Mould making

Practice tips

HP-Textiles

About us

Since the company was founded in 2004, HP-Textiles GmbH has stood for the development and distribution of fibre-reinforced materials. In addition to a wide range of fibre reinforcement materials and specially formulated epoxy resins, further strategic business areas have been created with DeinTeich.de and bredderpox®. As a result, our satisfied customers include not only the composites industry but also users from the pool construction and surface protection systems sectors.

Our business areas:

Composite Materials

hp-textiles.com/shop

GRP-Coatings

deineinteich.de

Building chemistry

breddermann-kunstharze.de

In order to guarantee our business partners a continuously high quality of our services as well as optimal process reliability, the quality management of HP-Textiles was certified according to DIN EN ISO 9001 in 2011. Through enthusiasm and passion for scientific research, coupled with an understanding of our customers‘ wishes, we guarantee optimal product properties in the future as well.

Together with strong partners from science and industry, we also offer custom synthesis and manufacturing of a wide variety of products. The establishment of a networked, cross-company development allows us to respond to customer wishes even at short notice. Variable batch sizes enable us to supply large industrial customers as well as small quantities for project developments.

Our young, qualified team, a large warehouse and reliable logistics partners guarantee fast processing of your order.

The constant further development of our product range should also be a basic requirement in the future in order to guarantee optimum component properties at economical prices!

Your team of
HP-Textiles GmbH

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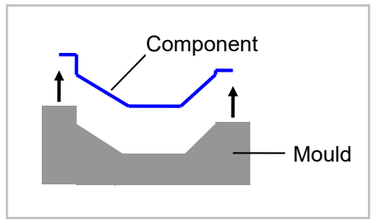
The background

Fibre composites combine the advantages of individual materials into an overall composite with completely new material properties. Since fibre-reinforced composites are only created by incorporating reinforcing fibres into synthetic resin, the quality of the component - apart from the material properties - is significantly influenced by the type and professionalism of the manufacturing process. In order to achieve these quality standards, most components are manufactured in moulds. For flat and simple components, (coated) wooden boards may still be suitable. As soon as the geometries become more demanding and complicated, moulds have to be specially manufactured.

The moulds

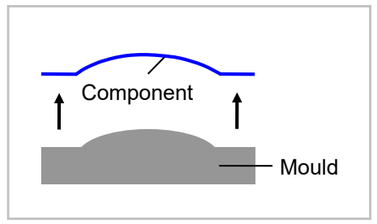
Two types of moulds are mainly used:

Negative moulds („high mould“)



smooth outer surface / visible parts for example car body parts, model making

Positive mould („stamp mould“)



Smooth inner surface for example bath tubs, containers

As a rule, the side facing the mould is the later visible surface.
A clean and smooth mould therefore saves reworking and guarantees the dimensional accuracy of the later component. For example, the first layer on the negative mould can be the subsequent top layer (gelcoat) or our in-mould coating (HP-IMC). Complex surface treatments can thus be completely omitted.

If the contours are more complex or have undercuts, the mould must be divided into several segments.
More information on multi-part moulds follows from page 12.
Here is an example:

A multi-part mould

The master model

To create a mould, a master model is usually made. In principle, this is a 1:1 model of the later component made of polystyrene, wood, plaster, modelling clay or other materials. In our example, a piece of polystyrene („Styrodur“) was machined and shaped. To create a smooth surface, the master model made of polystyrene can be coated with a medium viscosity epoxy system (e.g. HP-E25KL or HP-E45KL). These are medium viscosity, resistant multi-purpose systems, with pot life of approx. 25 or 45 minutes.

Sealer for master moulds:

The medium viscosity epoxy resin systems HP-E25KL and HP-E45KL (slightly thixotropic with thixotropic agent) are used as sealing resins in the construction of master moulds.

Polystyrene model in single parts

Lightweight glass filament fabric laminated

The model after it has been grinded and prepared for the moulding.

Alternatively, master models can also be made from painted plastic blocks and wood.

Note:
Polyester filler should not be used for the master model!
This has a negative impact on the effectiveness of release agents.

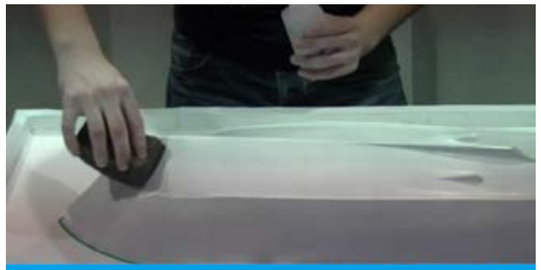
The separation layer

For a reliable release layer on the master model, a combination of priming wax and film release agent (also release lacquer) is often applied.

1st coat: Apply a thin layer of priming wax with a cotton cloth, do not polish and then allow to dry for approx. 5-15 minutes. It is particularly suitable for porous substrates and forms the primer for the subsequent film release agent. It is available as a flowable wax and is soluble in white spirit.

2nd layer: The film release agent
This is an aqueous, silicone-free release agent based on polyvinyl alcohol. It is applied with a sponge or brush without streaks and after drying (approx. 5-10 minutes) forms a film that can be easily washed off with water.

This is a considerable advantage, especially when demoulding!
Warm water is placed between the mould and the component and after a short dissolving time, separation is possible without any problems.

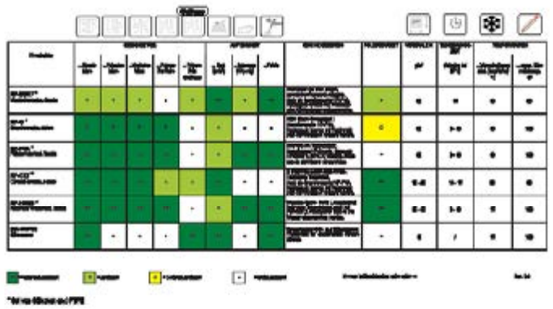


The film release agent (HP-PVA)

The film release agent is applied with a fine-pored sponge.

The application temperature for both systems is between 15° - 30°C. They are heat resistant up to 100°C when cured.

For high-gloss surfaces, we offer other release agents as an alternative. Details can also be found in our selection guide for release agents:

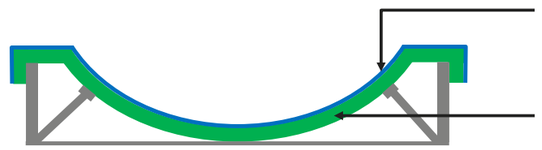


The selection guide to our release agents:

In the online shop (shop.hp-textiles.com) under „downloads“, in the category „decision support“ or simply via the QR code:

Selection guide for mould making resins

The choice of resin systems is decisive for the professional production of moulds. Mould construction resins are needed for the later top layer (also: mould top layer resins, i.e. for the surface of the mould), as well as for the constructive backbone of the mould.



Epoxy resins in mould making

The surface of the mould (mould top layer).
Here, particularly good surface properties, such as scratch and chemical resistance, are required.

The reinforcement of the mould (rear structure).
The laminates produced here should primarily offer optimum strength and thus absorb forces.

Selection for epoxy resins:

	Article-No.	Type	Properties	Areas of application
Top Coat	**HP-E25FB**	Mould top coat resin	- base for EP foams (use aditiv BEL11) - gelcoat - Tg Max = 65°C	- grindable and polishable - production of fine layers in mould making - colouring with colour paste possible
	HP-30FB	Mould top coat resin	- very high edge strength - highly viscous - limited polishability - Tg Max = 115°C	- high-quality mould coatings - high mechanical load - immediate layer build-up after application the top coat - metal-like properties - good thermal conductivity
	HP-E25KL **HP-E25L** **HP-E45KL** **HP-E45L**	Multi-purpose systems	- unfilled, medium viscosity - hard elastic - grindable and polishable - Tg MAX = 78°C (HP-E25KL) - Tg MAX = 66°C (HP-E45KL)	- if reworking is required or few impressions are planned - for coupling layers - chemical resistant (also to styrene)
Laminate	**HP-E28L** **HP-E55L** **HP-E110L**	Laminating resin	- pot life of approx. 25 - 110 min - Tg MAX = 81°C	- laminations for backside reinforcement of the mould
	HP-E29L **HP-E56L** **HP-E111L**	Laminating resin	- pot life of approx. 25 - 110 min - Tg MAX = 93°C	- laminations for backside reinforcement of the mould - better cross-linking with heat curing

Basically, we recommend working with a so-called coupling layer for all topcoat resins used. This creates a good bond between the moulding topcoat resin and the laminating resin, even if both are NOT produced „wet-on-wet“.
Alternatively, you can work directly „wet-on-wet“.

Under no circumstances should you wait until the top layer has hardened (gelled) too much, as adhesion with other laminate layers (rear layers) will be negatively affected.
This can be the case (especially with HP-E30FB, depending on temperature and humidity) after only half of the pot life!

Other important selection criteria for mould top resins are surface hardness, heat (dimensional) stability, shrinkage behaviour and resistance to chemicals.

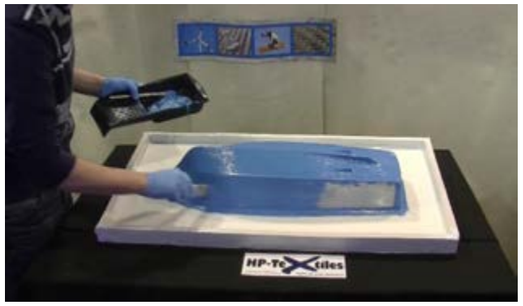
Structure of the mould top layer

... quick solution without a coupling layer!

When the surface of the master model has been provided with release agent as prescribed and has flown off, the application of the mould making resin can be started. This resin (also called mould coating resin) represents the later surface of the mould and is applied as the first resin layer on the master pattern.

For this purpose, the mould making resin is carefully applied with a brush to the surface provided with release agent. Make sure that the underlying release layer is not damaged by too intensive spreading.

A total layer thickness of between 0.3 and 2 mm should be applied. The resin component of e.g. HP-E30FB is very thixotropic („stab-proof“), so that it does not run off steep surfaces.



Application of the mould making resin (special colour blue)

The hardener must be mixed in carefully. Also, make sure that it does not just settle on the walls of the mixing container!

Note:
The mould making resin should not be tempered for too long!
Otherwise there is a risk that the adhesion to the subsequent laminate is greatly reduced!
Once this time limit has been exceeded, a slightly oily surface becomes noticeable.
Once this has happened, the surface should be cleaned intensively with acetone before applying a subsequent coating in order to achieve adhesion.

...time-shifted work WITH coupling layer => the SAFE variant!

For this purpose, glass fibre chips and cotton flocks are mixed in equal parts and sprinkled directly onto the wet layer of mould top resin.The protruding fibres achieve an optimal bond to the subsequent laminate layer.

Spreading the dry coupling layer
(glass fibre chips and cotton flocks)

The application of a coupling layer is therefore always advisable if the rear construction is NOT realised immediately (within minutes).
This may be the case, for example, with larger objects or less experienced users.

Excess material can simply be tapped or vacuumed off after curing.

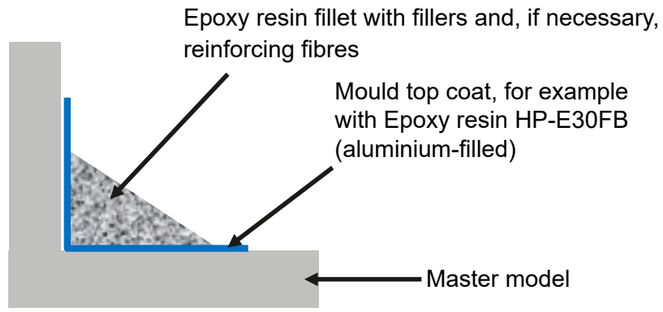
The reinforcement layers

The edges / corners

To further strengthen the shape, the rear frame is constructed.
For this purpose, in larger moulds -in addition to the reinforcing fibres- further stabilising materials, such as wood or even metal struts, are often incorporated.
With smaller moulds, this can usually be done without and the mould can be backed with suitable reinforcing materials (fabric, scrim, combi-mats,...) and the appropriate number of layers.

Sharp corners and edges should be filled with a mixture of resin, cotton flocks and/or thixotropic powder on the subsequent top layer.

For larger edges or component sections, glass fibre chips (in 3mm or in 6mm) can also be stirred into the resin.



The filled areas soften the radius, as the restoring force of the fabric could otherwise lead to detachment and thus to the formation of bubbles between the layers.

Particularly stressed areas can also be reinforced with glass or carbon roving. Larger fillets should be reinforced with a fabric or scrim tape.

Carbon roving

Glass fabric tape

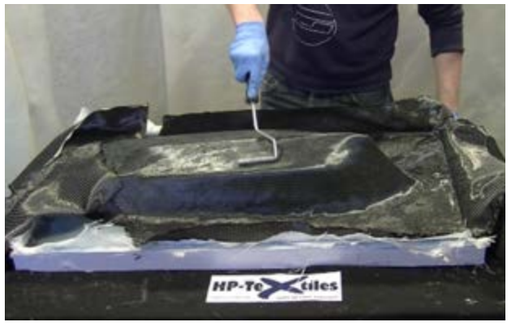
Structure of the reinforcement layers for the rear frame

A light glass filament fabric is often applied as the first layer (i.e. on the back of the mould liner resin). Due to the low weight per unit area and the high number of threads, the material can be laminated particularly well in/around complicated geometries. In addition, a fine material does not stand out so clearly on the surface later (Fibreprint).The fabric is carefully dabbed into the resin layer with a brush until it is sufficiently saturated by the resin and becomes correspondingly more translucent.

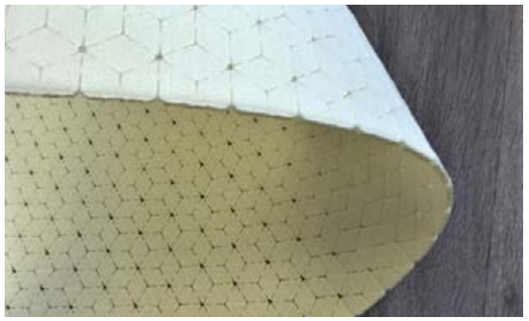
Designation	Weight/m²	Properties	Application
Glass filament fabric SILANE	80g - 300g/m²	- good drapability - low fibreprint - very good value	Also suitable for small, complicated shapes (model making, art). Good fibre impregnation
Glass filament fabric FINISH	25g - 200g/m²	**- very good drapability** - low fibreprint - very high quality - For first layer(s) following the mould top layer, as they hardly show on the surface.	Also suitable for small, complicated shapes (model making, art). **Outstanding fibre impregnation,** very low dust development during cutting.

The subsequent layers are usually built up from reinforcing materials with a higher weight. This is necessary to achieve a certain component thickness and the resulting dimensional stability.

Laminated mould edges or profiles also provide additional strength. Below are some products for mould making (see also the table on the following page).



Carbon fabrics in mould making



core material

mould construction

Selection of reinforcement fibres for the rear frame

Designation	Fibre direction	Properties	Application
Multiaxial Glass Fabric	+/- 45° 0° / 90°	- solid laminate layers due to high fibre volume ratio - specific fibre alignment possible - relatively low resin consumption	limited draping (medium radii from approx. 2cm), therefore mainly used for medium to large shapes without very fine radius
Glass Roving Fabric	0° / 90°		
Multiaxial Carbon Fabric	+ / - 45° 0° / 90°	- high-strength laminate layers due to high fibre volume ratio and high stiffnesses - specific fibre alignment possible - relatively low resin consumption	often better draping than glass scrims with comparable grammage
mould construction fabric	0° / 90°	- high laminate thicknesses (4-5mm) - resulting time saving - Dimensionally stable **Hardening „spiky“ on the reverse side - therefore only recommended recommended.**	drapes well We recommend a low viscous laminating resin system
	0° / 90°	**- high weight per unit area (1000g/m² !)** **- resulting time saving**	very well drapable - therefore versatile in use!
Core materials	x	- high-strength laminate layers due to sandwich effect	limited drapeability (medium radii from approx. 2-5cm), therefore mainly used for medium to large shapes without very fine radius Note the restoring force!

Note: In our shop, in the category „Special items“, there are many interesting glass and carbon fabrics or scrims at extremely favourable prices!

Mould making video

Production of multi-part moulds

Created by the....

Akademische Fliegergruppe
am Karlsruher Institut für Technologie

... with materials from

HP-Textiles ...light up your future!!!

This is a short instruction, from the Akademische Fliegergruppe from Karlsruhe, explaining how to build a mould with GRP materials.

Our original positive is approx. 150cm long and approx. 50cm high and 25cm wide at the point of greatest circumference. Because of this size, the material cost of milling a mould was far too high for us. Therefore, we decided to build an original positive and mould it.
The following materials were used:

- 5m² Glass filament fabric 105g/m² twill HP-T110E
- 25m² Glass filament fabric 1000g/m² HD canvas HP-HD1000EF
- 10kg Moulding resin HP-E30FB
- 15kg Laminating resin HP-E56L
- 500ml Priming Wax HP-G
- 500ml Release Agent HP-PVA
- Cotton flocks HP-BF1
- Chopped Glass Fibre HP-GS3/6

To get a better idea of the following steps, you can watch a video under the QR code where similar materials have been processed, but the procedure is identical.

Step 1: Priming wax applied

To make a mould, we need an original positive. To be on the safe side, this should be separated with separating wax before starting to make the mould. For this purpose, the priming wax is applied with a cloth and gently polished out after approx. 10 min. Then apply a thin but completely covering layer of separating varnish, preferably with a small, fine-pored sponge.

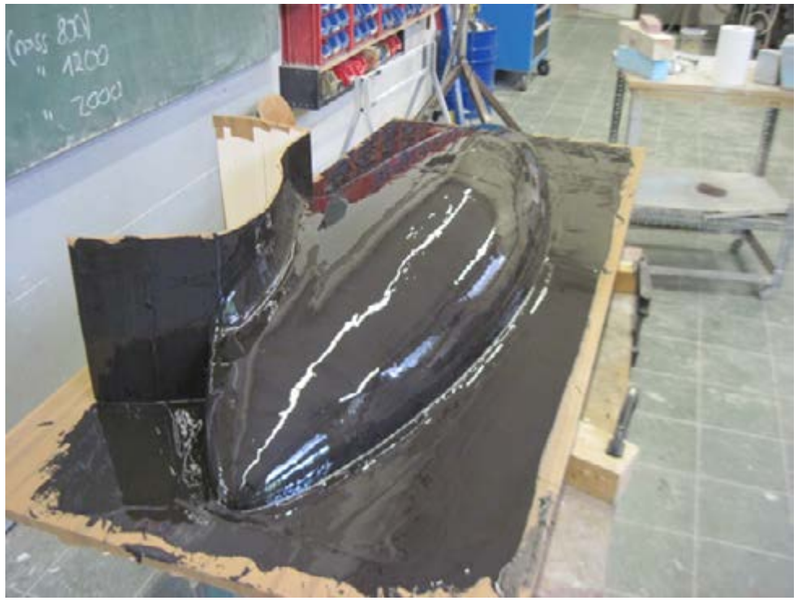
Step 2: Separation layer

The positive to be moulded must not have any undercuts, otherwise it is not possible to create a single mould. If this condition is not fulfilled, the positive must be divided into parts that fulfil this condition again.
The division is realised by the separation planes that separate the shapes from each other. In our case, we decided on a total of three shapes; two large half-shells and one small section.
The parting planes should be as flat as possible and, if possible, exploit symmetries. In addition, the area that spans a parting plane should be as large as possible so that the shape is stable.
A parting plane can be realised well with simple wood: cut out the contour of the positive roughly, but as close as possible, and then adapt it exactly to the contour with putty (polyester putty or epoxy putty is suitable here, as it can be easily removed from the separated positive) by moving the mould away. Then the parting plane must also be treated with parting wax. For this purpose, you can stick a foil on the wood or simply use parcel tape. On sharp curves or gaps, you can also work with softer tape, plasticine or acrylic sealant. In the end, as already mentioned, everything must be separated with release wax.

Apply release agent

Step 3: Mould resin

The mould resin (HP-E30FB) is metallically filled and ensures a metal-like and high-quality surface of the mould. This way, the best results are achieved later when creating the duplicate positive.
The mould resin is applied about 1-2mm thick over the entire surface. This is best done with a spatula: simply pour the mould resin onto the positive and spread it generously with a brush or spatula. In order to minimise the risk of pushing off fabric in the mould, we work with a dry coupling layer - a mixture of cotton flocks and glass fibre shavings is sprinkled on the mould resin. We then give the mould resin a day to cure.
harden.



Mould resin application

Dry coupling layer of cotton flocks & glass fibre shreds

Step 4: Processing of the reinforcement materials

Before starting to lay the floor, the loose cotton flocks and glass fibre shavings must be removed. To do this, you can carefully sweep the surface with a hand brush or use a hoover.

Now apply a layer of laminating resin thickened with cotton flocks to the mould. Pay special attention to corners, edges and unevenness and even them out as much as possible. If necessary, you can allow the layer to set slightly before you start laminating.

The high load laminating resin used (HP-E56L) is low viscosity, has a pot life of approx. 1h and reaches a TgMAX >90°C.
The first layer of the laminate consists of 105g/m² glass fibre fabric (HP-T110E). This also minimises the risk of the fabric seeping through and ensures a high surface quality. This is followed by several layers of 1000g/m² glass fibre fabric (HP-HD1000EF) to ensure the strength and stability of the mould. The advantage of this heavy fabric is that you have to apply many fewer layers compared to lighter fabric. to get the same result. Also, because of the special weave, it is very good for laying fine curves, despite the large grammage. For our shape we used 5 layers.
It makes sense to build up the fabric layers from individual pieces of fabric, this way you can better adapt the fabric to the contour of the positive. Make sure that the individual pieces of fabric always overlap by about 2 cm and that the overlapping zones in the different layers do not lie on top of each other. Also, make sure that the orientation of the fabric varies from layer to layer. Finally, apply a layer of peel ply. Then give the mould another day to cure.

Reinforce back with epoxy resin and carbon/glass

Reinforce back with epoxy resin and carbon/glass

Smooth the reverse side with a brush

Finished reverse side

Step 5: Substructure

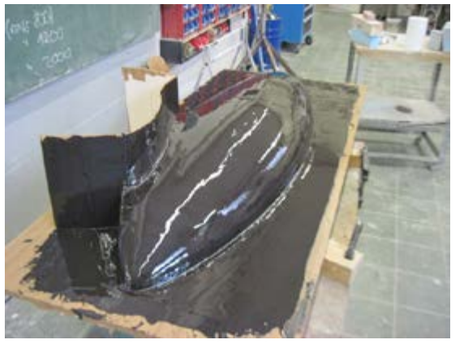
Since you will have to turn the mould over later to work with it, you still need to attach a base. You can use simple wooden boards and attach them to the mould. The base also increases the strength of the mould. If the positive is not so big, you can also make the substructure directly in step 4 together with the mould from laminate.

Install substructure

Step 6: Building the second mould

As soon as the first mould is ready, the second one can be built. To do this, place everything carefully on the base of the first mould - making sure that the positive part does not come loose from the mould. The wooden parting plane is now removed, as the first mould now also has a parting plane and this is moulded. You may have to add smaller planes. Then you can start again at step 3 and create the next mould.

Apply release agent

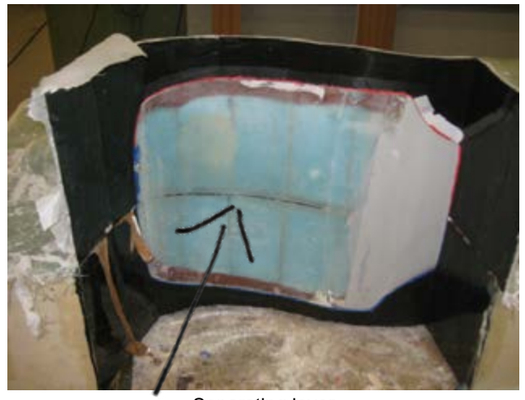


Apply mould resin

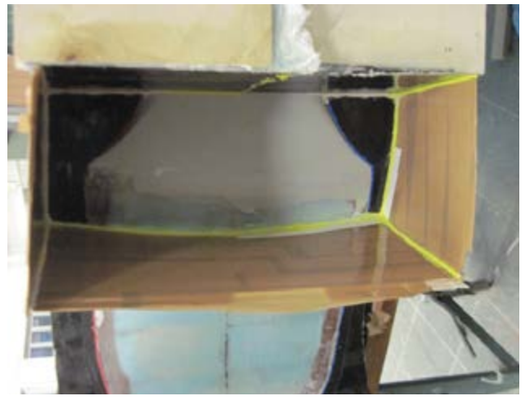
Dry coupling layer

Epoxy resin & carbon/glass reinforcement

Substructure

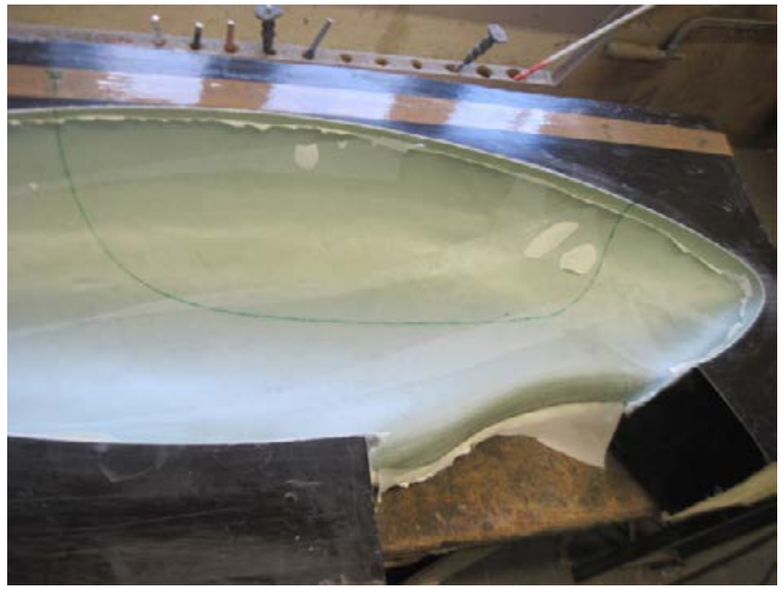


Separating layer



Step 7: Separate the moulds from each other

When all the moulds have finished curing, you can separate them and remove the positive. You can immediately start inserting a duplicate positive.



Finished mould

The information in this practical guide has been compiled to the best of our knowledge and corresponds to our current state of knowledge.
-> However, due to market dynamics, we reserve the right to make revisions at short notice at any time.
However, due to the multitude of possible applications and the storage and processing conditions of our products, which are beyond our control, we cannot assume any liability / warranty for the processing result in individual cases.
When using and processing the products, the current product data sheet must always be observed. In addition, our general terms and conditions apply. We generally advise preliminary tests.

With the publication of a new revision of this practical guide or the product data sheets, all previous editions and resulting data become invalid.

Our products

- In-Mould Couting HP-IMC
  Top coat resin (gelcoat) HP-E25DM

In-Mould-Couting HP-IMC

epoxy resins

- HP-E30FB
- HP-E25KL
- HP-E45KL
- more epoxy resins on p. 7

Epoxy resin HP-E25L

Release agent

- Priming Wax HP-G
  Film Release Agent HP-PVA

Priming Wax HP-G

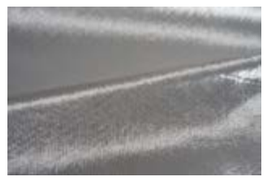
Fillers

- Cotton flocks HP-BF1
  Thixotropic powder HP-PK22
  Chopped Glass Fibre
    HP-GS3 (3mm)
    HP-GS6 (6mm)

Choppped Glass Fibre
HP-GS6

Reinforcement Fabrics

- Glass filament fabric - HP-T110E
  Multiaxial glass fabric - HP-B320E
  Mould making fabric - HP-HD1000EF
  Core material - for example 3D|CORETM XPS



Multiaxial glass fabric

Mould making complete set

This set makes it possible to create a positive or negative mould from a master model. The materials are sufficient for small to medium-sized impressions.

The set offers an optimal introduction to mould making. It contains a suitable epoxy resin and fabric, as well as priming wax, mould release agent, cotton flocks, glass fibre shavings, a painting and lacquering set, nitrile gloves, mixing cup and stirring spatula.

The complete set can be found in our online shop (shop.hp-textiles.com) under the category „Complete sets“ with the following item number: „Mould making - Complete set HP-KS-FB“.

Or you can easily find it via the QR code:

Our business areas:

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Teich Pool Dach
GRP Coatings

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Building Chemistry

HP-Textiles

Otto-Hahn-Str. 22
48480 Schapen
Germany

phone.: +49 (0) 5905 945 98 70
fax: +49 (0) 5905 945 98 74

info@hp-textiles.com
www.hp-textiles.com