nidaplast
composites

Handling Instructions for infusion

NIDAPLAST® 8 RI

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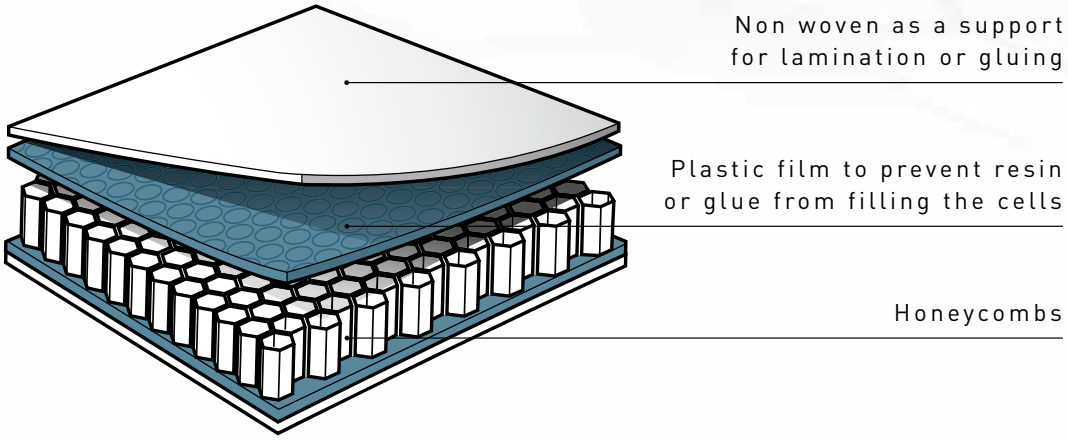
Nidaplast® 8 is an extruded Polypropylene honeycomb covered on both faces with a polypropylene film and a non-woven fabric. It is available in 2500 x 1200 mm sheets ready for direct use: lamination, gluing or infusion.



These flexible and light sheets enable an easy use in sandwich panels where most usual techniques of cutting, laminating and gluing can be applied. Since it is a thermoplastic product, other additional specific properties make its use even easier.

In order to meet the specific constraints of this technique,
Nidaplast has developed a new special polypropylene honeycomb for infusion process:

Nidaplast® 8RI

This new range of honeycombs can be used in the following markets for infusion :

Wind turbine

Yachting

Transport

1 – WHY CHOOSE THE INFUSION PROCESS

The main grounds for using the infusion process are the following :

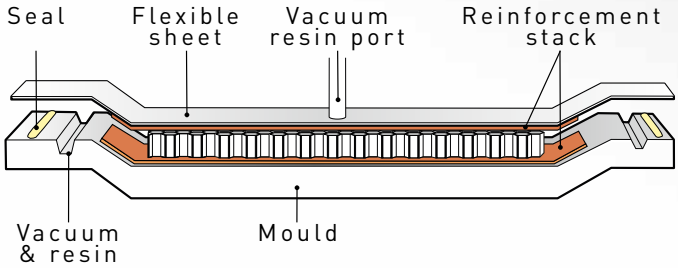
- **Meet the environmental standards** and **improve the working conditions,** with regard to the decrease in COV emissions
- **Reduce the raw material cost** thanks to a better estimation of raw material quantities, and **reduce labour costs**
- **Improve quality,** with a better surface appeal, a low porosity and a high fibre rate.
- **Improve cost prices**

*This process is particularly well adapted to industrialization and to the production of **large sandwich panels**.*

2 – PRINCIPLE OF THE INFUSION PROCESS

The principle of the infusion process is to impregnate layers of dry resin fibres held between an airtight rigid mould and a flexible sheet sealed to the border of the mould.

The resin is a thermoset resin usually made of polyester, epoxy or vinylester. Some formulations are specially elaborated for infusion with a low viscosity and a low exothermic property.



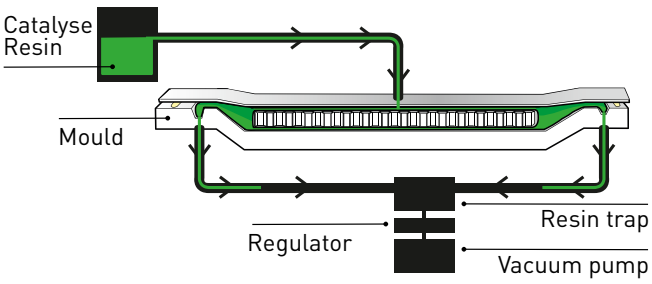
A partial vacuum is created in the cavity of the mould so that the resin can infuse in the **fiberglass reinforcements**. Vacuum is upheld during resin curing time.

The low cost tooling mainly consists in the vacuum system and the composite mould and can be re-used. Yet some consumables must be taken into account such as breather, peel plies and the vacuum bagging.

The emissions of solvents and particularly styrene are minimized in this closed mould process.

Infusion allows the production of structural parts with **high fibre rates** (60 – 70 %). More generally the process allows several meter long structures with complex shapes and the possible **inclusion of inserts**.

3 – MATERIAL USED



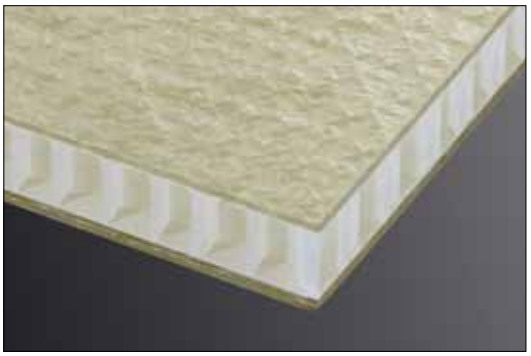
1. The catalysed resin is shut in a semi-watertight barrel, thus **reducing the emissions of styrene**. The resin gets into the mould through flexible pipes.
2. Sealing between the vacuum bagging and the mould is obtained by a vacuum bag sealant tape (tacky tape) specially adapted for this application.

3. The resin trap consists in a tin on which a lid is fixed to prevent the styrene for evaporating. Pneumatic pipes link the mould to the trap. Should the resin be sucked by the pipes on its way out of the mould, then the resin trap would absorb the extra resin thus separating the resin from the vacuum pump.

4. A pressure sensor fixed to the vacuum tank checks the depression in the circuit.

5. The vacuum pump provides the vacuum in the vacuum bag once watertight sealed.

4 – THE PRODUCT



Nidaplast® 8RI is a **polypropylene honeycomb core coated with a PP film** and a polyester **non-woven fabric** specially reinforced to resist to the pressure of resin on the core during the infusion process. **It limits the resin from filling the cells.**

It is available in **1200 x 2500 mm or 2134 x 1219 mm panels** in various standard thicknesses from **5 to 40 mm**.

Specific dimensions and thicknesses can be available up to a minimum quantity.

5 – INFUSION

5.1 – GENERAL NATURE

The working principle of a sandwich panel is to have **a perfect grip between the core and the rigid skins**.

Therefore when processing the panel, make sure of:
- **a good resin impregnation of both skins**
- **a good contact and a good grip between the core and the skins, thanks to the pressure of the vacuum bagging on the sandwich.**

The non woven polyester on **Nidaplast® 8RI** provides an **ideal surface** for direct infusion of polyester type thermoset resins (or others). Knowing the large number of formulations of resins and processing techniques, it is yet highly recommended to check their compatibility with **Nidaplast® 8RI**.

Nidaplast® 8RI non woven polyester and plastic film have been specially studied **to limit the flow of resin through the cells**.

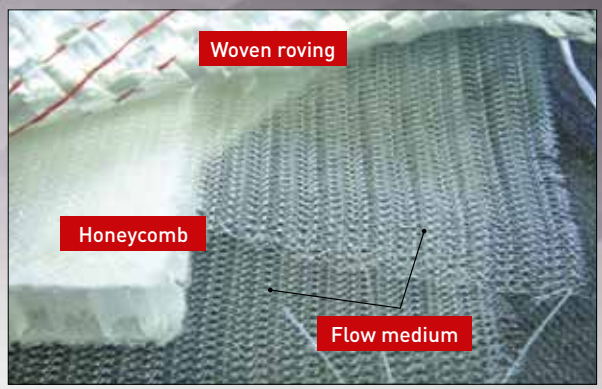
Infusion of thermoset resin is currently carried out with resins with a viscosity under 300 cps and under a pressure between –0.6 and –0.9 bars, following the manufacturer's prescriptions.

We advice with a **Nidaplast® 8RI** product to infuse under a pressure around 0.7 bars.

5.2 – RESIN FLOW

The gel time varies according to the resin type. With 2 % catalyst gel times can vary from 90 to 175 min. These times obviously need to be adapted according to the requested piece or to the type of reinforcement used.

The infusion span depends on the viscosity of the resin, on the feeding rate but also on the draining capacity of the reinforcements: porosity. **To allow the resin , the draining capacity should be eased by the use of either «mat » or « fabrics with «reinforcement effect» or «flows fabrics without reinforcement effect» on both side of the Nidaplast.**



DRAINAGE ON THE MOULDSIDE

Preliminary tests to check drainage of the resin on the mould side draining

It is absolutely necessary to use one of these draining surfaces in contact with Nidaplast® 8RI on the mould side of the structure so that the resin impregnates the fibres when in contact with the mould.

If a flow fabric is used on contact with the core, we advise the use of an interlaminate PET grid for a better resistance to delamination. A PET grid like VI5 from Aerova, or ENKA Fusion from Colbond, is suitable to this type of application. It is also possible to use a mat flow such as a mat with continuous fibres, which will directly ease the flow. Lots of flow fabrics are available in the composites market and can be used as well. In this case, we advice to ask the suppliers for more information.

Drainage distances depend on the rate of reinforcement of your structure. Therefore it seems wise to make sure beforehand, thanks to small preliminary tests, that drainage on the mould side operates correctly.

DRAINAGE ON THE VACUUM BAG SIDE

On the vacuum bag side, drainage can be traditionnally carried out either a peel ply and a PE flowing grid (SCRIMP™ process) or with flow media (PET grid, Unifilo, ...) on contact with Nidaplast® 8RI.

Drainage carried out with a peel ply and a PE flowing grid

FINAL ADVICE

In all cases, the use of these flow media and resins has to be carried out according to the prescription of the product suppliers.

The quality of the acheived panel has to be checked whether on aesthetics (no poorly infused area) or on mechanical values (good grip between fibre reinforcements and **Nidaplast® 8RI**).

5.3 – INFUSION STRATEGIES

To impregnate the fibres in contact of the mould, you can use different strategies.
The infusion can be done by filling the piece from one edge to the other, or by using the junction of the panels.

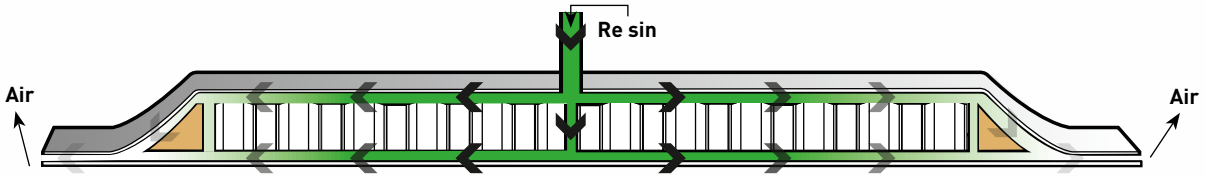
INFUSION BY FILLING FROM ONE EDGE TO THE OTHER (SMALL PIECES)

If the resin can flow all the length of the piece with media flow, the strategy of infusion can be to put a resin arrival on one side and to put the air vacuum on the other side. The resin flows up and down the core.

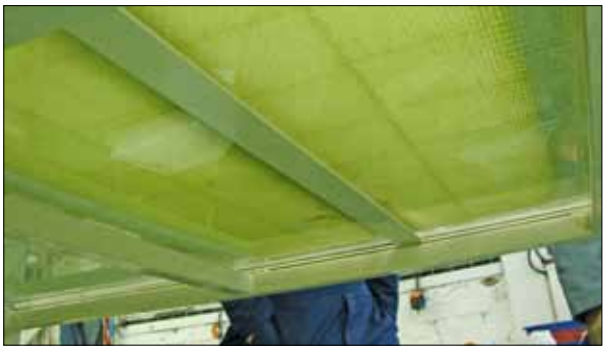
INFUSION USING PANEL JUNCTION

If the piece is bigger and needs to have a resin arrival on top of the panel, the better strategy to drain the resin each side of the core material is to put the spiral tubing above a panel junction.

This configuration of infusion is very interesting because the resin line on both sides of the core can be about the same if the sandwich is symetric and has got the same flow media.



Drainage on the vacuum bag side



Drainage on the mould side and homogenous impregnation of the fibres at the same time

The impregnation of the fibre on the mould side is very homogenous.

This strategy of infusion needs to cut **Nidaplast® 8RI** panel or to put the panel junction underneath the spiral tubing of resin infusion.

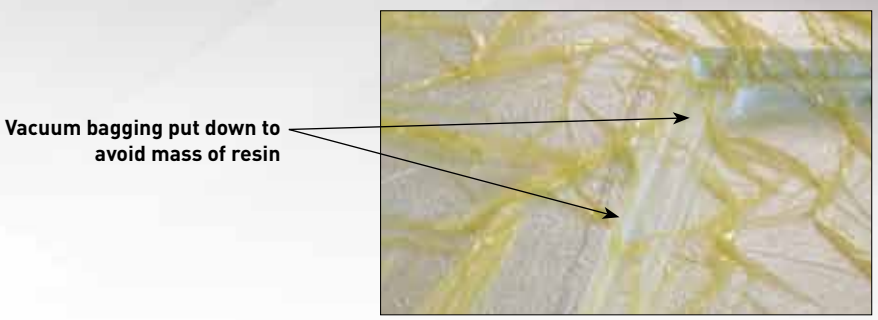
FINAL ADVICE

In all cases the use of these strategies has to be cheeked by preliminary tests. The choice of one of these strategies depends on lots of parameters: viscosity of resin, quantity of fibreglass, piece geometry...

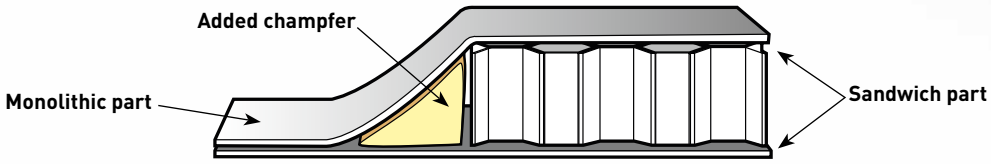
In the end the quality of the panel achieved has to be checked whether on aesthetics (absence of poorly infused area) or on mechanical values (good grip between fibre reinforcements and polypropylene honeycombs).

5.4 – PANEL EDGES

When possible, if you want to end the structure with a 90° angle (for a flat piece for example), ensure that the vacuum bagging is well put down to avoid mass of resin.



A softer angle could be preferred and can be obtained by adding foam or wooden parts.



Also make sure that the edges are well sealed with mastic or an adhesive film.

5.5 – OPERATING STEPS

The traditional operating steps for infusing **Nidaplast® 8RI** :

1. Traditionally prepare the mould, with cleaners, sealers, multishield...
2. Apply gelcoat to obtain a good appeal piece.
3. Let the gelcoat polymerize.
4. Apply the sealant tape around the mould.
5. Place the spiral tubing for the perimeter vacuum.
6. Put the fiberglass reinforcements carrefully cut at the right dimensions into the mould.
7. Lay and cut a flow media.
8. Lay the **Nidaplast® 8RI.**
9. Treat the edges of the panel and if necessary make sure of the panel junctions.
10. If you use an interlaminate flow media on the vacuum bag side, put it in contact with **Nidaplast® 8RI**, then lay down the well cut fibreglass reinforcements. If you use a peel ply and PE grid on the vacuum bag side, lay down the fibreglass in contact with **Nidaplast ® 8RI**, then traditionnaly lay down the peel ply and the grid.

nidaplast composites

11 Likewise, according to the prescriptions of the resin supplier and to your infusion sequence, distribute the vacuum and resin inlet spiral tubings and fix them with cellotape or mastic.
On a sequential infusion the resin inlet tubings can be placed every 50, 70 or 120 cm, for example, according to the resin viscosity, reinforcement rates...

If necessary, do not hesitate to contact us.

12 Put and glue the vacuum bagging with some sealant tape while leaving way to feeding drains.

13 Stop the resin inlet with some pliers.

14 Put the vacuum on.

15 Add the catalyst, stir and open the pliers to start infusion. If need be, delay when opening the pliers following your infusion scheme.

16 Once the piece is infused, shut the resin inlet.

17 Once totally hardened (according to the prescriptions of the resin's suppliers), stop vacuum, take off the sealant tape and the peel ply.

18 Unmould the part, use compressed air if you meet any difficulties.

6 – MECHANICAL* AND PHYSICAL PROPERTIES

Properties	**Nidaplast® 8RI**				
Indicative surface mass	10	15	20	28	mm
	1,4	1,8	2,1	2,7	kg/m²
Compressive strength, 20° C	ISO 844		1,2 Mpa		
Compressive modulus, 20° C	ISO 844		30 Mpa		
Perpendicular tensile strength (at break), 20° C	ASTM C297		0,5 Mpa		
Shear strength, 20° C	ISO 1922		0,4 Mpa		
Shear modulus, 20° C	ISO 1922		5 Mpa		
Water resistance , % retention of shear strenght, 20° C	ASTM C393		~100 % **		
Heat resistance for honeycombs core th 20 mm			R≈0,3 m².°C/W (Δ ≈ 0,067 W/(m.°C))		
Behaviour with fire	*Standard quality inflammable. Possibility of M1/F0 classification for finished sandwich panels, depending on the sandwich skin*				
Chemical properties	*Excellent resistance to water and most acids, bases and salt solutions*				
Resistance to Ultraviolet rays (U.V.)	*U.V. protection is ensured by the skins of the sandwich panel*				

** : Data for a 20mm thickness. Charateristics vary with the thickness. Please call us for further information*
*** It is assumed that the material does not absorb water (or just absorb very small amounts)*

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