Composites
Reinforcements

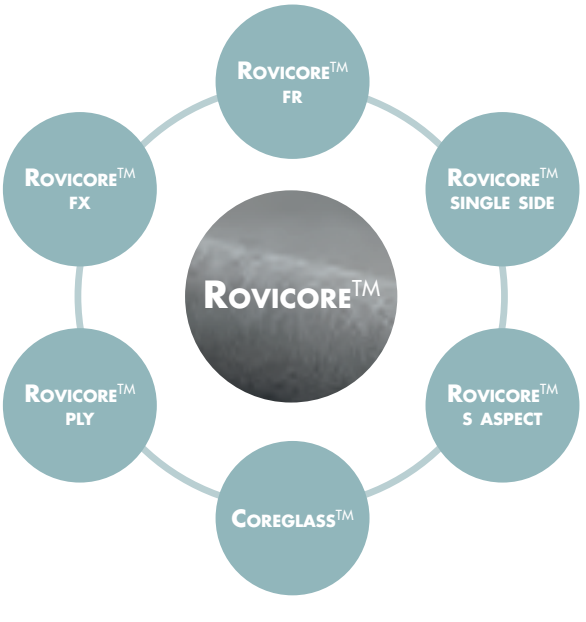
ROVICORE™

Increases in the number of FRP parts, the pace of production, and air polution regulations lead us to focus on closed mold production techniques: RTM, Light RTM, CCBM, SRIM, Injection, Vacuum, Press, Infusion. All business sectors benefit from these technologies: marine, transport, industrial and agricultural goods, sports and leisure.

The **ROVICORE**™ product line is a technological response to ever more demanding production needs.

CHOMARAT

SUMMARY



CHOOSING A TRANSFORMATION PROCESS

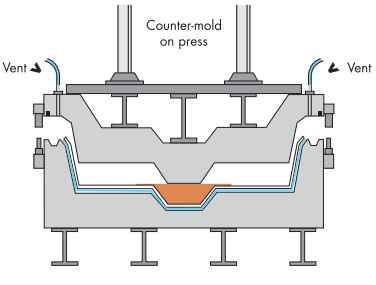
WHICH PROCESS SHOULD YOU CHOOSE WITH ROVICORE™ ?

Several variants of injection or press processes exist. Here are the most common ones. There are a few determining parameters when choosing a process.

Processes	CCBM	Light RTM	RTM	Cold Press	Infusion
Pieces/Year	50 to 500	200 to 2000	1000 to 10000	5000 to 20000	<100
Piece Size	1 to 20 sqm	1 to 20 sqm	1 to 5 sqm	1 to 5 sqm	2 to 100 sqm
Surface Aspect	1 Gel-Coated Face	1 or 2 Gel-Coated Faces	1 or 2 Gel-Coated Faces	1 or 2 Gel-Coated Faces	1 Gel-Coated Face
Glass Ratio weight	30 to 40%	20 to 25%	20 to 35%	20 to 35%*	50>

* Glass Ratio given for a draining core

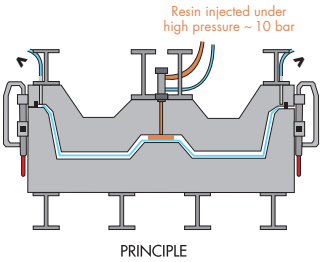
COLD PRESS



PRINCIPLE

Casting aided by a compression press between a rigid mold and counter-mold without the addition of external heat.

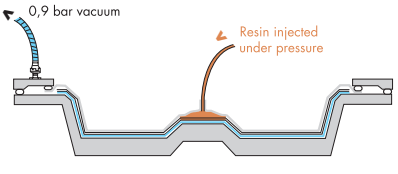
RTM



PRINCIPLE

injection of a TD resin under pressure between a mold and a counter-mold.

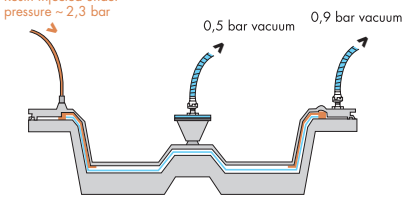
CCBM



PRINCIPLE

Vacuum-aided injection or infusion of resin under a flexible reusable membrane.

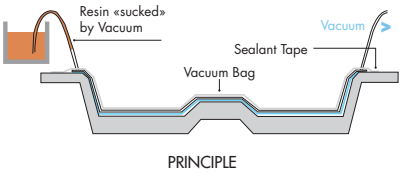
LIGHT RTM



PRINCIPLE

Low pressure vacuum-aided injection of a resin between a mold and counter-mold.

INFUSION



PRINCIPLE

Infusion consists of using a vaccum to rub a thermoset resin in a mold which contains reinforcement. The mold is covered by a flexible, airtight membrane that acts as counter-mold.

ROVICORE™ LINE

DESCRIPTION

ROVICORE™ is a reinforcement made with a synthetic non-woven core and chopped glass fibers mechanically stitched together.

APPLICATIONS / MARKETS

- Marine
- Transportation
- Industrial Goods
- Wind Energy Components

ROVICORE™ LINE

ROVICORE™ can be used for all the closed mold process needs and helps improve productivity and quality. It contributes to your part's success.

Because of its versatility, the **ROVICORE**™ **LINE** can be used to make a wide array of composite parts:

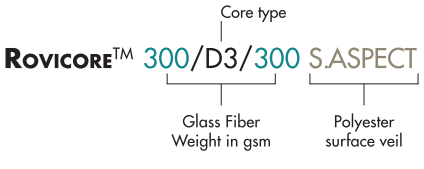
- With sandwich areas
  - Single side **ROVICORE**™
- When a good surface aspect is needed
  - **ROVICORE**™ **S ASPECT**
- When high mechanical performance is needed
  - **ROVICORE**™ **PLY**
  - **COREGLASS**™

THICKNESS

Depending on the construction methods chosen, **ROVICORE**™ allows for the production of parts from 2 to 8 mm thick.

Refer to the **ROVICORE**™ Table of Use to select your product.

NOMENCLATURE



RANGE

CORE	C2: 100 gsm D3: 180 gsm B5: 250 gsm
CSM (1 or 2 layers of 50 mm cut glass)	From 150 to 900 gsm
Optional	Fabric / NCF (non crimp Fabric) Polyester veil / Adhesive resin
Width	Standard: 125 cm Custom width, upon special request

ROVICORE™ LINE

ADVANTAGES

→ Easy Manipulation

ROVICORE™ can be easily formed, in angles and more complex shapes. This allows for time and labor savings.

→ Adaptable Thickness

ROVICORE™'s different constructions and weights allow for the construction of single-layer parts, wich saves time and labor.

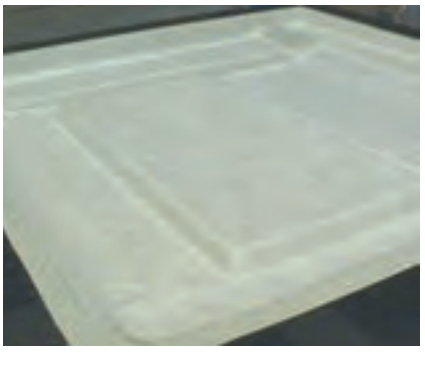
→ Core Resilience and Compressibility

This allows **ROVICORE**™ to adapt to the different thicknesses of composite parts.

Different thicknesses ; just one **ROVICORE**™.

→ Good surface aspect

The homogeneous finish of the cut glass fiber helps improve the surface aspect of finished parts.



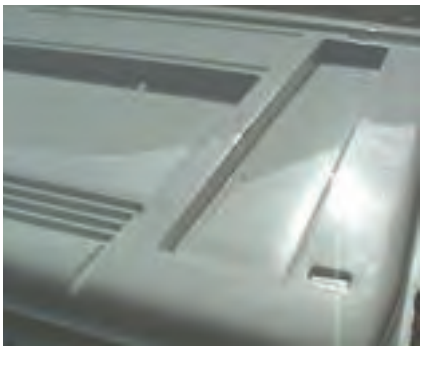
→ High Permeability of the Synthetic Core

The high permeability of its synthetic core allows the resin to flow throughout the unit.

ROVICORE™ is thus perfectly adapted to low-pressure injection processes, while ensuring a rapid flow.

→ Lack of Chemical Binder

The lack of a chemical binder in the mat enables rapid wet out of the glass fibers and a good impregnation of the reinforcement.



→ Adaptability

The number of possible combinaisons of the mat and the core satisfy most mechanical and thickness requirements for molded parts.

SINGLE SIDE ROVICORE™

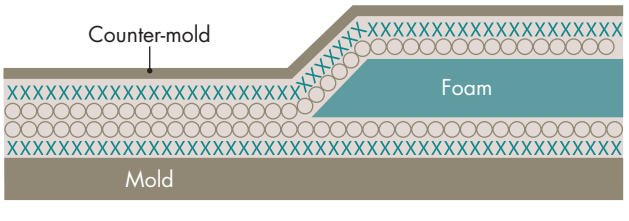
DESCRIPTION

SINGLE SIDE ROVICORE™ is a **ROVICORE™** with mat on one side instead of two. It's the ideal reinforcement for sandwich construction with foam, rubber or balsa wood.

All the standard **ROVICORE™** range can be produced with one single side.

ADVANTAGES

- Improvement of mechanical properties and **reduction of weight** through an optimal positioning of the glass mat on the outside surfaces of the composite part.
- **Improvement of resin flow** aroud the sandwich core, which is not slowed by the glass fiber.
- Good compatibility between **ROVICORE™** 's core and the foam rubber or balsa wood allows for a better adhesion between these materials, thereby reducing the risk of delamination.



X : Glass mat
O : Core

RANGE

CORE	C2: 100 gsm D3: 180 gsm B5: 250 gsm
CSM (1 layers of 50 mm cut glass)	From 150 to 900 gsm
Width	Standard: 125 cm Custom width, upon special request

ROVICORE™ S. ASPECT

DESCRIPTION

ROVICORE™ with a polyester veil sewn on one surface.
It can be used in two different applications:
to improve the surface aspect of finished parts or to form a barrier to chemical aggression.

ADVANTAGES

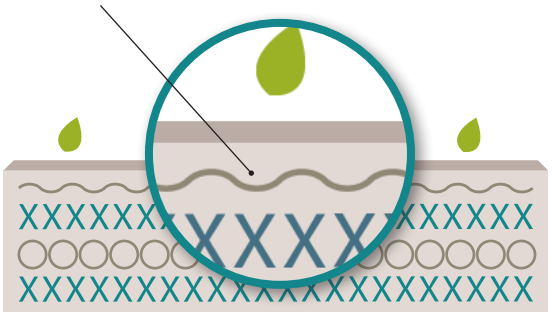
To improve the surface aspect of finished parts

- ➜ The presence of the polyester veil reduces the print-thru of glass fibre.
- ➜ Save time with a single draping layer.

To form a barrier to chemical aggression

- ➜ The polyester veil offers a resin-rich surface and thereby helps avoid capillarity problems.
- ➜ Save time with a single draping layer.

The permeated veil creates a protective layer



X : Glass mat
O : Core

RANGE

CORE	C2: 100 gsm D3: 180 gsm B5: 250 gsm
CSM 1 layers of 50 mm cut glass	From 150 to 900 gsm
Polyester veil	60 gsm
Width	Standard: 125 cm Custom width, upon special request

ROVICORE™ PLY

DESCRIPTION

ROVICORE™ PLY comes from a combination of the flow medium of the **ROVICORE™** core and a multiaxial structure. It is assembled in a single step with a single stitch.

APPLICATIONS / MARKETS

ROVICORE™ PLY is designed for the production of composite parts that require a structural element, while at the same time optimizing the resin flow.

In particular, it may be used in :

- Wind Energy Components (nacelles, spinners)
- Transportation
- Industrial Parts
- Marine

A MODULAR LINE

The **ROVICORE™ PLY** line comprises a synthetic core and a multiaxial as a base, to which further elements (veil/CSM) can be added.

- In construction: veil / CSM / core / multiaxial / CSM.
- In the choice of multiaxial:
  UD, Biaxial, Triaxial, Quadriaxial, up to 4000 g/m^2.
- Fibers: glass, aramid, carbon, hybrids.
- Mats weight range: from 150 to 1,200 g/m^2.
- Veils options: polyester.
- Angles: 0°/90° ; +/- 45° ; -20° to 90°.
- Width of 250 cm and sub-multiples.

ROVICORE™ PLY

ADVANTAGES

Developed thru years of manufacturing experience and process mastery, **ROVICORE™ PLY** offers:

- All the recognized advantages of the **ROVICORE™** line conformability, compressibility, resilience, ease of impregnation.
- Allows for reduced lay-up time and increased productivity by integrating the flow medium and the multiaxial in a single layer.
- Improves the mechanical properties of composite parts by the addition of a multiaxial.
  A multiaxial provides better mechanical performance than fabric.
  (As there is no take-up, there is less resin between the fibers).
- Veil addition enables improvement of the surface aspect and chemical resistance.
- Fabric thickness may vary 2-8 mm depending on the choice of construction and is adaptable to most uses.

FAQ

1.What is the impact of the position of the core in the reinforcement?

- The position of the synthetic core allows for a uniform distribution of the resin.
- The core positioned directly behind the chopped strand mat helps improve the surface appearance by screening the multiaxial's marking.

2. Is ROVICORE™ PLY conformable?

- Yes, but less so than our **ROVICORE™** product.

3. Are strength properties better than that of ROVICORE™?

- Yes, generally speaking. Depends on specific part and structureal design.

4. Can ROVICORE™ PLY be used with any kind of resin?

- The main standard resins are compatible (Polyester, DCPD, Vinyl ester).

5. Can ROVICORE™ PLY be used in infusion?

- Yes, but we recommend the use of **ROVIFLOW™** with an integrated multiaxial.

ROVICORE™ Fire Resistant

ROVICORE™ FR (Fire Resistant) complements the **ROVICORE™** range in providing a solution geared towards the manufacture of composite parts requiring fire resistant characteristics.

DESCRIPTION

ROVICORE™ FR contains a porous draining core with two layers of fibreglass mats which are mechanically assembled and cut using stitching. Its distinguishing feature lies in the fact that its core has been designed without using halogen products.

PROCESS

As with all the products in the range, **ROVICORE™ FR** is specifically adapted to closed mold procedures, namely RTM, RTM Light.

The specific construction of its core makes it of particularly high-performance for low pressure injection methods.

MARKETS

- Rolling Stock (train, underground rail networks, tramway)
- Building and construction
- Industrial elements requiring fire resistance

ADVANTAGES

The changes made to the **ROVICORE™ FR** core do not alter its properties in any way, preserving all the advantages from the **ROVICORE™** range:

➜ Good levels of deformability and elongation allowing for easy reduction of angles and the manufacture of complex elements. This is not the case with some products made from 100% glass.

➜ Resilience and compressibility of the core allowing for **ROVICORE™** to adapt to the different thicknesses of composite parts.

➜ Excellent permeability of the synthetic core facilitating rapid creep even in the case of a heavily filled resin.

- No filtering of loads
- Homogeneity throughout the entire reinforcement.

All these advantages mean gains not only in terms of time but also in terms of cost.

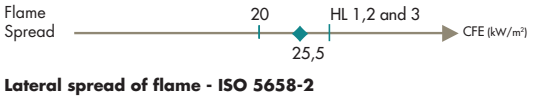
ROVICORE™ Fire Resistant

The main purpose of **ROVICORE™ FR** lies mainly in its behaviour in response to fire which contributes to the possible granting of the HL3 rating in accordance with the new norm NF EN 45 545. This new European norm regulating the railways should come into force in 2016.

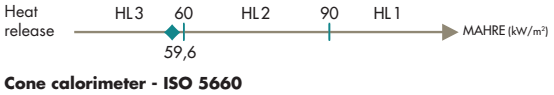
Testing undertaken by certified laboratories on the composite parts combined with different types of resins have proven the effectiveness of using **ROVICORE™ FR**.

TEST RESULTS

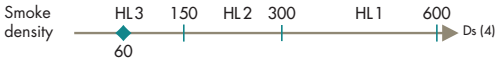
Evaluation of molded parts according to EN TS 45545 with CCP Composites intumescent resin and **ROVICORE™ FR** 450/D3/450

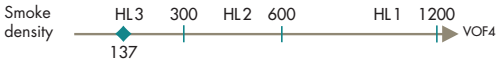


Lateral spread of flame - ISO 5658-2



Cone calorimeter - ISO 5660





Smoke box - EN ISO 5659-2

RANGE

	Core weight g/m²	Total Weight g/m²	Length cm
ROVICORE™ FR 300/D3/300	180	780	125
ROVICORE™ FR 450/D3/450	180	1080	125
ROVICORE™ FR 600/D3/600	180	1380	125
ROVICORE™ FR 300/B5/300	250	850	125
ROVICORE™ FR 450/B5/450	250	1150	125
ROVICORE™ FR 600/B5/600	250	1450	125

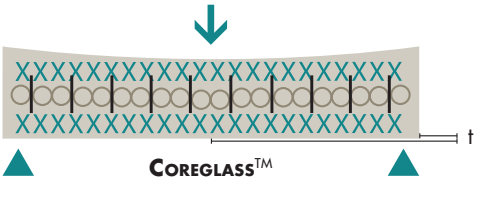
COREGLASS™

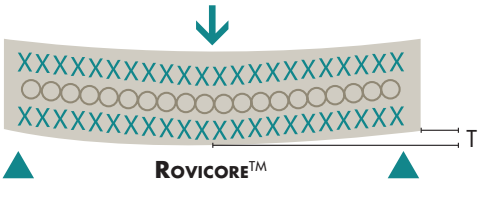
DESCRIPTION

COREGLASS™ is a **ROVICORE™** product in which the vertically-positioned glass fibers are blended into the synthetic core.

ADVANTAGES

- 20-25% increase in mechanical resistance (flexing).
- Dry product with a greater compression resistance.
- **COREGLASS™** is particularly well-adapted to injection processes and infusion under flexible reusable membranes (i.e. CCBM) Due to its good behaviour under pressure.
- Product exhibits a **high level of pre-formability.**





RANGE

	Synthetic fibers	Glass fibers
CORE	CG3: 180 gsm CG5: 250 gsm	CG3: 180 gsm CG5: 250 gsm
CSM 1 or 2 layers of 50 mm cut glass	From 150 to 900 gsm	
Optional	Polyester veil Adhesive resin	
Width	Standard: 125 cm Custom width, upon special request	

ROVICORE™ FX

DESCRIPTION

ROVICORE™ FX is a **ROVICORE™** with a self-adhesive resin which enables the positioning of reinforcement products.

FX is a key function to ease the production of large parts with complex geometries in closed mould processes. It is well suited for markets like marine and transportation.

ADVANTAGES

Facilitator of reinforcement positioning:

➜ Easier lay-up of vertical sections.

Consistent quality:

➜ Weight regularity: delamination risks controlled (*vs* spray. Too much glue can affect the laminate).

➜ Optimal mechanical performances (Interlaminar Shear Strength).

➜ Lay-up quality improved.

Environmental friendly:

➜ No Volatile Organic Compound (VOC) emission.

Time and cost saving:

➜ Lamination time improved.

➜ Enables manufacturing costs.

RANGE

Resin compatibility	Polyester and vinylester
Process	CCBM, L-RTM, infusion, RTM, WLU
Adhesive weight	5 gsm or 10 gsm per side depending on the reinforcement
Options	Applied on one or two sides: FX or FX² With perforated and coloured interlayer
Operating temperature	Minimum 15°C Maximum 30°C
Shelf life	1 year. Store in dry place under 30°C

SUMMARY OF THE LINE'S CHARACTERISTICS

Over the last 20 years, since the first **ROVICORE**™ product was created, **CHOMARAT** has perfected its reinforcements. Today, the breadth of the **ROVICORE**™ line lets us meet virtually all of clients' needs.

		ROVICORE™	ROVICORE™ SINGLE SIDE	ROVICORE™ S. ASPECT	COREGLASS™	ROVICORE™ PLY	ROVICORE™ FX	ROVICORE™ FR
PRIMAL BENEFITS	**Conformability**	+++	+++	+	++	+	++	+++
	Permeability	+++	+++	+++	+++	+++	+++	+++
	Thickness adaptability	+++	+++	+++	+++	++	+++	+++
SPECIFICITIES	**Aspect**			+++				
	Sandwich Construction		+++					
	Chermical resistance			+++				
	Bending performance				+++	+++		
	Structural part					+++		
	Simplified Draping						+++	
	Fire Resistant							+++

FAQ

1. Is the ROVICORE™ core sold by itself?
- No, the minimum construction is the core + CSM.

2. Can ROVICORE™ be used with all resins?
- Most standard resins are compatible (Polyester, DCPD, Vinylester).

3. Can ROVICORE™ be used in infusion?
- Yes **ROVICORE™** can be used in infusion, and we also recommend **ROVIFLOW™**, specifically adapted to this process for even better infusion results.

4. Is it possible to use many layers in the same assembly?
- Yes, if the finised part is sufficiently thick.

5. What is the impact of the core's position on the reinforcement?
- The position of the synthetic core allows for a uniform distribution of the resin.
- In the case of **ROVICORE™ PLY**, the position of the core directly behind the mat helps improve the surface aspect by screening the multiaxial's marking.

6. Is it possible to use a single adhesive on the entire ROVICORE™, ROVIFLOW™, and ROVICORE™ PLY line?
- Yes, on the entire **ROVICORE™**, **ROVIFLOW™**, and **ROVICORE™ PLY** line.

7. Is it possible to add an aspect veil to the entire ROVICORE™ line?
- Yes, on the entire **ROVICORE™**, **ROVIFLOW™**, and **ROVICORE™ PLY** line.

APPENDIX

USES OF THE DIFFERENT **ROVICORE**™ PRODUCTS

The range of uses for each type of **ROVICORE**™ was theoretically established following these rules:

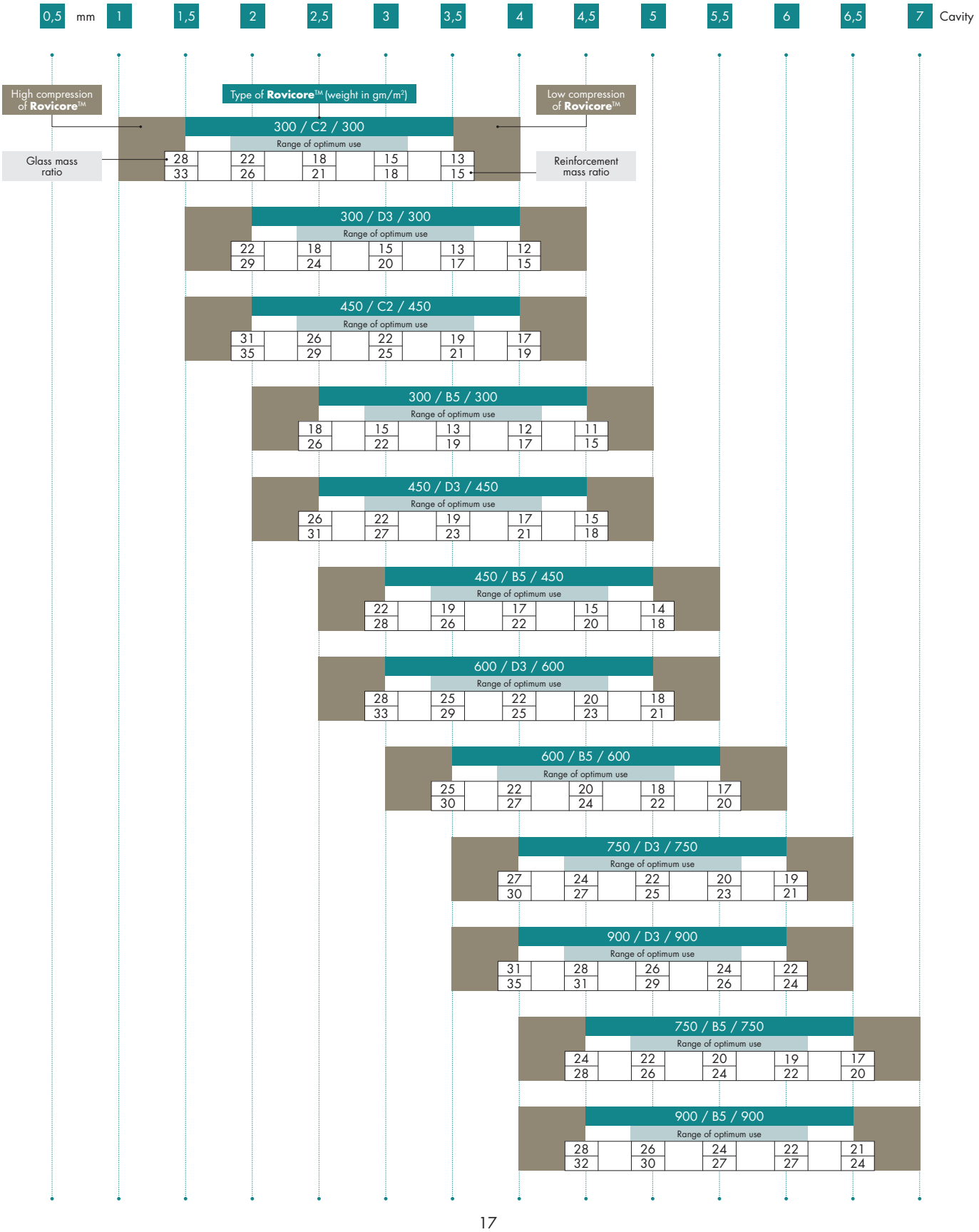
- Minimum compression of 0.5 bars for a minimum support of **ROVICORE**™ in the mold.
- Maximum total glass mass ratio between 10% and 30% in the composite (5-17% by volume).
- These results are valid for a standard polyester resin, bearing no load, and with gel coat on one surface of the part.

VACCUM

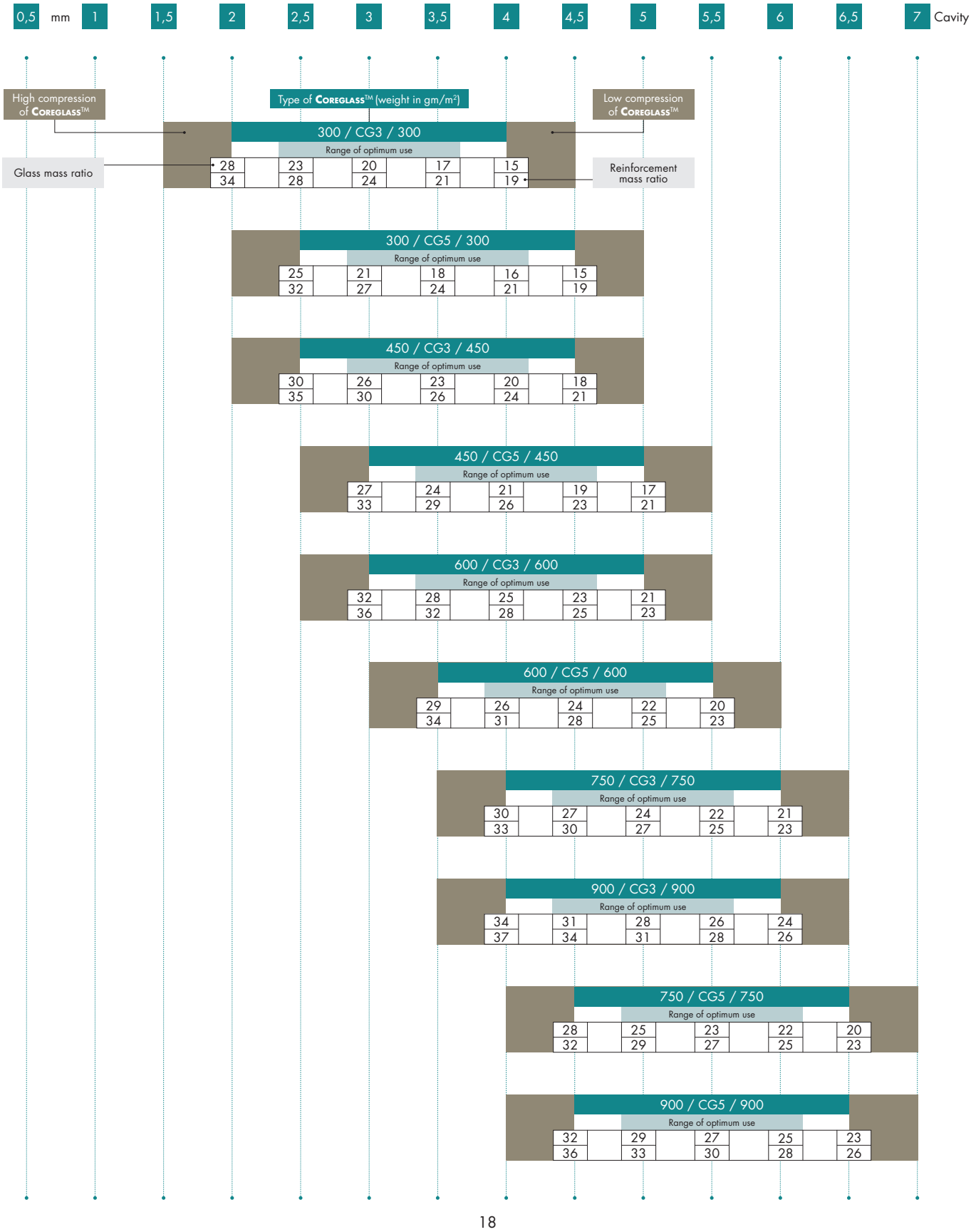
- In a vacuum, the thickness of the composite will depend on the type of **ROVICORE**™ used and the type of vacuum applied.
- Thickness variations may be observed in the case of moldings in a vaccum with film depending on the production system used and the weight of the resin.

Note: This table does not account for the different permeabilities of the cores.

ROVICORE™ CHART OF USE



COREGLASS™ CHART OF USE



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