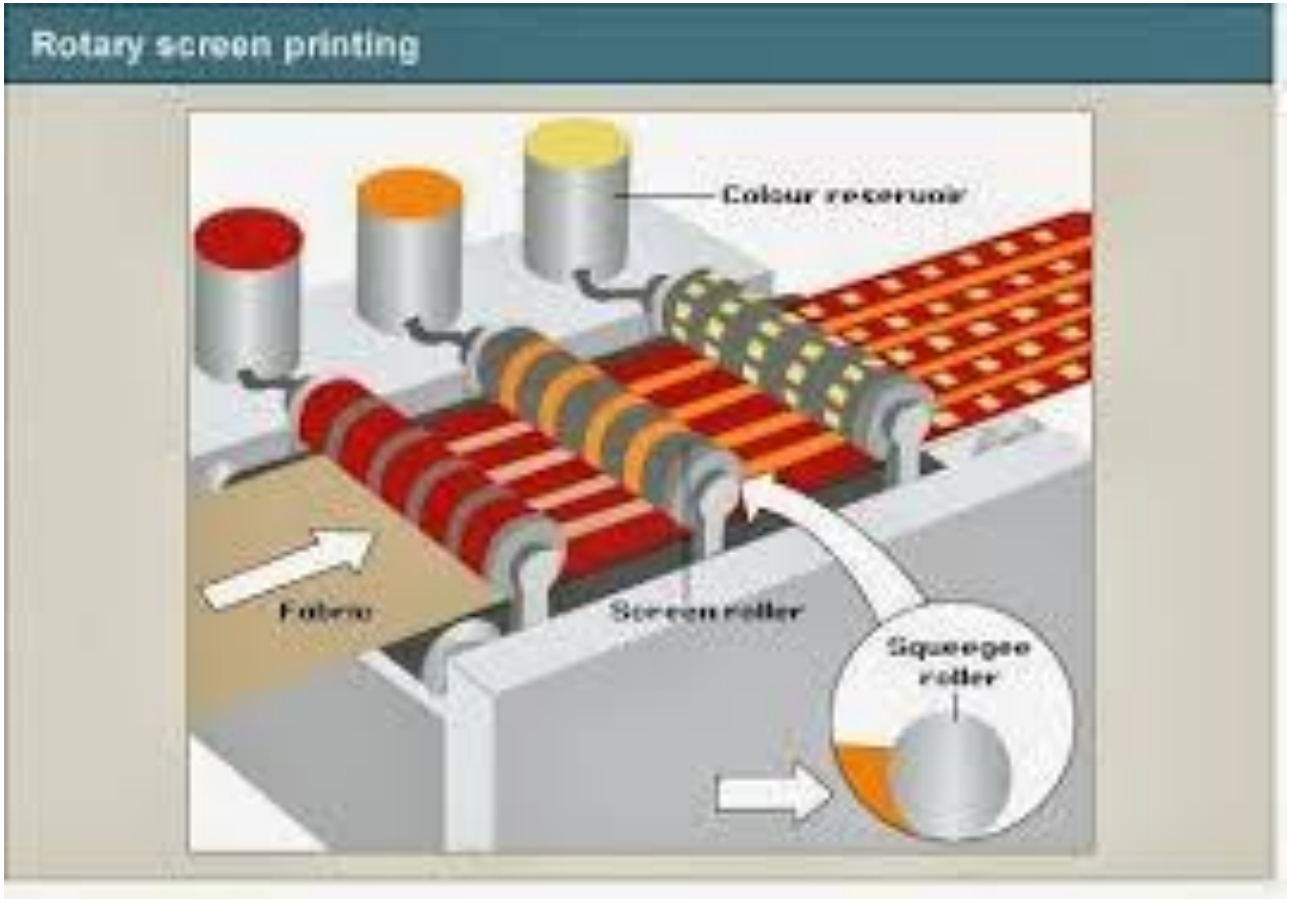
Textile Printing



PRINTING

The printing is described as localized dyeing. Dyestuff or pigments are applied locally or discontinuously to produce the various designs.

Printing is the production of all active designs with well defined boundaries made by the artistic arrangement of motifs is one (in case of white or color ground) or more colors.

Printing is a process for reproducing text and image, typically with ink on paper using a printing press. It is often carried out as a large-scale industrial process.

Steps of printing:-

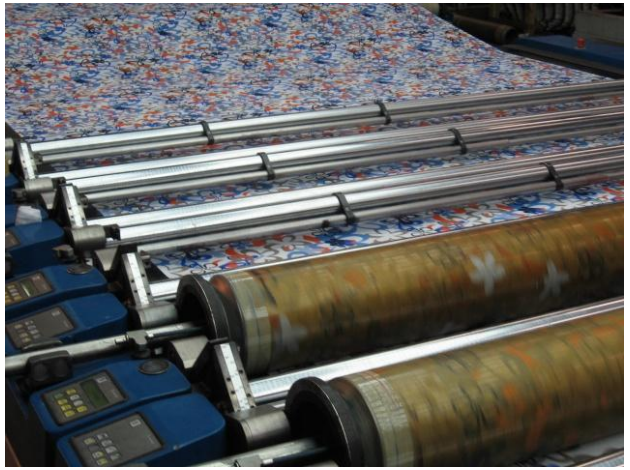
1. Preparation of the fabric to be printed.
2. Preparation of the print paste.
3. Making of Design on Block/Roller/Screen/Transfer Paper
4. Making an impression of the print paste on the fabric.
5. Drying of the printed fabric.
6. Steaming /fixation and after treatment (Soaping) of the printed fabric.

Print Methods/Techniques

- Block Printing

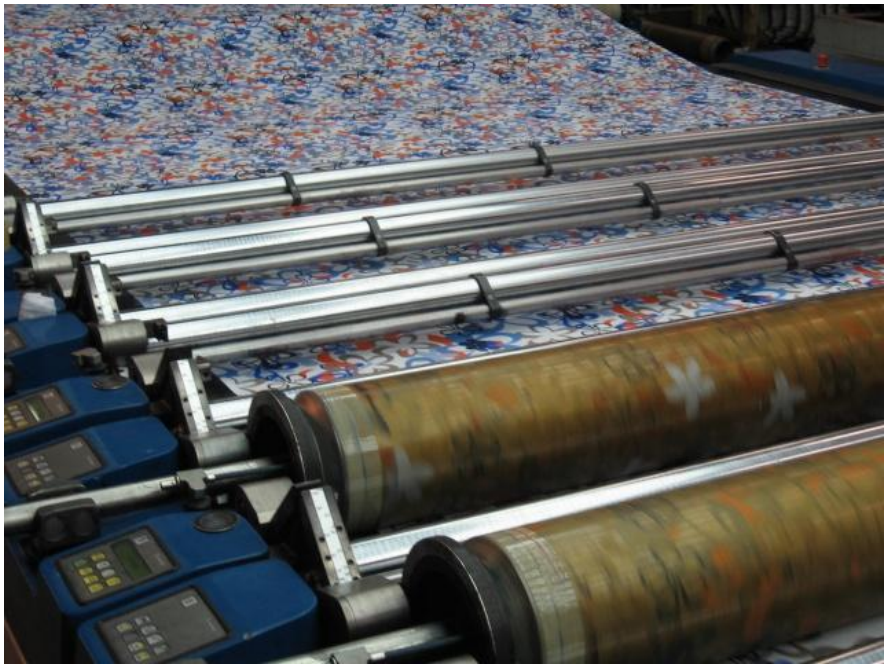
- Stencil Printing
- Flat (Silk) Screen Printing
  - Manual
  - Semi-Auto/Flat-Bed

- Rotary Screen Printing
- Roller Printing
- Heat Transfer Printing
- Ink Jet and Digital Printing



There are four common styles of pattern printing:

1. Direct Printing



What type of printing method you know?

Direct Printing:

- In direct printing a design is etched into a wooden block or copper roller/cut into Stencil/composed in a silk screen.
- A dye that has been thickened into a paste with starch, gelatin, or synthetic polymers is applied to the etched area while the un-etched surface is kept clean.
- The color design is transferred to the cloth under pressure.
- Direct printing may also involve forcing the paste onto the fabric through a screen, a technique similar to stencil printing except that the screen controls how much paste is applied to the cloth.

There are four common styles of pattern printing:

2. Resist Printing

Resist dyeing.

What type of printing method you know?

Resist Printing:

- In resist printing a reverse-printing method, a dye repelling substance is selectively applied to the cloth, which is then placed in a dye bath.
- This method is used for example, to produce white polka dots on a color background.

There are four common styles of pattern printing:

3. **Discharge Printing**
    - **White Discharge**
    - **Colored Discharge**

Discharge Printing:

In discharge printing, the whole fabric is dyed. A pattern is then printed on the fabric with a chemical that oxidizes or reduces the dye, creating a white pattern on a colored background.

There are four common styles of pattern printing:

4. Heat transfer printing

What type of printing method you know?

Heat transfer Printing:

- This is essentially transferring an image to fabric from a paper carrier. When heat and pressure are applied to this paper the inks are transferred. Some transfers are topical, and the image sits on the surface of the fabric. Other transfers are absorbed into the fibres of the fabric.

- Heat transfer printing is clean and environmentally safe. The only by-product is the paper carrier. It is the perfect print method for short run and sample production, but can also be used for batch production as well.

Pigment Print

- Pigment used in textile printing is mainly synthetic organic materials, except for carbon black, titanium dioxide and copper & aluminum alloys & sometimes iron oxide.
- When choosing these synthetic pigments, the price, the fastness properties, the brilliance & the coloring power of the many produce available are all taken into consideration.
- Pigments are various organic & in organic insoluble substances, which are widely used in surface coating.
- **Chemical in use:-**
    - Water- 80kg
    - Binder- 15kg
    - Thickener- 5kg
    - Pigment Color

Requirements of Pigment print:-

- Pigment must have mixing ability.
- Pigment should be non toxic.
- Pigments have good covering power.

Advantages of pigment:-

- Pigment printing is most economical printing process & allows maximum output of goods.
- Genera fastness properties are ok.
- It can be applied for natural and man made fibres.
- Pigment print presents least problem for the printers.

Disadvantages of pigments:-

- Pigments are sensitive to crushing during roller printing.
- Rubbing fastness is medium & no pigment is completely fast to dry clearing.

There are four common styles of pattern printing:

Discharge Printing

- **White Discharge**
- **Colored Discharge**

What type of printing method you know?

Discharge Printing:

In discharge printing, the whole fabric is dyed. A pattern is then printed on the fabric with a chemical that oxidizes or reduces the dye, creating a white pattern on a colored background.

DYED FABRIC | AFTER PRINTING | AFTER STEAMING | AFTER WASHING

Steps of Discharge Screen Printing

1. First the table is prepared by stretching the cloth and pinning it up on the table.
2. Now the paste is prepared to discharge the dye on the fabric. Remember to get your discharge paste ready a few hours before the process takes place.
3. Apply discharge paste for print so that the dye becomes soluble and comes out.
4. The fabric should keep for drying out before the fabric is ready for steaming.

Discharge Screen Printing

5. Steaming should be done within 24 hours to produce best results.

6. Then wash the fabric thoroughly to get rid of the chemicals.

7. Hang the fabric and allow it to breathe for about 30 minutes, this helps in developing color.

8. There you go!! Finally wash the fabric in detergent to prevent loosing of any vat dye left on the fabric which helps in fixing the dye to the fiber. It is recommended to wash the

Fabric Pretreatment for Reactive Printing

- The importance of pretreatment for Reactive printing

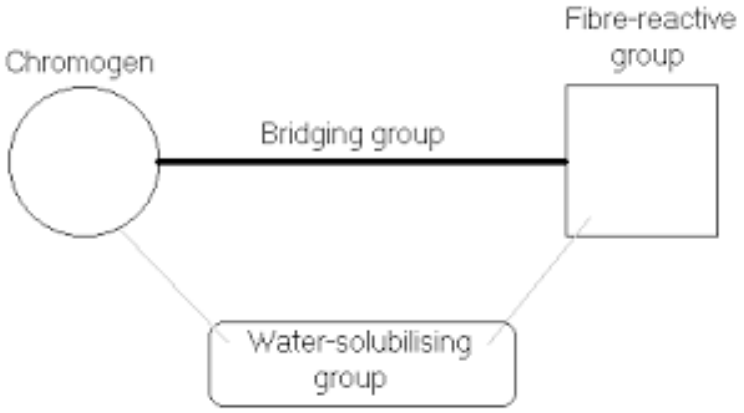
1) Woven fabric must be thoroughly de-sized for reaction of reactive paste with fabric, as the presence of SIZE material lower the color yield.
2) Mercerization or Semi-mercerization is recommend to enhanced (fabric to dye) reactivity for full color value.
3) Causticizing (swelling) in caustic soda solution at room temperature under tensionless conditions, improves color yield of the print.

Fabric Pretreatment for Reactive Printing

4) Fabric should be well rinsed but not neutralized to achieve maximum result.
5) An alternative would be to pre-pad with urea and caustic soda.

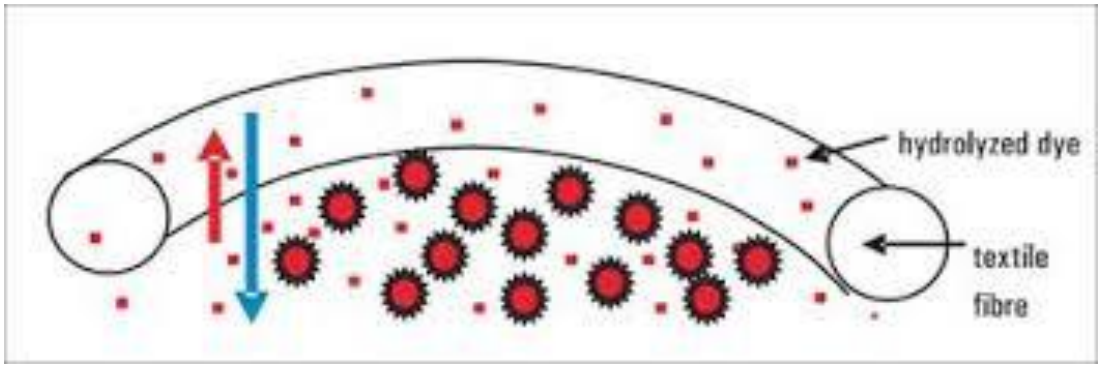
Reactive Printing

1) The application of reactive printing paste for cellulose fibres has given the printers the using only FAST dye with simple application conditions unlike VAT, DIRECT and PIGMENTS.
2) The formation of Covalent bonds between DYE FABRIC make it possible to use small molecular size and good solubility.



Reactive Textile Printing

1) Reactive dyes in printing paste can be brighter, faster diffusing and easily removed in the washing-off process.
2) While using reactive printing, attention must be paid to it STABILITY and STAINING of during wash-off.



REACTIVE PRINT PROCESSES

AFTER DISCHARGE

AFTER STEAMING

AFTER WASHING

All-in Method of Reactive Printing

1. A typical reactive paste is prepared by sprinkling required amount of dye into the stock paste.

Recipe. 1:

- Reactive dye — As per shade%
- Alginate thickener (3-12%) — 400-500 g
- Urea (Humectants) — 100-200 g
- Sodium bicarbonate (Alkali) — 20 g
- Sodium m-nitrobenzenesulphonate(Oxd.Ag) — 10 g
- Water — 470-270 ml-g

1000 grams

Reactive Dye-stuff for Textile Printing

1. The solubility of reactive dye is sufficient for this sprinkling method, followed by high speed stirring to give perfectly smooth paste.
2. The dye can be alternatively pre-dissolved in small amount of hot water, using the Urea to increase the solubility.
3. Alkali should only be added after the mixture of water, dye and thickener (printing paste) has cooled to room temperature.

Selection of Thickener

1. Alginates are the only natural thickeners suitable for use in printing with reactive dyes.
2. All other carbohydrates react with the dye and result in low color yield.
3. In absence of the substrate(textiles) the amount of dye react with thickeners is as mentioned:

1.	Starches	18% (Low cost)
2.	Alginates	9 -13.9% (High cost-limited supply)
3.	Poly-acrylic acid	0%
4.	Emulsion Thickeners	0%

All-in method of Reactive Printing

1. Recipe. 2 (Half emulsion with synthetic thickener)

• Reactive dye	As per shade%
• Alginate thickener (3-12%)	100-200 g
• Urea (Humectants)	80-150 g
• Emulsifier	10-20 g
• Sodium bicarbonate (Alkali)	20 g
• Sodium m-nitrobenzene-sulphonate	10 g
• White spirit	500 g
• Water	280-100 ml-g
	1000 grams

Selection of Alkali

1) Alkali is essential for reactive printing paste reaction with fabric. However care must be taken while selection of alkali based on factors i.e

   A. REACTIVITY of dye and

   B. STABILITY of printing paste.

   - Sodium carbonate is preferred alkali because

     1. It is weak alkali
     2. Give sufficient printing paste stability
     3. It is also cheap in price

Alkali selection

2) Select a weak Alkali for a high reactive dye and vice versa.
3) A weak alkali must be used if the stability of printing paste required for long time.
4) Stability for 28 days is normally attainable with appropriate alkali selection.
5) Strong alkali give higher color yield but printing paste stability is adversely affected.
6) Common alkali used are Sodium Carbonate, Soda ash and Caustic Soda .

Selection of Oxidizing Agent

1) Since the reactive dyes are susceptible to reducing influence under steam i.e, the destruction of reactive dyes in steaming process.
2) A mild oxidizing agent is incorporated in reactive printing paste to avoid color destruction.
3) Sodium m-nitrobenzene sulphonate widely acceptable for this purpose.

Selection of Hygroscopic agent (Humectants)

1) The hygroscopic agent is added in printing paste to absorb the condensed steam during steaming process.
2) Recommended to use optimum quantity of hygroscopic agent as
   - Less quantity result in low color yield
   - Higher quantity spread of color that result in print sharpness loss (lose of defined boundaries in the print)
- Urea is most commonly used

One-phase (All-in) Reactive printing process Flow

→ Fabric feeding

→Printing

→Drying

→Steaming/fixation

→Washing & Soaping

→Rinsing

→Drying

Two-phase Reactive printing process Flow

→ Fabric feeding

→Printing with out Alkali

→Drying

→ Alkali treatment

→Steaming/fixation

→Washing & Soaping

→Rinsing

→Drying

Fixation Condition for Reactive Print Process flow

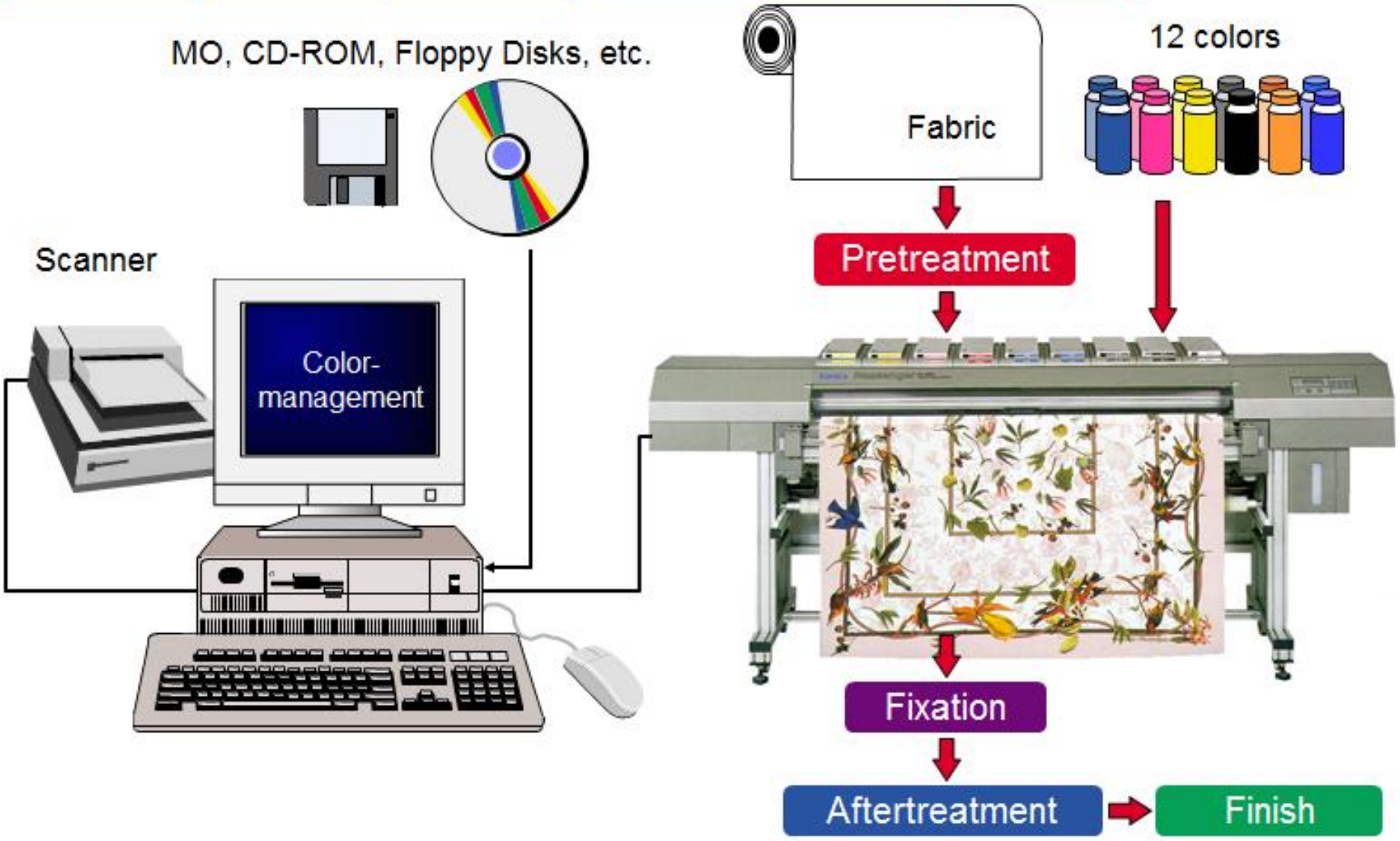
Steaming：	102-103℃	5-10min（cotton）
Curing：	150℃	3-5min（cotton）
HT steaming	175℃	6-8min（PC）
Curing method：	190-200℃	1-2min（PC）

Alkali treatment: Padding 30-40%
Fixation：135℃ 8-15sec

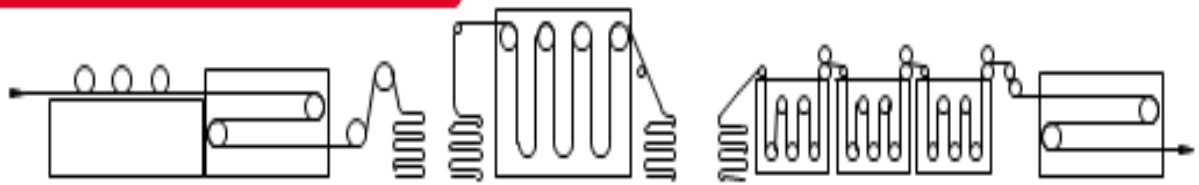
Washing
1) Overflow cool water rinse
2) Hot wash70℃
3) Soaping ,nonionic soaping agent 2g/L
4) Hot water rinse70℃
5) Cool water rinse

The digital textile printing system

DyStar

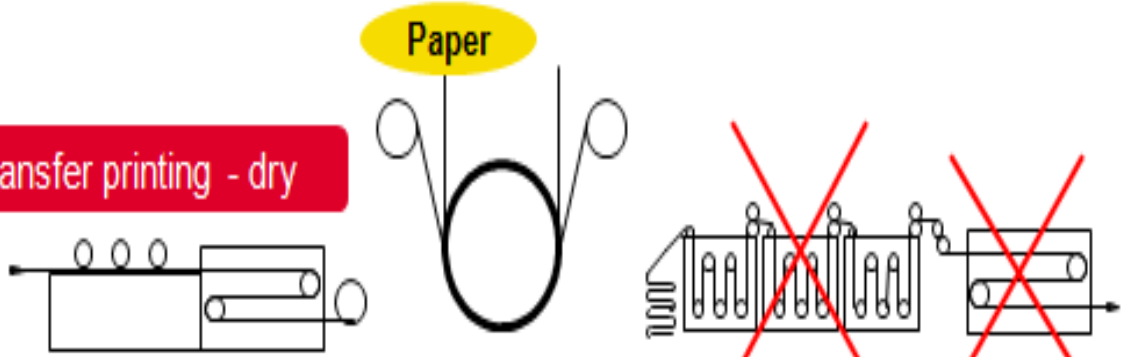


Conventional textile printing



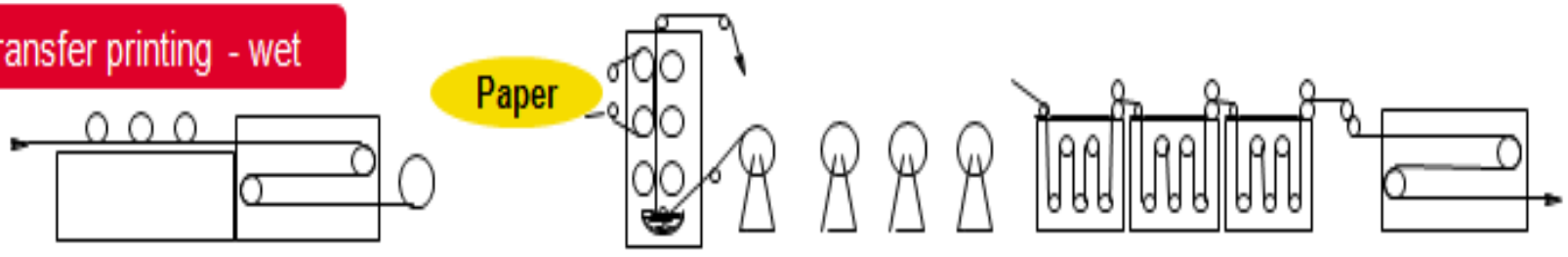
Printing Drying Fixation Washing Drying

Transfer printing - dry



Printing (paper) Drying Transfer Washing Drying

Transfer printing - wet



Printing (paper) Drying Transfer Fixation Washing Drying