

## Some important dates for your diary ...

Event	Date	Location
JEC Composites Show 2003	30th, 31st March & 1st April 2004	Stand C40/D43, Paris Expo, Porte de Versailles, Paris, France
Light RTM Training Course	23rd & 24th June 2004	Cornwall, UK Contact Kim on Tel: + 44 (0) 1822 832621 kim.harper@plastech.co.uk for further details
RP Asia 2002	1st & 2nd September 2004	Shangri-La Hotel, Bangkok, Thailand
Training Course	Winter 2004	Cornwall, UK Contact Kim on Tel: + 44 (0) 1822 832621 kim.harper@plastech.co.uk for further details

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# RTMtoday

Published by Plastech TT Ltd for Users of Closed Mould Technology

## Factoring Accuracy into Polyester Moulding

How often is a moulder asked about shrinkage and fit tolerance? Ask a resin supplier how much their resin will shrink and thus affect part dimension and invariably the answer will be: UP resin has a general shrinkage of 8% but it depends on the part thickness, overall dimension and glass content.

Composite moulder's, Biobe AS of Fredrikstad, situated south of Oslo, Norway, required a 5m<sup>2</sup> radome to be made in polyester using the LRTM process. Plastech were approached to manufacture the unheated tooling, and although the part's geometry presented little difficulty, the tolerance on the important base diameter was 1163mm -0, +0.5mm and naturally this raised a few eyebrows! The part was required to match an SMC base-ring

moulding at this diameter. The immediate question arose of how much to factor this important diametric dimension. If the master pattern was made to drawing, then experience of polyesters leads you to predict that the moulded part would be too small, and therefore would not fit over the ring.

Plastech asked for an easement on the upper tolerance to +1mm instead of the +0.5mm. This represented a 0.1% plus, dimension tolerance. However, from previous experience a further 0.1% was added, thus a master was produced 2mm larger on the critical dimension of 1163mm. Plastech produce size for size tooling from master patterns at ambient temperature using their Vinylester / low



Completed Radome Assembly

profile composite tooling construction. This tolerance factoring allows for normal resin shrinkage and temperature shrinkage, and took into account the CTE of UP glass/resin of approximately 25° Kelvin ppm. ( 25 x temperature difference between peak exotherm and ambient x dimension, all divided by 1000000 ).

An initial 4 gel coated mouldings were produced from Plastech's LRTM tooling which proved the fit was within the tight tolerance demanded.

## LRTM Radome Moulding: Technical data

- Gel coated - Reichhold XTG type.
- Non heat control LRTM tooling from Plastech.
- Two composite face moulds, and one semi rigid composite matching male mould.
- Production requirements - 1000 per year.
- Rovicore mat from Chomarar / PolyLite injection. Resin from Reichhold.
- 3 mm thickness, 12 kg resin.
- Injection time 3-4 min.
- SSB Sprinter RTM injection machine.
- Optimized fill - Plastech's PVSensor system.

[www.biobe.no](http://www.biobe.no)
5m<sup>2</sup> Light RTM Radome production at Biobe

## Inside this issue

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## The all new Turbo Autosprue™ -cannot be beaten on price or performance

Many will agree that to make closed mould production user friendly, an absence of liquid resin within close proximity of the operator is the ideal situation.

Over 6 years ago Plastech introduced the first Autosprue™ to the composites industry. This injection valve allowed liquid resin mixes to be delivered to a closed mould with no liquid resin exposure for the operator.

Today over 3000 of Plastech's Autosprue™ valves are in service world wide. Building on this product's success, the new Turbo Autosprue™ provides design improvements far beyond a simple valve upgrade. It represents a departure from convention and from the copies of the Autosprue™ that are currently offered by Plastech's competitors.

The most noticeable feature of the new Turbo Autosprue™ is its compact size - Although almost half the size of its predecessor, this new model provides twice the throughput offered on previous models.

It would seem these features alone would be enough, but the Turbo Autosprue™ is a breakthrough in design for many other reasons.

In the past all injection valves were inserted and sealed into a mould insert and held in place by a system of brackets, nuts and bolts. This alone brings about added complications for the mould builder who needs to fabricate these necessary holding devices. All such complications are now a thing of the past as the Turbo Autosprue™ simply clicks, seals and locks into its new 'Locksert' mould insert, in less than 2 seconds.

Unlocking and removal is just as quick. Furthermore should the valve be installed deep within a press mounted mould the new Turbo Autosprue™ single main seal can be changed rapidly from the mould's face side through the valve's nose, without the need to access or remove the valve from the rear of the mould.

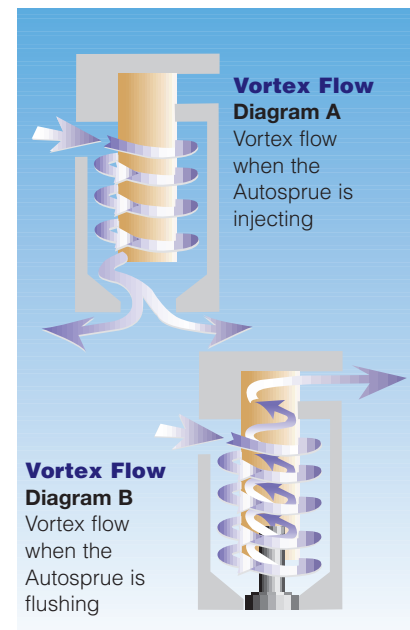
The Turbo Autosprue™ will still fit and seal in the original Plastech Autosprue™ insert, however this can be retrospectively changed to the new 'Locksert' valve locking insert.

All previous designs have suffered from their need for a pneumatic control valve to work the injection valve when signaled to open. This also meant that once a mould was injected it had to be left connected to the workshop air supply to ensure that the valve did not move open whilst the resin cured. The Turbo Autosprue™ design has now

eliminated the need for an external control valve and a constant air supply.

The new design is completely fail safe and closes automatically upon removal of the open signal. The Turbo Autosprue's™ proprietary seals provide very little friction and open even if the signal strength is as low as 3 bar (45 psi).

Great attention has been paid to the design of the new valve's sealing and internal flow paths. The result is that only one main seal is employed, whilst the shaft seal needed to work during the flushing process is entirely manufactured from PTFE, operating within a PTFE liner. The unique vortex internal flow characteristics ensure a thorough and complete flush even when using highly filled resin mixes. Test cycles of more than 1000 individual injections have proved that this seal technology combined with the completely new internal flow paths make the new Turbo Autosprue™ highly reliable for the rigours of today's production moulding requirements. Up until now a small degree of air has



always been present in the first few grams of resin entering the mould at the start of an injection. For most applications this is not a major concern, however, aerospace applications require absolute air free resin from the start. During injection the initial flow of resin mix purges through the Turbo Autosprue™ without any air entrapment as the valve's design has no galleries or redundant spaces within its body.



All these features combine to make the Turbo Autosprue™ the first choice for automatic mould filling.

### Specification:

- Nominal 11.8 cm x 5cm (4.7" x 2.0")
- Nozzle outlet -10mm
- Feed inlet 1/4" BSP
- Drain outlet 1/4" BSP
- Open pneumatic signal 6 bar (3.0 bar minimum)
- Close signal not required - Automatic on loss of open signal
- Signal feed 4mm push-fit
- Open and closed indicators (Top semaphore)
- Limit switches available
- Clean/flush - Solvent with built in unique vortex flow action
- Operating Temperature range (120°C standard, 240°C option Max)
- Service life - greater than 1000 cycles. (all resins) Based on tests
- Using SP3 solvent pump system. (180cc solvent per flush)
- Weight - 380 g. (13oz) as shown.
- Materials - Various all non ferrous. Seals - Standard fluid section solely PTFE. Air section (I only-PU)
- Nominal max working pressure - minus 1 bar to 0 to plus 20bar ( -14.7 to 300psi)

### Installation requirements:

- 'Locksert' in mould. Push to install and safe lock automatically.
- Unlock - 6mm movement to release 'Locksert' clip.
- Built to European CE machinery directive (No external pinch points).
- Supplied with Quick fit inlet hose for machine nozzle connection, and drain pipe.

Design right Plastech 2003. World Pat Pend

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## QUOVIS - A specially designed vehicle



The QUOVIS, is a specially designed vehicle for drivers with reduced mobility, or physical disability. The vehicle is fully moulded in RTM by MOLDEO Y DISEÑO (Madrid-Spain). All external bodywork panels as well as interiors are produced using the RTM process, from moulds manufactured by Plastech's nominated mould manufacturing company: Moltec Levante SL, in Alicante, Spain.

The novel feature of this design allows the driver to enter the car without the need to leave the wheelchair as the remotely controlled rear gate doubles up as an access ramp allowing the user to drive the car directly from the wheelchair. This removes the need for the driver to change over from the wheelchair to the car's seat or stow the wheelchair in the car.

Moltec have produced an initial set of RTM moulds to produce the 14 body and interior panels needed for the vehicle. At present 6 car sets per day (84 individual panels) are injected



using 2 Megaject Sprint machines with Reicholds Norpol PO 6005 resin and Chomarat's Rovicore reinforcement.

Production is semi automatic using Autosprues and pneumatic mould manipulators. However with the ever increasing enquiries worldwide for the

unique Quovis design, full RTM MIT technology is planned with potential manufacturing plants in Mexico and the far east.

The design brief was to market a vehicle which would enhance the social integration of wheelchair users, or those with reduced mobility who for one reason or another are not able to drive a conventional car. The company has therefore used the available technology to deliver a product of the highest possible quality and benefits that a vehicle of its class can offer.

The QUOVIS was created as a young, modern vehicle that stands out for its functional qualities and contemporary appearance. Making excellent use of composite materials, the comfortable, spacious and ergonomically designed interior with rounded lines make the QUOVIS a stylish car.

It is offered with the option of a sun roof and aluminium wheels, and is available in six colours.

A front mounted 505cc diesel engine with 2 inline cylinders makes the QUOVIS an agile, economical and safe car. One of the available models offers a fuel consumption of 3.5 litres/100km, a top speed of 100km/hour, and a CVT type automatic transmission.

## "Moulding on the stand and standing on the mould"



The International Conference and Exhibition on Reinforced Plastics - ICERP 2004 - held in February this year at the Chennai Trade Centre, was well attended by over 80 exhibitors.

Alan Harper of Plastech gave a presentation to the conference in which he described their most recent innovations in LRTM technology, and gave live moulding demonstrations. The Injection of several 2 metre structural walkway panels loaded with a 25mm Nidacore sandwich, took place on the joint stand of Plastech and Nidacore. The mould fill which featured Plastech's new Turbo Autosprue and PVSensor system attracted large crowds.

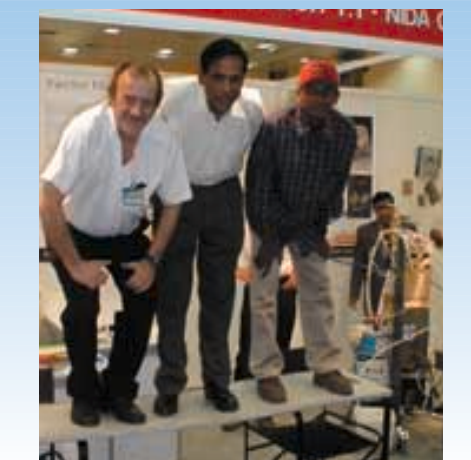
To demonstrate the excellent structural properties of Nidacore's Structiso sandwich construction, visitors were invited to test the strength of the panel by using their combined weights standing on the panel.

Plastech were supported in their demonstrations with raw materials supplied by Scott Bader - Resin, Catalyst from Norac, Glass from SearTex and Release agents from Axel.

At present, the Indian composite industry's closed moulding sector accounts for only 2% of combined output and the majority of this is RTM. The Light RTM process is almost non-existent, however this is about to change as visitors to the stand could witness first hand the ease with which quality closed mould mouldings could be produced using the type of light weight tooling exhibited, and the economical Plastech SSB injection machine and accessories.

Compared to the same event two years ago, this year's conference and exhibition attracted far more attendees from a market that is now recognized

as one of the most buoyant in Asia. At present a glass mat suitable for the closed mould process is unavailable from local sources. Although local needle mats work, the need still remains for a suitable combination mat with a resin-permeable core. The availability of a locally produced material would dramatically aid the growth of the Indian closed mould sector.



# New glass mat breakthrough confirmed by PVSensor system

**Polymat 'Hi-Flow'**, the new combination mat developed by Flemings Textiles Ltd of Kilmarnock, has an outstanding permeability characteristic that allows resin to flow at twice the rate of other mats currently available. No wonder it is being heralded as a breakthrough for closed mould applications.

Plastech have run trials on many mats for manufacturers and suppliers, and the claims made by Flemings regarding the **Polymat 'Hi-Flow'** seemed to too good to be true. To confirm the new mat's characteristics it was agreed to conduct accurate and controlled Light RTM test injections using a multi cavity mould at Plastech's new Manufacturing and Technology Centre in Cornwall, UK during January this year.

## Test equipment and procedures.

It was most important to ensure that there was no possibility of error during the tests, so the mould and the machinery were set up with precise flow, pressure and volume control and logging systems.

The recently introduced PVSensor system designed and manufactured by Plastech was employed to control the tests and provided a simple and highly effective way of confirming the flow characteristics of the new mat.

In essence the system comprises of a precision in-mould pressure sensor which provides accurate readings of mould pressure build up as the injection proceeds. These pressure readings can be viewed instantly upon the large LCD screen on the systems control panel. In the tests a preset pressure of 1010 mb was set within the controller which in turn indicated when the mould had reached this set point and also provided a signal to the Megaject SSB injection machine to automatically reduce the flow. The resulting machine flow reduction meant that the mould pressure decreased proportionately, and thus the machine output was automatically throttled to an optimum level during mould fill.

With this type of mould pressure feedback, an automatic optimum rate of injection is provided without any need for operator intervention. Therefore by altering no settings in the machine's control, resin type / viscosity or mould vacuum levels, different glass

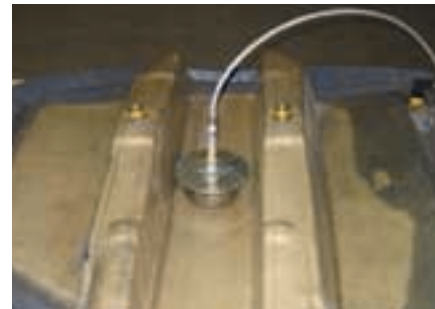
mats can be compared back to back to indicate which is the most efficient in terms of permeability and thus suitability for efficient production use.

## Observations and results.

### Test 1

Using the Flemings **Polymat 'Hi-Flow'**, the mould was vacuum clamped, the machine counter zeroed and the PVSensor system set at 1010 mb. Prior to injection the in mould vacuum reading displayed on the PVSensor system's LCD read 460mb (absolute). The machine was signalled to commence injection and the flow was seen to circumvent the cavity and proceed to fill towards the mould's central vacuum catchpot in the conventional manner. However, the low build up of back pressure was immediately apparent as it slowly increased towards atmospheric pressure. It was only towards the end of the injection with around 80% mould fill, that sufficient back pressure was reached (at the pre-set point of 1010mb) at which point the system throttled the machine's output back to a new slower rate, finally achieving a total mould fill in 210 seconds for 5.8 litres of catalysed resin.

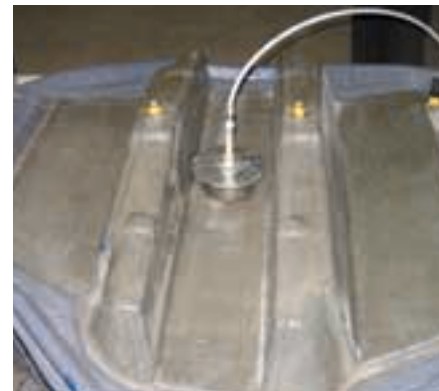
Test 1, Polymat Hi-flow injection progress



(a) after 30 seconds



(b) after 120 seconds

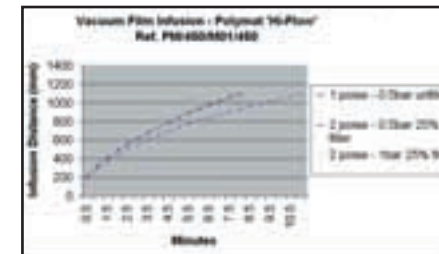


(c) after 200 seconds

### Test 2

After cure and release the mould was reloaded using a leading manufacturer's glass mat of the same weight and dimension. No machine or vacuum levels were altered and a second injection made. Within 90 seconds, the back pressure had built up to the set point and the machine slowed. The fill at this stage had only reached 50% and it was very evident that greater resistance was preventing

the resin flowing as easily as it had in the previous test. It could be argued that the fibre mat under test this time was less resilient to the fixed vacuum level and as such was squeezed tighter by the flexible mould, thus offering more resistance. However, one would have immediately deduced that had this been the case a lower volume of resin would be needed. Surprisingly 20% more resin was consumed and took over 50% longer to fill the mould (Fill time 460 seconds for 7 litres of catalysed resin).



The tests were duplicated and each time the same beneficial result for the new **Polymat 'Hi-Flow'** product was confirmed. Flemings report that the

product's uniquely engineered thermoplastic core, sandwiched between two layers of chopped strand glass fibre is the key element of its low permeability feature. The core also demonstrates its ability to maintain a high degree of product thickness control. It was observed that the surface fibre mat could be compressed into a mould's concave radii with great efficiency, thus reducing resin richness in these zones.

Polymat's success is sure to offer production moulders the opportunity to increase their output considerably by using this product in their existing moulds, as quicker gel times can now be set allowing overall faster cycle times with the same resin system.

## PVSensor system production application.

The tests reported above could only be substantiated using accurate in mould pressure readings and the automatic control of the injection machine. Although the PVSensor

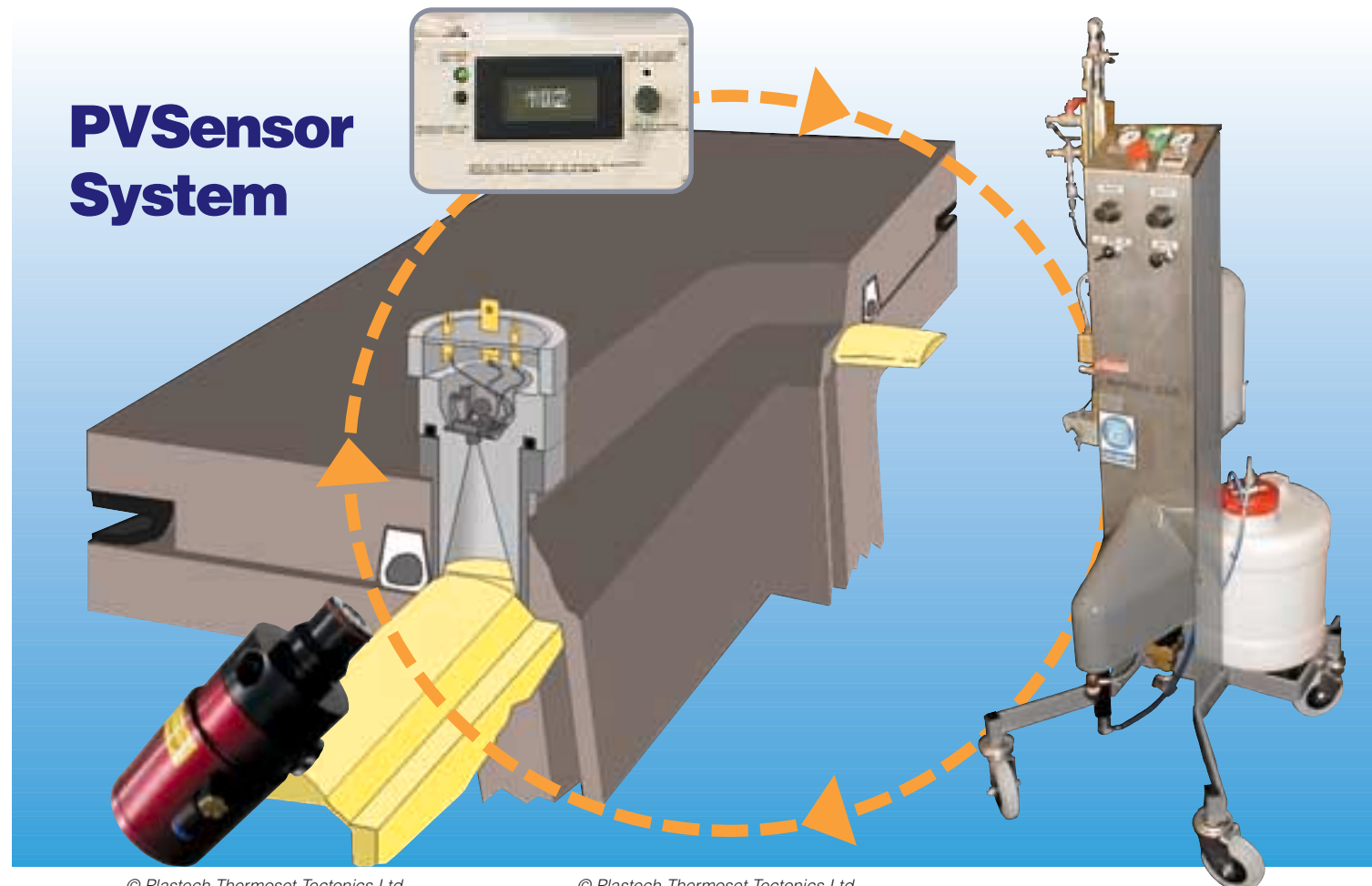
system met this task without effort, its main design function is for production use, to achieve the safe optimization of mould fill. Whilst these conditions could be achieved by a trained and attentive operator, the new system allows a total 'mould by wire' operation, by freeing up production staff for other duties during mould fill.

Illustrated is the basic control function, from in mould pressure sensing to machine flow control, and thus pressure control with the PVSensor's economic closed loop control system.

Without a system of this type, production using the Light RTM process, is wholly reliant upon the operator's process experience to control the mould fill. The new PVSensor system now provides operators with precise in mould pressure conditions and a means to link this information directly to the meter mix machine's output. Automatic control parameters are easily set and provide confidence that flow rates are as high as possible to achieve optimum fill speed, but can not hazardously exceed the mould vacuum clamping pressures.

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## PVSensor System



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### PVSensor System - Plastech Part Ref: 5801 Comprises the following items:

- PVSensor
- Dummy Sensor
- Mould Insert
- Amplifier with large LCD digital readout, set point adjustment, set point 'read' button, hysteresis preset, input 12volt socket, 12volt output for machine control circuit, 3m sensor input lead with plug,
- 12VDC power supply (110/240VAC Input)
- Machine control unit

Design right Plastech 2003. World Pat Pend

## Norac Andos AB - Your supplier of Organic Peroxides for RTM

In 2003 Norac Inc celebrated 50 years as a producer of organic peroxides. They are the leading producer of ketone peroxides in North America and are in the front line of the development of initiators for the reinforced composites industry, and through Norac Andos AB, the 100% subsidiary company based in Sweden, Norac has now reached the position of being a major player in Europe as well. The Corporation's aim is to focus on the composites industry, and to supply the most comprehensive product range for all existing and future manufacturing methods in the sector.

temperature increases it activates the TBPB, which finishes the curing reaction. The overall result is a more efficient cure, harder parts and lower residual styrene levels. Andonox RTM-12 also develops a higher exotherm temperature than typical ketone peroxides, making this initiator ideal for low profile or low shrinkage resins for automotive applications.



Produced by Viking A/S, Denmark. Viking are using Peroxides from Normac in the production of life raft containers.

### Andonox TLC-88

This initiator, which is based on MEKP, was also developed for elevated temperature RTM, but particularly for vinyl ester resins accelerated with cobalt, or cobalt/amine. Suitable working temperature is 40-80°C. The performance of TLC-88 when compared to a typical MEKP shows less foaming, longer wet-out time of the glass fibre, improved cure and reduced residual styrene levels.

However, if you are working with

elevated RTM but with UP resin and you need a long gel time, Andonox TLC-88 will be an excellent choice. Again you will see a better curing of parts, when compared to those moulded using a typical MEKP.

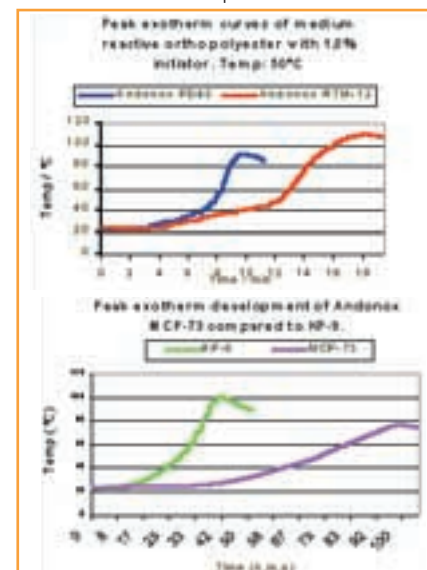
### Andonox SHP-90

If you need an extra kick and better curing results in your RTM process, you could try Andonox SHP-90. This product can be used from room temperature up to 50°C with cobalt, or cobalt/amine accelerated UP resins. Andonox SHP-90 gives the same gel time and cure time as conventional acetyl acetone peroxide, but the final cure will be better. Suitable for low

profile resins and production of parts with class A surfaces.

### Andonox MCP-73

When building up a laminate in a single step as in Vacuum Foil Infusion, there is a risk of high exotherm temperatures and shrinkage problems. Moreover, when injecting large parts you need a long gel time plus a good safety margin to get complete wet out of the reinforcement, and time to fill the mould before its starts to gel. Andonox MCP-73 is the perfect choice for this process. It will give you a long gel time, a low and gradually increased peak exotherm, very good final cure and less shrinkage problems. All this means you get less fibre print-through of the gelcoat layer and therefore a better finish on the part.



Graphs showing peak curves

For more information about which peroxide to use in different processes, please visit our web site [www.andos.se](http://www.andos.se) or contact Technical Service +46/854512160 or [norac@andos.se](mailto:norac@andos.se)

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Produced by LM Glasfiber A/S, Denmark. LM are using Normac Peroxides in the production of turbine blades.

After many years in the composites industry Norac Andos AB has built up a wealth of experience and knowledge of the closed moulding sector and using this knowledge have developed a number of different organic peroxides, some of which are described below:

### Andonox RTM-12

This is a special formulation based on acetyl acetone peroxide and TBPB. Andonox RTM-12 is designed for use at elevated temperatures, 40 - 80°C, with cobalt or cobalt/amine accelerated unsaturated polyesters. It is a two-step initiator where the ambient temperature-curing AAP starts the curing reaction, and when the peak exotherm

# Plastech



Plastech have moved premises to meet even greater demand of its design development and manufacture of quality Resin Injection Machines for the closed mould industry, and the supply of bespoke RTM, LRTM and RTM MIT tooling to production moulders worldwide. A comprehensive range of tooling ancillaries are also supplied to customers through our UK office and our distributors who cover most parts of the globe. The decision to move was taken some time ago, but finding the right premises took a little longer. By chance a highly suitable complex of buildings became available close to the original Delaware Road site, and the new much larger 4,000m<sup>2</sup> premises were purchased.

After planning permission was granted for a change of use, the first phase of the works began to transform the buildings from their last usage into the now spacious offices with conference room seating for 16. The factory space has been transformed to provide some 1,200m<sup>2</sup> of production space in the tooling

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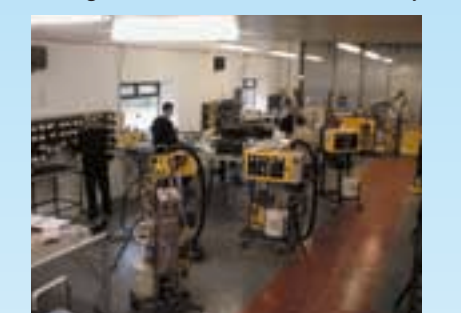
workshop and a further 1,200m<sup>2</sup> of machine workshop. Stores, despatch and goods in, which now occupy 8 times the original space, enabling Plastech to stock even greater quantities of seals, tooling ancillaries etc for mould build applications in both RTM and LRTM, thus ensuring that prices and turnaround of orders remain highly competitive.

The spacious workshops and new conference room now provide the ideal setting for the Tool Training Courses which Plastech run 4 or 5 times a year. This now means that all facilities are provided under one roof; apart from the hotel accommodation at the nearby St Mellion Golf and Country Club, which offers excellent food, accommodation and sporting facilities.

The new site at Chilsworthy Beam was occupied for industrial use in the 1800's for the production of arsenic to satisfy the ever-growing demand worldwide for gunpowder. Later the arsenic kilns were converted to brick kilns supplying bricks, tiles and fine ornamental brick architraves, as the

boom in house building in towns and cities grew rapidly during the industrial revolution. The fine listed brick chimneys and the later kilns still stand as testament to those times, whilst the now redundant railway sidings that once carried the finished products by steam train to cities both at home and in the Empire are now only visible through the undergrowth.

How apt it is then that throughout its industrial past, Plastech's new home has supplied the world with fine products from Cornwall, and through the supply and manufacture of quality Resin Injection Machinery and RTM tooling, this tradition continues today.



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