Event	Date	Location
Plastech Light RTM Training Course	1st & 2nd February 2006. Arrival on the 31st pm January	Cornwall, UK. Contact Kim on Tel: +44 (0) 1822 832621, kim.harper@plastech.co.uk for further details
ICERP 2006	23rd – 25th February 2006	Chennai, India
JEC Composites Show 2006	28th – 30th March 2006	Hall 1, Paris Expo, Porte de Versailles, France
Plastech Light RTM Training Course	Spring/Summer 2006	UK, contact Kim, details above

www.plastech.co.uk

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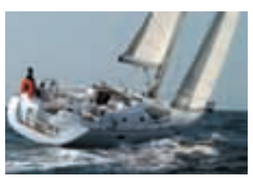
Jeanneau's closed mould production puts wind in their sails

Jeanneau's production team - committed to closed mould excellence

Jeanneau, one of Europe's leading boat builders manufacture in excess of 1,000 yachts and motor cruisers per year ranging in size from 35 to 45 feet. Their boat designs and the developments that they have made in their closed mould production and processing have promoted them to the position of world leaders in the supply of large marine craft and to the forefront of this 21st century composite technology.

Over the last 2 years Jeanneau have increased the size of their main facility in Cholet, Central France to occupy over 17 hectares. Their dedicated, state of the art closed mould injection facility occupies 5000m² and concentrates on the manufacture of large hulls and decks. Two further facilities on the same site of 13,500m² and 10,500m² provide additional manufacturing and assembly production areas. To service these new facilities the number of employees has now risen to over 80, and will increase again over the next 2 years to between 300 and 350.



The Sun Odyssey 42 DS

An example of one of their most impressive closed moulded parts is a 42ft long yacht deck of 55m² surface area and complex geometry. Over 500 of these decks have been moulded to date using Jeanneau's own variant of the Light RTM closed mould process. This large complex part has precisely positioned layers of glass fabric and matt combined with a host of various shaped cores loaded into the mould cavities prior to vacuum closing and injection. Once the automatic injection machine is signalled to start, all details of resin flow, programmed automated catalyst ratio adjustment, temperature, resin volume and precise cavity injection pressure are all monitored and written to data logging files. By recording data of the moulding progress in this detailed manner Jeanneau have records of each injection thereby ensuring a high degree of quality control from one moulding to the next. The injection machine's data files, which are stored on a compact flash memory card can easily be removed and transferred to a PC for detailed analysis.

The quality of these large moulded parts; in thickness control, surface finish and precision laminate placement is second to none and demonstrates the success brought about by Jeanneau's attention to detail and their excellent composite production engineering. The cleanliness and efficiency of the closed mould production plant is a fine example to all production moulders, and is reflected in the company's position as market leaders.

Plastech are honoured to be suppliers of injection equipment and ancillaries to Jeanneau, and are dedicated to responding to their particular machine design requirements.

Inside this issue

Challenge successfully met ! 72,000 litre fish farm tanks

Scophthalmus maximus

Mr Mandiola, chief of Mandiola Composites S.L. in Bilbao, Spain, has successfully met the challenge set by his clients, Orrua Itsaondo Arraiak S.A. who presented him with the task of moulding large 72,000 litre fish farm tanks using the Light RTM method and installing them on site. Orrua needed the tanks to fit within their existing premises without undue disruption to production. This meant that Mandiola had to design the tanks to be free standing and strong enough to withstand the 72 tonnes of water when installed. The tanks were designed to be made in sections to allow efficient on site installation.

Transportation of tank section

Tanks fully installed

The assembled tank's design comprised four basic quadrant LRTM mouldings, each weighing 530kg and needing 350kg of Scott Bader's orthophthalic, low viscosity injection resin. Multi layers of Pentacore MAT450 WR 800PP125 from Glasscom were used. For further laminate stiffness 10mm Nida-Plast honeycomb from Nida-Core and 40kg/m^3 density Polyurethane foam was moulded in during each injection to form the structural ribs on the outside of the tank.

Mr. Mandiola attended one of several successful Light RTM training schools held in Spain, organised by Eckard Arlt of Equipamiento Formacion Y Asesoria (EFA), Plastech's representative for Spain, Portugal and South America. This was followed up with further specialist training and consultancy at Plastech which enabled him to confidently build the large injection moulds in house at his Bilbao facility.

Finished tank sections ready for installation

Once the mould sets were complete he set up the production unit using 2 Megaject SSB Sprinter machines in tandem and a third as a standby. These machines were fitted with the PVSensor system from Plastech, which gives the operator precise barometric pressure control over the machines output.

Due to the complexity of the moulded-in core structures which taper in towards the centre of each quadrant, Mandiola used 16 vacuum vent points to ensure total fill by the 392 litres of injected resin. All Machines, mould ancillaries, seals, ejectors and injection valves were supplied by Plastech.

Assembled tank

This year Mandiola have successfully completed the production of 27 fully assembled tanks using the Light RTM process, with an overall composite weight of 58 tonnes. His tank design allows for additional sections to be installed between the quadrants, thereby increasing the volume of the tanks as required. Orrua have plans to extend the capacity of their fish farm with orders for two similar tank systems for Mandiola expected in 2006.

The gloves are off !

– A simple and effective approach to moulding in metal inserts

A question often asked by clients attending our training courses is; how do you mould metal inserts into the composite part when moulding by vacuum with Light RTM? Naturally, the main concern of many is sealing the mould in a robust enough manner when using a mould insert location and holding device.

In former times of normal RTM production tooling it was common to have through mould, insert fixing devices; however there is a high chance that such designs would cause vacuum leakage when applying similar devices to the Light RTM process.Wherever possible Plastech try to share their methodology and do so here for the location and sealing of inserts. This system simply removes any need for through hole fixing and sealing. Silicone gloves are designed to encapsulate the insert, and special pockets are built into the appropriate mould face to take the glove.

Below we give two examples of this technology. In both cases the insert has the additional complication of not aligning with the mould's opening axis.

Case 1

First we look at a Stainless Steel tongue to be moulded on the reverse side of a boat hatch cover. The rear mould is made with additional pocket space to take a silicone glove which can easily be inserted over the metal tongue bracket. This covers the tongue sufficiently to leave only the exposed tongue's foot which is wrapped in reinforcement before the mould is closed. To ensure the dry assembly does not fall off the contra mould as it is turned and lowered onto the fibre pack, the back of the silicone glove is smeared with silicone grease. This provides sufficient greasy adhesion to hold the glove in the mould pocket.

Insert gloves - Plastech innovation at work

After cure and opening of the mould, the silicone pocket is massaged off the metal tongue ready for reuse in the next moulding cycle.

As a safeguard, the silicone gloves have their own mould so further gloves can be accurately reproduced.

Case 2

The second case study describes the moulding in of a standard threaded metal stud that is in common usage in our industry and supplied by "Bighead Bonding Fasteners Ltd."

Here we show an M8 stud which must be kept free of resin during the moulding cycle and which is moulded off axis to the mould's opening by at least 40 degrees.

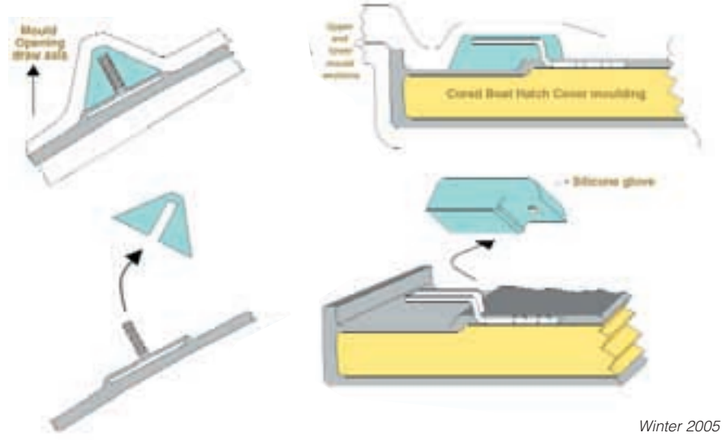
The silicone pocket in this case is made in a conical form which as illustrated not only shrouds the male insert thread but holds it accurately at its design axis and position relative to the moulding geometry.

It will be appreciated that such designs eliminate any chance of vacuum leak and are easy to use whilst offering good location accuracy, and excellent sealing around the exposed insert or bracket.

A whole range of shapes and sizes of metal inserts, brackets, or complex nut holders can just as simply be accurately moulded in during production in this manner.

Examples can be seen being demonstrated at Plastech's next Light RTM Training Course to be held on 1st & 2nd February 2006, or their 'Introduction to Closed mould Technology' - 1 day seminar in the Spring of 2006.

In this instance aluminium cones are shown, however silicone is a more user and mould friendly material



Light RTM - A review of process problems and their remedies

Light RTM is now firmly established as a major closed mould manufacturing process; however, like all technologies it does have common problems and inherent weaknesses. Here we review the process and provide solutions and remedies to some of these perceived shortcomings based upon our long experience of the manufacture of LRTM tooling and the operation of Plastech's inhouse test moulds and our clients production moulds.

Light RTM, or RTM Light is a process employing two lightweight matched composite mould faces between which dry reinforcement is positioned before the two halves are clamped together with vacuum, thereby locking the mould set closed prior to the resin being introduced. Resin is then injected into the peripheral cavity to fill the dry reinforcement within the mould. Two sets of mould seals are employed; one to exclude atmospheric air and the other to ensure that no resin leaks from the mould cavity during mould fill.

This operating principle is simple and is the main reason why the process has attracted so many production moulders to adopt it as their preferred closed mould, moulding method. However, aborted or scrap mouldings occasionally occur, often due to the operator's general misconception that the process is totally robust and needs little attention paid to mould maintenance regimes or correct manufacturing procedures.

Without doubt, air entrapment in the guise of incomplete fill, dry patches, or voids is the most common fault. To provide a definitive listing of reasons for these phenomena would alone occupy several pages, therefore we provide below a review of the most common causes and solutions.

Air voids

The use of vacuum - in other words sub atmospheric pressure - inherently creates a major cause for potential air voids, or bubbles in the finished moulded part. During the moulding process, air at atmospheric pressure is eagerly attempting to enter the mould and as it is some 17,000 times less viscous than resin it can do so with remarkable ease through even the smallest of holes. Even when the mould is completely filled with resin it still remains under a vacuum condition before gelling and curing.

It may be surprising to learn that leaky mould vacuum seals are not, as would be expected, the reason for air voids. The mould fittings, inserts and pipe connections, or cracked moulds are however the usual source of such leaks. As described earlier, Light RTM mould technology uses two seals; one seal preventing resin from leaking out of the mould and the other, set further away on the edge of the mould flange, sealing against the ingress of atmospheric pressure. A high vacuum source is connected to the flange area between these two seals which act as a vacuum security fence around the mould cavity. Any small outer seal leak will simply be scavenged by this high vacuum barrier whilst the vacuum level maintained within the cavity is held at a lower level.

It is without doubt that resin inlet connections - whether simple pipe fittings, or the more sophisticated resin injection valve inlet are the main source of leaks. This can be due to damaged O ring seals, or incorrectly installed or badly fitting seals. In fact any supposedly sealed holes or inserts in the resin cavity of the mould should always be rigorously checked for leaks - including the catchpot/s and cavity vacuum vents.

A more obscure cause of voids in the moulded part can be due to a small crack in either the mould face or contra mould skin. This can cause major problems with voids in the moulded part, and in these cases the source of the leak can be notoriously difficult to detect.

These voids rarely manifest themselves on the inner surface of the mould in exactly the same position as the micro crack/leak appears on the outer surface of the mould. - Air leaks into the cavity have been known to travel some distance through the mould laminate before entering into the mould cavity via the mould's cracked gel coat.

A coat of catalysed resin wash applied to the mould's outer surface whilst the mould is NOT on vacuum, can quickly remedy this phenomena. - If this repair work is carried out whilst the mould is under vacuum, then the leak will simply suck the repair resin through the leak path often making such repairs non effective.

Dry patches

The discovery in a filled mould of patches of dry glass that consistently appear in the same area is in the main caused by mould cavity inaccuracy. This inaccuracy during mould calibration will result in significantly inconsistent cavity thickness within a mould cavity supposedly designed to be of a constant thickness. In this scenario, resin will, given the choice, always flow more easily and preferentially through the thicker cavity areas, assuming of course that the same weight of glass is placed throughout the cavity at the outset.

In addition to the problems caused by poor calibration, the cause of parts being inaccurately moulded in a mould that has perfect calibration can often be traced back to the matched mould set not aligning or not being locked together correctly. When closed the location of the mould's x and y axes is normally established by side mounted dowels - These are especially important for moulds with flat or shallow draft cavities. Without the use of correctly aligned location dowels each closing of the mould could be out of the designed alignment, thereby causing unpredictable and changing mould fill characteristics and dry glass patches to appear from one moulding cycle to the next.

Another reason for dry patches, especially near, but not at the vent/catchpot is basically due to the incorrect positioning of the catchpot point. Either this point can be relocated, or alternatively another can be retro fitted in the area of dry glass to 'mop up' the last vestiges of trapped air

Corner cracks

Cracks in the gel coat of a moulded part - usually observed in external radii - demonstrates a classic problem associated with resin rich areas, and can again be traced back to inaccurate mould build, whereby the second mould half does not faithfully follow its counterpart and therefore has a local corner thickness greater than the desired main cavity thickness. Apart from scrapping the contra mould and rebuilding the inaccurate mould half, it may sometimes be appropriate to compensate for the unintentional over thickness by applying extra glass strips in these thicker corner areas to prevent the product cracking.

Cracks in flat zones

Cracks observed within large flat areas of the moulded part are caused by over thickness of the part. It is possible for the Light RTM process to be abused by the operator's inadequate control, or their lack of understanding of the control needed with mould fill speed. Too fast a fill can inflate the mould cavity, if this is followed by rapid cure before the mould has a chance to relax back to the set cavity thickness then this can result in high exothermic reaction (from the excess of trapped resin) and cracking of the moulded part. In extreme cases this might even result in irreparable cracking of the mould face itself.

Catchpot overfill

Many moulders still feel that a large catchpot is necessary to accommodate the anticipated volume of vented resin before cure. This is basically an admission of their failure to accurately control the mould fill. When the mould is filled too quickly it is almost impossible to judge when to stop the injection, because if it is stopped when the resin is seen to witness the catchpot then it should not be a surprise to see that an excessive amount of resin flows into the catchpot as the over inflated mould relaxes to its original dimension. To overcome the likelihood of this happening, the catchpot should be replaced with a larger catchpot to prevent the resin filling the catchpot and flowing up the catchpot vacuum line. All would agree this represents an unnecessary waste of expensive resin in what should be a controlled process.

The simple answer to avoid these situations is to know what volume of resin mix the mould needs and to inject just sufficient to fill and spill into the catchpot by just a few millilitres. For larger moulds it is not sufficient to assume that each mould fill will be of exactly the same volume, so another approach should be considered. To remove any doubt it is best to optimise fill volume by adding precise pressure control to the process thereby removing the necessity for the operator to constantly make blind judgements. The use of in mould pressure readings that provide accurate machine control at, or just below atmospheric pressure mould fill, provides a far more qualified method of mould fill and negates the need for catchpots of ever bigger volume.

We have found that such a system will without doubt give consistently complete mould fill with overfill of between 10 and 100cc per injection – clearly demonstrating that providing pressure control keeps wastage to a minimum and profits up.

Resin in the mould flange vacuum area

The presence of resin leaking in between the two outer mould seals can stem from one or more of the following:

- Ineffective primary seal.

Leakage due to poor seal cavity accuracy is especially likely in areas where the primary seal follows a non horizontal path. Often when the mould flange has changes of plane the primary seal can be less effective in the convex curve sections and thus lead to ineffective sealing. In these zones the seal needs to be repositioned to trace a path that will create greater compression on the seal.

A better solution to having simple, passive primary seals such as mushroom profile seal, is to install a dynamic seal which offers a more compliant seal for moulds with complex flange paths. These seals can be gently inflated when the mould is closed and thus engage and seal even when there are mould flange inaccuracies. - Plastech offer the most extensive range of mould seals available and will be pleased to recommend the ideal seal for your particular application.

- If when placing fibre into the mould some is positioned incorrectly or is not trimmed back sufficiently, so that fibres are not kept within the confines of the mould cavity thus interfering with the primary seal path, then this will undoubtedly result in resin leakage. It is therefore most important to check the fibre loading before each injection cycle to correct any misplaced reinforcement.
- Another common error which results in seal resin leakage can be put firmly at the door of over pressurising the mould fill channel whilst injecting. The Light RTM mould is only kept closed with atmospheric pressure however, resin injection machines are able to create much higher pressures than that actually needed for the process. Without sensitive and accurate pressure control it is left to the operator to judge how fast, and thus how much pressure the mould will take. Mistakes are often made, whereby resin leaks so profusely that it finds a path into the flange vacuum connection and vacuum system. This also leads to loss of flange vacuum and disastrous leaks from the mould edge and an aborted moulding.

By using the Plastech PVSensor system - which provides the injection machine with the necessary fine pressure control - this hazard can be eliminated and any guesswork by the operator removed.

- Finally it must be said that the loss of flange vacuum, either over prolonged periods or even momentarily, may cause a leakage. It is essential therefore not to have other moulds being operated on the same vacuum system, as this will cause major vacuum decrease as the system gathers vacuum to lock additional moulds closed. A simple, automatic vacuum lock valve in the vacuum flange line will reduce this danger and should be seriously considered.

As written at the outset, this article is not claiming to be a definitive list of the problems and remedies that can be encountered, however it is hoped to have highlighted the most common likely occurrences, and from well founded experience to give best advice for their elimination.

All seals and vacuum ancillaries and machine control systems can be seen on Plastech's new web site **www.Plastech.co.uk**

In the first few months of 2006, Plastech will be running some one day courses that will specifically target LRTM production best practise. These informative sessions are ideal for those already using the process as well as those considering a move to the closed mould technology.

Optimising mould fill through precise pressure control will also be covered.

For further details and dates **contact Kim Harper on**

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Workshop Vacuum Supply – Now available with simple DIY installation

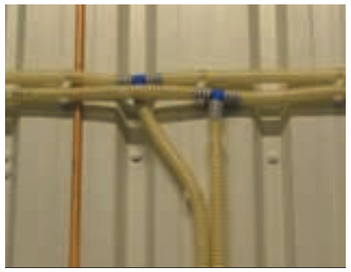
The continued success of the Light RTM process which employs vacuum as the main mould clamping force and infusion power, has led to a greater need for moulders to seek larger factory vacuum systems designed specifically for this process.

Secure wall mounted outlets with isolation valves

Plastech now offer a complete Vacuum Station which has been designed to give high vacuum security and optimised energy savings.

Based upon two individual vacuum pumps, one for high vacuum and the other for medium vacuum use, the unit brings unparalleled features to the infusion and Light RTM moulding industry.

Housed in a rugged, trolley mounted stainless steel cabinet; the controls feature digital vacuum level indication and precise vacuum set points. Normal over load protection and fuses are incorporated requiring just a simple plug and use operation from a standard 13amp single phase outlet. To ensure exceptionally low running costs, both vacuum pumps switch off once vacuum is reached, thereby extending motor and pump service life. Built in, in-line filters prevent plant debris from entering



Instant, vacuum tight push in fittings

the precision pump vanes thus providing high vacuum quality at all times. Individual on/off switching is supplied with power on indication features on the control cabinet's fascia panel.

The standard system's pumps provide quality vacuum control using two 17m³/hour vacuum delivery units, although higher output pump capacities are also available housed within cabinets of the same size.

Plastech consider that the often onerous and costly task for the new user of having to source and pay contractors to install workshop vacuum pipes and fittings, needs to be addressed, and we now offer a simple and low cost solution which can be easily installed by the client themselves. To this end the new Vacuum Station system can be supplied with all of the pipes and fittings needed for an average moulding shop installation. Simple one screw wall pipe fixings and the continuous, vacuum secure flexible

Flexible vacuum ring main provides swinging overhead supply

reinforced pipe provide a most economic vacuum plant installation. The use of these low cost, rapid to connect, vacuum tight push in fittings greatly reduce the time needed to install the system.

Full details of the vacuum pipe, pipe fittings and fixings required to install a vacuum ring main in your workshop are available from the Plastech website.

Innovative vacuum station - Needs no vacuum reservoir

Nida-Core, Plastech's New North American Distributors

Nida-Core Corporation of Florida, USA, have recently reached an agreement whereby they have become sole distributors of Plastech's RTM and Light RTM injection machinery, consumables, and technology in North America.

Eight of Nida-Core's technical sales consultants have successfully completed Plastech's specialist, Light RTM technical and practical training course in the construction and operation of Light RTM, closed mould tooling.

Nida-Core are now in a position to offer American moulders the most up to date European technology available from a single, long established and highly reputable source. Prospective and existing customers are offered a full range of mould build materials and consumables; comprehensive training in the design and fabrication of LRTM tooling, together with Plastech's wide range of resin injection equipment.

Plastech are the world's foremost innovators in closed mould technology, and the unique suppliers of precision mould control equipment designed to optimise the injection speed of LRTM moulds. This technology has up until now been unavailable in the U.S., however, as from January 2006 this is now obtainable solely through Nida-Core Corporation.

Nida-Core will also be offering from stock, all major serviceable parts for existing and future owners of Plastech/ Nida-Core resin injection equipment within North America. These are available through their two main warehouses for immediate despatch.

Plastech's resin injection machinery offers across the range systems, from the basic Megaject SSB, manual injection machine, to the fully automated injection system offered by the latest Megaject RTM-Pro using Allen and Bradley programmable logic control.

For further information please contact:
Nida-Core Corporation
Tel: (1) 772 343 7300
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E-mail: tjohnson@nida-core.com
Website: www.nida-core.com
Contact Name: Tim Johnson

Monovac - The new system for easy entry into closed moulding technology

The NEW Monovac System from Plastech is a simple technique for composite closed moulding. As its name implies it features the use of only one moderate level vacuum source and can be described as an introductory process to composite closed moulding.

The system only requires an inexpensive, moderate vacuum source and does not require the use of any meter mix injection equipment and therefore has an extremely low start up price tag for a closed mould technology.

If like many, you are a production moulder with limited resources but would dearly like to enter the field of closed moulding, then the Monovac System is the ideal low cost technology for you.

The global composites industry is now applying the Light RTM closed mould technique with great success, however there are still a great many traditional hand lay manufacturers who are reluctant to use LRTM due to concerns over the perceived costs involved and the level of technical expertise required, although the experience of many who have introduced LRTM into their workshops has dispelled these misplaced perceptions. The Monovac System offers first time users the opportunity to learn, understand and use the benefits of closed mould technology at a very low entry cost.

Essentially the Monovac System uses a matched composite mould set with a resin inlet and vacuum connection. Sealing on the edge of the mould is employed for vacuum security and resin containment.

Once the mould has been closed and a vacuum applied, the resin mix is simply funnelled into the mould and left to fill and cure. One of Plastech's clients uses the Monovac System to mould over 100 riding helmets per 8 hour shift employing just one operator. For a more rapid cure the mould can be water temperature controlled.

Currently the technology is best applied to relatively small mouldings. Examples being: motorcycle cowlings, helmets, sports goods or any moulding in the range of up to 2-3 kg.

Size is not a limiting factor however parts over 0.5m² (5ft/sq) can take a long time to fill and might be more suited to the Light RTM process.

High fibre volume fraction is achievable, with the process reaching aerospace specification, however a moderate 30 - 50% fibre weight is more common.

Plastech have developed the Monovac System and are the sole suppliers of technical data and build manuals, along with supplies of the recommended injection, vent and vacuum inserts, seals and latch clamps.

Full packages of specialist mould build kits are also available, providing the first time user with an easy entry into this economic closed mould technology.

Easy to understand instruction manuals can be purchased directly from Plastech's web site www.plastech.co.uk - Technical backup and mould build ancillaries are also available from Plastech's specialist mould building team on +44 (0)1822 832621

PVSensor Accuracy

Since the successful introduction of Plastech's low cost PVSensor system for accurately measuring resin pressure in closed Light RTM moulds, there are now over 250 sensors in service in the composites industry.

The system basically provides moulders with a precise reading of the resin pressure inside the mould, thus allowing the safe optimisation of mould fill when using a high pressure meter mix machine, whilst at the same time preventing the over pressurisation of the mould.

Some sceptics question the accuracy of this sensor based mainly on their misconception concerning the fact that the sensor employs a small column of compressible air between the sensor's measuring face and the resin surface. This appears to have led some to think that as air is compressible it cannot accurately transfer the precise resin pressure. Air is compressible, however it does compress to a point where its pressure precisely equals the system pressure compressing it - in this case the mould resin pressure.

In the case of the PVSensor, the air void below the sensor's highly accurate silica diaphragm is a mere 1cc and is thus compressed instantly to the resin pressure within the coned PTFE sensor tube. In many ways the PVSensor can claim greater accuracy than the more expensive stainless steel diaphragm sensors, due to the fact that there is no need with the PVSensor to distort a thin, yet slightly more rigid than air stainless steel diaphragm and thus it requires zero effort to reach the electronic diaphragm and as such can be considered more precise than second hand pressure readings via the conventional secondary metal diaphragm type sensors.

This innovative breakthrough in the design of the PVSensor - as heralded in the October 2005 publication of *Eureka magazine* - not only provides highly accurate pressure readings from absolute zero to 2000mb but is available from Plastech at less than half the price of conventional sensors. Furthermore, being designed specifically for use in the composites industry it is unaffected by resin or normal exothermic temperatures, and its robust design make it almost indestructible with normal use and handling in the composite workshop.