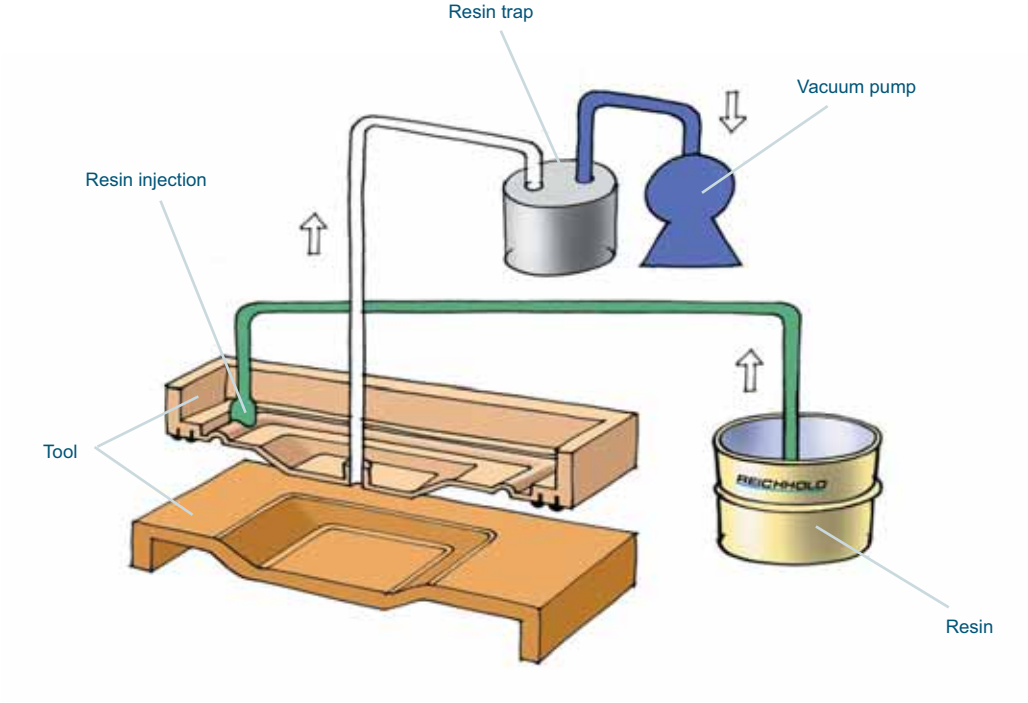
Vacuum Foil Infusion/ Resin Transfer Moulding
Application Selector Guide

REICHHOLD

Quality Parts, Low Emissions

Achieving better part functional performance, a cleaner working environment and reduced styrene exposure and emissions are major challenges for the composites industry. For that reason the need for improved working processes has been a priority for resin manufacturers for many years, and has resulted in the development of resin systems with low styrene emissions and low styrene content.

Vacuum Foil Infusion and RTM processes tend to fill up the gap in production volume between open moulding, like Hand lay up and Spray up (HLU/ SU) and Press Moulding, like Sheet Moulding Compound (SMC).



Vacuum Foil Infusion and Resin Transfer Moulding processes are widely used in the composites industry for manufacturing high quality components. These processes typically consist of the following steps:

- Preparation of the mould tool
- Placement of reinforcement materials in the tool
- Tool closure
- Resin injection or drawing into the mould
- Saturation of the reinforcements
- Curing
- Demoulding

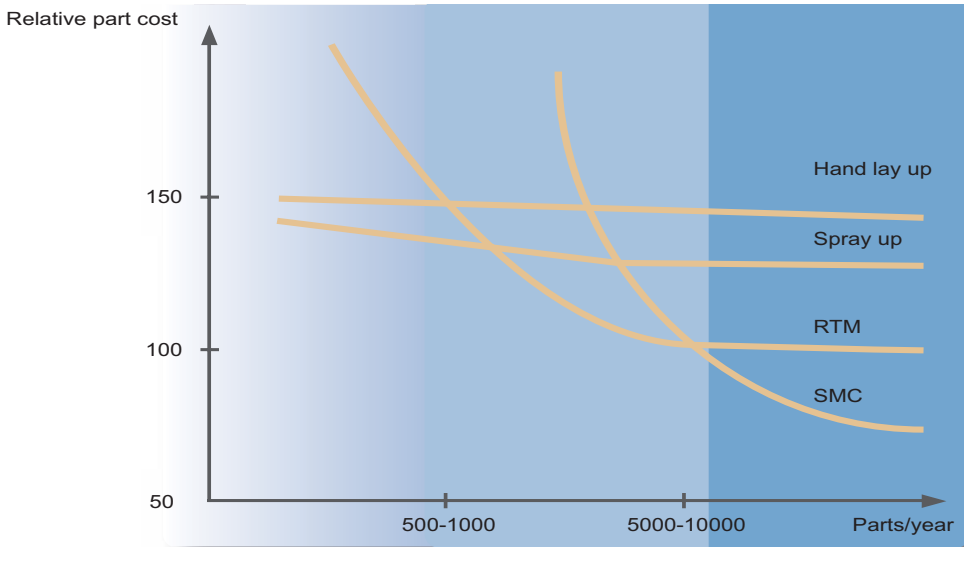
Advantages:

- Considerably reduced styrene emissions
- Capable to make 2 smooth surfaces
- Class A surface possible
- Good control part tolerance
- Improved part to part reproducibility
- Cleaner production
- Improved GRP part properties
- Reduced cycle times

Limitations:

- Mould and tooling design influence the flow, good tooling know-how required
- Pre-forms and reinforcements alignment critical
- Requires matched leak-proof moulds, higher mould/ tooling costs
- Higher reinforcement cost

Process Comparison



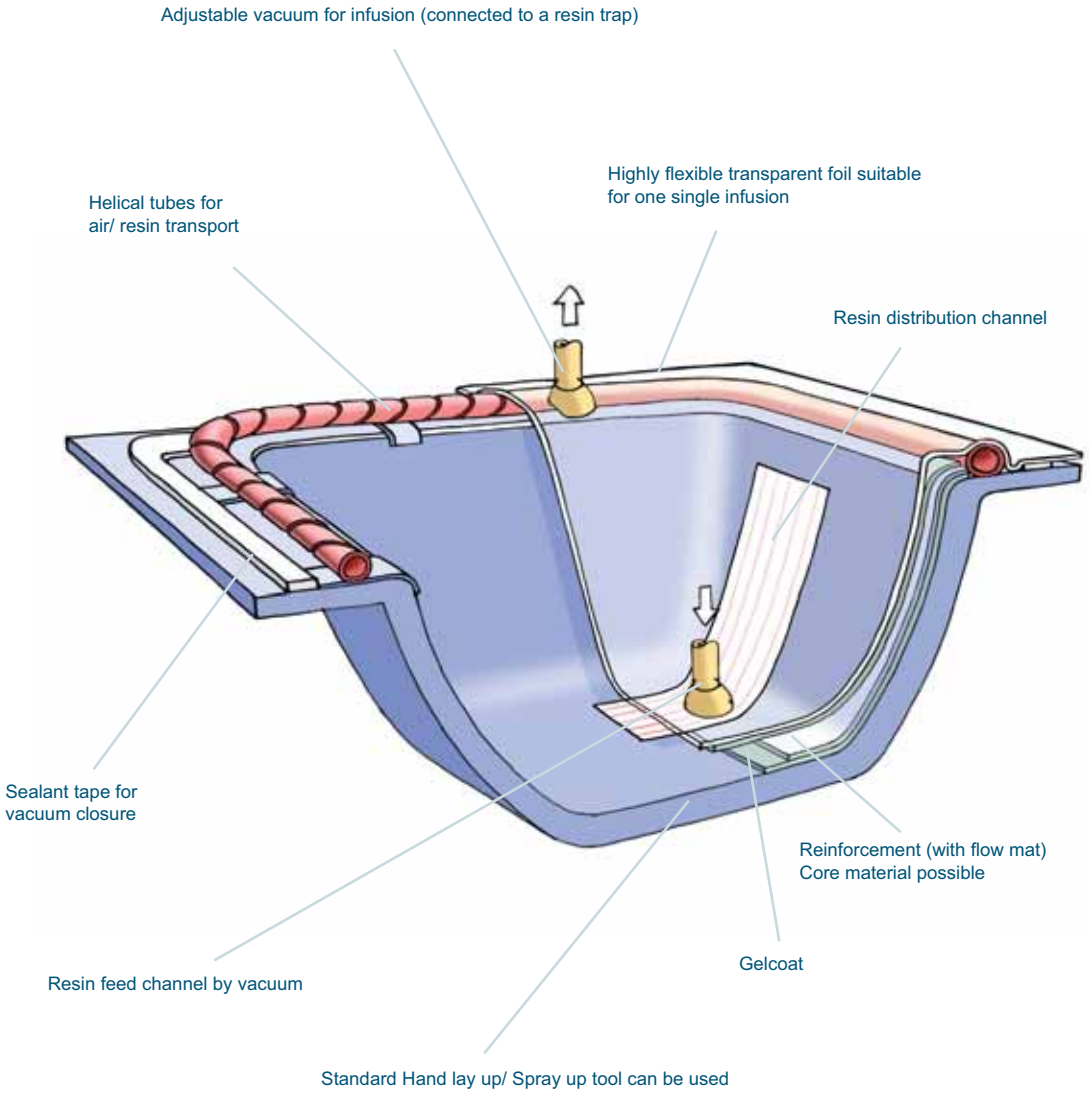
The cost break-even point between the processes will be dependent on several parameters as indicated above, so this graph represents only an indication of system cost.

Vacuum Foil Infusion

Vacuum Foil Infusion is the first step for the fabricator to consider when moving from an open process to a closed process, especially for manufacturing larger sized products (e.g. boat hulls or decks).

On a mould prepared with gelcoat, the dry reinforcement is sealed with a flexible transparent foil by vacuum. A special low viscosity injection resin is injected through a vacuum port and resin feed lines (e.g. bleeders).

A special resin trap system protects the vacuum pump against resin contamination. Vacuum is required until the product is sufficiently cured.



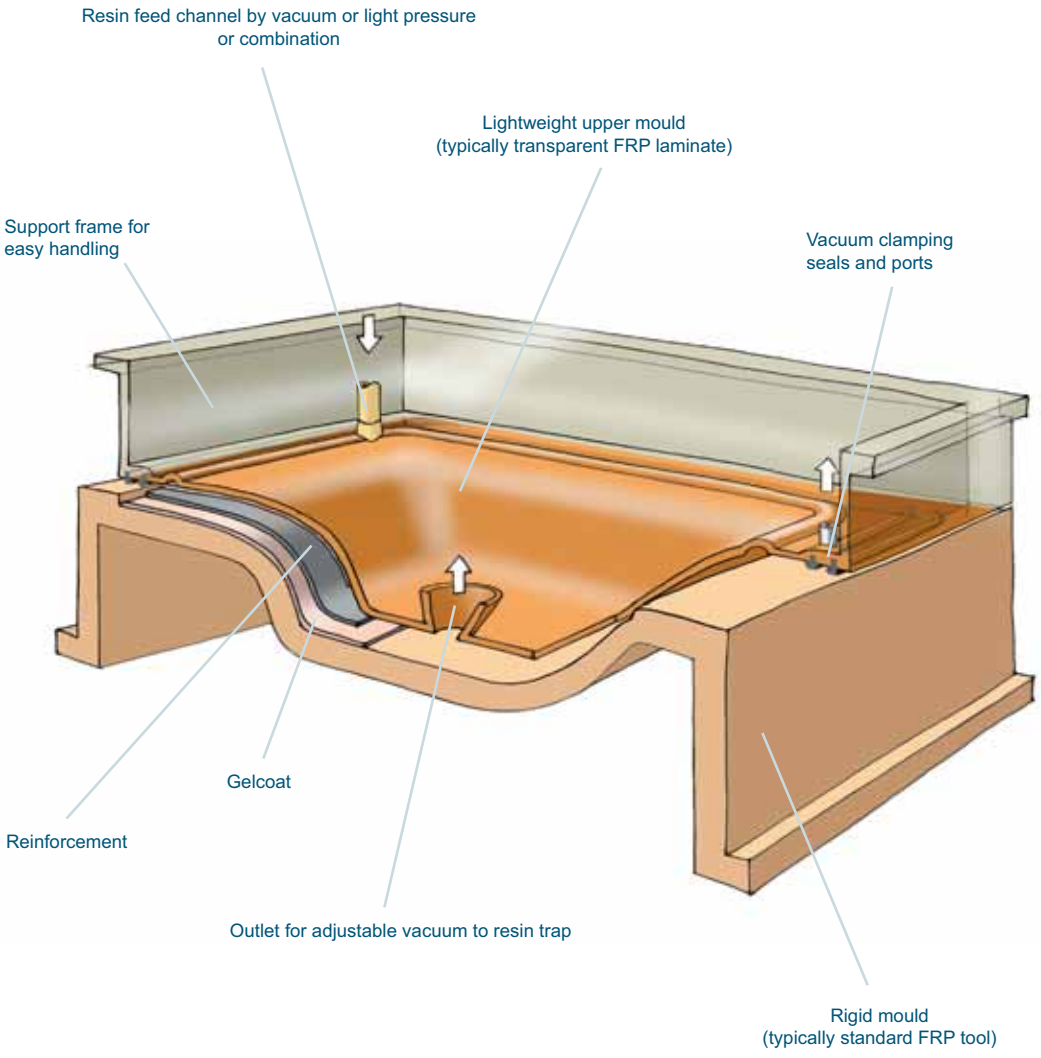
The Vacuum Foil Infusion method is typically considered cost effective for production of 50 - 1000 parts per tool per year.

RTM Light

RTM Light is suitable for small series production of composites components of miscellaneous shape and size with low investment outlay.

The process requires a rigid female mould and a semi-rigid male top mould. The mould closure is obtained by applying vacuum aided by simple clamping mechanisms.
The resin is usually injected at low pressure into a peripheral channel surrounding the piece, and vacuum is applied onto an exit port near the centre of the piece.

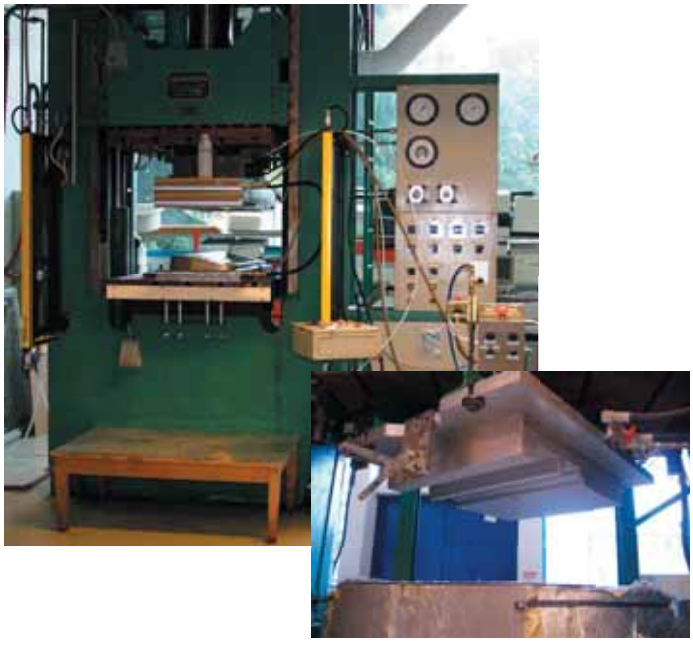
The low net closing pressure and low internal mechanical forces enable use of lightweight tools. For that reason it is possible to use tools similar or adapted from open moulding tools without significant extra investments.



The RTM Light method is typically considered cost effective for production of 50 - 1500 parts per tool per year.

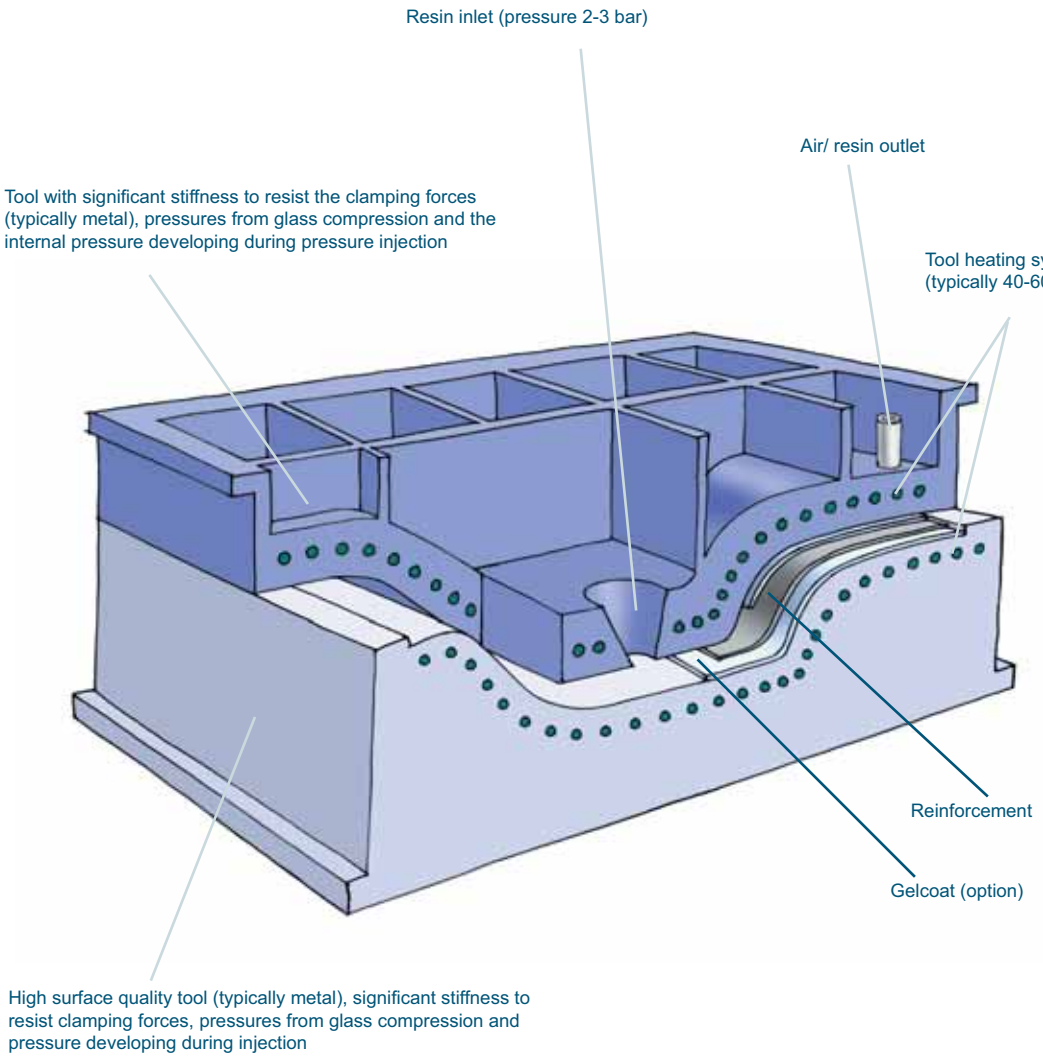
Pressure RTM

Pressure RTM is a versatile technique used for the processing of glass fibre reinforced products in a variety of size, shape and complexity.



In this system the resin is forced into the mould by applying pressure. Usually heavy tooling is required on both male and female halves of the mould tool in order to resist the pressure generated during injection and to maintain dimensional consistency.

The pressure RTM method is most appropriate where production speed is of relatively high importance. This system allows for faster mould filling than Vacuum Foil Infusion and RTM Light methods. The process can accurately produce complicated part shapes, in combination with good surface aesthetics. It is possible to use resins with high filler content.



The pressure RTM method is typically considered cost effective for production of 500 - 5000 parts per tool per year.

Comparison and Selection of

		Hand lay up/ Spray up	Vacuum Foil Infusion
			
Materials/ Tools	Materials: Glass Content	Polyester/ Vinyl Ester 30% - 35%	Polyester/ Vinyl Ester 30% - 65%
	Product Size Tool	Free Brush/ Roller/ Spray Equipment	Free Vacuum Pump
Curing	Temperature in °C Pressure in Bar	Room Temperature Atm.	Room Temperature -0.1 to -0.4 bar
	Cycle Time	15‘ - Several Days	1 - Several Hours
Technical and Design	Wall Thickness Difference in Wall Thickness	2 - 10 mm Possible	2 - 10 mm Possible
	Gives Uniform Thickness	Non - Controlled	Non - Controlled
	Gelcoat	1 Side	1 Side Possible
	Possibility for Filling	Yes	Limited due to Flow and/ or Filtering
	Sandwich Material Inserts	Possible Possible	Possible Possible
	Labour Costs Investment	High Low	Medium Low
Economic Viability	Number of Units Produced per Year	10 - 1000	50 - 1000

For advice on application processes, product and resin selection feel free to contact your Reichhold representative.

Manufacturing Processes

RTM Light	Pressure Injection	SMC
		
Polyester/ Vinyl Ester 30% - 50%	Polyester/ Vinyl Ester 30% - 35%	Polyester/ Vinyl Ester 25% - 65%
0.2 - 30 m^2 Vacuum Pump	0.2 - 10 m^2 Injection Equipment/ Double Mould	Few cm^2 to > 3 m^2 Steel Moulds/ Nickel Shell Moulds SMC/ Hot Press
Room Temperature 0.4 to 1 bar	Room Temperature - 60 °C 1 to 5 bar	130 - 155 °C 50 to 150 bar
15‘ - Several Hours	15‘ - Several Hours	2 - 5‘
2 - 10 mm Possible	1 - 8 mm Possible	2 - 30 mm Possible
Medium Controlled	Controlled	Controlled
2 Sides Possible	2 Sides Possible	In-mould Coating
Limited due to Flow and/ or Filtering	Yes	Highly Recommended
Possible Possible	Possible Possible	Possible Possible
Medium Low	Low Medium	Low High
50 - 1500	500 - 5000	3000 - 100 000