat builders should follow for successful infusion:

- Qualify the laminate by sound engineering and appropriate on-site testing. This is essential as the fabric, core, infusion epoxy, consumables and network placement will influence the repeatability and consistency of the part to be made.

- Dry laminate the mould with reinforcement fabrics and core, as well as - where required - peel ply and perforated release film.

- Set up a network of epoxy feeder tubes across the hull and connect them to containers of PRO-SET Infusion epoxy. There are two methods of assisting the feed to the reinforcement fabrics: a) Using channelled core material, or b) using a disposable distribution mesh.

- Install a sheet of graded, perforation-free vacuum bagging film over the part to be infused.

- Create a seal between the mould and the bagging film using PRO-SET vacuum bag sealant tape - this is a sticky adhesive putty.

- Use a vacuum pump to remove air from under the bag, which creates a pressure differential that propels the epoxy along the distribution network of pipes and through the laminate stack and transport consumables. Vacuum levels should be maintained for a fixed period prior to infusion and a vacuum 'drop test' should be performed to ensure the vacuum integrity.

- Once the epoxy has been fully cured, the vacuum bag film and consumables can be easily removed to reveal the exquisite finish of the infused component.

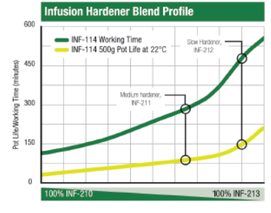
It is important to note that any single choice or on site blend of the PRO-SET INF Hardeners yields little, if any, variation in the mixed viscosity.

Epoxy infusion for Solution60, a 60ft power boat

THE PRO-SET INFUSION EPOXY RANGE

PRO-SET® products formulated for infusion are PRO-SET INF-114 Infusion Resin, as well as a range of INF Hardeners. The mixed INF epoxy requires a short post-cure time of 8 hours at 50°C. PRO-SET INF-114 Infusion Resin can be used in conjunction with a range of PRO-SET INF Hardeners depending on specific project requirements. These are:

PRO-SET INF-210 Fast Infusion Hardener
PRO-SET INF-211 Medium Infusion Hardener
PRO-SET INF-212 Slow Infusion Hardener
PRO-SET INF-213 Extra Slow Infusion Hardener



The graph shows that hardeners may be blended for targeted cure time