



LET'S TALK / NEOMOULD

Tool Manufacturing made Easy

October 2017

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QUALITY RESINS

COMPOSITE TOOLS ARE BROADLY USED

- Flexibility of shape and surface quality
 - Gloss and matt finish, texture, smoothness
- Cost-effective for smaller production series
 - Up to 500-1000 parts per year
- Enables manufacturing of large components
 - Wind turbine blades, boats, façade panels, roofing/ BLOB
- Mostly used for Vacuum Infusion, Hand Lay-up and Spray-up, to some extent also for RTM
- Fast production of tooling (compared to steel)
- Potential integration of heating and cooling channels
- Track record of performance

COMPOSITE TOOLS USED FOR LOWER PRODUCTION VOLUMES

Method	Production volume	Tooling cost	Other features
Hand Lay-up	Low < 500-1,000 parts/yr.	Low to Moderate	Simple processing, design flexibility, high level of part finishing required
Spray-up	Low < 500-1,000 parts/yr.	Low to Moderate	Simple processing, design flexibility, high level of part finishing required
Vacuum infusion	Low < 500-1,500 parts/yr.	Low to Moderate	Suitable for complex shapes and large components (up to 100 m), medium level of part finishing required
RTM	Low to Moderate 500-5,000 parts/yr.	Moderate	Faster production, design flexibility, complex shapes possible, smooth surfaces, medium level of part finishing required
SMC BMC	High 500-100,000 parts/ yr.	High	Better part-to-part reproducibility, design flexibility, complex shapes possible, outstanding finished surfaces, minimal part finishing cost
Metal	Very high > 100,000 parts/yr.	High	Excellent part-to-part reproducibility, moderate design flexibility, outstanding finished surfaces (minimal part finishing cost), cost competitive at larger production series

FREEDOM TO DEVELOP UNIQUE
SHAPES AND SURFACE QUALITIES



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NEOMOULD® 2017-S-1 MAKES TOOLMAKING EASY

- Robust and easy processing
- Zero-shrinkage feature enables to mirror plug surface and dimensions
- Excellent application on vertical surfaces without sagging
- Optimized curing characteristics even for making thick parts
- Once cured, resisting temperatures up to 80 °C
 - Note: resistance to styrene at such temperature requires also high quality tooling gelcoat and use of a tie coat

TOOLMAKING STEP BY STEP

1. Preparation of materials
2. Cleaning of plug with (if required) subsequent polishing
3. Cover surface with mold release agent, with subsequent evening out for uniform surface finish
4. Application of gelcoat (brush or spray)
5. Application of resin rich layer
 - Using surface veil or Tie coat
6. Lamination of structural laminate
7. Integration of supporting structure after curing several layers applied
8. Part cure
9. Release tool from plug

BEFORE YOU START

- Check temperature conditions in workshop, the plug and for the materials to be used to be at 18 – 22 °C
- Check that all materials requested are present in the workshop
 - Please keep in mind that materials taken from outside or from cold storage may require 2-5 days to reach workshop temperature
- Homogenize pails and drums of tooling gelcoat and Neomould® 2017-S-1 resin thoroughly prior to taking out any quantity
- Check that sufficient soft pads are available for mold release agent application and for polishing

A man wearing a white lab coat and glasses is using a buffing machine with a white brush to polish a large, curved, red surface. The machine has a grey handle and a red and yellow disc. The man is wearing a silver watch on his left wrist. The background is slightly blurred, showing an industrial or laboratory setting with overhead lights.

PLUG CLEANING, POLISHING AND PREPARATION

RECOMMENDATIONS FOR PLUG PREPARATION

- Check the entire plug surface for defects
 - Remember that even tiny defects will be mirrored in the mold and subsequently in all parts manufactured from the mold
 - If required, repair any defects
- If desired, polish the surface until required gloss is obtained
- Check with manufacturer of plug to determine suitable cleaning agents for plug materials used
- If using solvents give the plugs sufficient time to dry so mould release sticks well afterwards
 - Avoid excessive amounts of solvents
 - Use relatively dry cleaning pads
 - If the plug is deep (e.g sink, bath tub), please take care of sufficient ventilation
- If the plug will be used next day, please cover plug and check next day before starting gelcoat application

APPLICATION OF MOLD RELEASE



REMOVAL EXCESS MOLD RELEASE

RECOMMENDATIONS FOR MOLD RELEASE APPLICATION

- Select right mold release agent so it will give the expected surface finish
- Apply the mold release agent in uniform layer(s)
 - When you see uneven layers, check the application pad
 - If saturated with mold release agent, change for a new pad
- Let mold release agent layer(s) settle according to supplier recommendations
 - Deep plugs (e.g. sinks, bath tubs) require significant air circulation
- After applying the final mold release layer, let it settle for the time indicated by the supplier before moving to polishing
- When polishing, regularly check the polishing pad
 - If it looks dirty use a new part of the pad or use a new one
- After evening out the mold release agent, check the entire surface if the gloss is uniform and as desired
 - It is recommended to inspect from several angles

GELCOAT APPLICATION (BRUSH, SPRAY)



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GELCOAT SELECTION

- BÜFA Tooling Gelcoats are recommended
- Available in 4 colors, for contrast with gelcoat color of final component

Product name	BÜFA-VE-Tooling-Gelcoat-S	BÜFA-VE-Tooling-Gelcoat-H	BÜFA-Conductive – Tooling GC-S
Application	Spray	Brush	Spray
Resin base	VE	VE	Hybrid
Styrene content (%)	40	40	49
Peroxide	2 % MEKP	2 % MEKP	2 % MEKP
Gel time (min)	14	14	15
HDT (°C)	130	110	120

RECOMMENDATIONS FOR GELCOAT APPLICATION BY BRUSH

- Select a wide and thick brush for allowing longer paint strikes
 - Apply gelcoat strip by strip do not patch, but long movements
 - Paint in the same direction and slightly overpaint
- Check the brush for loose fibers, and eliminate
 - Do use new brushes not cleaned ones
- Prepare for application of 400 g/m² of wet gelcoat in one layer
- Weigh the gelcoat quantity required
 - Allows to keep control of the amount used during painting
- Use 1.5-2.0 weight % of peroxide, mix thoroughly with gelcoat
- In the beginning, check thickness of the gelcoat at multiple spots
 - 350 microns wet gelcoat minimum
- Typically surface quality is less even because of use of brush
- Let the first layer cure well and apply a second layer in same wet weight

RECOMMENDATIONS FOR GELCOAT APPLICATION BY SPRAYING

- Check if equipment works properly
- Select the right nozzle
 - Tooling gelcoat may be thicker than normal gelcoats
 - Selecting right nozzle will avoid inclusion of excess air
- Adjust the required pressure
- Adjust the peroxide content = 1.5-2.0 weight %
- Check the spray pattern on a carton prior to start painting
- Ensure that you can move/ walk freely around the mold
- Paint in the same direction, move along the mold following the shape of the plug to keep distance all time
 - Required for uniform thickness distribution
- Apply 700 – 800 g VE Tooling gelcoat in one go
- In the beginning, check thickness of the gelcoat at multiple spots
 - Use sufficient overspray in order to ensure uniform gelcoat distribution and thickness

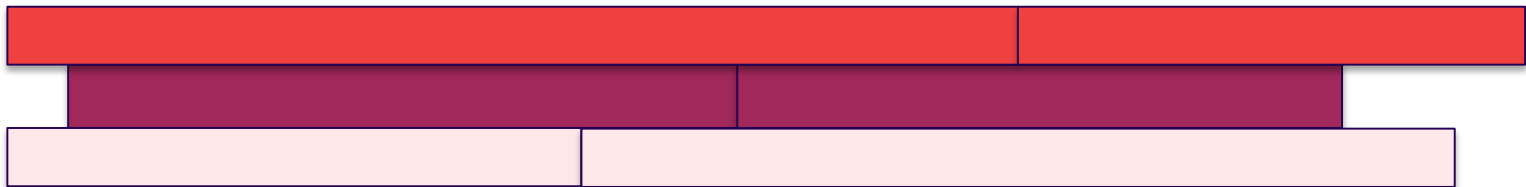


PREPARATION OF GLASS

Best to cut in advance for efficient processing

RECOMMENDATIONS FOR GLASS FIBER PREPARATION

- Prepare glass fiber mat in line with plug dimensions/ laminate design
- Avoid overlay areas of mat layers
 - These may result in thickness variations and uneven curing
- Prepare the glass fiber layers according to the planned laminating sequence



APPLICATION OF FIRST LAYER OF NEOMOULD® 2017-S-1



RESIN APPLICATION THROUGH HAND LAY-UP

- Prepare only the resin amount to be used within 15 minutes
 - Make sure that the pail or drum used for the preparation is mixed thoroughly
- Apply 1.5-2 weight % of MEK Peroxide
 - Adjust in line with workshop temperature
- Use large rollers for gentle resin application, avoiding damage to gelcoat and glass fiber mat
- Apply a rich resin layer before laying up the mat
- Roll over softly and apply more resin if needed, avoid air bubble enclosure
- Ensure air bubble free application before laying down more glass fiber mat
- Apply layer by layer and do not apply different number of layers on different parts of the plug
 - For avoiding uneven cure and part warpage
- Use right shop temperature
 - 15 °C is absolute minimum for 8 layers, 18 °C for 4 layers
 - Keep in mind to adjust MEKP level

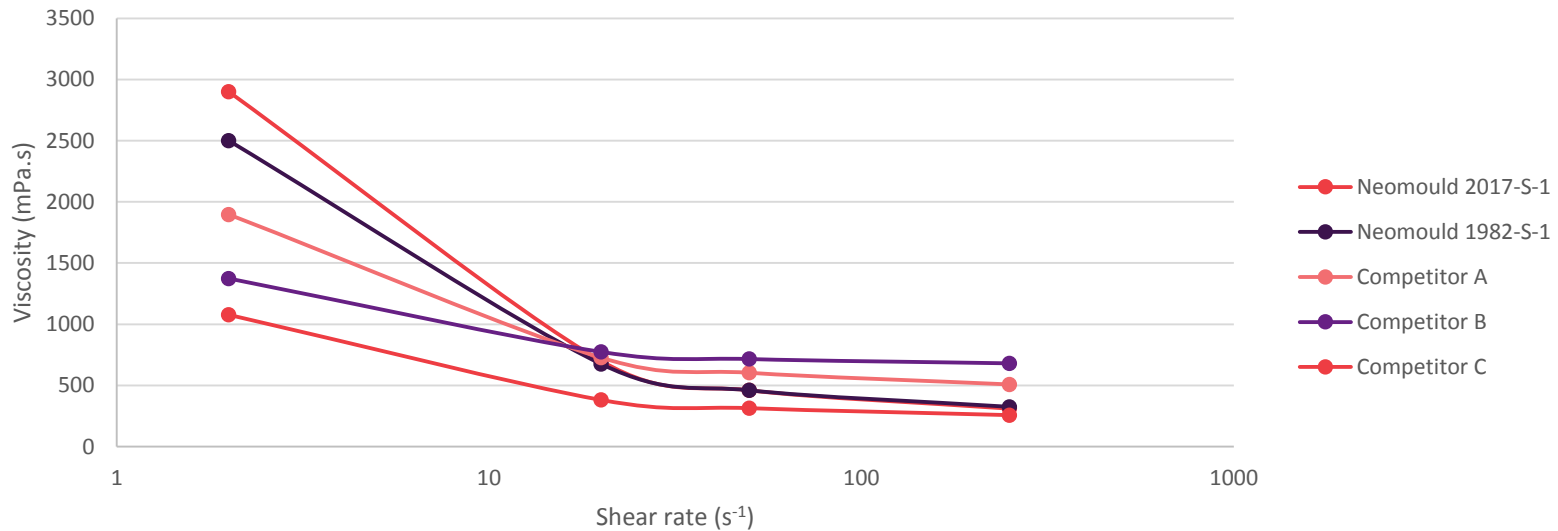
RESIN APPLICATION THROUGH SPRAY-UP

- Make sure that pail or drum located on the machine is thoroughly mixed
- Apply 1.5-2 weight % of MEK Peroxide
 - Adjust in line with workshop temperature
- Check quantities of resin and glass fiber and check spray pattern i.e. distance chopped glass – resin stream
- Apply a thin resin layer before starting the chopper
- In the beginning apply all over 2-3 mm thick layer only and laminate avoiding air bubbles
- Keep distance of chopper gun to the mold surface
- Avoid having different layer thicknesses to gel and cure in different parts of the plug
 - Uneven cure may result in lower surface quality and warpage
 - In huge plugs apply specific thickness all over the plug within the normal gel time, rather than a larger thickness on a single spots

EXCELLENT RESISTANCE TO SAGGING

NEOMOULD® 2017-S-1 HAS HIGHEST VISCOSITY AT LOW SHEAR

- Easy application on vertical surfaces
- Allows application up to 12 layers



RIGHT CURING BOTH IN THICK AND THIN LAYERS

- Temperature development of Neomould 2017-S-1 measured in laminate on mold side (2 % MEKP)

Laminate thickness	25 °C	20 °C	17 °C
4 mm	32	30	Not recommended
8 mm	42	40	40
10 mm	52	50	50

- Competitor products showed in all test conditions 5-20 °C higher peak temperature compared to Neomould® 2017-S-1

APPLICATION OF FIRST CSM LAYER

Subsequent rolling for de-aeration



A person wearing a white lab coat and teal gloves is working on a large, green, textured surface. The person's hand is visible, holding a thin, light-colored string or wire. The background is blurred, showing what appears to be a laboratory or industrial setting with some equipment and lights.

INTEGRATION OF THERMOCOUPLE

If desired for measuring peak exotherm

RECOMMENDATIONS FOR PART BUILD-UP

- Behind the gelcoat two different types of layers may be applied
 - Surface veil bringing superior smoothness
 - VE based Tie coat bringing both superior smoothness and styrene resistance
- Glass mat types
 - Use CSM powder bond (easier to dissolve in styrene vs. emulsion bond), but slightly less stiff in the corners
 - In Hand lay-up use maximum 8-12 layers of 450 g/m² CSM in one lamination step, keeping in mind the Tg of the plug surface
 - In Spray up mind dont make layers too thick for avoiding air bubble enclosure
- Avoid the application of Woven Roving layers before having applied at least 4 CSM layers or 1800 g chopped glass fibers
 - If not, this may negatively affect surface quality (woven rovings visible)



APPLICATION ADDITIONAL CSM LAYERS





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BROWN RESIN COLOUR
WHEN UNCURED



TURNING WHITE WHEN CURED

SEPARATION PLUG AND TOOL

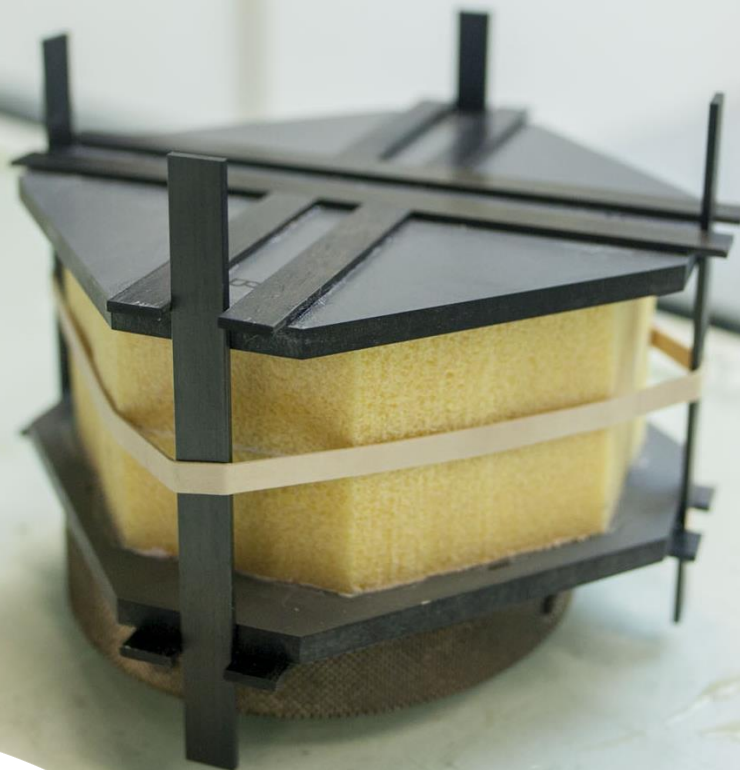


THE END RESULT

Tool surface mirrors plug surface



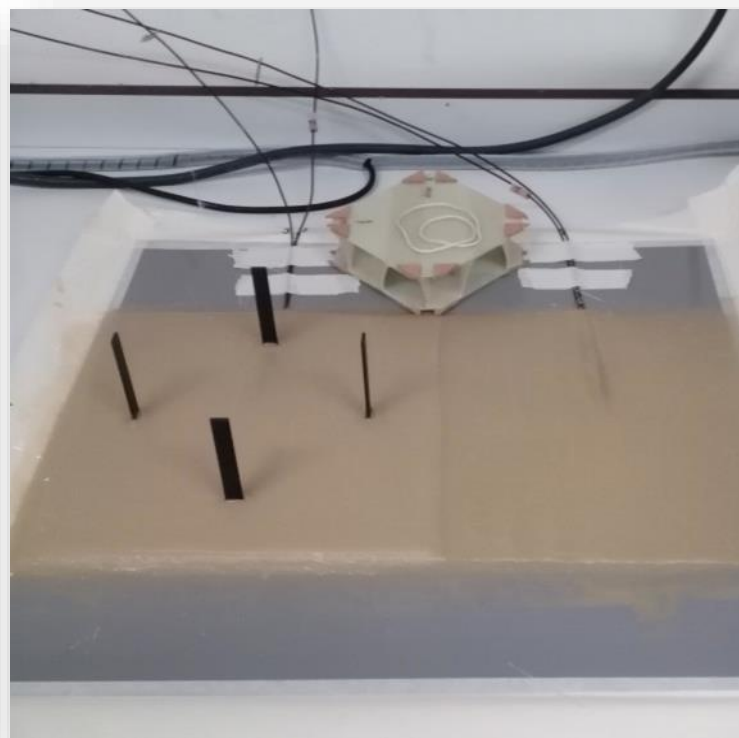
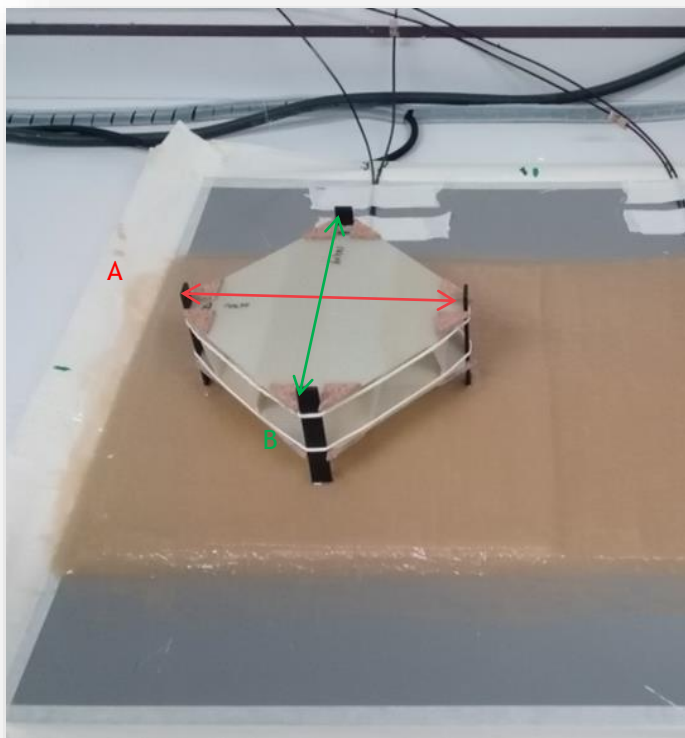
SHRINKAGE MEASUREMENT DEVICE



SHRINKAGE MEASUREMENT SET-UP

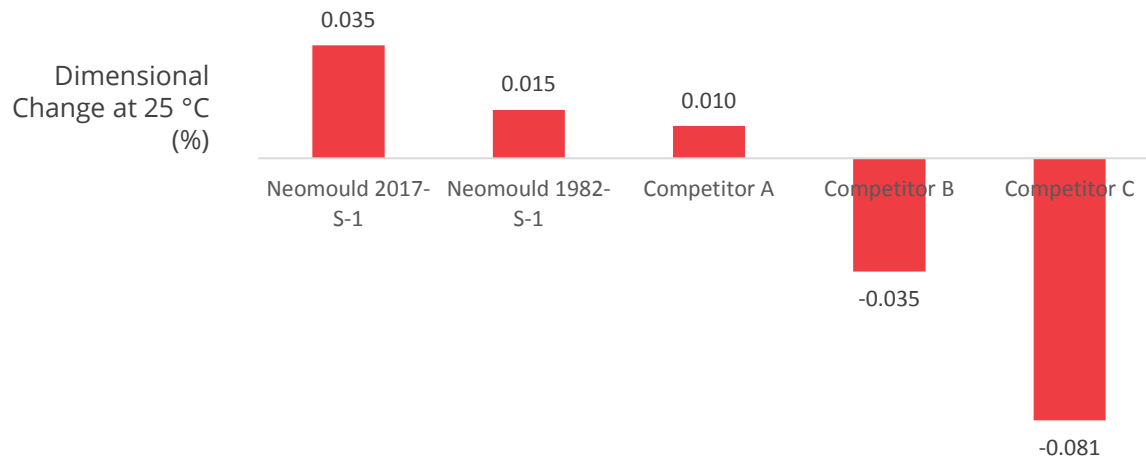


DISTANCE MEASUREMENT BETWEEN STRIPS



NEOMOULD® 2017-S-1 HAS UNIQUE DIMENSIONAL SHRINKAGE PERFORMANCE

- At 25 °C resin has slight expansion
- At less favorable temperature conditions, shrinkage is still zero
- Best guarantee to mirror the surface of the plug



NEOMOULD 2017-S-1 IS IMPROVEMENT VS. PREVIOUS NEOMOULD RESINS

- Improved thixotropic properties for better application performance
 - Easier to make thicker layers in one go
- Optimized development of exotherm reaction
- “Negative” shrinkage, reduced risk when working in unfavorable temperature ranges

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