Technical Information

Helizarin® recipes

TI/T 306 e
September 1997 (AJM)

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Production recipes for

- **Direct printing**
- **Discharge printing**
- **Resist printing**
- **Special effects**

Textile and Leather Dyes and Chemicals

BASF

Contents

Recipe recommendations for printing with the Helizarin system

In pigment printing – unlike printing with fibre-affinitive dyes – it is not possible to provide a standard printing recipe that is suitable for all applications. The formulation of the printing recipe is much more likely to be determined firstly by the properties specified for the printed material, and secondly by the price a particular print quality can be expected to fetch. In pigment printing, these points can largely be satisfied by appropriate combination of the printing auxiliaries. While the printing binders and additives allow a wide range of variations in this respect, the formulation of the best printing recipe – both technically and costwise – for a particular purpose necessitates detailed knowledge of the recipe components, their mode of action and the right amounts to use.

The **production recipes for Helizarin printing** provided in this Technical Information Bulletin should be seen as guidelines, and must be adapted to the particular plant conditions. It is understandable that, with the many influencing factors to be considered, there is no standard recipe that will satisfy all requirements. In most cases, optimizing the print pastes is unavoidable.

General information

The publication "BASF auxiliaries for textile printing" – TI/T 252 e – provides summarized descriptions of the range of auxiliaries in the Helizarin system. Detailed information on the individual products is contained in the relevant Technical Information Bulletins.

The following, additional information will assist in the recipe formulation.

Luprimol® SIG/Luprimol SE

The addition of 5 g/kg Luprimol SIG or SE can, in many cases, result in an even smoother print surface. This addition also often produces a further improvement in the fastness properties (particularly the fastness to dry rubbing) and can have a positive effect on the handle of the prints and – in the case of aqueous formulations – also promote their brilliance. In principle, both these auxiliaries can be stirred into the stock mix at any stage. With Luprimol SIG, however, the mix should already contain the emulsifier (Luprintol® type) before the Luprimol SIG is stirred in, which should be carried out with a good high-speed stirrer to ensure its homogeneous dispersion.

Helizarin Fixing Agent LF

The addition of 7 – 10 g/kg Helizarin Fixing Agent LF often produces a significant improvement in the fastness of the prints on synthetic fibres and regenerated cellulosic fibres, and on blends of these fibres with cotton. Also on pure cotton, however, an addition of Helizarin Fixing Agent LF can further improve the standard of wet fastness to a certain extent (fastness to wet rubbing and to washing).

Urea

Where the requirements for low formaldehyde values are concerned, these can generally be satisfied by adding 10 – 15 g/kg urea to the recipes listed.

Preparation of a pigment thickening

The requisite amount of water is run into the mixing vessel and, if necessary, an antifoam added (e.g. 2 – 3 g/kg Vitexol® K). The Helizarin binder, the Luprintol emulsifier and, if required, Helizarin Fixing Agent LF and Luprimol SIG or SE are then added successively, with stirring. Finally, the Lutexal® HEF or HP is stirred in, after which the mix is stirred with a high-speed stirrer until the thickener has swollen to its full extent (approx. 8 – 10 min). With low-solvent formulations, the white spirit is next emulsified into the mix, which is finally homogenized by stirring for a further 12 – 15 min.

pH

The print pastes should have a pH of at least 7.5 – 8. Lower values must be corrected by adding ammonia.

Viscosity measurement and correction

The viscosity measurements were carried out with the Viscotester VT 02 (Haake Mess-Technik GmbH & Co., Karlsruhe, Germany).

Subsequent adjustments can be made to the viscosity of the mix. To **increase the viscosity** of aqueous pastes, Lutexal HEF or HP can be stirred direct into the paste. Pastes that contain white spirit can also be thickened by adding 0.5 – 2 g/kg Lutexal HVW.

A **reduction in the viscosity** of pastes that contain Lutexal HEF or HP can be achieved by stirring in small amounts of an aqueous solution of diammonium phosphate or ammonium sulfate.

White spirit

In most countries, pigment printing is now carried out with aqueous or low-solvent formulations (up to approx. 300 g/kg white spirit). The white spirit used should meet the following specifications:

- aromatics content: max. 15 %
- boiling range: 150 – 220 °C
- flash point (Abel-Pensky): > 30 °C

These requirements are particularly important in printing with full emulsion systems, which is still carried out in some countries.

Helizarin Binder TW and UDR are not suitable for printing with high-solvent systems. For such systems, Helizarin Binder UD and TS are mostly used and give very successful results.

Aqueous printing formulations

Coloured prints

Standard recipe for woven fabrics composed of cellulosic fibres and blend fabrics

... g	water
80 – 180 g	Helizarin Binder ET (or ATN)
25 g	Luprintol MCL
35 g	Lutexal HEF (or 40 g Lutexal HP)
1000 g	

Recommended viscosity range: 70 – 80 dPa·s (= Poise)

Soft prints on cellulosic-fibre materials and fibre blends

... g	water
80 – 180 g	Helizarin Binder TW
15 – 20 g	Luprintol SL
4 – 7 g	Luprimol SIG or SE
42 g	Lutexal HEF (or 50 g Lutexal HP)
1000 g	

Recommended viscosity range: 70 – 80 dPa·s

Ladies' outerwear

... g	water
80 – 160 g	Helizarin Binder ET (or ATN)
20 g	Luprintol MCL
5 g	Luprimol SIG or SE (if necessary)
30 g	Lutexal HEF (or 35 g Lutexal HP)
1000 g	

Recommended viscosity range: 50 – 60 dPa·s

Pure cotton bed sheeting

... g	water
100 g	Helizarin Binder ET (or ATN)
50 g	Helizarin Binder TW
15 – 20 g	Luprintol SL
5 g	Luprimol SIG or SE
38 g	Lutexal HEF (or 45 g Lutexal HP)
1000 g	

Recommended viscosity range: 70 – 80 dPa·s

High-quality, soft, pure cotton bed sheeting

... g	water
100 g	Helizarin Binder TW
0 – 80 g	Helizarin Binder ATN (depending on the pigment concentration)
25 g	Luprintol MCL
3 g	Luprimol SIG
32 g	Lutexal HEF
1000 g	

Recommended viscosity range: approx. 60 – 70 dPa·s

High-quality cotton flannelette and terry bed sheeting

... g	water
2 – 3 g	Vitexol K
110 g	Helizarin Binder TW
7 g	Luprintol PE New
9 g	Luprimol SIG or SE
7 g	Helizarin Fixing Agent LF
32 g	Lutexal HEF (or 38 g Lutexal HP)
1000 g	

Recommended viscosity range: ca. 60 – 70 dPa · s

High-quality knitted and terry fabrics, T-shirts

... g	water
80 – 130 g	Helizarin Binder TW
25 g	Luprintol MCL
5 g	Luprimol SIG or SE
10 g	Luprimol U (if necessary)
34 g	Lutexal HEF (or 41 g Lutexal HP)
1000 g	

Recommended viscosity range: 40 – 50 dPa · s

Knitted fabric (cotton) with high fastness to dry rubbing

... g	water
40 – 80 g	Helizarin Binder TW
40 – 80 g	Helizarin Binder TS
25 g	Luprintol MCL
10 g	urea
5 g	Helizarin Fixing Agent LF
32 g	Lutexal HEF (or 38 g Lutexal HP)
1000 g	

Recommended viscosity range: 60 – 70 dPa · s

Curtaining fabric, cotton

... g	water
up to 250 g	Helizarin Binder ET (or ATN)
13 g	Luprintol SL
10 g	Helizarin Fixing Agent LF
30 g	Lutexal HEF (or 35 g Lutexal HP)
1000 g	

Recommended viscosity range: 50 – 70 dPa · s

Economical prints on cotton woven fabrics

... g	water
80 – 150 g	Helizarin Binder UDR
12 g	Luprintol MP
32 g	Lutexal HEF (or 37 g Lutexal HP)
1000 g	

Recommended viscosity range: 70 – 80 dPa · s

Stock paste with Lutexal HDL for automatic mixing stations with direct metering

400 kg	water
4 kg	Vitexol K
50 kg	water (rinsing)
12 kg	Luprintol MP
50 kg	water (rinsing)
9 kg	Helizarin Fixing Agent LF
50 kg	water (rinsing)
7 kg	Luprimol SE
50 kg	water (rinsing)
100 kg	Helizarin Binder ET
100 kg	Helizarin Binder TW
50 kg	water (rinsing)
40 kg	Lutexal HDL
78 kg	water (rinsing)
1000 kg	

After each metered auxiliary addition, the feed pipes are rinsed through with part of the total volume of water necessary. There is no need to pump any water through the feed pipes between the two Helizarin binder additions; this makes more water available for the final rinsing process after the Lutexal HDL has been metered in.

After all the components have been stirred in, the mix is homogenized with the high-speed stirrer in the usual manner for 12 – 15 minutes.

Details of the procedure with Lutexal HDL are provided in the Technical Information Bulletin “Lutexal HDL” – TI/T 6001.

Low-formaldehyde prints

Today, **LAW 112** is the most commonly used method for measuring the free formaldehyde. It has to be realized that free formaldehyde can come from various sources. With pigment-printed textiles, free formaldehyde mainly derives from the crosslinking agents, which are usually melamine-formaldehyde condensation products. Much smaller amounts originate from the self-crosslinking binders. However, formaldehyde can not only be released from the pigment print, but also, to a very small extent, from the textile substrate itself. There can therefore be no “formaldehyde-free”, but rather a “low-formaldehyde” pigment print.

In Germany, the maximum values for free formaldehyde specified in the Öko-Tex Standard 100 are currently:

Babywear and children’s clothing:	20 ppm
Clothing with direct skin contact:	75 ppm
Clothing without direct skin contact:	300 ppm
Furnishing fabrics:	300 ppm

To meet requirements for low amounts of free formaldehyde, print pastes can be used which, apart from the usual amounts of binder and auxiliaries, also contain 10 – 15 g/kg urea. Urea acts as a “formaldehyde scavenger” and makes it possible to keep to the specified limits for free formaldehyde. Provided that the amount used is not too high, some Helizarin Fixing Agent LF can also be added to improve the fastness.

Apart from the selection of the products and the amounts used, further factors are decisive for the amount of free formaldehyde formed. For example, **optimum curing of the prints** is essential for the achievement of low formaldehyde values. The amount of print paste applied also influences the formaldehyde value; for example, a more superficial print and a lower print-paste application result in lower formaldehyde values.

Provided that these various factors are taken into account, the following guideline recipe allows the production of prints that do not exceed the specified formaldehyde values.

Stock paste for low-formaldehyde prints, max. 20 ppm (LAW 112)

	... g	water
	35 g	Lutexal HEF
	12 g	Luprintol MP
80 –	150 g	Helizarin Binder ET, ATN or TW
	8 g	Luprimol SIG or SE (if necessary)
4 –	5 g	Helizarin Fixing Agent LF (if necessary)
	15 g	urea
	1000 g	

Matt white prints with Helizarin White Paste DFT

Matt white prints on dark grounds

Helizarin White Paste DFT is supplied ready for use. If its viscosity should be too high for printing, Helizarin White Paste DFT can be diluted with a small amount of water.

On **polyamide 6.6,** an addition of 10 – 20 g/kg Helizarin Fixing Agent LF and 20 g/kg diammonium phosphate 1 : 2 may be necessary to obtain the desired standard of fastness.

With white prints on grounds that have been dyed with disperse dyes (e.g. on synthetic fibres, PES/CO etc.), there is the possibility that some disperse dye may migrate into the binder film during the hot-air fixation of the matt white print and stain the white. If the disperse dyes used can be destroyed by reduction, an addition of

	50 g/kg	water
10 –	15 g/kg	Decrolin®
	20 g/kg	ammonium sulfate 1 : 2 or diammonium phosphate 1 : 2

to the print paste can prevent or lessen this phenomenon. If the staining should still be too pronounced after the prints have been fixed, the prints must be steamed with saturated steam for approx. 6 min at 102 °C. In view of the small amount of Decrolin used, there is usually no need for the prints to be washed off.

In the following recipe, based on Lutexal HEF or HP, the use of Decrolin is not possible because these thickening agents are not compatible with zinc salts.

Matt white prints on light grounds and white fabric

For printing on light grounds and white fabric, Helizarin White Paste DFT can be mixed with a reduction thickening containing binder, e.g. in the proportions 1 : 3. This usually produces a fall in viscosity, which is corrected by adding Lutexal HVW.

Guideline recipe for an aqueous reduction thickening:

	... g	water
	130 g	Helizarin Binder TW, ET or ATN
	25 g	Luprintol MCL
2 –	3 g	Lutexal HVW
	34 g	Lutexal HEF (or 40 g Lutexal HP)
	1000 g	

Matt white prints with Lutexal HEF or HP

White stock for dark grounds

400 g	Helizarin White RTU
400 g	Helizarin Binder ET or ATN
4 g	Vitexol K
10 g	Luprintol PE New
15 g	Luprintol MP
10 g	Helizarin Fixing Agent LF
10 g	Luprimol SIG
20 g	Luprimol U
2 g	ammonia 25 %
2 g	Calgon®* T New
13 g	Lutexal HEF (or 16 g Lutexal HP)
... g	water
1000 g	

If the mix should be slightly “mealy” (i. e. grainy, not smooth), a little more Calgon T New can be added.

Matt white prints on light grounds and white fabric

For white prints on light grounds and white fabric, the white stock is mixed with the reduction thickening recommended for use with Helizarin White Paste DFT (cf. page 10):

On light grounds:

400 g	white stock
600 g	reduction thickening
1000 g	

On white fabric:

250 g	white stock
750 g	reduction thickening
1000 g	

Matt coloured prints

Prints pastes for matt coloured effects are prepared by adding Helizarin pigments to the matt white pastes described above. For matt coloured prints that are required to be fast to dry cleaning, it is necessary to use Helizarin pigments with the letter “T” in the index. The Helizarin binder used must also have a “T” in the index. Helizarin White Paste DFT is resistant to dry cleaning.

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Low-solvent printing formulations

Coloured prints

Woven fabrics composed of cellulosic fibres and blend fabrics

... g	Wasser
80 – 180 g	Helizarin Binder ET (oder ATN)
25 g	Luprintol MCL
25 g	Lutexal HEF (oder 28 g Lutexal HP)
150 g	white spirit
1000 g	

Recommended viscosity range: 70 – 80 dPa · s (= Poise)

Matt white prints

Matt white prints with Helizarin White Paste DFT on dark grounds

To give Helizarin White Paste DFT somewhat more “flow”, besides diluting it with water some white spirit can also be emulsified into the paste:

800 g	Helizarin White Paste DFT
100 g	water
100 g	white spirit
1000 g	

This operation can be conveniently carried out in the 50-kg drum, as follows:

50.00 kg	Helizarin White Paste DFT
6.25 kg	water
6.25 kg	white spirit
62.50 kg	

Matt white prints with Helizarin White Paste DFT on light grounds and white fabric

For this purpose, Helizarin White Paste DFT is mixed with a reduction thickening containing binder, e. g. in the proportion 1 : 3. Any fall in viscosity that occurs can be corrected by an addition of Lutexal HVW.

Guideline recipe for a low-solvent reduction thickening:

... g	water
130 g	Helizarin Binder ET, ATN, TW or UDR
25 g	Luprintol MCL
1 – 2 g	Lutexal HVW
20 – 22 g	Lutexal HEF (or 23 – 26 g Lutexal HP)
150 g	white spirit
1000 g	

Matt coloured prints

Prints pastes for matt coloured effects are prepared by adding Helizarin pigments to the matt white pastes described above. For matt coloured prints that are required to be fast to dry cleaning, it is necessary to use Helizarin pigments with the letter “T” in the index. The Helizarin binder used must also have a “T” in the index. Helizarin White Paste DFT is resistant to dry cleaning.

High-solvent printing formulation

Coloured prints

With natural auxiliary thickening agents

...	g	water
50	g	low-bodied thickening (e. g. alginate thickening)
10	g	Luprintol PE New
750	g	white spirit
7 – 12	g	Helizarin Fixing Agent LF (if necessary)
5 – 8	g	Luprimol SIG (if necessary)
80 – 180	g	Helizarin Binder UD, TS*
5 – 20	g	diammonium phosphate or ammonium sulfate solution 1 : 3**
1000	g	

Recommended viscosity range: 40 – 50 dPa · s

* *Helizarin Binder TW and UDR are not recommended for printing from high-solvent formulations (cf. also note "White spirit" on p. 5).*

** *For hot-air fixation, 20 g/kg are used. In HT-steam fixation, only 5 g/kg may be used in order to avoid damage to the fibre surface and thus a reduction in fastness.*

Discharge printing

Pigment discharge printing on cellulosic-fibre grounds, dyed with reactive or direct dyes, is a simpler and more economical alternative to the traditional *discharge printing with vat dyes* – a process that generally requires considerable experience.

The best results are obtained with the recipes given in the following sections. The viscosity data refer to measurements made with the Viscotester VT 02 supplied by Haake Mess-Technik GmbH & Co., Karlsruhe, Germany.

The amount of Rongalit® ST Liquid necessary depends on the substrate and the nature of the ground dyeing, and must be determined by preliminary trials.

While Lutexal HEF is the thickening agent most commonly used for aqueous discharge printing, Lutexal HP is also quite suitable.

The products are stirred into the water with a high-speed stirrer in the order listed. After the addition of the Lutexal HEF or HP, the mix is stirred well until the thickening agent has swollen to its full extent. The other auxiliaries are then added successively, after which the stock discharge paste is homogenized by stirring for a further 8 – 10 minutes.

If the mix should foam excessively, 2 – 3 g/kg Vitexol K can be stirred into the mix after the thickening agent has fully swollen.

The pastes should have a pH of 8; if necessary, the pH must be corrected by adding ammonia.

The printing results also depend on the pH of the predyed fabric, which must be around pH 7. If the dyed fabric contains too much residual alkali, this will lead to a reduction in the brilliance and the fastness and it should therefore be neutralized with a non-volatile acid, e. g. Eulysin® S.

The **stability of the Helizarin pigments** to reducing agents depends not only on the stability of the pigment to reduction, but also to a large extent on the amount of pigment applied. In other words, the lower the pigment concentration, the greater the risk of reductive decomposition of the pigment. Owing to the fact that Decrolin is a much more aggressive discharging agent than Rongalit ST Liquid, the stability of the discharge print pastes and of the pigments they contain is considerably lower with Decrolin. The reductive influence of Decrolin on the Helizarin pigments is already as great after 24 hours as with Rongalit ST Liquid after 7 days.

For high-solvent discharge-printing formulations, in addition to Helizarin Black HDT, Helizarin Black TT can also be used in the same amounts. A list of suitable Helizarin pigments is provided in the Technical Information Bulletin “Discharge printing with Helizarin pigments” – TI/T 103 e.

The Helizarin pigments should not be added to the stock mix containing the reducing agent until shortly before printing is due to start.

The auxiliaries listed in the recipes have been checked against one another in their action. Auxiliaries that are not specially mentioned are not recommended for the process.

Aqueous discharge prints

Discharge stock for cotton (high quality requirements)

... g	water	
80 – 100 g	Rongalit ST Liquid	Stir in successively with the high-speed stirrer
5 – 10 g	Luprintol PE New	
90 g	Lutexal HEF	
3 g	Lutexal HVW	
5 g	Luprimol SIG or SE	
130 – 180 g	Helizarin Binder ET (or TW)	
2 g	triethanolamine	
20 g	diammonium phosphate 1 : 3	
5 – 10 g	Helizarin Fixing Agent LF	
1000 g		

Viscosity: approx. 50 dPa·s

Discharge stock for cotton (high quality requirements, simple recipe formulation)

... g	water	
80 – 100 g	Rongalit ST Liquid	Stir in successively with the high-speed stirrer
90 g	Lutexal HEF	
25 g	Luprintol MCL	
130 – 180 g	Helizarin Binder ET (or TW)	
2 g	triethanolamine	
20 g	diammonium phosphate 1 : 3	
1000 g		

Viscosity: approx. 50 dPa·s

Discharge stock for cotton knitgoods

... g	water	
80 – 100 g	Rongalit ST Liquid	Stir in successively with the high-speed stirrer
5 – 10 g	Luprintol PE New	
80 g	Lutexal HEF	
2 g	Lutexal HVW	
5 g	Luprimol SIG or SE	
150 g	Helizarin Binder TW	
2 g	triethanolamine	
20 g	diammonium phosphate 1 : 3	
1000 g		

Viscosity: approx. 40 dPa·s

Discharge stock for viscose (good fastness, soft handle)

... g	water	
80 – 100 g	Rongalit ST Liquid	Stir in successively with the high-speed stirrer
25 g	Luprintol MCL	
90 g	Lutexal HEF	
5 g	Luprimol SIG	
10 g	Luprimol U	
90 g	Helizarin Binder ET	
90 g	Helizarin Binder TW	
2 g	triethanolamine	
20 g	diammonium phosphate 1 : 3	
10 g	Helizarin Fixing Agent LF	
1000 g		

Viscosity: approx. 50 dPa·s

Print paste (coloured discharges)

... g	Helizarin pigment
... g	discharge stock
1000 g	

Print paste (white discharges)

50 – 200 g	Helizarin White RTU
... g	discharge stock
1000 g	

High-solvent discharge prints

In high-solvent discharge printing, either Rongalit ST Liquid or Decrolin can be used.

Rongalit ST Liquid allows the preparation of zinc-free print pastes. Pastes containing Rongalit ST Liquid should have a pH of around 8; if necessary, the pH should be corrected with ammonia.

Discharge print pastes prepared with Decrolin are stable for *only up to max. 48 hours,* depending on the amount of pigment used and its stability to reduction.

Discharge stock with Rongalit ST Liquid

... g	water	
10 g	Luprintol PE New	
70 – 100 g	Rongalit ST Liquid	} Premix
150 g	auxiliary thickener 6 – 10 %*	} Premix
130 – 180 g	Helizarin Binder ET	
5 – 10 g	Luprimol SIG	
30 g	diammonium phosphate 1 : 3	
2 g	triethanolamine	
480 g	white spirit	
1000 g		

Discharge stock with Decrolin

... g	water	
10 g	Luprintol PE New	
130 – 180 g	Helizarin Binder ET	
70 g	Decrolin	} Premix
150 g	auxiliary thickener 6 – 10 %*	} Premix
5 – 10 g	Luprimol SIG	
480 g	white spirit	
1000 g		

The products are stirred into the water in the order listed. The mix is then stirred well for 3 – 5 min before the white spirit is emulsified in, after which the stock paste is homogenized by stirring for a further 8 – 10 minutes.

Print paste (coloured discharges)

... g	Helizarin pigment
... g	discharge stock
1000 g	

Print paste (white discharges)

50 – 200 g	Helizarin White RTU
... g	discharge stock
1000 g	

When Decrolin is used, the Helizarin pigments should not be added to the stock mix containing the reducing agent until shortly before printing is due to start.

** The reducing agents should not be added to the mix in the concentrated state, but first premixed with a thickening that is stable to electrolytes. When Decrolin is used, attention must also be paid to the stability of the auxiliary thickener in the strongly acid range of the print paste (pH 2 – 3). Suitable auxiliary thickeners include, for example, selected bean gum ethers.*

Procedure

– Print, dry
(Rongalit ST Liquid: *not above 110 °C on the fabric)*

– Steam: 6 – 10 min at 102 °C (saturated steam, air-free)

– Cure: 5 min at 150 °C (hot air)

– Rinse cold,
treat at 40 – 60 °C with 2 ml/l peroxide,
soap at 60 – 70 °C with 1 g/l Kieralon® B High Conc.,
rinse cold,
dry.

At a drying temperature of above 120 °C there is a noticeable fall in the discharging action of the Rongalit types and the discharge effect is much weaker.

Fabric printed with Rongalit ST Liquid, and then well dried, should *not be kept for longer than 2 days* before it is steamed.

Fabric printed with Decrolin, and then dried, must **not be kept for longer than 6 – 8 hours** before it is steamed.

The printed and dried fabric should be protected from the action of moisture, because this, in combination with the retained heat in the fabric, will cause decomposition of the reducing agent and thus impair the discharge effect.

The steaming with saturated steam in an air-free steamer is necessary for the reductive decomposition of the ground dyes; the curing with hot air is decisive for achieving a good standard of fastness.

Fixation with high-temperature steam is not suitable for discharge prints produced with Rongalit ST Liquid.

Although a single-stage fixation with high-temperature steam (6 – 7 min at 160 °C) is, in principle, possible for discharges produced with Decrolin, the discharge effects are weaker and less brilliant, and the standard of fastness is not up to that of a print that has been steamed with saturated steam and then cured.

Resist printing

To produce the resist, a pigment print paste is applied that contains a specific amount of a non-volatile organic acid (usually tartaric acid). In the printed areas, the subsequently applied alkaline reactive ground is neutralized by the excess acid and shifted into the acid pH range, in which the reactive dye can no longer fix. The unfixed reactive dye is later washed out.

Preprint/pad process

This is the most widely used process. Although it requires two processing steps, it also produces the best results. The pigment resist paste is printed on the white substrate and dried, after which the print is fixed in the normal manner for pigment prints, with hot air. The reactive ground is then applied by padding or lick roller, dried, fixed in the usual manner for reactive dyes, followed by rinsing, soaping hot, rinsing and drying.

In padding, attention must be paid to the high dissolving rate of the tartaric acid. In liquor boxes with a long immersion path, this property can lead to flushing or cloudy resist effects, also the acid can accumulate in the pad liquor. For this reason, the padder used must have a short immersion path (horizontal padder, with the liquor in the nip). Lick-roll application is also possible, but this inevitably cannot give the impression of a discharge print.

In the padding of the ground, the liquor pick-up should be kept as low as possible (70 – 80 % squeezing effect) so as to prevent migration. For the same reason, the fabric should be dried in hot-flue or jet dryers.

Wet-on-wet process

This process is carried out on a rotary-screen printing machine, with the resist pastes being printed first and the reactive ground paste applied by overprinting with a full-cover blotch screen in the last position. This process is, however, only carried out to a small extent.

Our recommendations for recipes and procedures are therefore confined to the preprint/pad process.

Recipes and procedures

Aqueous resist formulation

Resist stock

... g	water	
80 – 150 g	Helizarin Binder ET, ATN or TW	
10 g	urea	
15 g	Luprintol PE New	
20 g	tartaric acid	} Premix
100 g	acid-stable thickening	} Premix
5 – 10 g	Luprimol SIG oder SE	
130 g	Lutexal HEF	
1000 g		

The amount of binder used depends on the pigment concentration and the fastness requirements specified for the printed fabric. The products are stirred into the water with a high-speed stirrer in the order listed, after which the mix is homogenized by stirring for about a further 10 minutes.

The viscosity should not be too low, in order that the paste not only serves as a chemical resist, but also forms a mechanical barrier for the reactive ground. Viscosities of approx. 70 dPa·s have proved suitable. Depending on the binder used and the plant conditions, the amount of Lutexal necessary may vary somewhat from that recommended.

High-solvent resist formulation Resist stock

... g	water	
25 g	Luprintol MCL	
10 g	Luprintol PE New	
100 g	acid-stable thickening	} Premix
40 g	tartaric acid	} Premix
2 g	Lutexal HVW	
80 – 150 g	Helizarin Binder ET, ATN or TW	
400 g	white spirit	
1000 g		

Here also, the amount of binder used depends on the pigment concentration and the fastness specifications for the printed fabric. The products are stirred into the water with a high-speed stirrer in the order listed, after which the white spirit is emulsified into the mix, which is then thoroughly homogenized by stirring for about a further 10 minutes.

Print paste

... g	Helizarin pigment
... g	resist stock
1000 g	

For a white resist, approx. 50 g/kg Helizarin White RTU is added.

Fixation of the prints

After printing and drying, the prints are fixed as for normal pigment prints. The best standard of fastness is achieved by *hot-air* fixation. The recommended temperatures and times are as follows:

aqueous:	5 min	at 150 °C, or
	3 – 4 min	at 160 °C
high-solvent:	5 min	at 140 °C.

Padding the ground

The reactive ground is next applied. The composition of the pad liquor depends on the type of dye used. These are mainly reactive dyes of the vinyl sulfone type, e. g. Basilen® F dyes. The addition of Primasol® AMK promotes the levelness of the dyeing.

Pad liquor

... g	Basilen F dye
250 ml	water 80 °C (to dissolve the dye)
	cool with cold water
7 – 10 g	Primasol AMK
... g	Basilen Fixing Agent F-RP*
	make up with water to
1 litre	

In place of Basilen Fixing Agent F-RP, approx. 20 g/l sodium bicarbonate can also be used. It should be noted, however, that in this case the pad liquor will have a lower stability. It is then also necessary to add 10 g/l Ludigol® Granules to the pad liquor.

** The amounts of Basilen Fixing Agent F-RP necessary depend on the amount of dye used:*

Basilen F dye	*1 – 5*	*6 – 15*	*16 – 30*	*31 – 45*	*> 45 g/l*
Basilen Fixing Agent F-RP	*15*	*25*	*40*	*50*	*60 g/l*

Drying

After the padding or lick-roll application of the reactive ground, the fabric must be *dried immediately.* The distance between the padder and dryer should be as short as possible so as to prevent the formation of haloes caused by the tartaric acid dissolving and bleeding out.

Fixation of the ground

After it has been dried, the reactive ground is fixed. The method of fixation depends on the type of reactive dyes used. The usual procedure is to steam with saturated steam for 8 – 12 min at 100 – 102 °C. Some reactive dyes can also be fixed on cotton with hot air. These include the Procion® PX and Procion P dyes. In this case, 100 g/l urea must be added to the pad liquor.

On conclusion of the fixation process, the prints are rinsed thoroughly cold and then hot, followed by soaping with 1 g/l Kieralon B High Conc. at 70 – 80 °C, then rinsing hot and cold again and drying.

Brilliant coloured prints on dark grounds

Printing with Helizarin Special Binder 4438

In printing with Helizarin Special Binder 4438, attention must be paid to the fact that the special components of this product have an extremely large surface area and therefore the print paste dries at a much faster rate than a normal pigment print paste. This can lead to rapid blocking of the printing screens. For this reason, Helizarin Special Binder 4438 is generally not used alone but in admixture with a reduction thickening. The effects are nevertheless still very good. In many cases, a less brilliant coloured print is even desirable on a dark ground. To supplement the covering effect, a small amount of Helizarin White RTU is added to the print paste. Some extra binder is also added to keep the fastness up to the required standard.

Stock paste

380 – 500 g	Helizarin Special Binder 4438
10 g	Luprintol PE New
2 g	Calgon T
408 – 358 g	reduction thickening
150 – 100 g	Helizarin Binder TW
50 – 30 g	Helizarin White RTU
1000 g	

Viscosity: 60 dPa·s (adjust with Lutexal HEF)

Guideline recipe for a reduction thickening:

... g	water
25 g	Luprintol MCL
100 g	Helizarin Binder TW
approx. 35 g	Lutexal HEF
1000 g	

Viscosity: 80 dPa·s

Print paste

... g	Helizarin pigment
... g	stock paste
1000 g	

Printing with bronze and pearlescent pigments

Printing with Helizarin Bronze Binder MT

Helizarin Bronze Binder MT is an aqueous, ready-to-print preparation for printing with bronze powders and pearlescent pigments. The prints prepared with this product are fast to dry cleaning and to ageing. They have a very good standard of fastness and are also much more brilliant than those prepared with customers' own stock thickenings. Furthermore, with Helizarin Bronze Binder MT, the amount of bronze powder necessary can be reduced by around 25 – 30 %.

Print pastes containing aluminium powder show much better stability when they are prepared with Helizarin Bronze Binder MT than when the pastes are "home-made"; there is, however, no improvement in the poor rubbing fastness of the aluminium powder. The tendency to formation of hydrogen in the paste and to blocking of the printing screens is also still present. It should also be noted that the fastness to dry cleaning of prints with aluminium powders is somewhat limited because perchloroethylene can contain small amounts of hydrochloric acid, which reacts with the aluminium powder. Prints with aluminium grades should therefore not be dry cleaned with perchloroethylene. In recent years there has been a growing trend, in the production of silver print effects, to the use of pearlescent pigments, e.g. Iriodin®* Silverpearl, which do not have the disadvantages of aluminium powder and, being pigments, have a very good rubbing fastness.

** Registered trademark of E. Merck Co., Darmstadt, Germany*

Print pastes

Gold bronze	150	–	–
Aluminium powder	–	100	–
Iriodin type	–	–	100
Helizarin Bronze Binder MT	850	900	900
		1000 g	

These pastes have a viscosity of 30 – 35 dPa·s, which is normally sufficient. If a higher viscosity should be required, this can be obtained by adding around 2 – 6 g/kg Lutexal HEF.

Gold bronze print pastes can be shaded with 2 – 5 g/kg Helizarin Brilliant Yellow RRT Conc. This addition intensifies the gold effect. The shade of prints produced with aluminium powder or with the Iriodin types can also be varied by the addition of Helizarin pigments. Bronze pastes shaded in this manner must be thickened with Lutexal HEF or HP in order to promote the colouring effect.

A particularly attractive pearlescent effect is obtained on white fabric when this is printed with Helizarin Bronze Binder MT and suitable Iriodin types, e.g. Iriodin 100 Silverpearl, and then calendered after the fixation treatment.

The aperture diameter of the screens should be in the correct ratio to the particle size of the bronze powder or Iriodin pigment used.

Fixation: as for normal pigment prints.

Caustic crêpe effects

The pronounced shrinking effect produced by concentrated caustic soda on cotton has been utilized now for many years. With the localized application of strong caustic soda, the fabric contracts in these areas, whereas in the remaining parts of the fabric the fibres retain their original form. After tensionless washing, neutralization with acid and drying, the fabric is left with a crimped appearance. The **seersucker** effect is obtained by the application of a paste containing caustic soda, usually by printing stripes of different widths (e.g. 10 – 12 mm in width, spaced 20 – 40 mm apart). These stripes are printed on rotary-screen or roller printing machines.

Today, in the production of caustic-crêpe effects, a distinction is made between the conventional **caustic direct-printing process,** and the **caustic-crêpe resist process** with the Helizarin system.

Caustic direct-printing process

This process is little used owing to the problems involved in working with strongly caustic-alkaline print pastes (goggles should be worn!). Furthermore, the back greys are likely to be damaged and the rubber printing blankets and conveyor belts are subjected to considerable strain. There is also the risk of the end rings in the rotary screens becoming detached.

If the caustic-crêpe paste is to be printed over coloured areas, it is necessary to first check that the alkali paste does not have any effect on the shade of these dyes.

Print paste:

210 g	alkali-stable thickening (e.g. British gum, starch ether)
20 g	Leophen® M
700 g	caustic soda 50 %
70 g	sodium hydroxide flakes (= NaOH 100 %)
1000 g	

After it has been printed, the fabric is run through the cold drying unit, free of tension, then thoroughly washed off, neutralized and dried – again without tension. After the washing and drying, the printed areas are flat and the remaining parts of the fabric become crimped. The crimp effect can be promoted still further if the fabric is allowed to shrink for 3 – 6 min before it is washed off, e.g. by suspension on a roller frame or by running it through a scray.

Caustic-crêpe resist process

In the caustic-crêpe resist process, the effect is reversed, i.e. the printed areas crimp, whereas the remaining parts of the fabric can shrink and therefore remain flat. A further difference, compared to the caustic direct-printing process, is that the caustic-crêpe resist process also allows the printing of coloured pastes.

For colourless prints, the stock paste is used alone, whereas for coloured prints Helizarin pigments are added to the stock thickening.

The stock thickening has a high binder content. Good print penetration is important to ensure that the fibres are completely covered with the paste, thereby promoting their resistance to the caustic soda after the fixation treatment. If possible, the use of an emulsifier (Luprintol type) should be avoided to restrict wetting of the print by the caustic soda.

Stock thickening for caustic-crimp resists:

... g	water
3 g	Vitexol K
100 g	cellulose ether thickening (if necessary)
10 g	diethylene glycol
200 – 240 g	Helizarin Binder TW or ET/TW
15 g	Luprimol SIG
30 g	Helizarin Fixing Agent LF
approx. 50 g	Lutexal HEF
1000 g	

In some cases, a somewhat softer and more supple crimp effect can be obtained by an addition of 100 g/kg of a cellulose ether thickening, e.g. Natrosol®* 250 MR, 4 %. The thickening also serves as an additional protective colloid.

The paste is printed, dried and fixed (4 – 5 min at 150 °C in hot air). This is followed by the padding or lick-roll application of caustic soda 26 – 37 °Bé (the higher caustic concentration gives a stronger crimp effect), after which the fabric is allowed to lie for a few minutes, free of tension. It is then thoroughly washed off and neutralized. This treatment should likewise be carried out free of tension.

If coloured effects are also wanted in the *shrunken* areas, the fabric can be printed not only with the resist paste, but also with reactive dyes or slightly modified pigment print pastes (max. 50 g/kg binder). It should be noted, however, that when pigment print pastes are applied, the shrinkage – and thus the crimp effect – is somewhat lower than with the combination with reactive pastes.

The printing of pastes with reactive dyes involves a more complicated procedure: print, dry, steam for 8 – 10 min at 102 °C with saturated steam (reactive dyes), fix for 4 – 5 min at 150 °C in hot air (pigment print), wash and dry.

The fabric is then padded with caustic soda as described above, allowed to lie free of tension, then thoroughly washed off and neutralized.

The pigment pastes for the shrinking part must only contain a very small amount of binder so that the fibre can still be readily wetted by the caustic soda. The low binder concentration does, however, restrict the strength of shades that can be printed; these should be as light as possible and their standard of fastness may be somewhat limited.

** Registered trademark of Hercules NV Co., Netherlands*

Stock thickening:

	... g	water
	3 g	Vitexol K
	10 g	diethylene glycol
	8 g	Luprintol PE New
	50 g	Helizarin Binder TW
5 –	8 g	Leophen RBD
	2 g	Lutexal HVW
	45 g	Lutexal HEF
	1000 g	

Helizarin pigments are added to the stock thickening. The procedure is the same as that described for colourless, caustic-crêpe resists on p. 25.

Localized chintz effect

Permanent, localized chintz effects can be produced as follows.

Print paste:

	50 g	water
	100 g	Fixapret® ECO
	80 g	Helizarin Fixing Agent LF
	50 g	Siligen® VN
	150 g	Helizarin Binder ATN
	530 g	Tylose®* MH 300, 5 %
	40 g	diammonium phosphate 1 : 3
	1000 g	

For colourless chintz effects, this print paste is used without further additions. Coloured chintz effects can be obtained by the addition of Helizarin pigments and 100 g/kg of an Iriodin type.

Print, calender (without friction) with 150 kp/cm at 190 °C and fix for 4 – 5 min at 150 °C. The fabric is then washed to allow the fibres in the unprinted areas to revert to their original, voluminous form and thus provide a particularly effective contrast to the printed and lustrous chintz pattern.

Wash-out effect

By markedly reducing the amount of binder in the printing recipe, the printed fabric intentionally has a poor washing fastness. The prints are fixed in the normal manner, but in the subsequent washing treatment a large proportion of the (mainly full cover) pigment print is washed out again, leaving the impression of a well-used, faded garment. The remaining pigment coloration is then so “wash-fast” that subsequent laundering produces no further significant lightening.

Wash-out stock:

	... g	water
	2 g	Vitexol K
	10 g	Luprintol PE New
20 –	30 g	Luprimol U
10 –	20 g	Helizarin Binder TW or ET
	5 g	Luprimol SIG
	34 g	Lutexal HEF
	1000 g	

Print paste:

up to approx.	50 g	Helizarin pigment
	... g	wash-out stock
	1000 g	

Print, dry and fix in the usual manner for 4 – 5 min at 150 °C. Then wash off thoroughly at 60 °C (if necessary, after making up).

** Registered trademark of Hoechst AG Co., Germany*

Note

The information submitted in this publication is based on our current knowledge and experience. In view of the many factors that may affect processing and application, these data do not relieve processors of the responsibility of carrying out their own tests and experiments; neither do they imply any legally binding assurance of certain properties or of suitability for a specific purpose. It is the responsibility of those to whom we supply our products to ensure that any proprietary rights and existing laws and legislation are observed.

Printed in Germany

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