RTM today
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Complete closed mould technology solutions

Magnum Venus Plastech can now bring complete closed mould technology solutions to the market. Our mission to provide proven closed mould technology is gathering pace with 4 mould building and technology training schools completed within the first 8 weeks of 2007 alone.

Practical sessions demonstrate all aspects of mould manufacture, combined with a full range of Light RTM moulds being demonstrated to produce parts that exhibit all aspects of the process, from high quality finish gel coated parts to non gel coated, self coloured mouldings with some featuring complex metal and foam inserts. These practical sessions, held alongside the theoretical classroom side of the course all go to educate MVP's training course attendees by illustrating at first hand closed mould manufacturing at its best.

With the wealth of over 25 years of closed mould training programmes, MVP are ideally placed to assist clients throughout the world with independent advice on composite or metal tooling design and manufacture, process control and optimisation and material selection. MVP also offer moulders the most comprehensive range of machines and accessories available in the market today.

Inside this issue

Light RTM or Film infusion?
- A financial decision

There is now without any doubt a trend to mould composite components by a variety of closed moulding processes. Increasing awareness of better working conditions through the reduction of VOC's might be considered the main reason for this. This trend is not only concentrated in Western industrial sectors where stricter government legislation to improve working conditions has had sufficient impact to force composite moulders to adopt cleaner closed mould alternatives. The closed mould process is also becoming more and more popular in all parts of the world for the self same reasons. India for example has embraced closed mould activity with great vigour and South America, notably Brazil, has long since embarked upon closed mould production techniques as the preferred route.

Informed opinion actually highlights the improved quality of moulded parts made by closed moulding as being the main factor leading the change from traditional open moulding techniques. The benefits of a cleaner environment, and better working conditions are simply a highly beneficial bonus.

Closed mould production is most certainly the way forward, but which particular closed mould process should a moulder be choosing? Compression Moulding – SMC and DMC, or perhaps RTM or Light RTM, or indeed Film Infusion? - All have their role to play, but as put forward in a recent presentation *1* at the Brazilian Composites Feiplar 2006 show, the greatest confusion seemed to centre around the choice between Light RTM and Film Infusion. Just one week earlier at the IBEX show in Miami, there were just as many Light RTM demonstrations to see at the well organised open air demo zone as there were live Film Infusion demonstrations.

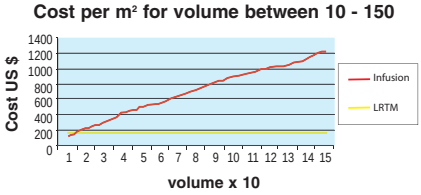
At Feiplar, a considered review was presented comparing the two most popular closed mould processes - Light RTM and Film Infusion. The presentation focussed attention on the relevant tooling costs, whilst not forgetting the important consideration of how many parts were needed, when choosing one process against the other.

Tool costs play an important role, and to avoid any doubt an objective study of real costs was presented which highlighted the comparative tooling costs for both processes.

The cost of the face tool was ignored as this should be the same for both processes. The similarity in costs however stopped there, as the disparity between the two processes became overwhelmingly evident when the study focussed on the cost of the contra tool. Costings for the construction of a Light RTM contra tool included the sacrificial calibration wax, all mould inserts, and the reusable matched tool channel profiles. The material cost totalled $171 per m² whereas for film infusion the cost per m² is only $10.

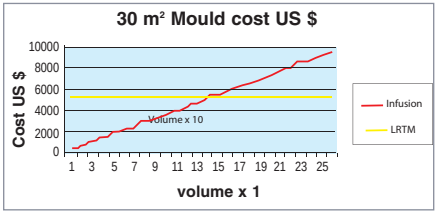
Bearing in mind that a LRTM mould is reusable, possibly up to 2,000 times before it is worn out and needs renewing, and that the equivalent Film Infusion tool face is scrapped after one cycle, the big question that must be asked is ……How many parts can be made by the Film Infusion process before the consumable waste costs equal those of the reusable Light RTM contra tool?..... and then go on inexorably to exceed it.

Based upon accurate research and an objective cost analysis the answer is as low as seventeen. Yes, unbelievable as it may seem, up to just seventeen moulded parts can be made by Film Infusion more economically than by Light RTM. For production volumes above 17 cycles it is quite evident that the most economic production method by far is the Light RTM process.



Cost per M² for tooling materials for Film Infusion V Light RTM contra tools, plotted against volume output

By enlarging the bottom left hand corner of the graph above, the second chart represents a product with a surface area of 30m² and again shows the comparison in real costs for the contra mould materials for both processes showing more accurately the cost break point.



No matter how one looks at it, the figures clearly illustrate that from a relatively low volume production requirement the significant cost savings to be gained through the use of the Light RTM process will increase moulding by moulding beyond this point.

The labour costs for manufacturing the Light RTM mould are not included, neither are the labour costs of reproducing the film surface every time a new part is manufactured by Film Infusion. - In fact if we consider the example above, the labour time needed to place 30m² of film, tacky tape, bleeder cloth, peel ply and resin feed and vacuum pipes, and the post moulding clean up over 17 cycles, it would add up to the same amount of time taken to make the Light RTM mould, so they would cancel one another out up to the 17 cycle break point. Another fact not indicated on the graphs is that after the production of 17 parts, the labour costs to apply and remove the consumables will continue with film infusion, whereas they have already been paid for with Light RTM and will not be part of the equation for another 1,983 cycles. What is more, you will not have the ongoing cost of the disposal of discarded infusion paraphernalia being removed from your factory in waste containers several times each week.

The Light RTM process does therefore enjoy great advantage in terms of cost saving beyond the 17 production cycle threshold, but it must not be forgotten that it has many other advantages. - For example, smooth engineered surfaces with accurate thickness control, a considerably higher production rate, appreciably lower amortising factors, and a favourably low impact upon the environmental. This salient point cannot be taken lightly in the current climate when one considers the high level of consumable waste generated from each and every moulding made by Film Infusion.

1 Paper 38, Feiplar Composites 2006 – Presented by Alan Harper, Technical Officer, MVP UK.

Technical note:
It must be stated that the volume fibre fraction achieved with film infusion can equally be achieved with Light RTM, as has been proven on many applications.

Moulding Net Size

– E & F Composites show the way

E and F Composites, UK have focussed on closed mould production techniques for many years and are now a major supplier to some of Europe's largest consumers. One such client, Caterpillar, called in E & F to re-tool and manufacture their 700 series truck bonnet.

Magnum Venus Plastech was awarded the contract for the modification of the pattern and tool build on the basis that all works could be completed within just 4 weeks. A master pattern was already available but required the appropriate re-flanging to be suitable for the LRTM process. The interesting feature of the pattern was that it was net size, with no over moulding dimensions provided. A decision was therefore made to build the LRTM mould as per the pattern and thus mould net size bonnet mouldings.

Reviewing the design it can be seen that not only did the fibre have to be accurately cut and placed up to, but not beyond a long product edge; it also in many cases had to be held in place on the vertical edged walls during mould closing.

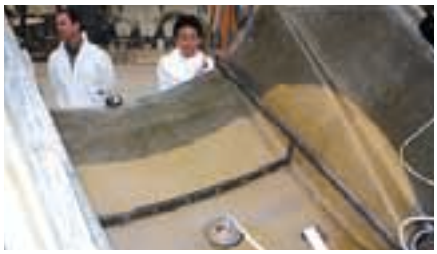
Any moulder will tell you that the prospect of moulding net size is tremendously attractive, as it reduces post finishing time to a minimum and saves on the cost of over moulded waste. However they would also argue that they could not rely on consistent and accurate dry fibre placement, and therefore it would be safer to over mould and trim back. If we look at this for one moment, could it not also be argued that we cannot rely on consistently accurate trimming of components, assuming that this is carried out manually, which for such a large piece is normal practise. - Trimming therefore must be accurate and done with utmost care if the part is not to be spoilt.

There are valid reasons for and against both methods, yet tradition says, 'Over mould and trim back!' …….. E and F however have now set a new standard by taking on a net size moulding philosophy and getting it right !

E and F Composites' Managing Director - Jim Embleton emphasises the importance of investing in the time to train production staff and that there are no shortcuts to achieving this. "Once trained", he says, "You can rely upon your production staff to maintain the right mind set to consistently apply what they know to be the only procedure that works."

The Caterpillar bonnet moulding has a general thickness of 5mm increasing to 7mm thickness at the edges, and if post trimming were necessary then it would add significantly to the production stage of the job. The dust generated by a diamond trimming disc when cutting through so much thickness would require the installation of costly dust management equipment.

The moulded edges were designed with a simple 1mm thick run off which can be simply broken off and the edge finished by light sanding to provide accurately finished, moulded edges.



NOTE: Moulding net size and accurate fibre placement techniques are some of the many topics covered in MVP's Light RTM Technology Schools. - Next UK school: April 24th & 25th 2007

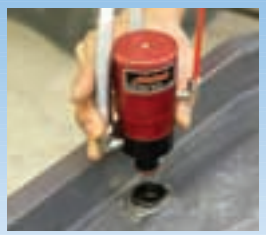
TAS Price breakthrough

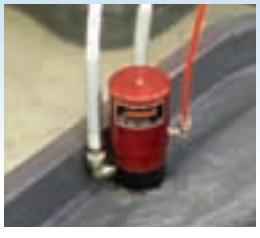
Since the introduction of the Turbo Autosprue back in 2004 many hundreds of this unique valve have been sold, and are being used daily with great success in workshops throughout the world of closed mould production.

Its performance has recently been further improved, with the **TAS** - as it has become known – now providing a service life of more than 1,000 flush cycles.

To celebrate the Turbo Autosprue's success and to enable even more moulders to benefit from its use, Magnum Venus Plastech have decided to dramatically reduce the sale price even further.

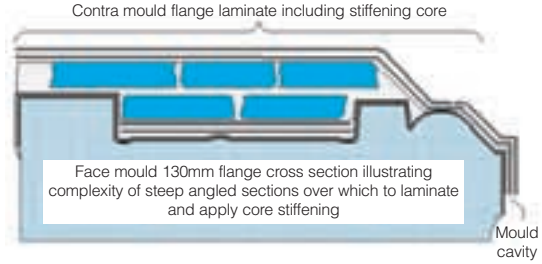
To discover just how much more economic it has now become to get into closed technology, visit **MVP at the JEC, on Stands: E02 & E10** and see the valves working. We will be operating live demonstrations of the Light RTM, closed mould production of a race car seat, where you can judge for yourselves the efficiency of the process and MVP's new range of closed mould equipment.





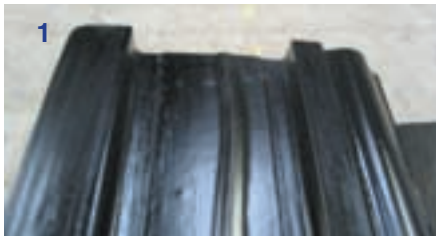
Mould Making – A simple solution to a daunting task

There are many who approach the lamination of a Light RTM mould flange zone that covers the seal and resin runner profile with some hesitation. The prospect of tackling the many steep angles and intricate shapes (as illustrated below) appears at first glance a daunting exercise to all except the most experienced laminator.



Here we explain a simple and rapid build method which can be achieved by all, without concern of trapped air bubbles, or loss of strength where needed, and can be carried out by the less experienced laminator.

Firstly, the flange needs to be very stiff if the recommended 1.0mm resin feed gate is to be maintained once the mould is closed under vacuum pressure. It would be foolish and technically wrong to simply laminate a few layers of 450gm CSM over the flange as it would simply bend under the force created by the high flange vacuum, and would lead to the distortion of the resin feed gap.



1. View of the contra mould flange zone showing the profile which must be laminated successfully.

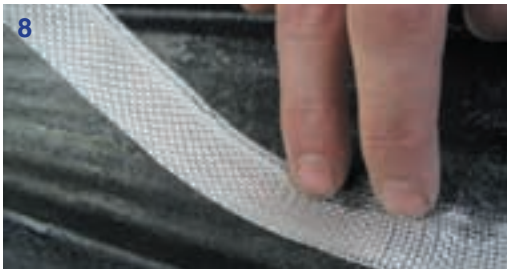
2. Clear gel coat application.

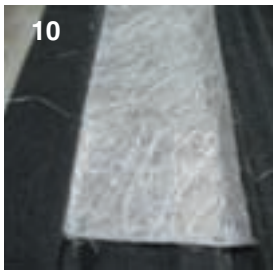
3. Tissue layer is carefully smoothed into flange detail, over the dry gel coat.

4 / 5. Butt joint the tissue, minimising the overlap and avoiding wrinkles.

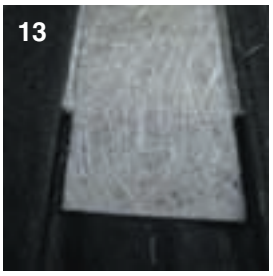
6 / 7 Use brush or roller to wet out and laminate tissue, using a minimum amount of resin. Do not use resin to flood the corners, instead gently work into the tissue. Do not over work the resin as this will lead to the splitting of the tissue layer.

8 / 9 We recommend that 25mm woven cloth tape is carefully placed over the resin flow channel profile as shown and laminated into the crevice between primary seal and resin flow profile. This provides extra high temperature strength and resistance behind the important resin runner which in service can exotherm to higher temperatures.





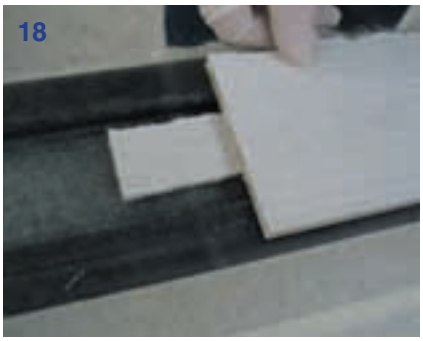
10 / 12 Illustrate the need to accurately cut the 450g/m² CSM strips 5mm narrower than the gap between the flange seal profiles. Wet out and laminate using 50mm brush and narrow roller.



13 / 14 Once the first layer is laminated, repeat with a second layer, and roll out wet on wet.

Important note - Work carefully to prevent the laminate rising up on the vertical edges of the seal profiles.

15 / 16 Once the 2 x 450g/m2 CSM lamination is complete, finish the flange with a 50mm wide strip of woven cloth tape over the outer wing seal profile as shown. This provides additional mould edge strength, and completes the initial flange laminating stages.



17 / 18 Measure and break Mastercore or similar rigid core to size for the two layers to fill firstly the gap between seals and secondly across the top of both seals.

19 / 24 Again using high temperature resin, add and mix in the catalyst, then stir in Fillite filler at 2.5 times by volume to 1 of resin, to make a suitable grouting mixture for the Mastercore. Apply the catalysed grout to the recess between seals as shown before the first layer of Mastercore is pushed firmly into the grout. Ensure no air gaps form between the Mastercore and laminate. or along the seal profiles on either side.

25 / 27 Press the narrower layers of Mastercore hard into the grout so that it oozes out from either side, expelling any air. Add a further layer of grout over the first layer of Mastercore in readiness to embed the wider, upper layer of Mastercore.

Continued overleaf...

28 / 29 Embed the final layer of 9mm Mastercore leaving it just short of the mould edge.

32 / 33 Complete the grout filling around the outer mould to form a neat edge as illustrated.

35 Apply the final 2 layers over the main mould cavity and continue up and over the Mastercored flange, right up to the mould edge.
36 A minimum of two layers of 450g/m2 CSM is required, although some clients have used three or more. It must be understood that the greater the thickness, the less transparent / translucent the back mould will become and observation of the resin flow will be obscured.

30 / 31 Remove the excess grout and neatly form a bevelled edge over the flow channel, and up to the masked edge. Remove the masking tape whilst the Fillite is still wet.

34 The Fillite now needs sanding to remove any high spots. Remove all dust.

It will be noted how this final laminate is easily achieved as the complex profile is now relatively smooth and requiring little in the way of expert laminating skills, having achieved the objective of simplifying the flange lamination.

Quantum Leap ahead with quality trailer production

Amongst **Quantum Mouldings'** many production parts there is one which stands out from the crowd, as it is large, has a high quality finish and is extremely well engineered.

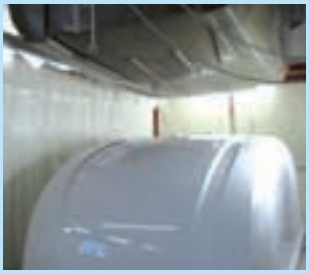
Covered trailers for the transport of cars and other high end goods need to have a degree of security not offered by tarpaulins or soft covers. Quantum's answer was to design with their client, *Brian James Trailers*, a lockable frp moulding which, with the use of gas springs and stiffening ribs would hinge up to provide easy roll on, roll off access.

"We needed to ensure the high strength and stability of the cover, and to guarantee this we included some accurate internal rib mouldings," explained Quantum's Chief, Peter Wooldridge. "These are moulded as non gel coated parts in a separate LRTM cluster mould, and bonded in at a later stage."

These moulded stiffening ribs were designed to accurately fit the inner profile of the main 27m² trailer cover, and by using the Light RTM process for the production of all of the trailer's moulded components, good engineering fits are achieved throughout, thereby enabling Quantum to consistently achieve the quality required by the customer.

Whilst the project initially took a lot of Quantum's resources to set up, it is now running smoothly. The injection resin has been specially formulated for Quantum and is injected using Magnum Venus Plastech's Megaject MkIV machine and Turbo Autosprue valves.

Peter adds. "Our biggest disappointment is that the time savings achieved by the closed mould process are virtually wiped out by the higher cost of RTM raw materials, when compared to production using spray lay-up GRP. Glass manufacturers in particular are not encouraging closed mould advancement in Europe." He pointed out that closed mould fibre mat costs are disproportionately higher in Europe than hand lay up glass. "We know that in the Middle and Far East glass mat prices for closed mould LRTM can be as low as half of what we pay here. If we could enjoy these prices in the UK we would certainly convert a higher proportion of our work to LRTM."



Peter Wooldridge illustrates the scale of the trailer top moulding at their UK facility.

Pressure control - Getting to the heart of the matter

Light RTM - unlike its predecessor regular RTM - does not work efficiently without fine pressure control. Machines delivering pressurised resin mixes into steel framed RTM moulds can measure the injection pressure at the mixer head outlet and therefore provide a sufficient degree of control to guard against the over-pressurisation of the mould. This however is not true of the Light RTM process, as the pressures involved are sub atmospheric, and a far finer control of the machine speed - and thus injection pressure - is required.

There still remains a degree of confusion within the industry as to which is the best system to provide safe, precise control for the injection speed of Light RTM moulds. One would be forgiven for being confused, as there are on the one hand, suppliers claiming that all that is needed is a machine-nozzle mounted, precision pressure sensor linked to the machines PLC control circuit, whilst on the other, a sophisticated mould sensor and machine system which provides complex vacuum changes linked to pump speed.

Let us consider the widespread misconception about using a system in which resin pressure is measured at the machine's mixer outlet.

Here, the resin is delivered from the injection nozzle through a pipe to the mould. The claim is that at this location the nozzle is so close to the mould cavity that any pressure difference between the machine nozzle and the mould resin feed channel is so negligible that it should be of no concern. To the contrary - concerned you should be, because pressure drops (which increase with flow rate) can be witnessed between the machine and mould and these drops are shown to be highly significant as they lead to unsafe pressures in the mould. The point is that during an injection, the pressure at the machine head will always be higher than that measured in the mould resin feed channel.

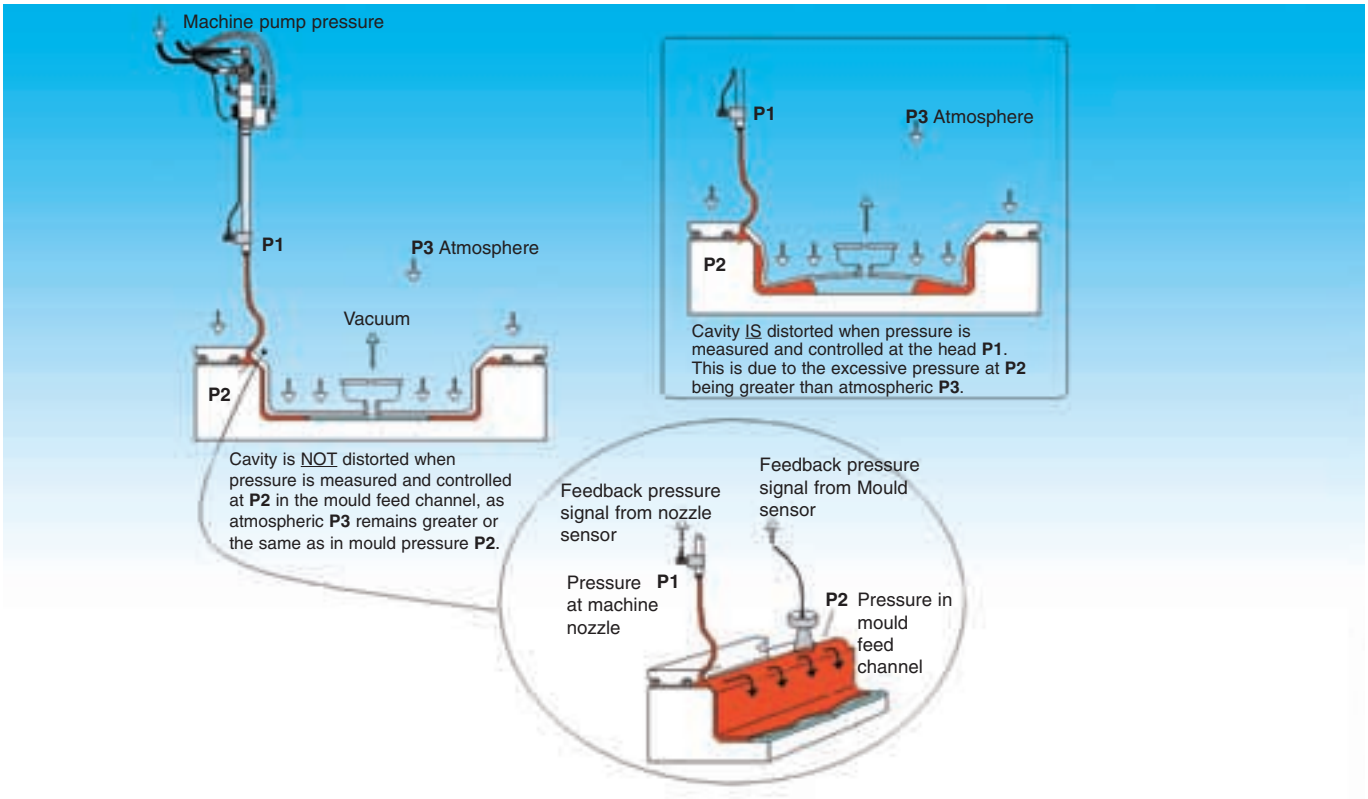
Bearing in mind that true Light RTM moulds are held together with atmospheric pressure alone, it is no surprise to learn that if this clamping pressure is exceeded by even the smallest amount of over pressurised resin mix, it will lead to the mould ballooning, distorting, or even being forced open. At the least, such an occurrence leads to a loss of control of the moulding process which requires immediate operator intervention. This scenario is in fact not uncommon, and for many LRTM moulders it is normal practice for an operator to oversee the injection process and manually reset the machine output.

All these concerns can however be overcome by employing a simple and accurate mould mounted pressure sensor from which a signal is fed directly to the injection machine to automatically control speed without any operator intervention.

By measuring the actual in mould resin pressure at a far more accurate and obvious location just downstream of the injection input point, it unquestionably provides the perfect solution for moulders by allowing moulds to be left to inject at safe pressures automatically, thereby allowing other preparatory tasks to be carried out by the operator during the injection period.

The economical but highly efficient **PVSensor** system is actually so sensitive (1/1000 of a bar) that it will stop the machine automatically once the resin enters the final catchpot as the mould goes 'hydraulic'. This means that the **Resin Gel Alarm** (RGA) system that monitors if and when an injection stalls for more than a few seconds, will automatically sound the alarm to recall the operator to switch off and flush out the machine.

The PVSensor and RGA systems are now standard features on MVP's extensive range of resin injection machines.



See MVP at these 2007 Events

Event	Date	Location	Booth No.
JEC	April 3 - 5	Paris, France	E02 & E10
Light RTM Training Course	April 24 - 25	MVP, Gunnislake, UK	
Sampe	June 5 - 7	Balitmore, MD	1223
ACMA Midwest Composites	June 13 - 14	South Bend, IN	
China Composites	September 12 - 14	Beijing, China	
UMMA	October 5 - 7	St. Louis, MO	
IBEX Show	October 10 - 12	Miami Beach, FL	
Sunbelt Expo	October 16 - 18	Moultrie, GA	
ACMA Composites Polycon	October 17 - 19	Tampa	909
METS	November 13 - 15	Amsterdam, Netherlands	

Silopren RTV 2025 VBS Blue

MVP's new low pressure Injection system brings breakthrough in rapid silicone bag production

Following the introduction last year of a new rapid cure silicone product - **Silopren RTV 2025 VBS Blue** by Momentive Performance Materials GmbH & Co. KG., (*formerly - GE Bayer Silicones GmbH & Co. KG*), Magnum Venus Plastech have conducted trials with silicone bags made using a spray up application to confirm the product's longevity in a production environment using both polyester and epoxy resin systems. These tests have proved the material's performance to be on a par with silicone bags made using more traditional systems.

Injection into composite matched mould

Unlike traditional silicone moulding systems however, the main advantage of Silopren RTV 2025 VBS Blue is the speed by which a production ready, moulded silicone bag can be made.

Due to the platinum cure system that Silopren RTV 2025 VBS Blue employs, a newly injected bag can be removed from the mould within minutes and immediately put into production use.

More recent trials to make bags using Silopren RTV 2025 VBS Blue by an injection process, have lead to an unparalleled breakthrough in rapid silicone bag production. The illustrations below show how a Silopren RTV 2025 VBS Blue silicone bag for a helmet tool is injection moulded in under three minutes, and ready for production use within 15 minutes.

An injected silicone bag ready for use

Light weight composite injection tools are employed to create the appropriate silicone bag shape, and also produce a controlled silicone thickness with engineered surfaces on both sides of the bag.

Injection moulding is an extremely efficient and cost effective way to produce silicone bags. Silopren RTV 2025 VBS Blue's unique rapid curing chemistry allows highly accurate and flawless silicone bags to be manufactured in minutes. The cost savings of this clean and waste free process are manifold when compared to conventional bag production techniques." explains Alan Harper, MVP's New Technologies chief. "We have now completed the trials on the **Siloject 121**, an affordable meter mix machine designed specifically for the task of handling this product. The Siloject 121 offers both a spray application and more importantly a machine system for bubble free injection moulding.

Accurate, 3mm thick injection moulded silicon that is smooth on both faces.

Examples of Silopren RTV 2025 VBS BLUE, and the new **Siloject 121** machine will be on show at the JEC, on MVP stand number E02.

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