



# NoriPET®

Ink System for Second Surface IMD/FIM Technology with Polyester Films (back molding of screen printed films)

## Area of Application

**NoriPET® is a solvent-based two-component screen printing ink for second surface IMD/FIM process (In-Mold-Decoration/Film Insert Molding) with polyester films and the option to integrate membrane switch functions in an IMD/FIM part.**

## Characteristics

**NoriPET® is optimized for the use on suitable PET films and has been developed in request of**

- **formability and elasticity**
- **temperature resistance in injection molding**
- **good adhesion between printed film and injected resin (like ABS) without additional adhesive**

## Equipment for Printing on Films within IMD/FIM Technology

- **Tunnel dryer, with final active cooling**
  - **3 heating sections with 80 °C (175 °F) minimum and high air exchange rate**
  - **active cooling adjustable to 15 °C (60 °F)**
- **Box oven adjustable up to 90 °C (195 °F)**
- **Racks for single placing of printed sheets**

**Different supplier of IMD/FIM parts utilize different equipment for production which requires individual adjustments of process parameters.**

**For this reason production parameters of the same IMD/FIM parts at different supplier can be very different for best results from each origin.**

## Films

**PET films: e.g. Autoflex® EBG 180 L and Autotex® V 200<sup>1</sup>**

and further plastic films after pre-tests.

## Finish

Glossy

The gloss level is influenced by the structure of the substrate.

## Pigmentation

NoriPET® basic colors are very brilliant and can be used for color matching.

<sup>1</sup> Autoflex® and Autotex® are registered trade marks used by MacDermid Autotype Ltd., UK

**Color Shades**

<b>Halogen Free Basic Colors</b>	108 Citron HF	445 Violet HF
	112 Yellow HF	566 Blue Transparent HF
	225 Orange HF	570 Deep Blue HF
<i>HF = halogen free</i>	318 Red Transparent HF	665 Green HF
	321 Bright Red HF	945 White HF
	372 Bright Red Transparent HF	952 Black HF
	412 Pink Transparent HF	093 Colorless HF
<b>Basic Colors (containing halogens)</b>	109 Citron	320 Bright Red
	171 Yellow Transparent	472 Violet
	213 Orange (not available in the USA)	669 Green Transparent
	307 Red	812 Brown
<b>Halogen Free Special Colors</b>	770 Silver HF	944 White Opaque HF
	780 Silver Coarse HF	953 Deep Black HF

Silver inks may be used to mix gold and other metallic colors.

**Effect Pigment Colors**

Further metallic, color-flop, pearl effect, fluorescent and other colors are available on request.

**Caution:**

The peel strength (bonding) of the silver and effect inks is lower than that of the basic colors. Back molding the special effect colors may alter the orientation of the pigment particles.

**Mesh Count**

Polyester mesh 77-48 threads/cm to 150-31 threads/cm (195-48 threads/inch to 380-31 threads/inch). A stainless steel mesh may be used for special requirements.

The following mesh counts are recommended for standard silver:

NoriPET® 770 – 120-34 threads/cm (305-34 threads/inch) or coarser

NoriPET® 780 – 77-48 threads/cm (195-48 threads/inch) or coarser

**Stencil**

Solvent resistant emulsions must be used. Excellent results during long production runs are achieved by using Pröll Diazo-UV-Polymer Emulsion Norikop 10 HQ.

**Auxiliaries**

All of the auxiliaries mentioned below are free of halogens (HF).

**Hardener**

Hardener 001 has to be mixed to the ink thoroughly prior to printing.

Addition: 1 – 3 %

Mixtures of NoriPET® ink and Hardener 001 have a pot life of 8 – 12 hours in closed cans depending on temperature and humidity.

**Thinner**

Thinner F 003 (fast)

Thinner M 212 (medium)

Thinner S 403 (slow)

They can be mixed in any ratio to achieve an optimized printing and drying result.

**Antistatic-Additive**

NORILIN® C to prevent static charging, especially when printing metallic inks.

Addition: 0.5 %

## Defoamer

Defoamer 9319 Depending on process speed and thinning percentage additional defoamer may be necessary.

Addition: 0.2 – 0.5 %

## Cleaning of Screens and Utensils

Thinner M 212 or UNI-REIN A III

## Drying

NoriPET® dries by evaporation of solvents in a jet dryer. The chemical curing process of the printed films continues in stack with no additional air supply.

## Tips on Drying

To achieve optimum results, drying in a jet-dryer should be done immediately after printing.

Drying speed can be increased by:

- drying at higher temperatures
- using dryers with good air exchange to remove the solvents.

When using a jet-dryer with different sections, recommendations can be given as below:

- First zone: 80 °C (175 °F).
- The last section with high air exchange is for cooling the printed films to ambient temperature to avoid blocking in the stack.

The drying result depends on a lot of parameters such as ratio of thinner, thickness of ink film layer and efficiency of dryer.

## Conditioning / Post-curing

For maximum heat resistance and a good long term adhesion of the injection molded parts, NoriPET® **must be post-cured.**

For this reason post-curing of the printed films prior to the molding process is strongly recommended. The best results are found when post curing is done directly after jet drying.

Highest efficiency is achieved when printed films are put on drying racks after tunnel drying to be placed in a box oven having good air circulation as well as sufficient air exchange.

### Post-curing conditions:

80 °C (175 °F) for 0.5 hours.

The forming and injection molding step should be made shortly after printing and post-curing.

## Adhesion

Most important factors for adhesion and peel strength of injection molded parts are:

- Amount of Hardener 001
- Time gap between drying and molding
- Post-drying conditions
- Resin type and quality
- Resin temperature
- Film quality

For good adhesion, at least **2 fully covering layers of NoriPET®** should be printed. The first layer can be composed of almost fully covering graphic motifs.

**Figure 1**

Process frame (time gap between drying and injection molding) for save adhesion depending on amount of hardener and resin temperature:

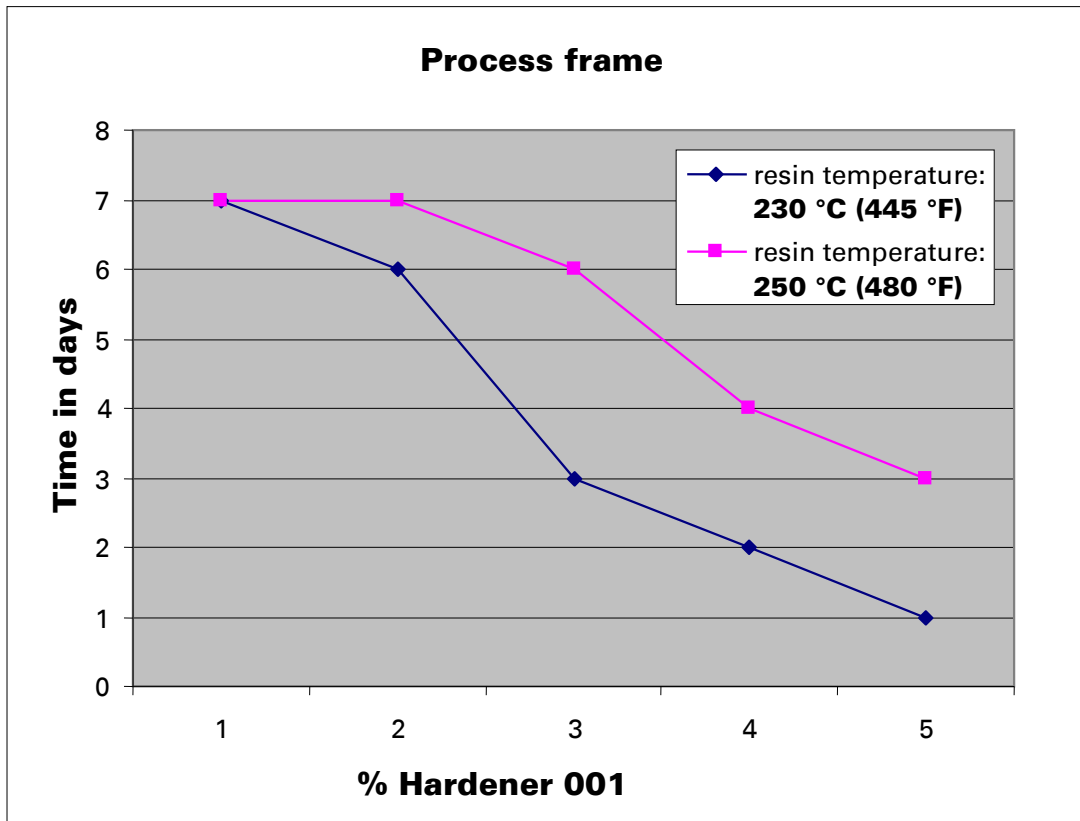
- Ink: NoriPET® 952 / NoriPET® 093 1 : 1
- Printing mesh: 100-40 threads/cm (255 threads/inch) – twice printed
- Film: Autoflex® EBG 180 L
- Resin: ABS Novodur P2H-AT
- Post drying: 0.5 h at 80 °C (175 °F)

The best adhesion is achieved when injection molding is done at high resin temperature (e. g. 250 °C, 480 °F) generally.

With the addition of 1 – 2 % Hardener 001 an optimum adhesion performance could be found within one week between printing/curing and injection molding. Additional amounts of hardener are decreasing the process window decisively, but a compensation is possible with increased resin temperature.

The post drying time and temperature should not exceed 30 minutes and 80 °C (175 °F).

**Figure 1**



**Note**

The limitation by this process frame can be avoided by a final backing of one to two layers of NoriPET® 093 without Hardener (screen mesh: 1 – 2x 100-40 threads/cm (255-40 threads/inch)). To improve the intermediate adhesion this backing should be done prior to the post-drying process.

**Safety Precautions**

NoriPET® inks are inflammable. Smoking or open flames are strictly prohibited during use of these products.

Processing NoriPET® inks requires normal hygiene in the workplace. Please see recommendations on label and read the material safety data sheets before use.

### **Shelf Life**

The shelf life stated on the label assures the ink's quality and refers to unopened original cans stored in a dry place at temperatures between 5 °C (40 °F) and 25 °C (75 °F).

### **Important**

Allow the ink as well as all the auxiliaries to be added to adjust to ambient temperature in the closed container before use.

Printing results, to a large extent, depend on the substrate as well as the printing and application conditions. We recommend checking your printing materials under your conditions of use prior to any production runs. Materials that are supposed to be identical may vary from manufacturer to manufacturer and even from batch to batch. Some substrates may have been treated with or can contain sliding agents, antistatics or other additives which will impair the adhesion of the inks.

It is not always possible to produce a given part using IMD/FIM technology.

The resins used for back molding IMD/FIM ink systems are supplied as commercial technical products. They are different in chemical composition as well as the content of additives. Process parameters will also influence the quality of the finished IMD/FIM parts.

Before starting a production run, it is necessary to test samples of each newly designed part systematically with regard to the specifications for the intended use (e.g. climatic chamber, resistance, etc.).

# Recommendations for use of **NoriPET®** in IMD/FIM Technology

## **IMD/FIM Technology**

IMD/FIM technology is distinguished by the interaction of several individual technologies:

- ink and printing
- forming
- cutting/punching
- back molding

The steps of the process must be optimized individually, then aligned with each other.

## **The NoriPET® Ink System**

NoriPET® is a solvent-based screen printing ink system expressly developed for use in the IMD/FIM process. It is suited to printing polyester films such as Autoflex® EBG 180 L or Autotex® V 200 to be back molded, particularly with ABS resins.

Each batch of NoriPET® undergoes a specific quality control test. Test results can be made available to customers upon request. This does not constitute a guarantee regarding the long-term stability of back molded parts produced with NoriPET®.

## **Forming**

Matched metal can be used as well as High-Pressure Forming. Forming depth is limited by the polyester film.

## **Back Molding**

A complex technology which **in any case** must be mastered to assure the successful application of NoriPET® in IMD/FIM technology. Specific know-how of the following parameters:

- geometry of injection gate
- temperature of molding resin
- choice of resin
- flow properties of resin
- pressure
- cycle time
- tool temperature
- cooling

are pre-requisite or must be gained through experience.

Here, the geometry of the parts to be produced is also of critical significance.

The information contained in the technical information/instruction sheets or other product information sheets is based on product testing conducted by Pröll. Because printing and environmental factors critically affect each individual ink application, the above mentioned information and instructions represent only general recommendations concerning product characteristics and directions for use and should not be construed as representing express warranties regarding the product. The information and instructions in no way release the purchaser from his obligation to verify and test the inks and their application for the specific request, regarding: product characteristics, weather resistance, mixing proportions, gloss, thinning, special mixtures, printability, drying speed, cleaning, effects on or of other materials to be contacted and safety precautions. All details contained in the instruction sheet "General Information on Screen Printing Inks" are to be considered. The further manufacture and use of products containing our inks by the purchaser takes place beyond our control, and the responsibility for further application and use of our product resides solely with the purchaser. Pröll disclaims any warranties, express or implied.

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