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NORIPHAN[®] HTR

The Ink System for Second Surface IMD/FIM Technology

NORIPHAN[®] HTR is a solvent-based one-component screen printing ink containing a thermoplastic binding agent which is resistant to high temperatures.

Films printed with NORIPHAN[®] HTR, such as Makrofol[®] and Bayfol^{®*}, are perfectly suited to the IMD/FIM process:

- formability
- temperature and washout resistance during injection molding
- good permanent bonding with injection molding resins, preferably PC

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

- Pigmentation**
- NORIPHAN[®] HTR inks contain no pigments based on toxic heavy metals (DIN EN 71, part 3).
 - NORIPHAN[®] HTR inks are based on high brilliance pigments. Nearly all shades can be mixed using basic colors.

Basic Colors

NORIPHAN[®] HTR

109	Citron	472	Violet
112	<i>HF</i> Yellow	566	<i>HF</i> Blue Transparent
171	Yellow Transparent	570	<i>HF</i> Deep Blue
213	Orange (not available in the U.S.A.)	670	Green Transparent
308	Red	812	Brown
318	<i>HF</i> Red Transparent	945	<i>HF</i> White
320	Bright Red	952	<i>HF</i> Black
372	<i>HF</i> Bright Red Transparent	093	<i>HF</i> Colorless
412	<i>HF</i> Pink Transparent		

HF = halogen free

For even greater temperature resistance (better resistance to washout), our basic colors are also available with the designation /050 (e.g. NORIPHAN[®] HTR 952/050 is high temperature resistant Black). It should be noted, however, that the formability of versions /050 may be somewhat reduced.

* Makrofol[®] and Bayfol[®] are registered trade marks used by Bayer MaterialScience AG, Germany

Special Inks

NORIPHAN® HTR

371/001	Red Transparent
770 HF	Silver
780 HF	Silver Coarse
790 HF	Silver Glossy (Press Ready)
943 HF	Blending White
944 HF	White Opaque
953 HF	Deep Black

HF = halogen free

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

Effect Pigment Colors

Additional metallic, color-flop, pearl effect, daylight and other pigments 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.

Mixed Color Shades

Mixed colors with a small proportion of NORIPHAN® HTR 945 White may exhibit coverage issues. This can be corrected by adding NORIPHAN® HTR 943 Blending White. NORIPHAN® HTR 943 should, however, be tested under the respective printing conditions (type of thinner, proportion of thinner, printing speed, etc.).

Halftone Inks

IMD/FIM halftone inks are available with the designation NORIPHAN® PCI. Additional information is given in a separate Technical Information bulletin.

Mesh Count

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

The following mesh counts are recommended for standard silver:

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

NORIPHAN® HTR 780 – 77-48 threads/cm (150-31 threads/inch) or coarser

NORIPHAN® HTR 790 – 100-40 threads/cm (255-40 threads/inch) or coarser

Stencil

Solvent resistant emulsions must be used. Excellent results during long production runs are achieved by using Pröll emulsion Norikop 8 HR.

Auxiliaries

Thinner NORIPHAN® HTR 090 (fast)

Retarder NORIPHAN® HTR 097 (medium)
NORIPHAN® HTR 097/003 (slow)

Paste NORIPHAN® HTR 097/002 (slow)

Newly formulated paste:

NORIPHAN® HTR 097/005 (fast)
NORIPHAN® HTR 097/006 (medium)
NORIPHAN® HTR 097/007 (slow)

Auxiliaries may be mixed with each other in any desired proportions.

Only NORIPHAN® HTR 090 Thinner and NORIPHAN® HTR 097 Retarder should be used for large printing areas.

Recommended addition of thinner: 15 – 20 %.

To print fine details, Retarder NORIPHAN® HTR 097/003 can be used alone or in combination with Paste NORIPHAN® HTR 097/002, 097/005, 097/006 respectively 097/007. The following proportions are recommended:

10 – 20 % NORIPHAN® HTR 097/002
5 – 10 % NORIPHAN® HTR 097/007

Matting Agent NORIPHAN® HTR Matt Paste 098
Addition: approx. 20 %

Elastificator NORIPHAN® HTR 051
To improve formability of ink layer.
Addition: 5 %

Antistatic Additive Norilin® C
To prevent static charging, especially when printing metallic inks.
Addition: 0.5 %

Defoamer Defoamer 9242
To prevent any possible flaws in color gradient (craters, bubbles). Adding too much Defoamer 9242 causes white spots.
Addition: max. 0.5 %

Cleaning Clean screen and equipment with UNI-REIN A III.

Important	<p>Printing results are dependent on the substrate as well as conditions of printing and application. We expressly recommend testing your substrate under your particular conditions before starting a print run. Materials presumed to be identical may vary from manufacturer to manufacturer or from batch to batch. Certain substrates may have been treated with or contain lubricants, anti-static agents, or other additives which could impair the adhesion of the ink.</p>
Drying	<p>NORIPHAN® HTR is a physically curing ink system which dries through evaporation of the solvent in a jet dryer.</p> <p>Note: To protect PC films from the effects of solvents, jet dryers should be used for small trial runs. Rack drying is not recommended.</p>
Tips on Drying	<p>Drying performance can be improved by:</p> <ul style="list-style-type: none"> - drying at higher temperatures - use of infrared rays (from second heating compartment on) - completely exhaust evaporated solvents lingering in the tunnel dryer – good air exchange. <p>The following settings are recommended for use with 3 zone dryers:</p> <ul style="list-style-type: none"> - First zone: 80 °C (175 °F). - Second Zone: In the second zone, the maximum temperature for processing heat sensitive Bayfol® films is 80 °C (175 °F). The maximum drying temperature for processing pure PC films (Makrofol®) is 100 °C (210 °F). If additional infrared emitters have been installed in the second compartment, they may be used to increase the efficiency of the drying operation. - Third Zone: Is for cooling at ambient temperature. <p>Drying results depend on the combination of thinner and retarder along with the thickness of the ink layer.</p>
Conditioning/ Post-curing	<p>Complete evaporation of thinner residues in ink and film is necessary for further processing of printed films in the IMD/FIM process.</p> <p>Thinner residues can lead to washout during the back molding process, or damage during the climatic test or use of the end product.</p> <p>Fully benefiting from NORIPHAN® HTR's superior properties (adhesion, suitability for back molding, etc.) requires guaranteeing an absolute minimum of solvent residues.</p> <p>Post-curing is done after printing the last color; the ideal conditions for each product must be determined individually.</p> <p>For best results, dry separately on a rack in a well ventilated box oven.</p> <p>Conditions: Post-curing at 75 – 90 °C (165 – 195 °F) for 5 hours. Maximum temperature 70 – 80 °C (160 – 175 °F) for processing heat sensitive films of PC blends such as Bayfol® CR. In case of an application of too high temperatures with Bayfol® CR a change into bluish coloring of the film could be observed.</p>

**Bonding
Strength**

The adhesion of a film/ink/plastic bonding system depends on a number of variables (production, process, and structure of product). For this reason, specific tests with respect to individual requirements are essential.

**Safety
Precautions**

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

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

Shelf Life

Do not open containers which have been cooled or heated through storage or transport until contents have attained room/ambient temperature. This also applies to auxiliaries used for adjustment.

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).

Recommendations for use of **NORIPHAN[®] HTR** in IMD/FIM Technology

Important note This special ink system has been used in production for many years, and has proven itself time and again. No adverse reports on the stability of the product or problems with adhesion/delamination have been received. Due to the great number of factors influencing the use of NORIPHAN[®] HTR for IMD/FIM Technology, no guarantees regarding the applicability of the system can be made.

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 NORIPHAN[®] HTR Ink System NORIPHAN[®] HTR is a solvent-based screen printing ink system expressly developed for use in the IMD/FIM process. It is particularly suited to printing polycarbonate films such as Makrofol[®] or PC blend films such as Bayfol[®] to be back molded, particularly with polycarbonate.

Each batch of NORIPHAN[®] HTR 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 NORIPHAN[®] HTR.

Forming The result of the forming process is strongly influenced not only by the choice of the forming technology, such as high pressure, thermal, but the geometry of the parts produced as well. Forming requires specific know-how gained through experience.

Back Molding

A complex technology which in any case must be mastered to assure the successful application of NORIPHAN® HTR 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 cooling

are a pre-requisite or must be gained through experience.

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

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

To assure suitability for its intended use, each part or combination of materials must be systematically examined using proper testing procedures (climatic test, resistance test, etc.) before start of batch production.

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.

This information supersedes all previous technical information.

Guidelines for Use of

NORIPHAN[®] HTR

- Problems and Solutions

Problem	Solutions/Recommendations
<p>1 Printing</p> <p><i>Inadequate screen open time</i></p> <p><i>Poor flow</i></p> <p><i>Cratering/Pinholing</i></p>	<ul style="list-style-type: none"> • Verify that thinning was done according to instructions. • Use NORIPHAN[®] HTR 097 or NORIPHAN[®] HTR 097/003; add more thinner. • Use Retarder Paste NORIPHAN[®] HTR 097/006 or 097/007 in combination with Retarder NORIPHAN[®] HTR 097/003 (check blocking resistance carefully). • Optimize mesh: fine threads with greater mesh opening are better than standard qualities. • Films contaminated? – Clean material and equipment. • Adjust machine settings: speed, hardness, angle, pressure of squeegee • Use finer mesh. • Check printing viscosity – try increasing and decreasing. • Check if mesh or auxiliaries are contaminated with silicone residue. Use only silicone free materials. • Check quality of films.
<p>2 Forming</p> <p><i>Cracks during forming process</i></p>	<ul style="list-style-type: none"> • Thicken ink layer by increasing number of prints or using coarser mesh (77 – 90 threads/cm, 195 – 230 threads/inch). • Verify if cracking occurs prior to forming process. If not, it can be stress cracking which can be avoided by accelerating the drying process and shortening the entire processing time: use jet dryer, no rack drying. • Check forming process and equipment. High Pressure Forming of HDVF, Niebling Junior (www.hdvf.com), is recommended. • Overprinting of the ink layers with transparent lacquer NORIPHAN[®] HTR 093. • Addition of Elasticator NORIPHAN[®] HTR 051 to the printing ink (Caution: the washout resistance will be reduced; please check the back molding results).

