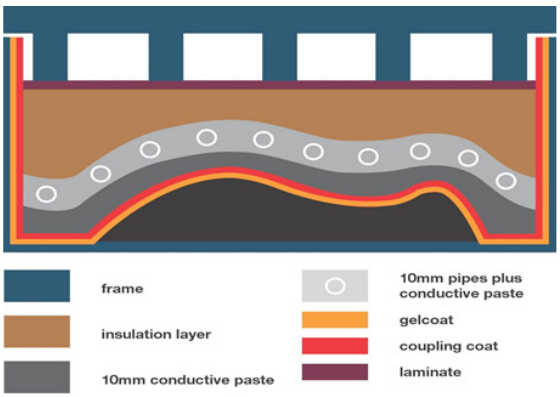
Temperature Controlled Tooling Guide for RTM, RIM and S-RIM

Epoxy RTM, RIM and S-RIM tooling, exhibits excellent physical properties and are stable at elevated temperatures provided the correct post-cure has taken place.

Polishable and highly polishable gelcoats with excellent resistance to chemical and styrene attack are available.

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It is recommended that the fibreglass used for the initial laminating be woven fabric not woven roving. This should be less than 100g/m^2 for the first two layers close to the gelcoat.

If required, a further two layers of glassfibre can be applied at a maximum weight of 350g/m^2 for each layer. The finer fabric will prevent print through and by keeping the surface layers down to a maximum of four this will allow for rapid heating/cooling of the surface of the tool. S-RIM tools will require additional layers of glass fabric due to the greater pressures involved.

For best results, where possible, ensure that the pipe work is installed at a maximum of 10mm from the surface. It is advisable to install the pipes in straight lines with inlet and outlet manifolds rather than a loop system; all connections can then be kept outside of the tool. This ensures rapid and even temperature control and water/oil leaks will not damage the tool but can be easily rectified.

The insulation layer of polymer concrete slows heat loss and minimises expansion of the steel backing structure. This reduces the possibility of tool distortion caused by the CTE mismatch between the resin tool and the steelwork.

For S-RIM or Tools where higher internal pressures are obtained during the production process additional steps are necessary. Before the frame is attached, either a 10-20mm layer of glassfibre or laminating paste is applied, or a 50mm layer of sand/resin (or similar) to add stiffness so that tool distortion from pressure is minimised.

Control Guide

1. Mix the JB-G 4615/5159 H (100:16) or S15/S15 (100:7) or S15/S15R (100:10) gelcoat thoroughly and apply evenly to the surface, making sure that there are no thick areas in corners and/or pockets. When at tack stage, apply second gelcoat.



2. When gelcoat has reached the tack stage, apply the coupling coat JB-K 99/5159 H (100:11) or mix your own using L84/L84 (100:25) and aluminium powder in a ratio of 1:1.5.



3. Laminate the whole of the tool surface with 2 layers of 78g/m^2-100g/m^2 woven glassfibre fabric using L84/L84 (100:25). Apply in the largest pieces practicable to minimize overlap and air entrapment at joints. For additional strength apply two layers of 280g/m^2-350g/m^2 woven fabric.

. **Keep resin content to a minimum.**

. The tool can now be left overnight. If this is done follow on from step 4. If tool build is to continue then go on from step 5. Small tools of approximately 1m^2 can be made in one and a half days if desired.

4. Check for voids, dig these out and repair with JB-K 99/5159 H (100:11) with the addition of a small amount of thixotrope to make a filler paste. Apply a thin coupling coat of JB-K 99/5159 H (or own mix as in step 2).



5. Mix and apply the conductive paste JB-P 4604/5159 H (100:3) to a thickness of 10mm onto the tool surface including the flanges. This layer must be consolidated to avoid air entrapment and the preformed copper pipes (preferably 10mm diameter) should be pressed into this layer and held in place. The pipework should be at 50mm centres and not be in a loop system if at all possible.



6. Check to see that the pipes are held firmly in place. Apply a further 10mm of JB-P 4604/5159 H (100:3) to just cover the pipes. Apply carefully so as not to leave voids around the pipes, consolidate well to ensure there are no voids in the layer.

7. Mix L84/L84 (100:25) with Fillite (or similar) in a ratio of 1:3 p.b.w. Apply and compact it to a minimum thickness of 40-50mm all over the tool (this is an insulation layer).



. **Allow to cure overnight.**

8. Mix and apply a coupling coat JB-K 99/5159 H (100:11) to the insulation layer and either Laminate 5-10mm of glassfibre or mix some of the L84/L84/Fillite mixture and bed the steel framework onto it and laminate the frame in place. If this is an S-RIM tool then replace the glassfibre layer with 40-50mm of L84/L84 (100:25) filled with 1-3mm dried sand at a ratio of 1:15; resin: sand. When this has cured, bed framework on as before.

. **Allow the tool to cure at room temperature for 24 hours and then demould.**

9. After applying sheet wax to the component thickness and sealing the surface, apply release agent and follow the same procedure for the second half of the tool.

10. If the tool is vacuum assisted RTM or is not temperature controlled in the top half, then this can just be laminated. Follow the procedure 1-4, increasing the laminate thickness in (4) to 10mm and then apply a 50mm thickness of polymer concrete as in (9).

. **Allow to cure overnight**

11. Mix a coupling coat as in (9), apply to the surface and laminate with at least 3 layers of 600g/m^2 glassfibre. Then bed the frame on and laminate it into position as before.

. **Allow curing at room temperature for 24 hours. Demould, remove sheet wax, clean, clamp both halves together and post cure.**

S-RIM and GFMU Tooling Procedure for the Vacuum Face

12. For a vacuum face follow (1-5) but do not compact the JB-P 4604/ 5159 H in (6&7).

. **Allow to cure overnight.**

13. Fix vertical lengths of 15mm copper pipe (or similar) with a quick setting thixotropic adhesive (as indicated in the above diagram) and then apply the insulation layer as before (at a minimum layer thickness of 50mm). Then follow (9&10).

14. Cure at room temperature for 24 hours, then demould. Remove sheet wax, clean, clamp both halves of the tool together and post cure to the desired temperature. Before or after post cure, drill the vacuum holes in the tool face where required, taking care not to drill deeper than 2-3 mm, just penetrating the porous layer.

15. Post curing should be done for a minimum of 12 hours at 60-80°C, ramping up at 10-20°C per hour. Preferably the tool should be post cured at a higher temperature than its working temperature e.g., working temperature 70°C then post cure up to 90°C.

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