MODEL, MOULD & PRODUCT

Systems for models

- Introduction
- The model
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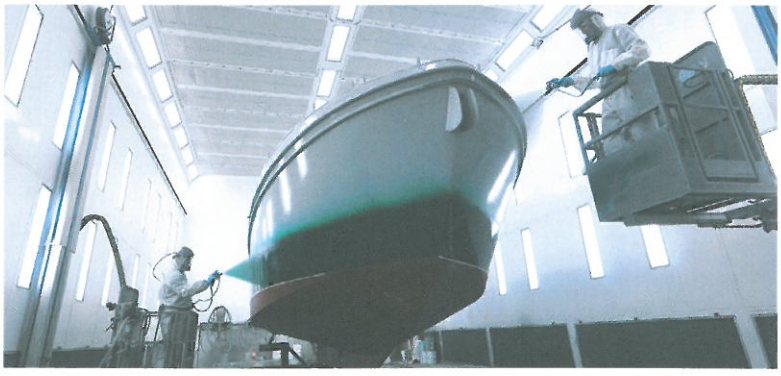

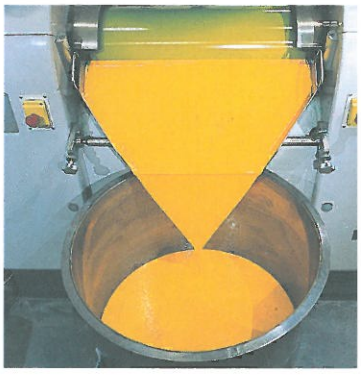

DE IJSSEL
COATINGS

MODEL, MOULD AND PRODUCT

CONTENTS

De IJssel Coatings B.V. supplies a full range of coatings and construction materials for new building, repair and maintenance of pleasure Boats. All products in the range are carefully developed and each combination of products (the paint system) offers the best protection against the influences of sun, wind and water. All products of De IJssel Coatings are easy to apply and offer colour and protection.

The product range includes materials for protection and decoration of various surfaces such as wood, steel, aluminium, epoxy and GRP. The range is as follows:

- IJMOPOX
  High solid two component epoxy primers and coatings.
- VARIOPOX
  Solvent free epoxy construction materials, adhesives, fillers and coatings.
- POLTIX
  Products for repair and fillers bases on unsaturated polyester resins.
- DOUBLE COAT
  A durable gloss and colour can be achieved with Double Coat, a high performance two component polyurethane finish.

This manual describes the requirements for models and which paint systems are suitable for models. Each system is recommended for different surfaces:

INTRODUCTION

Products made from glass-fibre reinforced unsaturated polyester resins are produced from negative moulds. In order to achieve a highest quality of finish, both the model and the mould should meet the highest demands for surface perfection.
Already at the first steps in the design process of the model or mould, the developer should take following topics into consideration:

- The number of products to be made in the mould;
- The size and dimension of these products;
- The shape and design of the products;
- The quality of surface.

A final consideration is the emission of styrene monomers during the application of unsaturated polyester resins. The aim is to reduce the emission to the lowest possible concentration which can be reasonably achieved. As a consequence, the production of products using closed moulds using RTM, vacuum or pressure injection moulding, increases. This requires moulds with an even higher quality of surface.
In this brochure the model is equivalent to the prototype, original or plug. The product is the final product which is produced in the mould.

THE MODEL

The model is the original and positive form. It is the base for the future products to be produced. The production of a high quality model involves many hours of delicate work and skill of labour. It is therefore important to select the most suitable material to produce this model. The choice of material depends on the shape and size of the model and the possibilities for surface preparation. In some cases the model may be used for other purposes as well. In the boat-building industry often the first boat is used as a model for a mould to produce future boats in polyester. In that case, other demands are required for the coating system than when ordinary one-off models are produced.

The final part is the selection of the coating system for the model. This coating system should be fully resistant to strong solvents such as styrene, acetone or ethyl acetate.

The time schedule between acceptance of the model and production of the actual mould may take a few weeks. This should be taken into consideration when producing the model. During storage, the materials used for the model may shrink or expand, especially when the temperature and relative humidity are subject to change.

A model may be treated with a paint system and cured curing is sometimes accelerated by increasing the temperature, sometimes between 40 and 60^{0}C. This will indeed accelerate drying and curing but may cause surface imperfections due to further shrinkage of fillers at such temperatures.

<u>Materials for the model</u>
The model may be produced from one of the materials mentioned in following table. Every material has its specific field of application, advantages and disadvantages during use.

Material:	*Application:*	*Advantages:*	*Disadvantages:*
Aluminium	• small models from cast aluminium • larger models from aluminium sheets	• fixed shape	• special tools required
EPS, foam	• medium to large models, substrate for tooling paste	• cost effective • easy to work	• not styrene resistant
Plasterboard, gypsum	• small models	• casting of complex shapes	• fragile • porous surface
Wood, plywood	• medium to large models	• fixed shape	• moisture and temperature sensitive

Material:	*Application:*	*Advantages:*	*Disadvantages:*
Wood, hardwood	• small models	• easy to use	• moisture and temperature sensitive
MDF	• small to medium models	• fixed shape and low shrinkage	• moisture sensitive
PU, foam	• small models	• easy to modify by cutting and sanding	• high costs
Steel, stainless or polished	• large models	• fixed shape	• special tools required
Tooling paste	• all models when accuracy in dimensions is important	• applied over EPS • easy to modify by CNC cutter	• moisture sensitive • solvent resistance • Tg value

Prior to the selection of the material for the model, the procedure how the model and mould are to be produced should be decided. The technical properties of all materials should be compatible with each other. The solvent resistance of all products used for the model and mould is important. Additionally, the temperature resistance is of equal importance. During the production of the mould the exothermic reaction will cause a rapid temperature increase. Models made from materials with a low T_g value might give distortions and surface defects. Systems known for an exothermic reaction are some rapid tooling systems and vacuum injection systems with low pot life.

Reinforcing the material

A laminate can be applied to improve the structural properties of the model. The stiffness, strength and dimensional stability will be improved. The best choice is an epoxy laminate combined with a woven glass fibre. Epoxy resins have lower shrinkage and better adhesion. Polyester resins or combinations of polyester and epoxy are not recommended.
Variopox products are free from solvents and recommended for EPS. An EPS model can be made resistant to styrene using suitable epoxy- or polyurethane compounds.

Tooling systems

A new development in the making of a model is shaping of EPS foam blocks using CNC milling machines. These blocks are first covered with a special tooling paste based on epoxy, polyurethane or unsaturated polyester. These tooling systems should resist solvents, equivalent to coating systems. Adequate solvent resistance of the tooling paste will prevent film defects and surface distortions during mould making.

FINISHING THE MODEL

Paint system

Normally the model is coated with a suitable paint system before applying the gelcoat for the mould. Using a paint system the final gloss and texture of the model may be determined. *When selecting a paint system it is essential that all separate components of the system, including fillers, are resistant against styrene.* Insufficient resistance against styrene will lead to surface defects in the mould. Not all two component coatings are resistant. An example of a coating with good styrene resistance is Double Coat.

It can be easily determined if a surface resist solvents or note. Place some cotton wool saturated with solvent 10 minutes on the surface of the model. When after 10 minutes the surface is dissolved or easily can be damaged by nail, the solvent resistance is not sufficient. In that case, the surface should be treated with Variopox Sealer before continuing the application of the coating system.

Secondly, the paint system of the model may not affect the curing mechanism of the unsaturated polyester gelcoat. Gelcoats may cure insufficiently when applied to models or moulds treated with epoxy paint systems. A finish based on epoxy is therefore not recommended.

MODEL, MOULD AND PRODUCT

When choosing the material to produce the model, it is important to consider the possibilities for application of the paint system. When the model has to be coated in a spray booth where the temperature is raised to 40 to 60°C, one has to consider possible shrinkage. The dimensional stability at such temperatures should be as high as possible.
In the table an overview is given of the product range of De IJssel Coatings for models. Please contact us for detailed paint system recommendation or coating schedule.

In all cases the surface should be clean, dry and free from dust, grease and other contamination. Steel and aluminium should be grit blasted with suitable grit to remove possible corrosion products and oxides. When fillers are required, always styrene resistant two component fillers should be used.

	Product name	*Description*
Primers	Variopox Sealer	Tw0 component epoxy sealer, solvent free. Eliminates porosity, improves solvent resistance, and reduces solvent retention.
	IJmopox ZF primer	Primer with excellent adhesion to metals.
	Tweecolux	Rapid curing and easy to sand primer. Several layers can be applied in one day.
Fillers	Poltix Rijplamuur Poltix Spuitplamuur Poltix Superplamuur Poltix Vezelplamuur IJmofix	Five different polyester fillers. Fast curing, excellent sanding properties.
	Variopox Plamuur Variopox Finishing Plamuur Variopox LG Plamuur	Three different epoxy fillers with low shrinkage, suitable for small and large surfaces.
Build coats	IJmopox HB coating	Two component high solid build coat.
Finishes	Double Coat Modellak	Two component polyurethane finish with rapid curing. Recommended for smaller models. High gloss. After 24 hours resistant to gelcoat.
	Double Coat	Mar and scratch resistant two component polyurethane finish. Excellent levelling, recommended for larger models. High gloss or semi-gloss, available in many colours.

Surface texture of the model
By applying a surface texture to the surface of the model, the polyester product made in the mould will obtain the same texture. This texture may be applied using special effects, such as:

Effect:	*May be achieved with:*
Anti-slip structure	Add anti-slip powder to Double Coat high gloss, Double Coat Modellak or Double Coat silk gloss and apply with air spray. Also special materials with an anti-slip profile are applied to the surface of the model.
High gloss	Apply Double Coat Modellak by spray or Double Coat high gloss by brush, roller or spray.
Leather grain	Apply artificial leather to the model.
Splatter structure	Apply Double Coat high gloss, Double Coat Modellak or Double Coat silk gloss by spray with nozzle with large orifice at low pressure.
Silk gloss	Apply Double Coat silk gloss by spray. A silk gloss surface is difficult to repair as gloss variations may be possible.

Anti-slip materials or artificial leather grains which are fixed to the surface with adhesives should be resistant to styrene.

PRODUCTION OF THE MOULD

Also the mould or negative form may be made from various materials. The choice depends on the size and design of the model as well as the number of products which will be made from the mould. In

many cases materials such as reinforced polyester is chosen. Alternatives are epoxy, vinyl ester or (stainless) steel.

When reinforced polyester is chosen, it is important to know if the product should be smooth on only one or on both sides. This determines the construction of the mould. A product which should be smooth on both sides requires a closed mould:

Required product	*Type of mould*	*Production method*
One side smooth	Open mould	• Hand lay up • Spray up
Both sides smooth	Closed mould	• BMC • Vacuum injection • Pressure injection • RTM

The mould may be made as one piece when the model is fully releasing. All angles and corners on the model should be smaller than 90 degrees. When angles or corners are smaller, the mould should be made consisting of various separate parts.

Application conditions
As during the production of the model, it is important during the production to control the temperature and relative humidity during application. Temperature, ventilation and relative humidity in the workshop should not be subject to rapid changes, both during daytime or night-time. Rapid changes in temperature or humidity, draft or poor ventilation may cause problems in the curing process of the materials, resulting in print-through of glass fibre or insufficient hardness of the gelcoat materials.

Surface preparation model
Before a start can be made with the production of the mould, the model should be prepared. First should be checked if the coating system is fully cured and resistant to styrene. If so, a suitable mould release agent may be applied.

Depending on the choice of release agent, four to five coats may be required. Wait between each coat for a few hours to allow solvents to evaporate. Every coat should be buffed carefully. Small residues of mould release agent may become visible in the mould, so buffing and polishing should be done thoroughly and carefully.

To complicated shapes a layer of liquid PVA release agent may be applied. When in doubt the model will release completely PVA should be applied. This requires skill of labour to apply this release agent without brush marks, sags or runs. *Models to which a structured material is applied (such as a leather grain or anti-slip profile) should always be coated with PVA mould release agent.*

Selection of system
The selection of the system and materials for production of the mould depend on the final use of the mould. Import criteria are the number of lifts a day, the required life time of the mould and the temperature during curing of the products when the mould is in use. For less critical use and applications with only a few lifts of products the quality requirements are lower compared to critical use with many lifts a day. For less critical use a standard system may be chosen, For critical systems with many lifts and higher temperatures a premium system is available. Both systems are summarized in following table:

MODEL, MOULD AND PRODUCT

	Standard system	Premium system
Step 1	Poltix Mallengelcoat • Based on isophtalic resins • Application by brush • Available in 9 colours • Flexible • Two coats recommended	Poltix Gelcoat M-EB • Based on vinylester resins • Application by brush • Available in 9 colours • High HDT • Scratch and impact resistant • High chemical resistance, no dull patches • Two coats recommended
Step 2	Poltix Lamineerhars in in combination with a glass mat of 150 gram/m^2 • Based on isophtalic resins • Hand lay-up application • Thixotropic • Cure indicator	Poltix Resin M-EB in combination with a glass mat of 150 gram/m^2 • Based on vinylester resins • Hand lay-up application • Light thixotropy • High HDT
Step3	Poltix Lamineerhars in in combination with a glass mat • Based on isophtalic resins • Hand lay-up application • Thixotropic • Cure indicator	Poltix Resin M-EB-K in combination with a glass mat • Based on vinylester resins • Hand lay-up application (vacuüm injection possible) • Low shrinkage
Step 4	Poly Lak ortho ED (Poltix Topcoat OB-E) • Based on orthophtalic resins • Application by brush • One coat application • Available in 4 colours	

Application of the gelcoat

Before applying the gelcoat, dust and foreign materials should be removed from the surface of the model. A first layer of gelcoat is applied by brush at a thickness of 350 µm. The gelcoat should be applied in an even film, without holidays or areas with low thickness. Spray application might lead to small air entrapment in the gelcoat. The gel time should be adjusted with MEK peroxide to approx. 20 minutes. Curing of the gelcoat at lower parts may be inhibited by styrene vapours, turning the model will avoid this.

When the first layer is fully cured, a next layer of 350 µm gelcoat may be applied. Usually, this is possible after 3 hours. Applying the second layer gelcoat in a different colour, it is possible to check if sufficient film thickness is applied.

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Laminating

After 6 to 8 hours the gelcoat is fully cured. The sharp edges may be reinforced with Balsaplast or IJmobond T. This will avoid air enclosures when the first chopped strand mat is applied. Usually the first layer has a thickness of approx. 80 gram/m^2 and following layers a thickness between 225 and 450 gram/m^2. Curved areas may be covered with small stripes of chopped strand mat of 225 gram/m^2. Sanding after curing will remove any protruding glass fibres, thus avoiding air entrapment when the chopped strand mat is applied. The laminate is built from chopped strand mat with a thickness of 300 or 450 gram/m^2. A rule of thumb is to construct a mould with a thickness three to four times the thickness of the product that will be produced in the mould.

Additional rigidity may be obtained by including polyurethane foam board to the flat areas in the laminate. The board is first cut to the right size and then glued with Balsaplast or IJmobond T to the surface. The sides of the board are cut at an angle to facilitate proper coverage with the chopped strand mat. Normally the foam board is covered with a laminate with a 450 gram/m^2 mat. Finally it may be necessary to construct a wooden frame around the mould.

24 hours after application of the last layer the mould may be released from the model. Using wooden or nylon wedges, damage to the mould may be avoided

Date: February 14

MODELS – TOOLING SYSTEMS

DESCRIPTION

This system describes how a model (or plug) for the production of a polyester mould and produced from a tooling paste, may be coated with a high gloss two component polyurethane system.

PRINCIPAL CHARACTERISTICS

This system may be applied to a model (or plug) made from a tooling paste cut and machined in the desired shape. The system is scratch resistant, and is resistant against various chemicals and solvents, including styrene. The system has an excellent gloss and colour retention.

SUBSTRATE CONDITIONS

Tooling paste, sanded with grit paper P180, dry, free from any contamination and in good condition.

SURFACE PREPARATION

1. The surface should be completely dry and free from grease (moisture content maximum 12%);
2. Grit paper the surface with grit paper P180 after any spot repair;
3. Thoroughly remove all dust and residue from the surface.

MATERIALS AND SPREADING RATE

The following materials are used in the paint system:

Variopox Sealer	spreading rate approx. 0,2 l/m²
IJmopox HB coating	spreading rate approx. 0,5 l/m²
IJmopox Verdunner	spreading rate depends on application method
Double Coat	spreading rate approx. 0,2 kg/m²
Double Coat Spuitverdunner	spreading rate depends on application method, see additional information

APPLICATION

1. Repair damaged areas and joints with a suitable filler (see additional information);
2. Apply one coat Variopox Sealer to a total dry film thickness of 200 µm (minimum spreading rate approx. 0,2 l/m², see additional information);
3. Apply three coats IJmopox HB coating to a total dry film thickness of 300 µm (minimum spreading rate approx. 0,5 l/m²). Apply preferably IJmopox HB coating in two different colours (see additional information);
4. Apply three coats Double Coat to a total dry film thickness of 90 µm (minimum spreading rate approx. 0,2 kg/m^2);

ADDITIONAL INFORMATION

- Tooling paste
  Tooling pastes contain a high volume of extenders and fillers to improve sanding and cutting properties. The resistance to solvents (a.o. styrene) depends on the type and quality of the resins and the percentage and type of fillers and extenders. When there is doubt the tooling paste will resist the solvents used in the materials during the subsequent process thorough testing is recommended. In any case, the tooling paste should be resistant to:
  - The solvents used in the paint system applied to the tooling paste;
  - The solvents (a.o. styrene) of the gelcoat to be used in the production process of the mould.

  This paint system is resistant to the most commonly used solvents in the polyester industry. When the tooling paste is not resistant to the solvents used in the paint system and/or the solvents used in the polyester industry, surface defects may occur during the production of the mould. These defects may be visible in both model and mould as spots with lower gloss, craters and cracks.

- Repair of tooling paste
  Damages to the tooling paste may be repaired with a filler. Any damage of the tooling paste should

be repaired.
Suitable fillers are:
- Variopox Finishing plamuur (buff, no shrinkage, but restrictions to sanding);
- Poltix Super Plamuur (grey, fast curing, easy to sand, slight shrinkage);
- IJmofix (white, fast curing, fine filler, easy to sand, slight shrinkage);

- Tg value tooling paste
  When the tooling paste has a Tg value lower than 45 ºC we recommend to use conventional systems to produce the mould. Fast curing, rapid systems applied at a high film thickness will result in higher temperatures during curing. A surface temperature during curing above the Tg value of the tooling paste will cause deformation and as a consequence surface defects in the mould or model.

- Durability and surface preparation
  The durability of any paint system depends on a number of variables, amongst others: total dry film thickness, method of application, skill of labour, the conditions during which the coating is applied and cured, the exposure conditions during service and the preparation of the surface. Insufficient surface preparation might lead to blistering and loss of adhesion.

- Sanding
  A durable adhesion will be obtained by thorough preparation of the surface. This may be achieved by sanding the surface. Sanding is also necessary when the time between application of each coat exceeds the maximum overcoating interval.
  During application of the finishing coats, we recommend to use for each coat a finer grit paper.

- Application Variopox Sealer
  Variopox Sealer may be applied best using a felt roller such as from Anza.

- Application IJmopox HB coating
  IJmopox HB coating is best applied in two different colours. Change the colour between each layer and it is easier to control film thickness. During sanding of IJmopox HB coating it is clearly visible when too much material is removed.

- Application of Double Coat
  Double Coat may be replaced with Double Coat Modellak. Double Coat Modellak is fully cured after 24 hours and is recommended when the model is exposed to the gelcoat the following day. Double Coat Modellak is fast curing and recommended for spray application to smaller models.
  For spray Application Double Coat Spuitverdunner may be replaced by Double Coat Spuitverdunner 60. Depending on the model, Double Coat Spuitverdunner 60 will result in less overspray and better levelling.

- Production of the mould
  The model (plug) should be allowed to cure at least 5 days after application of the final coat of Double Coat. Apply several layers of release agent; a suitable release agent is Mirrorglaze TR88 or equivalent. Buff the release agent thoroughly.

MODELS – TOOLING SYSTEMS

- Forced curing
  Avoid forced curing of the paint system as much as possible. Forced curing might result in surface defects in the tooling paste. This will affect the surface quality of the mould negatively.

- Example working schedule

Step	Activity	Dry film thickness (µm)	Spreading rate (m^2/l)	Recoating interval at 20 °C	Preparation before next step
1	Surface pre-treatment				
2	Repair with suitable filler	n.a.	n.a	8 hours	Sanding with P180.
3	Apply Variopox Sealer	200	5,0	24 hours	Sanding with P180.
4	Apply first coat IJmopox HB coating	100	3,5	12 hours	When recoated within 24 hours no preparation required, otherwise sanding with P240.
5	Apply second coat IJmopox HB coating	100	3,5	12 hours	
6	Apply third coat IJmopox HB coating	100	3,5	12 hours	Sanding with P320.
7	Apply first coat Double Coat	30	14,3	24 hours	When recoated within 48 hours no preparation required, otherwise sanding with P320-P400. Use between ach layer finer grit paper to avoid scratches.
8	Apply second coat Double Coat	30	14,3	24 hours	
9	Apply third coat Double Coat	30	14,3	24 hours	After 5 days production of mould may start. Apply several layers mould release agent first.

For detailed information on the products mentioned in this sheet, please refer to our technical information sheets.

Date: February 14

Disclaimer
The information in this data sheet is based on thorough research and development in combination with practical experience, is to the best of our knowledge and correct at the date of printing. De IJssel Coatings BV does not accept any liability as the final result depends on a number of factors beyond our control, amongst others, but not limited to, skill of labour, application conditions and surface preparation. De IJssel Coatings BV reserves the right to change data without prior notice. This data sheet supersedes all previous issues.

MODELS – MDF

DESCRIPTION

This system describes how a model (or plug) for the production of a polyester mould and produced from MDF, may be coated with a high gloss two component polyurethane system.

PRINCIPAL CHARACTERISTICS

This system may be applied to a model (or plug) made from MDF. The system is scratch resistant, and is resistant against various chemicals and solvents, including styrene. The system has an excellent gloss and colour retention.

SUBSTRATE CONDITIONS

MDF, sanded with grit paper P180, dry, free from any contamination and in good condition.

SURFACE PREPARATION

1. The surface should be completely dry and free from grease (moisture content maximum 12%);
2. Grit paper the surface with grit paper P180 after any spot repair;
3. Thoroughly remove all dust and residue from the surface.

MATERIALS AND SPREADING RATE

The following materials are used in the paint system:

Tweecolux	spreading rate approx. 0,1 l/m²
Poltix Spuitplamuur	spreading rate approx. 0,5 l/m²
Double Coat	spreading rate approx. 0,2 kg/m²
Double Coat Spuitverdunner	spreading rate depends on application method, see additional information
Poltix Ethylacetaat	spreading rate depends on application method

APPLICATION

1. Repair damaged areas and joints with a suitable filler (see additional information);
2. Apply one to two coats of Tweecolux to a total dry film thickness of 50 µm (minimum spreading rate approx. 0,1 l/ m²)
3. Apply one coat Poltix Spuitplamuur to a total dry film thickness of 350 µm (minimum spreading rate approx. 0,5 l/m²);
4. Apply three coats Double Coat to a total dry film thickness of 90 µm (minimum spreading rate approx. 0,2 kg/m^2);

ADDITIONAL INFORMATION

- MDF

  MDF is an engineered wood product made from wood fibers and a resin binder formed by applying high pressure and temperature. Some advantages of MDF are:
  - A high density;
  - Good mechanical properties and rigidity;
  - Does not contain knots or rings;
  - Easy to cut and sand.

  MDF consists of small particles and does not have a surface texture such as plywood. MDF may be coated with various paint systems. The resin binder may migrate slowly from the MDF, having a negative effect on the adhesion of paint systems. Some sharp solvents may dissolve the resin thus reducing the strength of the MDF. It is always recommended to test the effect of the solvent on MDF.

  This paint system is resistant to the most commonly used solvents in the polyester industry. When the paint system is not resistant to the solvents used in the polyester industry, surface defects may occur during the production of the mould. These defects may be visible in both model and mould as spots with lower gloss, craters and cracks.

- Repair of MDF
  Damages to MDF may be repaired with a filler. Any damage of the foam core should be repaired. Suitable fillers are:
  - Variopox Finishing plamuur (buff, no shrinkage, but lower sanding properties);
  - Poltix Super Plamuur (grey, fast curing, easy to sand, slight shrinkage);
  - IJmofix (white, fast curing, fine filler, easy to sand, slight shrinkage);

- Durability and surface preparation
  The durability of any paint system depends on a number of variables, amongst others: total dry film thickness, method of application, skill of labour, the conditions during which the coating is applied and cured, the exposure conditions during service and the preparation of the surface. Insufficient surface preparation might lead to blistering and loss of adhesion.

- Sanding
  A durable adhesion will be obtained by thorough preparation of the surface. This may be achieved by sanding the surface. Sanding is also necessary when the time between application of each coat exceeds the maximum overcoating interval.
  During application of the finishing coats, we recommend to use for each coat a finer grit paper.

- Application of Double Coat
  Double Coat may be replaced with Double Coat Modellak. Double Coat Modellak is fully cured after 24 hours and is recommended when the model is exposed to the gelcoat the following day. Double Coat Modellak is fast curing and recommended for spray application to smaller models.
  For spray Application Double Coat Spuitverdunner may be replaced by Double Coat Spuitverdunner 60. Depending on the model, Double Coat Spuitverdunner 60 will result in less overspray and better levelling.

- Production of the mould
  The model (plug) should be allowed to cure at least 5 days after application of the final coat of Double Coat. Apply several layers of release agent; a suitable release agent is Mirrorglaze TR88 or equivalent. Buff the release agent thoroughly.

- Forced curing
  Avoid forced curing of the paint system as much as possible. Forced curing might result in surface defects in the tooling paste. This will affect the surface quality of the mould negatively.

- Example working schedule

Step	Activity	Dry film thickness (µm)	Spreading rate (m^2/l)	Recoating interval at 20 °C	Preparation before next step
1	Surface pre-treatment				
2	Repair with suitable filler	n.a.	n.a	8 hours	Sanding with P180.
3	Apply first coat of Tweecolux	25	18,0	2 hours	Sanding with P180
4	Apply second coat of Tweecolux	25	18,0	2 hours	Sanding with P180
5	Apply Poltix Spuitplamuur	350	2,0	8 hours	Sanding with P180-P240-P320.
6	Apply first coat Double Coat	30	14,3	24 hours	When recoated within 48 hours no preparation required, otherwise sanding with P320-P400. Use between ach layer finer grit paper to avoid scratches.
7	Apply second coat Double Coat	30	14,3	24 hours	
8	Apply third coat Double Coat	30	14,3	24 hours	After 5 days production of mould may start. Apply several layers mould release agent first.

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MODELS – WOOD

DESCRIPTION

This system describes how a model (or plug) for the production of a polyester mould and produced from wood, may be coated with a high gloss two component polyurethane system.

PRINCIPAL CHARACTERISTICS

This system may be applied to a model (or plug) made from wood. The system is scratch resistant, and is resistant against various chemicals and solvents, including styrene. The system has an excellent gloss and colour retention.

SUBSTRATE CONDITIONS

Wood, sanded with grit paper P180, dry, free from any contamination and in good condition.

SURFACE PREPARATION

1. The surface should be completely dry and free from grease (moisture content maximum 12%);
2. Grit paper the surface with grit paper P180 after any spot repair;
3. Thoroughly remove all dust and residue from the surface.

MATERIALS AND SPREADING RATE

The following materials are used in the paint system:

Tweecolux	spreading rate approx. 0,1 l/m²
Poltix Spuitplamuur	spreading rate approx. 0,5 l/m²
Double Coat	spreading rate approx. 0,2 kg/m²
Double Coat Spuitverdunner	spreading rate depends on application method, see additional information
Poltix Ethylacetaat	spreading rate depends on application method

APPLICATION

1. Repair damaged areas and joints with a suitable filler (see additional information);
2. Apply one to two coats of Tweecolux to a total dry film thickness of 50 µm (minimum spreading rate approx. 0,1 l/ m²)
3. Apply one coat Poltix Spuitplamuur to a total dry film thickness of 350 µm (minimum spreading rate approx. 0,5 l/m²);
4. Apply three coats Double Coat to a total dry film thickness of 90 µm (minimum spreading rate approx. 0,2 kg/m^2);

ADDITIONAL INFORMATION

- Wood
  Wood is a natural product. Upon exposure to moisture and heat the wood may expand or shrink. The surface texture may become visible in the model and the mould. To prevent any such surface defects it is possible to apply a laminate:
  - When the model is for single use, a polyester laminate may be applied. An example is a combination of Tweecolux as primer and Poltix Lamineerhars and Poltix Glasmat 225 as laminate.
  - When the model is for multiple use or when the model is a real prototype, an epoxy laminate is recommended. An example is a combination of Variopox Injectiehars as primer and Variopox Impregneerhars and Variopox Glasweefsel 160 as laminate.

  Always use the surface pretreatment and primers recommended by the supplier.
  This paint system is resistant to the most commonly used solvents in the polyester industry. When the paint system is not resistant to the solvents used in the polyester industry, surface defects may occur during the production of the mould. These defects may be visible in both model and mould as spots with lower gloss, craters and cracks.

MODELS – WOOD

- Repair of wood
  Damages to wood may be repaired with a filler. Any damage of the foam core should be repaired. Suitable fillers are:
  - Variopox Finishing plamuur (buff, no shrinkage, but lower sanding properties);
  - Poltix Super Plamuur (grey, fast curing, easy to sand, slight shrinkage);
  - IJmofix (white, fast curing, fine filler, easy to sand, slight shrinkage);

- Durability and surface preparation
  The durability of any paint system depends on a number of variables, amongst others: total dry film thickness, method of application, skill of labour, the conditions during which the coating is applied and cured, the exposure conditions during service and the preparation of the surface. Insufficient surface preparation might lead to blistering and loss of adhesion.

- Sanding
  A durable adhesion will be obtained by thorough preparation of the surface. This may be achieved by sanding the surface. Sanding is also necessary when the time between application of each coat exceeds the maximum overcoating interval.
  During application of the finishing coats, we recommend to use for each coat a finer grit paper.

- Application of Double Coat
  Double Coat may be replaced with Double Coat Modellak. Double Coat Modellak is fully cured after 24 hours and is recommended when the model is exposed to the gelcoat the following day. Double Coat Modellak is fast curing and recommended for spray application to smaller models.
  For spray Application Double Coat Spuitverdunner may be replaced by Double Coat Spuitverdunner 60. Depending on the model, Double Coat Spuitverdunner 60 will result in less overspray and better levelling.

- Production of the mould
  The model (plug) should be allowed to cure at least 5 days after application of the final coat of Double Coat. Apply several layers of release agent; a suitable release agent is Mirrorglaze TR88 or equivalent. Buff the release agent thoroughly.

- Forced curing
  Avoid forced curing of the paint system as much as possible. Forced curing might result in surface defects in the tooling paste. This will affect the surface quality of the mould negatively.

- Example working schedule

Step	Activity	Dry film thickness (µm)	Spreading rate (m^2/l)	Recoating interval at 20 °C	Preparation before next step
1	Surface pre-treatment				
2	Repair with suitable filler	n.a.	n.a	8 hours	Sanding with P180.
3	Apply first coat of Tweecolux	25	18,0	2 hours	Sanding with P180
4	Apply second coat of Tweecolux	25	18,0	2 hours	Sanding with P180
5	Apply Poltix Spuitplamuur	350	2,0	8 hours	Sanding with P180-P240-P320.
6	Apply first coat Double Coat	30	14,3	24 hours	When recoated within 48 hours no preparation required, otherwise sanding with P320-P400. Use between ach layer finer grit paper to avoid scratches.
7	Apply second coat Double Coat	30	14,3	24 hours	
8	Apply third coat Double Coat	30	14,3	24 hours	After 5 days production of mould may start. Apply several layers mould release agent first.

MODELS – WOOD

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Date: February 14

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MODELS – POLYSTYRENE CORE

DESCRIPTION

This system describes how a model (or plug) for the production of a polyester mould and produced from a polystyrene (EPS) core and protected by a suitable barrier coat, may be coated with a high gloss two component polyurethane system.

PRINCIPAL CHARACTERISTICS

This system may be applied to a model (or plug) made from a polystyrene (EPS) core. The system is scratch resistant, and is resistant against various chemicals and solvents, including styrene. The system has an excellent gloss and colour retention.

SUBSTRATE CONDITIONS

Polystyrene (EPS) core protected by a suitable barrier coat, sanded with grit paper P180, dry, free from any contamination and in good condition.

SURFACE PREPARATION

1. The surface should be completely dry and free from grease (moisture content maximum 12%);
2. Grit paper the surface with grit paper P180 after any spot repair;
3. Thoroughly remove all dust and residue from the surface.

MATERIALS AND SPREADING RATE

The following materials are used in the paint system:

Poltix Spuitplamuur	spreading rate approx. 0,5 l/m²
Double Coat	spreading rate approx. 0,2 kg/m²
Double Coat Spuitverdunner	spreading rate depends on application method, see additional information
Poltix Ethylacetaat	spreading rate depends on application method

APPLICATION

1. Repair damaged areas and joints with a suitable filler such as Variopox Plamuur, Variopox LG plamuur, Variopox Finishing plamuur;
2. Apply one coat Poltix Spuitplamuur to a total dry film thickness of 350 µm (minimum spreading rate approx. 0,5 l/m²);
3. Apply three coats Double Coat to a total dry film thickness of 90 µm (minimum spreading rate approx. 0,2 kg/m^2);

ADDITIONAL INFORMATION

- Polystyrene (EPS) core
  Polystyrene (EPS) has a poor resistance against solvents. Without a suitable barrier coat polystyrene (EPS) is not suitable as substrate for solvent based paint systems or as basematerial for models. Only when a suitable barrier coat is applied a solvent based paint can be applied and a mould can be made from the polystyrene (EPS) model.
  Suitable barrier coats are:
  - A tooling paste based on polyurethane or epoxy. Paint systems for this surface are given in the system Models – Tooling paste.
  - A combination of two layers of Variopox Impregneerhars with Variopox Glasweefsel or Variopox Keperweefsel.

  This paint system is resistant to the most commonly used solvents in the polyester industry. When the paint system is not resistant to the solvents used in the polyester industry, surface defects may occur during the production of the mould. These defects may be visible in both model and mould as spots with lower gloss, craters and cracks.

MODELS – POLYSTYRENE CORE

- Durability and surface preparation
  The durability of any paint system depends on a number of variables, amongst others: total dry film thickness, method of application, skill of labour, the conditions during which the coating is applied and cured, the exposure conditions during service and the preparation of the surface. Insufficient surface preparation might lead to blistering and loss of adhesion.

- Sanding
  A durable adhesion will be obtained by thorough preparation of the surface. This may be achieved by sanding the surface. Sanding is also necessary when the time between application of each coat exceeds the maximum overcoating interval.
  During application of the finishing coats, we recommend to use for each coat a finer grit paper.

- Application of Double Coat
  Double Coat may be replaced with Double Coat Modellak. Double Coat Modellak is fully cured after 24 hours and is recommended when the model is exposed to the gelcoat the following day. Double Coat Modellak is fast curing and recommended for spray application to smaller models.
  For spray Application Double Coat Spuitverdunner may be replaced by Double Coat Spuitverdunner 60. Depending on the model, Double Coat Spuitverdunner 60 will result in less overspray and better levelling.

- Production of the mould
  The model (plug) should be allowed to cure at least 5 days after application of the final coat of Double Coat. Apply several layers of release agent; a suitable release agent is Mirrorglaze TR88 or equivalent. Buff the release agent thoroughly.

- Forced curing
  Avoid forced curing of the paint system as much as possible. Forced curing might result in surface defects in the tooling paste. This will affect the surface quality of the mould negatively.

- Example working schedule

Step	Activity	Dry film thickness (µm)	Spreading rate (m^2/l)	Recoating interval at 20 °C	Preparation before next step
1	Surface pre-treatment				
2	Repair with Variopox Plamuur, Variopox LG plamuur or Variopox Finishing plamuur	n.a.	n.a	8 hours	Sanding with P180.
3	Apply Poltix Spuitplamuur	350	2,0	8 hours	Sanding with P180-P240-P320.
4	Apply first coat Double Coat	30	14,3	24 hours	When recoated within 48 hours no preparation required, otherwise sanding with P320-P400. Use between ach layer finer grit paper to avoid scratches.
5	Apply second coat Double Coat	30	14,3	24 hours	
6	Apply third coat Double Coat	30	14,3	24 hours	After 5 days production of mould may start. Apply several layers mould release agent first.

MODELS – POLYSTYRENE CORE

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MODELS – POLYURETHANE FOAM CORE

DESCRIPTION

This system describes how a model (or plug) for the production of a polyester mould and produced from a polyurethane foam core, may be coated with a high gloss two component polyurethane system.

PRINCIPAL CHARACTERISTICS

This system may be applied to a model (or plug) made from a polyurethane foam core. The system is scratch resistant, and is resistant against various chemicals and solvents, including styrene. The system has an excellent gloss and colour retention.

SUBSTRATE CONDITIONS

Polyurethane foam core, sanded with grit paper P180, dry, free from any contamination and in good condition.

SURFACE PREPARATION

1. The surface should be completely dry and free from grease (moisture content maximum 12%);
2. Grit paper the surface with grit paper P180 after any spot repair;
3. Thoroughly remove all dust and residue from the surface.

MATERIALS AND SPREADING RATE

The following materials are used in the paint system:

Poltix Spuitplamuur	spreading rate approx. 0,5 l/m²
Double Coat	spreading rate approx. 0,2 kg/m²
Double Coat Spuitverdunner	spreading rate depends on application method, see additional information
Poltix Ethylacetaat	spreading rate depends on application method

APPLICATION

1. Repair damaged areas and joints with Poltix Superplamuur or IJmofix;
2. Apply one coat Poltix Spuitplamuur to a total dry film thickness of 350 µm (minimum spreading rate approx. 0,5 l/m²);
3. Apply three coats Double Coat to a total dry film thickness of 90 µm (minimum spreading rate approx. 0,2 kg/m^2);

ADDITIONAL INFORMATION

- Polyurethane foam core
  In general a polyurethane foam core has an excellent resistant to styrene. Combined with good sanding properties polyurethane foam core is very suitable for smaller models. The spreading rate of the filler depends on the density of the foam core: less filler will be required for a more dense foam. Larger models or models with joints may be treated with polyester resin in combination with a chopped strand glass fibre., i.e. Poltix Lamineerhars and Poltix Glasmat 225.

  This paint system is resistant to the most commonly used solvents in the polyester industry. When the paint system is not resistant to the solvents used in the polyester industry, surface defects may occur during the production of the mould. These defects may be visible in both model and mould as spots with lower gloss, craters and cracks.

MODELS – POLYURETHANE FOAM CORE

- Repair of polyurethane foam core
  Damages to the foam core may be repaired with a filler. Any damage of the foam core should be repaired.
  Suitable fillers are:
  - Poltix Super Plamuur (grey, fast curing, easy to sand, slight shrinkage);
  - IJmofix (white, fast curing, fine filler, easy to sand, slight shrinkage);

- Durability and surface preparation
  The durability of any paint system depends on a number of variables, amongst others: total dry film thickness, method of application, skill of labour, the conditions during which the coating is applied and cured, the exposure conditions during service and the preparation of the surface. Insufficient surface preparation might lead to blistering and loss of adhesion.

- Sanding
  A durable adhesion will be obtained by thorough preparation of the surface. This may be achieved by sanding the surface. Sanding is also necessary when the time between application of each coat exceeds the maximum overcoating interval.
  During application of the finishing coats, we recommend to use for each coat a finer grit paper.

- Application of Double Coat
  Double Coat may be replaced with Double Coat Modellak. Double Coat Modellak is fully cured after 24 hours and is recommended when the model is exposed to the gelcoat the following day. Double Coat Modellak is fast curing and recommended for spray application to smaller models.
  For spray Application Double Coat Spuitverdunner may be replaced by Double Coat Spuitverdunner 60. Depending on the model, Double Coat Spuitverdunner 60 will result in less overspray and better levelling.

- Production of the mould
  The model (plug) should be allowed to cure at least 5 days after application of the final coat of Double Coat. Apply several layers of release agent; a suitable release agent is Mirrorglaze TR88 or equivalent. Buff the release agent thoroughly.

- Forced curing
  Avoid forced curing of the paint system as much as possible. Forced curing might result in surface defects in the tooling paste. This will affect the surface quality of the mould negatively.

- Example working schedule

Step	Activity	Dry film thickness (µm)	Spreading rate (m^2/l)	Recoating interval at 20 °C	Preparation before next step
1	Surface pre-treatment				
2	Repair with suitable filler	n.a.	n.a	8 hours	Sanding with P180.
3	Apply Poltix Spuitplamuur	350	2,0	8 hours	Sanding with P180-P240-P320.
4	Apply first coat Double Coat	30	14,3	24 hours	When recoated within 48 hours no preparation required, otherwise sanding with P320-P400. Use between ach layer finer grit paper to avoid scratches.
5	Apply second coat Double Coat	30	14,3	24 hours	
6	Apply third coat Double Coat	30	14,3	24 hours	After 5 days production of mould may start. Apply several layers mould release agent first.

MODELS – POLYURETHANE FOAM CORE

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