huber group

UV-curing inks and varnishes

Directions for use

Contents

Composition of UV-curing varnishes

UV inks are put together from pigments, vehicles and additives. With a few exceptions, the pigments are the same as those used in conventional inks. In addition to chromatic colours, black, opaque white and metal-pigmented UV-curing inks, fluorescent versions are also available.

Vehicles (acrylates)		**Photoinitiator**	**Additives**
Prepolymer (high-viscosity)	Monomer (low-viscosity)		Stabiliser Slip agent Extender

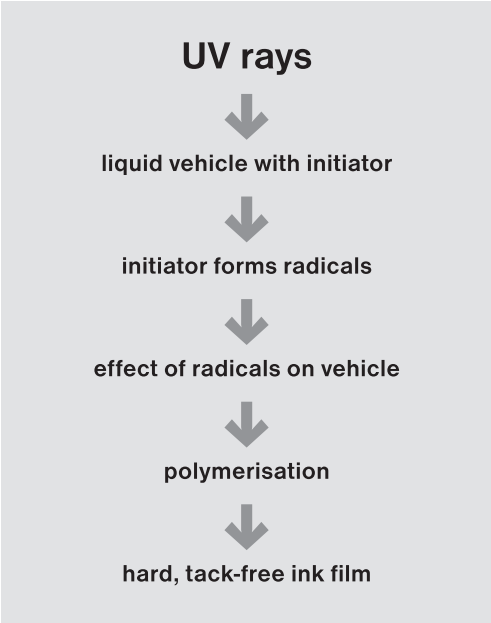
Wetting of the pigments by the relatively polar UV vehicles is in some cases less favourable than with conventional offset inks. This has a negative effect with respect to the consistency and intensity of the inks. The inks are short (viscous), compact and have poor flow characteristics. The pigment uptake of UV vehicles is limited. In isolated cases, the shelf life of the inks is also negatively influenced by the pigmentation.

The vehicles are products that are manufactured on a purely synthetic basis. They are acrylates of different chemical structure and varying viscosity. In conjunction with photoinitiators, these acrylates are highly reactive. Additives take the form of stabilisers, extenders, slip agents and photoinitiators. In particular, photoinitiators are responsible for triggering and for the course of the crosslinking reaction.

UV inks are not miscible with inks or auxiliaries with a conventional vehicle or auxiliaries composition.

Drying

Crosslinking of the liquid, reactive vehicle components takes place by means of the chemical mechanism of a radical chain reaction triggered by the application of UV radiation energy.



The energy potential of electromagnetic rays is inversely proportional to their wavelength. The shorter the wavelength, the higher the energy potential of the radiation. Short-wave UV light consequently has greater energy than long-wave light.

Hindrance of reaction

Absorption of short-wave UV radiation energy by pigments and fillers is high, the penetration depth of the UV rays in ink films low.

One characteristic of pigments – which account for up to 30 % of the overall composition of inks – is that they absorb those short-wave rays necessary for the reaction and consequently extract activation energy from the reactive components in the ink (the photoinitiators and vehicle).

The absorption characteristic of dark and opaque pigments is high and it increases as the pigment concentration and ink film thickness increase. High-energy, short-wave UV radiation is “consumed” at the surface of ink films. With thick ink films, this results is crosslinking of the vehicle being hindered, right down to the lower layers of the print.

When carrying out wet-on-wet multi-colour printing, UV inks with the highest rate of UV absorption are therefore printed first.

Washup solution

Alcohol, ester, ketones are suitable.

RECOMMENDATION

Use diacetone alcohol with 15 to max. 20 % water added. White spirit is not suitable.

Diacetone alcohol has the following advantages:

a) Miscible with water.

b) Flash point 58 °C; with 15 % water added = 94 °C

Available under the sales reference number **10 V 1004 09**.

Never use any washup solutions containing chlorinated hydrocarbons!

Technical prerequisites

The vehicles of UV-curing products, which differ from those of conventional offset inks, and UV washup solutions necessitate the use of special inking-roller and fount-roller coverings. EPDM material (ethylene propylene-diene rubber) provides a solution when using exclusively UV-curing inks. This is not the case for dayglow fluorescent inks and metal-pigmented inks.

Nitrile-rubber-based (NBR materials) roller coverings are suitable for the use of metal-pigmented UV inks and for alternating operation with conventional, mineral-oil-based offset inks.

- NBR quality – suitable for alternating operation with conventional and UV inks
- EPDM qualities – exclusively for UV inks

CAUTION

Mineral oils destroy EPDM materials.

Rubber blankets

Nitrile-rubber blankets (suitable for alternating use of conventional and UV inks). EPDM blankets are also suitable; however, they are destroyed by mineral oils and white spirit.

Printing plates for wet offset

All printing plates with a smooth surface in the non-image areas are suitable.

Stereotype plates – positive or negative working – should be baked if possible. Contact your plate supplier for plates which are suitable for this purpose.

IMPORTANT

Gum the plates during stoppages as there is a risk of oxidisation.

UV emitters

Sufficient power and suitable (ozone-producing) lamps with a short distance to the substrate must be provided.

Ink agitators (recommended)

Depending on the pigment, UV-curing inks are frequently of a short consistency – “sleeping” in the duct may be a consequence. We therefore recommend the use of ink agitators.

Extraction system

An extraction system should be installed at the inking and varnishing units for removal of ink and varnish mist.

Handling UV-curing inks, varnishes and washup solutions

UV-curing inks and varnishes irritate and washup solutions degrease the skin. Special handling and safety instructions must therefore be observed. Relevant information leaflets are available from the UV ink and varnish suppliers or from “Verband der Druckfarbenindustrie, Karlstrasse 21, 60329 Frankfurt/Main, GERMANY”.

- Avoid skin contact. (Wear gloves made of neoprene or butyl rubber, not leather gloves.)
- In case of skin contact, wash immediately with soap and water.

  Never use a solvent or detergent!
- If there is a risk of ink or washup solution splashing into your eyes, wear protective goggles. If either does get into your eyes, rinse them thoroughly with copious amounts of water and consult a doctor.
- Use a skin care product.
- If clothing becomes soiled, change it and have it washed immediately.
- If you spill any ink, varnish or washup solution, clean it up immediately.
- Store used cleaning materials in special containers.

Using UV-curing inks

Inking unit

Remove conventional ink residue from the inking unit by using **UV Washup Solution 10 V 1004 09.**

CAUTION

Residue of conventional vehicle systems may cause ink transport problems in the inking unit. Bad ink transfer as well as printing and drying problems may be the consequences. If necessary, repeat the following inking unit cleaning procedure 3 or 4 times: ink up together with **UV Paste Reducer 40 U 1002** and wash off with **UV Washup Solution 10 V 1004 09.**

After cleaning and before inking up, make sure that the inking unit is free from all washup solution residue. (Even the slightest remains of the washup solution cause splitting, curing and scumming problems.)

“Drying-on” of inks during make-ready

Depending on their condition and until they are completely saturated, the cleaned ink roller coverings may absorb reactive reducer from the UV inks and varnishes, making them appear as if they have dried up.

REMEDY

After having cleaned and dried the inking unit, ink up together with small amounts of **UV Paste Reducer 40 U 1002** or **UV Varnish 40 U 5100** to saturate the roller coverings. Excessive amounts of paste reducer cause ink/water balance as well as drying problems.

Apply some **UV Paste Reducer 40 U 1002** onto the inking rollers before resuming printing after short stoppages (e.g. lunch break).

For longer stoppages (end of shift), wash the inking unit and cover up the ink duct.

Fount solution

Print with the minimum amount of fount solution possible. UV-curing inks are sensitive as regards the ink/water balance. They absorb more water than conventional inks.

Use pH stabilisers, possibly combined with isopropanol, to reduce surface tension and improve wetting of the plate. Example: 5 to 8 % (maximum) isopropanol combined with 2 % **HYDROFIX®-R 8016 09**, or in case the tap water contains high amounts of hydrogen carbonate (> 250 mg/l) with 2 % **HYDROFIX®-K 8032 09** (pH ~ 5).

With non-absorbent substrates like films, foils and metals, use 2 % **HYDROFIX®-B 8013 39** (pH ~ 5) with 5 to 8 % (maximum) isopropanol. This solution is also suitable for cardboard printing.

NOTE

Washup solution residue must not enter the fount solution, otherwise problems may occur – risk of scumming! Replace the fount solution with freshly prepared solution in such a case.

CAUTION

When printing and varnishing films and foils on both sides with UV-curing inks and varnishes and if an unsuitable fount solution additive was used, a greasy, usually water-soluble film with a strong odour may form in the stack after prolonged storage. The cause of this problem are non-evaporating products like glycerine and gum arabic contained in many fount concentrate. **HYDROFIX®-B 8013 39** is suitable.

Cleaning the press

Inking unit

UV Washup Solution 10 V 1004 09 (Flash point: 94 °C as per DIN 51 758)
Allow to dry thoroughly before inking up.

UV Washup Solution 10 V 1004 09 is also suitable for blanket washing facilities.

Plate / Rubber blanket

A mixture of 50 parts isopropanol and 50 parts **UV Washup Solution 10 V 1004 09** is suitable for final manual cleaning.

CAUTION

Ink roller coverings and UV washup solution must be compatible, as unsuitable UV washup solution may damage the material (swelling, stickiness and early destruction). Drying of UV inks on the press during start-up and ink misting may be the consequence. Mechanical faults in the inking unit also lead to disturbance of the ink/water balance.

Disposing of inks and varnishes

All materials must be disposed of as special waste (including cleaning material, scrap prints, uncured UV inks and varnishes, washup solution residue, and also non-returnable containers with remainders of UV-curing inks and varnishes). Metal containers may be disposed of as scrap iron after previous complete cleaning.

Once dry, materials printed with UV inks can be disposed of together with scrap printed with conventional inks.

Storing UV inks and varnishes

- Keep ink/varnish containers closed. Avoid exposure to light.
- Store in a cool, dry place.
- **Storage guarantee**
  For inks: 6 months at 20 °C from date of delivery. For varnishes: 3 months at 20 °C from date of delivery. Storage room temperature should not exceed 20 °C. Lower temperatures increase the shelf life of the inks and varnishes considerably beyond the periods indicated above.

NOTE

Ink always begins to harden (dark reaction) at the bottom of the container. The ink changes from a rubber-like to a hard consistency. A skin does not form on UV inks.

Do not use hardened UV inks and varnishes! There is a risk of ink or varnish misting.
Contact your supplier for advice if this should occur.

Ink auxiliaries – their use and effect

Ink too strong

2 – 5 % **UV Paste Reducer 40 U 1002** (contains photoinitiator)

Ink too thin

2 – 5 % **UV Transparent White 40 U 5100**

Insufficient curing

2 – 3 % **UV Activator 400 1003**. The activator has a thinning effect!

Lightening of colours

5 – 95 % **UV Transparent White**. Use **UV Varnish 40 U 5100** for golden shades on metallised surfaces to maintain the translucent effect!

Miscibility

Only UV-curing inks are intermiscible.

NOTE

Mix in all additives thoroughly to avoid printing problems.
Always wear gloves when carrying out the work procedures described above.

More processing information

Adhesion to different films, foils, metals and cast-coated substrates

The keying of UV-curing inks and varnishes to different pretreated metals, films, foils and cast-coated materials may be negatively influenced by separating agents, slip agents and plasticisers adhering to their surfaces. Good resistance to the adhesive tape test does not necessarily imply a good scratch resistance (nail test). Varnishing with UV-curing overprint varnish containing slip agents can improve scratch resistance. However, keying to a given substrate cannot be improved in this way although it may appear to be the case. At any rate, a good tape resistance is imperative to ensure trouble-free further processing of UV-cured ink and varnish films. We recommend preliminary tests of suitability due to differences among the listed materials.

Keying can be improved by:

a) corona discharge or open flame pretreatment of the printing surface and

b) UV-curing 2-component **2-K CureLac UV Primer UC 7300** with 5 % **2-K Hardener 40 Z 401009*** – to be applied from the inking unit of an offset press.

See page 10 for further information under “Wet-on-wet varnishing of UV-curing inks”.

Printing on a screen-printed surface containing solvent residues

Dried screen-printing inks can, depending on how dry they are, still contain solvent residues that “dissolve” pigments out of dried or UV-cured ink films. Dissolved pigments then migrate to the screen-printed films and this in turn leads to bleeding.

We therefore recommend that you test the UV inks to be used before starting the print run in order to determine whether or not they are resistant to the solvents used in screen-printing inks.

CAUTION

When printing and varnishing films and foils on both sides with UV-curing inks and varnishes and if an unsuitable fount solution additive was used, a greasy, usually water-soluble film with a strong odour may form in the stack after prolonged storage. The cause of this problem are non-evaporating products like glycerine and gum arabic contained in many fount solution additives.

Setting off in the stack

UV-cured inks and varnishes are thermoplastic materials. Particularly on non-absorbent materials (films, foils, tinplate), they may soften as a result of increased pressure and temperature which in turn may lead to sticking and adhesion to the reverse sides of the sheet or tinplate (tin printing) lying on top.

REMEDY

Air the printed sheets after they have passed the UV drier and stack them in as cool a condition as possible (< 30 °C).

Cracking of cured UV ink and varnish films

Cracking is caused by tension between the different materials (applied layers and substrate) occurring during subsequent thermal and/or mechanical strain, especially if there is an insufficient bond between the different layers. (In extreme cases layers may chip off.)

Wet-on-wet varnishing of prints made with conventional inks

Wet-on-wet varnishing of conventional printing inks with UV-curing varnishes does not always provide the desired result. The two systems are not compatible. Trapping problems may occur to a greater or lesser extent with the varnish depending on the amount of ink and varnish applied and on the type of substrate used. Uneven matt effects in the printed areas after curing of the varnish can be the consequence. (Preliminary print tests are recommended!). Keying properties of the hardened varnish film can also be negatively affected in some cases.

We recommend the use of a specially formulated ink series, in combination with a suitable dispersion primer varnish, for wet-on-wet UV varnishing of conventional inks.

Varnishing of dry prints made with conventional inks

- Use special absorption-drying sheet-fed offset inks (it is imperative to test the keying of the varnish after complete drying of the conventional offset inks by means of the adhesive tape test). When UV varnishing substrates with non-absorbent surfaces or films and foils, there is a risk of the UV varnish being repelled.
- Conventional inks must have thoroughly dried before UV varnishing. Prolonged stacking of the prints is also not necessarily beneficial. Frequent airing is recommended.
- **Dry conventional ink containing pigments which are not fast (like the HKS® shades 13, 27, 33, and 43 as well as PANTONE® Warm Red, Rhodamine Red, Purple, and Reflex Blue) and mixtures from all these colours may alter in shade when UV varnished! This applies also to non-fast black inks printed in low concentration and to light colours containing such a black.**

RECOMMENDATION

UV varnishing of dry prints printed with conventional ink may lead to varnish trapping problems, resulting in insufficient keying and repelling and creating effects such as orange peel and dimples. The reason for this are decomposition products which may form in larger or smaller quantities during oxidative drying of conventional printing inks. The generation of such decomposition products is often directly related to the vehicle constituents used in the ink.

The drying process of conventional oxidation-drying inks and the formation of decomposition products are influenced by the climatic conditions in the working place, the type of substrate and its surface structure, the amount of offset ink applied, the type of pigments used, the composition of the fount solution as well as the amount of emulsified fount solution.

Another significant factor that affects keying of UV varnish is the degree to which the conventional inks have dried.

Poorly or insufficiently dried conventional inks have a negative influence on keying. Cast-coated stock and substrates of low absorbency as well as films and foils often create conditions that do not assist keying of UV-cured varnishes on dried conventional inks. Avoid adding siccatives to the inks and use absorption-drying inks that contain only a minimal quantity of oxidative-drying vehicle.

The following procedure is recommended to ensure maximum safety when UV varnishing jobs which have previously been printed with conventional inks:

- Avoid ink additives.
- Print using a minimum quantity of fount solution.
- Ensure thorough drying of the conventional inks after printing (air the stack if necessary!).
- Use UV varnishes formulated to suit the purpose.
- Test the suitability of new substrates.

The risk of poor varnish trapping can be reduced by a corona discharge pretreatment of the dry conventional prints. Moreover, keying conditions can be improved by applying an intermediate wet-on-wet varnish coating using a dispersion primer varnish containing no slip agents.

UV varnishing over conventional metal-pigmented inks may lead to trapping and keying problems caused by the presence of ingredients which are necessary for impasting bronze.

Never use “surebronze” (magnesium stearate) when bronzing with metallic pigment.

Metal-pigmented UV inks provide good adhesion and trapping conditions for UV varnish.

Wet-on-wet varnishing of UV-curing inks

Wet-on-wet varnishing of UV-curing inks with dispersion and UV-curing varnishes does generally not present any problems. In cases of high ink and varnish film thickness, the curing of the underlying ink film may be affected as the varnish film absorbs effective UV radiation. The consequence is insufficient keying of the different layers (cured ink and varnish films) on the stock used and matt effects. The coatings may become detached when subjected to subsequent thermal or mechanical strain such as in hot-calendering or folding. Intermediate UV drying of ink and varnish will be a remedy. Inks with a high absorption rate of UV radiation such as black, dark blue, and opaque white are particularly prone to causing the described problem. For this reason it is advisable to use as little as possible opaque white (6 – 10 %) for mixing inks. It may be substituted by transparent white and/or **UV Varnish 40 U 5100** for silver.

CAUTION

Inks which are not fast, such as HKS® 13, 27, 33, 43, and PANTONE® Warm Red, Rhodamine Red, Purple, and Reflex Blue, may alter in shade.

To avoid this, use only inks with fast pigmentation or specially formulated UV varnishes.

Suitability for gluing

UV-varnished material can only be glued with suitable dispersion glues. Contact the suppliers for recommended products. It is preferable to leave blank or roughen areas that need be glued. Preliminary tests are necessary especially when using UV varnishes containing slip agents.

Heat-sealing resistance

The heat-sealing resistance of UV-varnished material can be guaranteed only if polypropylene film (PP) is employed. MSAT cellophane film may be suitable but must be tested beforehand. XS film is not suitable.

Suitability for hot-foil and gold-foil embossing

Only UV varnishes containing little or no slip agent provide good keying conditions for subsequent hot-foil or gold-foil embossing. The embossing pressure and temperature need be adjusted.

CAUTION

Varnishes containing little or no slip agents have poor flow characteristics, tend to foam when pumped and provide poorer surface wetting than UV varnishes with slip agents.

Greying of cardboard surface – Causes

- UV varnish penetrates the upper layer of the board making it transparent and the colour of the supporting layer shows through.
- Refraction of light in the varnish film.

RECOMMENDATION

Contact the supplier of the board and use cardboard with whiter inside material.

Cracking of UV-varnished cardboard surfaces when creased and folded

Cured UV varnishes are brittle. UV varnish applied on absorbent stock penetrates into its top layer and causes it to become still more brittle after curing. Avoid applying heavy varnish films. (Check absorbent stocks for suitability).

Water resistance of UV-curing inks and varnishes

UV-cured ink and varnish films do not act as a barrier to moisture or water. They demonstrate changeable resistance to the influences of moisture depending on their adhesion on film and metal surfaces. The lower the adhesive strength on the substrate surface, the less favourable the conditions become under the influence of moisture. Ingressing water undermines cured UV varnish and ink films and this leads to the film surface lifting off or becoming detached from the film surface when subjected to mechanical loading. Once the ink and varnish have dried completely, their adhesive properties can considerably improve again.

Pretreatment measures, such as corona treatment, precoating with screen-printing primer or priming with **2-K CureLac UV Primer UC 7300** with 5 % **2-K Hardener 40 Z 401009** can improve resistance to moisture.

If UV-cured ink and varnish films are required to be weather resistant, we recommend that you carry out a suitability test under field conditions on the print result.

The use of UV-curing inks and varnishes on thermographic paper

UV-curing inks and varnishes can be printed on thermographic paper. Depending on the paper quality, the paper may get tinged and/or keying problems of the cured UV inks and varnish films may occur. Previous testing is highly recommended.

In case of the paper getting tinged, it is possible to obtain specially adapted UV inks and varnishes.

To improve the keying of UV inks and varnishes in continuous forms printing, we recommend inline corona pretreatment.

Laser printing on UV-cured ink and varnish films

Problems of insufficient acceptance or adhesion of toners on UV ink and varnish films are unheard of, except with UV varnishes containing slip agents. If the latter ones are used, it is essential to test their suitability.

Build-up on the fusing roller or the fusing plate of the heat laser printer may occur as a consequence of a high toner fusing temperature (the thicker the ink and varnish films, the greater the risk) due to the thermoplastic characteristics of the cured ink and varnish films.

Possible formation of fumes in heat laser lettering is not caused by UV inks and varnishes. They contain no solvents (also no solvent with a high boiling point).

PANTONE® Rhodamine Red, Purple, Blue 072 and Reflex Blue as well as HKS® 27, 33 and 43, contain pigments of poor resistance to high temperature that may sublimate while the toner is being fused. They must be substituted by inks of similar shades formulated with heat-resistant pigments.

Fittings and bearings for varnish and ink pumps

Avoid using fittings and piping systems which contain copper! Through contact with UV-curing ink and varnish systems, the hardening process (so-called dark reaction) may be triggered.

UV-curing inks and varnishes do not possess any self-lubricating properties. This fact must be taken into account when selecting materials for bearings and ink pumps etc.!

Teflon is a suitable material for bearings.

Technical information literature

Further details about UV inks and varnishes can be found in the following Technical Information sheets:

TI 32.03 E	**CureInk UV – UB/UE 4000**
TI 32.04 E	**CureInk UV – UB/UE 4015 low-odour**
TI 32.05 E	**CureInk UV – UB/UE 4200/4500**
TI 32.06 E	**CureInk UV – UB/UE 4300**
TI 32.07 E	**CureInk UV – UP 7300**
TI 32.08 E	**UV inks and varnishes for food packaging**
TI 32.09 E	**CureLac UV for UV-curing**
TI 32.11 E	**UV varnish-coating of jobs produced with conventional offset inks**

Moreover, we draw your attention to our ink chart **MK 18** for tin printing,