

# Screen Printing Ink

**High gloss, high opacity, fast drying two-component ink, resistant to chemicals and weathering**

## Application

### Substrates

The Marabu PU is a two-component screen printing ink which is excellently suitable for application onto pre-treated polyethylene (PE) and polypropylene (PP), polyurethane (PU), polyamide (PA), melamine resins, phenolic resins, metals, coated substrates, powder coatings, thinly anodized aluminium, as well as wood.

As the mentioned substrates may be different in their printability, depending on the manufacturer, even within an individual type, preliminary trials are essential to determine suitability for the intended use.

### Field of use

Marapur PU is a versatile and highly resistant two-component ink which is applicable in all cases where highest demands for chemical and mechanical resistance for indoor and outdoor use have to be met. PU is also designed for printing onto polyolefines (PE, PP), the substrate's surface has to be pre-treated as usual by flaming or Corona-discharge. This increases the surface tension, and a sufficient adhesion can be achieved with a minimum surface tension of 42 - 48 mN/m.

For multicolour prints, especially for bronze shades, flaming is possible only once, i.e. no intermediate flaming between print sequences. The surface treatment can be tested by appropriate test inks in the usual way, or a water test, where a wetted PE or PP surface must hold the unbroken water film for about 20 sec.

Marapur PU is only suitable for printing on new PE and PP with a max. percentage of 20 % regrind in the granulated material. Any more than this, and adhesion will suffer. Therefore, preliminary trials are necessary. (For further details, please see supplementary Aweta-Info 1/97.)

On non pre-treated PP, ink adhesion can also be achieved by a coat of our colourless Special Primer P 2, without flaming or Corona treatment.

PU can also be processed with a spray gun, but preliminary trials are necessary for this process. We recommend to filter the thinned ink (25 µm screen) before processing, as otherwise there could be bubbles in the ink film.

## Characteristics

### Mixing ratio

Prior to printing, it is necessary to add hardener PUH, PEMH, or HT 1 to the ink in the proper mixing ratio. Please mix this ink-hardener mixture well, then thin it to printing viscosity by adding thinner and/or retarder and mix again.

This slows down somewhat the hardening reaction which begins spontaneously, and so the pot life is extended to an acceptable period of time.



Marabu

## Marapur PU

**For pre-treated polyethylene (PE) and polypropylene (PP), thermo-setting plastics, metals, and top-coated surfaces**

The proper mixing ratios are:

### All basic shades

4 parts by weight of ink + 1 part by weight of hardener  
or  
800 gs Marapur PU + 200gs of Hardener PUH, PEMH, or HT1

### Printing varnish PU 910 or PU 911

3 parts by weight of varnish + 1 part by weight of hardener  
or  
600 gs varnish + 200gs of Hardener PUH, PEMH or HT1

For ink mixtures of basic shades with varnish PU 910, the proper addition of hardener must be calculated in the correct ratio.

Before printing, the finished ink mixture should rest for 10 min., to allow the air bubbles to rise and burst.

### Pot life (processing period)

The mixture ink-hardener is chemically reactive and must be processed within the following periods (if stored at 20 °C):

PU + PUH: 8 hours  
PU + PEMH: 4 hours  
PU + HT 1: about 6 months

The Hardener HT 1 is a heat-reactive isocyanate hardener and therefore must be dried with forced heat at 150 °C for 30 min. in an oven.

Increased processing temperatures of more than 20 °C reduce the pot life. If the mentioned pot life is exceeded, the ink's adhesion and resistance may be reduced, even if the ink characteristics show no noticeable change.

By continuously adding freshly mixed ink plus hardener, the pot life can be extended up to 24 hours in the 3-shift operation with less ink consumption.

### Drying/Hardening

Parallel to physical drying, i.e. evaporation of solvents, the actual hardening of the ink film is caused by the chemical cross-linking reaction between ink and hardener.

The following standard values concerning the progressive cross-linking reaction (hardening) of the ink film are experienced:

Simple print, fabric 100-40 (T):

Drying degree	temperature	PUH	PEMH
ready to be overprinted	20 °C	15 min	10 min
	60 °C	4 min	2 min
	120 °C	1 min	20 sec
stackable	20 °C	4 h	3 h
	60 °C	30 min	20 min
	120 °C	10 min	6 min
final hardness	20 °C	8 days	6 days
pot life	20 °C	8 h	4 h



As the drying times mentioned above vary according to the printed ink film thickness, air humidity, drying conditions and the selection of auxiliaries used such as thinner and/or retarder, the mentioned times are only guidelines. If multicolour prints are dried with forced heat between printing sequences (by hot air or infra-red), the time for overprinting is reduced to approx. 3-4 min.

Due to the extreme high stress for substrate and ink, we do not recommend intermediate drying by flame. When drying with forced heat of more than 160 °C, the heat application must not exceed 5 min., as otherwise there will be a yellowing, especially with White 070.

Generally an extended drying time is necessary when overprinting the ink.

Processing and hardening temperatures should not be below 15 °C during printing and 8 hours after printing, otherwise irreversible damage can occur when the ink film is formed. Please also avoid exposure of the ink to high humidity or directly to water (rain) during and after printing, for 8 hours at 20 °C or 12 hours at 15 °C, because adhesion between ink and substrate will be affected strongly.

### Overprinting

Please bear in mind that the ink film underneath is not chemically cured when first overprinted. If the ink film is dried at room temperature 20 °C, overprinting must be carried out with hardener PUH in the course of 12 hours and with hardener PEMH in the course of 8 hours at the latest. We recommend to carry out the overprinting as soon as possible, in order to guarantee good adhesion between the ink layers.

### Fade resistance

Marapur PU contains a highly weather-resistant binder and fade-resistant pigments. Therefore, the basic shades of Marapur PU plus overcoating with PU 911 are suitable for long-term outdoor use up to 5 years (referred to the moderate Central European climate). However, the ink must be processed properly, the printed layer thickness (fabric 77-55 [T] to 90-48 [T]) must be appropriate, as well as the adhesion and scratch resistance of the substrate, and the pre-treatment and substrate quality.

Shades mixed with more than 20 % of printing varnish PU 910, and/or other standard shades (especially white), show a lower fade and weather resistance. The outdoor resistance is also reduced, if the density of the printed ink film is reduced (due to the use of finer fabric). For outdoor use, we recommend the White 070 instead of the highly pigmented Opaque White 170 as well as the non yellowing hardeners PUH or HT 1 instead of PEMH.

All pigments used are resistant to solvents and plasticizers.

### Stress resistance

After proper and thorough drying (20 °C - 8 days), the ink film exhibits outstanding adhesion as well as rub and scratch resistance and is resistant to most usual fillers (slightly alkaline to acid), as well as to alcohol, oils, greases, finger sweat, petrol, battery acid, and other solvents. In general, the chemical resistance of PU is improved by heat forced drying, e.g 150 °C for 30 min. If hardener HT 1 is used, oven drying is essential.

### Range

Marabu-ColorManager (MCM) colour matching system includes the basic shades of System 21. All shades are intermiscible. The Marapur PU ink should not be mixed with other types of ink, to maintain the special characteristics of this outstanding ink range.

The pigments used in the below mentioned standard shades, based on their chemical structure, correspond to the EEC regulations EN 71/part 3, safety of toys - migration of specific elements -. All colours are suitable for printing onto toys.

### Basic shades

see Shade Card Marapur PU

PU 020	Lemon	PU 055	Ultramarine Blue
PU 021	MediumYellow	PU 056	Turquoise Blue
PU 022	Yellow Orange	PU 057	Brilliant Blue
PU 026	Light Yellow	PU 058	Deep Blue
PU 031	Scarlet Red	PU 059	Royal Blue
PU 032	Carmine Red	PU 064	Yellow Green
PU 033	Magenta	PU 067	Grass Green
PU 035	Bright Red	PU 068	Brilliant Green
PU 036	Vermilion	PU 070	White
PU 037	Purple Red	PU 073	Black
PU 045	Dark Brown		

By using these basic shades in accordance with the mixing ratios given in the Marabu-ColorManager (MCM) software, it is possible to produce shades of the ink systems HKS, RAL and Marabu System 21.

### Further basic shade

PU 170 Opaque White

### Press-ready bronzes as standard shades

PU 191 Silver, press-ready  
PU 193 Rich Gold, press-ready

### Additives

Bronze binder:	PU 910 (600 gs)
Printing varnish, high-gloss:	PU 910 (600 gs)
Printing varnish with UV absorber:	PU 911 (600 gs)



The printing varnish PU 911 additionally contains a UV-absorber and is designed to overcoat prints for long-term outdoor use.

**Bronzes:** to be mixed with PU 910

All bronze shades are shown in a separate bronze colour chart.

S 181 Aluminium (6:1)	S 184 Pale Gold (4:1)
S 182 Rich Pale Gold (4:1)	S 186 Copper (3:1)
S 183 Rich Gold (4:1)	S 190 Aluminium (rub-resistant, 8:1)

Mixed bronzes are unstable and must be processed within 8 hours.

Bronze shades of bronze powder are susceptible to dry abrasion which can only be reduced by appropriate over-vernishing with PU 910.

All figures in brackets are guidelines which can be varied, according to opacity and ink price. The ratio figures in brackets refer to the mixture bronze binder PU 910 to bronze powder, the first figure standing for the parts by weight of bronze binder PU 910. Due to the larger grain size of bronze pigments, we recommend a fabric of 120-34 (T), 120-31 (S) or coarser.

### High-gloss bronzes, pastes

Furthermore, 3 high-gloss bronze concentrates are available as pastes, to be used by mixing them with bronze binder PU 910 (mixing ratio 5:1 - 10:1), (see separate Technical Data Sheet "High-Gloss Bronze Concentrates").

S 291 High-gloss Silver
S 292 High-gloss Rich Pale Gold
S 293 High-gloss Rich Gold

Due to the smaller pigment size compared to the bronze powders, you can work with finer fabrics of 140-31 (S) threads to 150-34 (T) at an acceptable price. Bronze shades of high-gloss bronze concentrates exhibit high weather resistance and only a small dry abrasion.

### Auxiliaries

Thinner:	PUV
Spray Thinner:	7037
Retarder, standard:	SV 1
Retarder, very slow:	SV 9
Hardener:	PUH
	PEMH, fast hardener
Hardener, heat-reactive:	HT 1

Mixing ratio: 4 parts of ink + 1 part of hardener  
3 parts of printing varnish + 1 part of hardener

Matt Paste: PUM (5-20 %)

Matting Powder: MP (1-4 %)

Special Primer for PP: P 2

Cleaner: UR 3

Printing Modifier: ES (0,5-1 %)

Briefly before using the ink, the hardener should be stirred into the undiluted ink. An addition of 5-10 % thinner and/or retarder will usually be sufficient to adjust printing viscosity. To produce a retarding effect for slow printing sequences, the retarder is added to the thinner proportionately (about 50 %). For an ink mixture containing retarder, only pure thinner without retarder should be used for additional thinning during print run. For hand printing, pure retarder SV 1 or SV 9 may be added.

By adding PUM matt paste, the gloss effect of the Marabu PU can be reduced. If hardener is added subsequently, please bear in mind the amount of PUM, i.e. to 4 parts by weight of ink mixture (plus PUM), one part by weight of hardener should be added. The addition of up to 20 % of PUM or 1-4 % (White up to 2 %) of MP powder will not affect noticeably the resistance of the ink. An excessive addition may reduce outdoor resistance and resistance to chemicals.

Printing Modifier ES contains silicone. It can be used to rectify flow problems of the printed ink film by adding 0,5-1 % by weight to the ink. If an excessive amount is added, flow problems are increased, and adhesion may be reduced, especially when overprinting.

The hardeners PUH, PEMH, and HT 1 are sensitive to humidity. Please always store these hardeners in a sealed container. The shelf life of the hardeners is one year maximum.

It is recommended to clean the screens immediately after printing with cleaner UR 3.

### Fabrics and stencils

All types of commercially available polyester fabrics and solvent-resistant stencils can be used. For a good opacity on coloured substrates, we recommend a fabric between 68-64 (T) and 90-48 (T), and for printing finest details 100-40 (T) to 120-34 (T).



## Labelling

For our ink type Marapur PU and its additives and auxiliaries there are current Material Safety Data Sheets according to EC-regulation 91/155, informing in detail about all relevant safety data including the labelling according to the present EEC regulations as to health and safety labelling requirements. Such health and safety data may also be obtained from the respective label.

The ink has a flash point between 21 °C and 100 °C. Since the ink is not considered as a flammable liquid due to its pastous nature, any specific regulations for the handling of flammable liquids do not apply to the ink.

## Note

Our technical advice whether spoken, written, or through test trials corresponds to our current knowledge to inform about our products and their use. This is not meant as an assurance for certain properties of the products nor their suitability for each application. You are, therefore, obliged to conduct your own tests with our supplied products to confirm their suitability for the desired process or purpose. The selection and testing of the ink for specific application is exclusively your responsibility.

Should, however, any liability claims arise, such claims shall be limited to the value of the goods delivered by us and utilised by you with respect to any and all damages not caused intentionally or by gross negligence.