

Pad Printing Auxiliaries and Additives

Information about the correct use

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Pad printing is a universal printing method of virtually unlimited potential, most commonly used for the decoration of 3D objects, and information purposes in industrial production processes. Considering the wide variety of applications and pad printing devices, naturally the pad printing ink must be fine-tuned individually, according to the required demands. The relevant auxiliaries and additives are described in this TechINFO.

Note

An optimal effect can only be achieved if the additives and auxiliaries are weighed accurately. The specifications for each particular type of ink are given in the technical data sheets.



Content

1. Viscosity
2. Ink adjustment
3. Opacity
4. Matting of inks
5. Ink flow
6. Static charge
7. Adhesion modifier
8. Pre-cleaning
9. Hardeners
10. Summary

Marabu offers a range of solvent-based inks, and a UV-curable ink for pad printing. The specific characteristics and applications for the different types of ink are described in detail on the Marabu homepage www.marabu-inks.com.

Attention

Addition of an auxiliary changes the characteristics of the ink system. It is therefore necessary to carry out adequate tests before starting the print run. All of the quantities specified below are percentage by weight, not percentage by volume.

An excessive addition of auxiliaries may have a negative effect on the print results and may cause ink flow problems or loss of adhesion, especially with overprinting. It is therefore essential to use a precise balance and to follow procedures exactly.

1. Viscosity

Viscosity is the measurement of how thin (low viscosity) or how thick (high viscosity) an ink is. It is necessary to verify the correct viscosity before printing as this has a very strong influence on the release of the ink from the pad, ink flow, edge definition, possible drying-in in the cliché, as well as adhesion of the ink.

Due to very different printing presses and market requirements, solvent-based inks are not press-ready. The viscosity of an ink is thus to be adjusted before printing by adding thinner.

The UV-curable ink series Tampacure TPC is no exception to this.

When formulating the basic shades of an ink type, they are as much as possible adjusted to as a uniform viscosity range. Exceptions are:

- **White/Opaque White** – these have a significantly higher viscosity than colour shades because of their particularly high pigment content. Nevertheless, the thinner percentage should not be increased above the given values for the corresponding inks.
- **High-opaque Shades** – like white and opaque white, they also have a higher viscosity than colour shades because of their elevated pigment content. As with white shades, however, the quantity of thinner added should not be more than for basic colour shades.
- **4-Colour Process Shades** – in some ink ranges, the 4-colour-process shades feature a higher viscosity than the basic shades in order to ensure optimal contour and dot definition.

Thinner

An addition of thinner not only affects the viscosity, flow properties, and release characteristics of the ink from the pad but also has a substantial influence on the drying speed, packaging characteristics, as well as adhesion to the substrate. Special thinners offering specific characteristics are also available. The standard range of thinners includes thinner TPV and the fast thinner TPV 2. The recommended thinner is listed in the technical data sheet of the respective ink series, or on the label of the ink container.

NEW:

Thinner VD 6661000 (soon-to-be „TPV7“)

All-purpose thinner for improved ink transfer of all pad printing inks, especially for fast printing. It features good mixing and solving properties, combined with a long processing period.

Retarder

Retarders are solvents that have a significantly slower evaporation rate. They are only added to the ink if the drying of the ink on the pad or in the cliché is to be slowed. This may be necessary if the cycle time is very slow or if a shuttle is used on multi-colour machines.

Product overview and properties

Thinners and retarders are generally a combination of different solvents that are formulated to achieve specific properties. Important criteria are the rate of evaporation as well as the dissolving strength. In general terms, thinners dry faster than retarders.

Thinner

	Evaporation val.*	Solving strength	Flash point	Odour	H&S symb.
TPV	30-50	good	44°C	mild	Xi
TPV2	10-20	very good	28°C	average	free
TPV3	200-250	very good	58°C	mild	Xn
TPV	30-50	good	44°C	mild	Xi
TPV6	30-50	very good	50°C	average	Xn,+ N
TPV7	30-40	satisf.- good	36°C	average	Xn,+ N
PPTPV	30-50	satisf.	33°C	mild	Xn + N
GLTPV	10-20	very good	29°C	average	Xi

Remarks

The figures given in the “evaporation value” column are based on data for the solvent used without taking into consideration possible interactions of solvent mixtures or their influence on the binder. Therefore, this value cannot be used for drawing conclusions about the quality of ink transfer. The values are provided as guides who need to be checked under real production conditions.

The data given in the column “H&S Symbol” are also only for guiding purposes and do not substitute a full and up-to-date declaration in the safety data sheet or on the label. The entries in the column “odour” are purely subjective, and reactions to odours may differ considerably.

Retarder

	Evaporation value*	Solving strength	Flash point	Odour	H&S symb.
SV1	450-500	good	82°C	mild	Xi
SV5	250-300	good	77°C	mild	Xn

2. Ink adjustment

All pad printing inks must be adjusted by adding thinner before printing. The adjustment of the ink generally depends on a number of parameters such as ink type, type and depth of cliché, ink cup system (closed/open), machine speed, as well as shape, size, and hardness of the pad. The quantities given on the following pages are based on a room temperature of 20°C and are intended to provide a quick start formulation:

Cleaner

	Evaporation value*	Solving strength	Flash point	Odour	H&S symb.
UR3	30-50	good	42°C	mild	Xn+N
UR4	80-100	good	52°C	mild	Xi

*compared to Ether = 1

satisf. = satisfactory

Xi = Irritant, Xn = Harmful, N = Dangerous for the environment

	Tampastar TPR	Tampaplus TPL	Tampapol TPY
	TPR is a 1 or 2-component solvent-based ink which should be precisely adjusted and processed within narrow limits. The ink otherwise may tend to build up on the pad, and static problems may be the result.	TPL is a 1 or 2-component solvent-based ink which offers very easy processing and full ink transfer. Special feature: Starting with batch 227, TPL is free of aromatic compounds & PAA and features lowest PAH values.	TPY is a 1 or 2-component solvent-based ink with a very high solid content, very easy processing, and full ink transfer.
Hardener H 1 (slow)	•	• *	•
Hardener H 2 (fast)	•	•	•
Hardener HT 1 (heat reactive)	•	-	•
Mixing ratio Ink : Hardener	10 : 1	10 : 1	10 : 1
Varnish : Hardener			
Cliché	steel etch 18 - 21µ	steel etch 18 - 28µ	steel etch 20 - 28µ
Ink well (open)	10 - 20 % TPV	10 - 20 % TPV or TPV3/TPV	15 - 20 % TPV
Ink cup (< 25 prints/min)	10 - 20 % TPV	10 - 20 % TPV	15 - 20 % TPV
Ink cup (>25 prints /min)	15 % TPV 2	15 % TPV 2	15 - 20 % TPV 2 TPV 3 for fine details
Rotary pad	Not recommended	25-30% TPV	25 - 30 % TPV TPV 2 for high speeds; Exception: TPY 470 max. 10-15 %
Retarder	SV 1, VP	SV 1, VP	SV 1, VP
Matting Powder MP	•	•	•
Antistatic Paste AP	•	• *	•
Opaqing Paste OP 170	•	• *	•
Primer P 2	-	-	•
Cleaner	UR 3, UR 4	UR 3*, UR 4	UR 3, UR 4
Printing Modifier ES	Max. 1%	Max. 1%*	Max. 1%
Overprint Varnish	TPR 910	-	TPY 910

* contains aromatic compounds!

	Tampapur TPU	Tampatech TPT	Tampaflex TPF
	<p>TPU is a 2-component solvent-based ink with a very high solid content and excellent chemical and mechanical resistance. TPU must be adjusted very accurately (not too thin) and is a rather slow drying ink system. Special feature: TPU 922-980, 122-162, and TPU 191 are certified according to Oeko-Tex® Standard 100. Certification #11.0.00714</p>	<p>TPT is a "fast" 2-component solvent-based ink with a high solid content and a long pot life (up to 16h). Generally, a full ink transfer is achieved and an easy-to-process 4-clr. process set is also available.</p>	<p>TPF is a 2-component solvent-based ink which is to be processed within narrow limits, showing best results using a hard and steep pad. Attention: Do not store TPF below 20°C</p>
Hardener H 1 (slow)	•	-	for TPE 's / 10%
Hardener H 2 (fast)	•	•	for soft touch surfaces / 25%
Hardener HT 1 (heat reactive)	•	•	-
Mixing ratio Ink : Hardener	4 : 1	4 : 1	H 1 = 10 : 1 H 2 = 4 : 1
Varnish : Hardener	3 : 1		
Cliché	steel etch 20 - 24µ	steel etch 20 - 24µ	steel etch 18 - 22µ
Ink well (open)	10 - 15 % TPV	10 - 15% TPV	20 - 25 % TPV 6
Ink cup (< 25 prints/min)	10 - 15 % TPV	10 - 15% TPV	20 - 25 % TPV 6
Ink cup (> 25 prints /min)	-	10 - 15% TPV 2	20 % TPV 2
Rotary pad	25 - 35 % TPV / TPV 2	25 - 30 % TPV / TPV 2	Not tested yet
Retarder	SV 1, VP	SV 1, VP	SV 1, VP
Matting Powder MP	•	•	•
Antistatic Paste AP	•	•	5-8%
Opaqing Paste OP 170	•	•	-
Primer P 2	•	•	•
Cleaner	UR 3, UR 4	UR 4	UR 4
Printing Modifier ES	Max. 1%	Max. 1%	Max. 0,5%
Overprint Varnish	TPU 910	TPT 910	TPF 910

	TampaRota-Speed TPRS	TampaRota-Speed TPHF	Tampacure TPC
	TPRS is a 1 or 2-component solvent-based ink with pre-adjusted viscosity for rotary pad printing.	TPHF is a 1 or 2-component solvent-based ink, free of halogen and aromatic compounds, with pre-adjusted viscosity for rotary pad printing.	TPC is a UV-curable pad printing ink and should be adjusted to the correct viscosity before use by adding thinner. TPC fully transfers and does not build up on the pad.
Hardener H 1 (slow)	•	-	•
Hardener H 2 (fast)	-	•	•
Mixing ratio Ink : Hardener	10 : 1,5	10 : 1	20 : 1
Varnish : Hardener	10 : 1	5 : 1	
Cliché	steel etch half tone: 22 - 30µ non half tone: 20 - 22µ	steel etch half tone: 22 - 30µ non half tone: 20 - 22µ	steel etch 18 - 22µ
Ink well (open)	-	-	5 - 10 % TPV2, or TPV
Ink cup (< 25 prints/min)	-	-	5 - 10 % TPV2
Ink cup (> 25 prints /min)	-	-	5 - 10 % TPV2
Rotary pad	Continua / Big Wheel:		10 - 15% TPV 2
	5 - 15 % TPV	5 - 15 % TPV	
	Rotoprint / Mini Wheel:		
	10 - 20 % TPV2 /altern. TPV7	10 - 20 % TPV2	
Retarder	SV 5, VP	-	-
Matting Powder MP	•	•	•
Antistatic Paste AP	•	• *	-
Opaqing Paste OP 170	•	-	•
Primer P 2	-	-	•
Cleaner	UR 3, UR 4	UR 3*, UR 4	UR 3, UR 4
Printing Modifier ES	Max. 1%	Max. 1%*	Max. 1%
Others	-	Thickening Agent STM (for flat printing only)	Accelerator UV-B 1 (1-2%) Adhesion modifier UV-HV 1 (2%)
Overprint Varnish	TPRS 910 + 10% H1 or TPU 910 + 15% H1	TPHF 910 + 10% H2 or TPT 910 + 25% H2	TPC 910

* contains aromatic compounds!

	Glass Ink GL	Maraprop PP
	GL is a 2-component solvent-based ink which is to be processed within narrow limits. For best results, use a very hard and steep pad and a screened cliché.	PP is a 1-component solvent-based ink for printing onto pre-treated and untreated polypropylene. Maraprop is rather viscous. It therefore requires a higher amount of thinner than other inks. The transfer of ink from the pad is low, but it does not build up a thick layer on the pad.
GLH	•	-
Mixing ratio Ink : Hardener	20 : 1	-
Varnish : Hardener		-
Cliché	steel etch 18 - 21µ	steel etch 18 - 25µ
Ink well (open)	5 % GLTPV / altern. TPV7 or 2 - 5 % AP-Paste	20 - 25 % PPTPV
Ink cup (< 25 prints/min)	5 - 10 % GLTPV/ altern. TPV7	20 - 25 % PPTPV
Ink cup (> 25 prints /min)		
Rotary pad	Not recommended	30 - 35 % PPTPV + 3 % AP
Retarder	SV 1	SV 1
Matting Powder MP	•	•
Antistatic Paste AP	•	•
Opaquing Paste OP 170	-	-
Primer P 2	-	•
Cleaner	UR 3, UR 4	UR 3, UR 4
Printing Modifier ES	-	Max. 1%
Others	Verlaufmittel VM 1	-
Overprint Varnish	GL 910	-

	Librastar HF	Maralox LX
	HF is a 1 or 2-component solvent-based screen and pad printing ink which is free of halogens, and suitable for printing onto electronic parts or casings, and toys.	LX is a 1-component oxidative drying pad printing ink, which is characterized by very good printability. Owing to a slower drying process, it is recommended for applications which are not immediately packaged or further processed.
Hardener H 2	•	-
Mixing ratio Ink : Hardener	10 : 1	
Varnish : Hardener		
Cliché	steel etch 18 - 21µ	steel etch 20 - 28µ
Ink well (open)	10 - 20 % TPV	10 -15 % PPTPV / TPV
Ink cup (< 25 prints/min)	10 - 20 % TPV	10 -15 % TPV
Ink cup (>25 prints /min)	15 % TPV 2	15 % TPV 2
Rotary pad	Not recommended	Not recommended
Retarder	-	SV 1, SV 5
Matting Powder MP	•	•
Antistatic Paste AP	•	•
Opaquing Paste OP 170	•	•
Primer P 2	-	-
Cleaner	UR 3, UR 4	UR 3, UR 4
Printing Modifier ES	Max. 1%	Max. 1%
Others	Plasticizer WM 1 (2-5%)	-
Overprint Varnish	HF 910	LX 910

3. Opacity

Almost all pad printing ink series feature 17 standard shades according to System Tampacolor. This ink system embraces a combination of opaque and transparent shades, thus allowing to achieve brilliant colours. If a high opacity is required for printing onto dark substrates, the following options are available. Keep in mind, however, that an increase in opacity will likely lead to a slight reduction in brilliance.

High-opaque shades

Most Marabu pad printing inks have been complemented with 4 high-opaque shades:

- 122 Light Yellow
- 130 Vermilion
- 152 Ultramarine Blue
- 162 Grass Green

The Marabu-ColorManager MCM includes optimized opaque and high-opaque colour

match formulas, enabling good matches with colour references such as RAL, HKS, and PANTONE.

Opaquing Paste OP 170

The addition of Opaquing Paste OP 170 significantly increases the opacity of colour shades without substantially influencing the resistance to chemicals or dry abrasion. Max. addition amounts to 15 %. OP 170 is not suitable for use with white inks.

4. Matting of inks

The gloss level of a solvent-based pad printing ink can be reduced by adding the corresponding auxiliaries.

Matting Paste ABM

Addition of 5-20% Matting Paste ABM – which can be used with all 1-component inks – will change the ink's degree of gloss to range from slightly matt to highly matt.

The matt effect is due to a roughening or structuring of the ink surface which reduces reflection of the light, thus giving a matt appearance. With an increasing addition of ABM, the opacity as well as resistance to abrasion is reduced.

We do not recommend the use of Matting Paste ABM with the 2-component inks TPU, TPT, and GL, nor the UV-curable TPC. Matting Powder MP must be used in these cases.

Matting Powder MP

If a matt effect is to be achieved without loss of opacity, the universally suitable Matting Powder MP is to be added. It is especially recommended for matting 2-component inks, as well as the UV-curable ink system.

Addition should be 1-4% max. (for white, max. 2%) and is to be stirred into the ink mechanically.

5. Ink flow improvement

All ink systems contain flow agents to avoid air bubbles in the printing ink through the continuous motion of the doctor blade or intensive stirring.

If flow problems arise, in most of the cases this will be the result of ink-repelling residues on the surface of the print substrate. This may also be due to the viscosity of the ink being too high which can be avoided by adding further thinner. If this does not improve the situation, Printing Modifier ES can be added.

This auxiliary contains silicone which reduces the surface tension of the ink with an additional defoaming function.

The quantity added must not exceed 1% (accurate weighing out!) as, otherwise, adhesion problems may occur, especially when overprinting.

6. Static charge

When printing onto non-polar plastics and plastics sensitive to static charge, we recommend to add 10-15 % of the antistatic paste AP to the ink. This paste decreases the viscosity of the ink and reduces at the same time the static charge through polar solvents.

7. Adhesion promoter

Polyolefins such as polyethylene (PE) and polypropylene (PP) must be pre-treated before printing to achieve an adhesion of the ink. An exception to this is polypropylene if Maraprop PP is used.

In addition to the traditional pre-treatments such as Corona or flame, a special product is available for polypropylene –Primer P2.

Primer P2

This special product is applied over the entire polypropylene surface manually prior to printing by using a cloth or spray pistol. After dry-

ing, the polypropylene substrate can be printed, using a 1 or 2-component ink.

Please note that printing must occur 1-2 days after the application of Primer P 2.

NEW:

Print and adhesion modifier HM6067200Rx

This universal additive can be used for all pad printing inks (except Glass ink GL), and improves the ink transfer from the pad to the substrate. The addition of 3-5% (max. 10%) also solves adhesion problems (tape test). Preliminary trials are essential.

8. Pre-cleaning

Many materials such as soft PVC or powder-coated or lacquered substrates have additives or plasticizers on their surface which are normally not visible to the naked eye. If they are not removed prior to printing, then the ink will be applied to this layer rather than directly to the material, often resulting in poor adhesion.

Tarpaulin Cleaner PLR

This mild alcohol-based cleaner can be applied with a cloth to remove residues from the surface of the substrate and improves the adhesion of the ink.

9. Hardeners

Some ink systems can be used as either 1- or 2-component systems. Hardener can be added to these universal inks to increase the adhesion to difficult substrates and to improve the chemical and mechanical resistances. For 2-component inks, hardener must be added.

It should be noted, however, that the addition of hardener will reduce pot life to 8-16 hours (except with Hardener HT 1), depending on the ink type. The following hardeners are available for the Marabu ink systems:

Hardener H 1

Hardener H 1 is an aliphatic polyisocyanate that produces a relatively flexible ink film with a long pot life. The film dries slowly and does not yellow upon exposure to UV radiation.

Hardener H 2

Hardener H 2 is a fast drying, aromatic polyisocyanate with shorter pot life producing a hard and brittle ink film. It causes a yellowing of the ink film upon exposure to strong UV-light which becomes evident with varnish, white, and light colour shades.

Hardener HT 1

This heat-reactive hardener reacts with the binder of the ink only when oven drying at 150 °C for 30 minutes. Hardener HT 1 may be used instead of H 1 or H 2 and is added in the same quantity. It has the considerable advantage of a pot life of up to 6 months! Caution: HT 1 can only be used with heat-resistant substrates.

Hardener GLH

This hardener has been formulated specifically for Glass Ink GL and is not recommended for any other ink type.

Notes on hardeners

Hardeners are generally sensitive to humidity. The printed products must dry over the first 24 hours in an atmosphere of possibly low humidity, otherwise components of the hardener react with the humidity rather than with the ink. The hardeners (tube or can) must also be stored completely sealed to avoid any entry of humidity.

Furthermore with all 2-component systems, the degree of cross-linking between hardener and ink is strongly influenced by the temperature which consequently influences the chemical and mechanical resistances of the ink film. An optimum cross-linking and best resistance is achieved with heat-forced drying at 150 °C for 30 minutes directly after printing.

2-component ink systems can be dried at room temperature. Full cross-linking, however, will take between 7 and 10 days and the resistance of the ink film may be lower than with heat-forced drying. Oven drying may be essential when printing onto difficult substrates such as glass, some metals, or thermosetting plastics, or if the ink film must be dish-washer resistant, for example.

10. Summary

Fact is: „Too much of a good thing is no good“. Auxiliaries and additives should be used carefully in order to adjust the ink to the printing conditions. Excessive addition may lead to anything but the desired effect, and may impair properties like drying, resistance, printability and over-printability. Preliminary trials are essential.

This TechINFO is intended to provide assistance if the ink needs to be modified. Selection and use of auxiliaries and additives must be well-considered and is the exclusive responsibility of the printer. The use of a precise scale is crucial.

For further questions, please feel free to contact our technical hotline!