



Training module: FINISHING, PRINTING and FUNCTIONALIZATION
Course: Basic Principles of Textile Printing

The course is developed under Erasmus+ Program Key Action 2:
Cooperation for innovation and the exchange of good practices Knowledge Alliance

ICT IN TEXTILE AND CLOTHING HIGHER EDUCATION AND BUSINESS

Project Nr. 612248-EPP-1-2019-1-BG-EPPKA2-KA

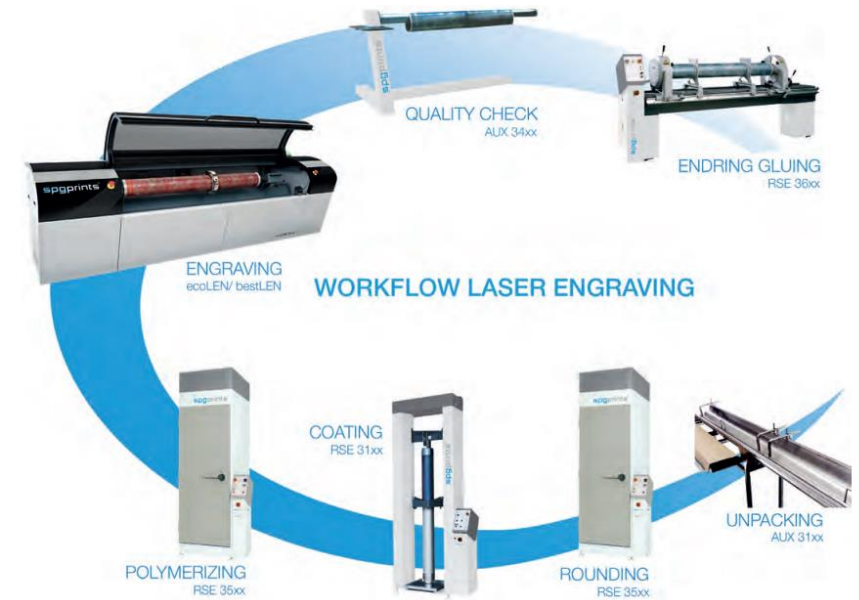


✓ Selection and methodologies of screen preparation

- Flat screens
- Rotary screens

Systems for:

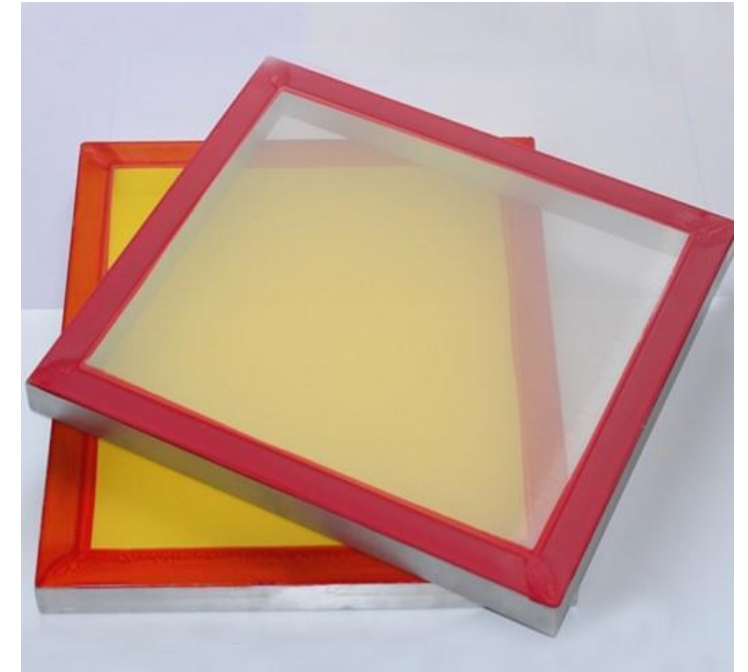
- Light exposure
- Laser exposure
- Laser engraving



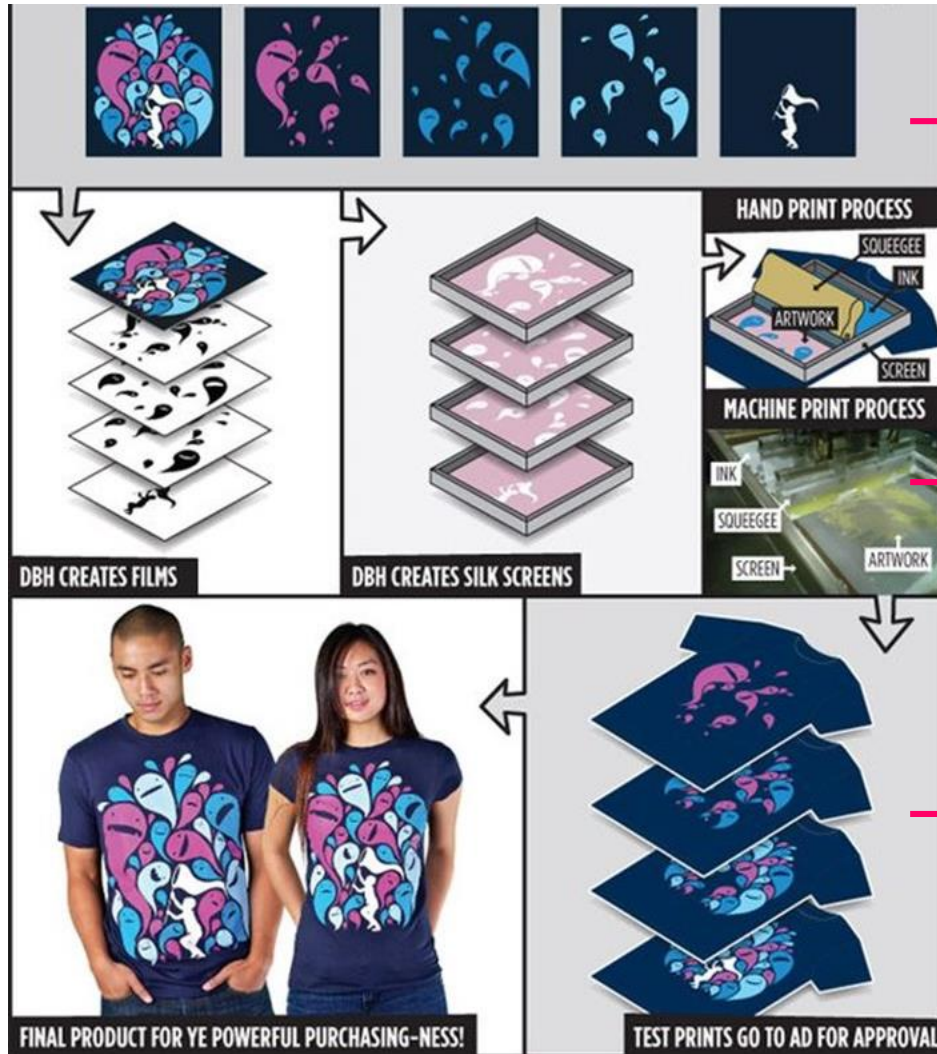


❑ TRANSFER of PATTERN TO FLAT SCREEN

- ❑ After the phase of sample preparation, which includes the separation of colors, ie the separation of each individual effect from the pattern, follows the phase of creating a stencil, ie the transfer of each individual effect to a separate screen.
- ❑ Let's remember that with **simple color separation**, which means that it is possible to accurately define the number of colors and clearly separate the effects, a separate stencil is created for each individual color or each individual effect. [How many colors/effects - so many stencils.](#)
- ❑ The flat screen construction involves the use of polyester (PES) mesh of defined density, stretched and firmly attached to a wooden or metal frame (today mostly metal). It is important to emphasize that these notes, which are listed and will be listed below as an overview of the process of making flat stencils, are valid for stencils intended for hand and for those intended for machine (industrial) printing.



❑ Flat screens with PES mesh



❑ Pattern separated on effects (number of colours equals number of effects).

❑ Preparation of the screen/stencil for each effect.

❑ Printing effects one by one until the whole pattern is reproduced.

- ❑ To transfer the pattern to the screen (stencil making process), it is necessary to coat the screen with a special photo-sensitive emulsion.

- ✓ **Photo-sensitive emulsion:** Some polymers, in the presence of a sensitiser, will crosslink when exposed to blue or ultraviolet light and so become insoluble. The polymers most used in the preparation of textile printing screens are mixtures of poly(vinyl alcohol) and poly(vinyl acetate), sensitised with a dichromate salt such as sodium or ammonium dichromate, or a 'diaz resin' (condensation product of formaldehyde (methanal) and *p*-diazodiphenylamine). The poly(vinyl acetate) is added as a dispersion and acts as a filler, but also increases the solids, improves the edge quality and imparts some water resistance to the finished stencil.





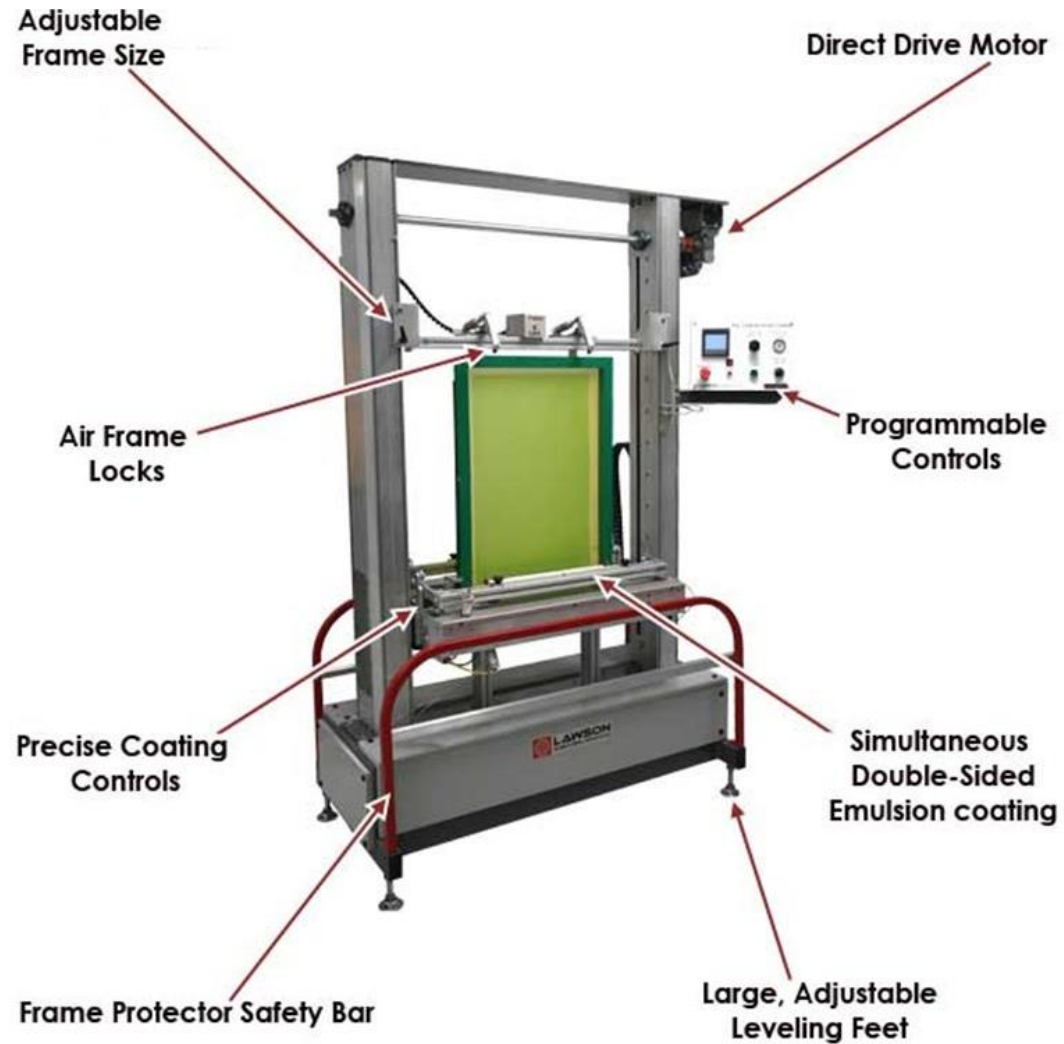
- ❑ The photoemulsion is applied to the screen by hand or by machine. It is necessary to achieve a uniform coating on both sides of the screen.



<https://www.mekanika.io/blog/learn-1/complete-guide-how-to-prepare-a-screen-3>

- ❑ Manually apply photoemulsion to the screen.





<https://www.lawsonsp.com/screen-printing-equipment/auxiliary-equipment/screen-equipment/pro-coat-emulsion-coater>

- Photoemulsion application machine for flat screens.

- ❑ After coating the screen with photoemulsion, drying in the dark is carried out, at a maximum temperature of 40 °C.
- ❑ In the next stage, the sample is transferred to the screen in one of the following ways:
 - ✓ Light exposure over a transparent foil on which the effect is printed in black opaque color
 - ✓ Direct digital ink-jet printing of the effect with black opaque color on the screen coated with photoemulsion, after which the classic lighting is carried out
 - ✓ Laser engraving

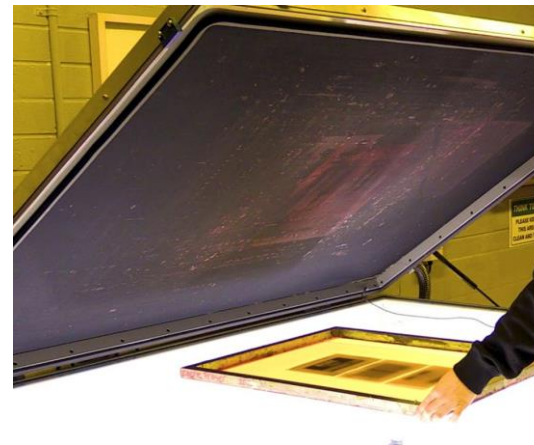
❑ **Light exposure over printed foil**

✓ Coated screen

✓ Printed foil with pattern



✓ Light exposing



✓ Final result - stencil





❑ FLAT SCREEN light exposure units



<https://www.screenprinting.com/blogs/news/led-exposure-new-standard>



- ❑ Stand-mounted UV LED screen exposure unit



- ❑ Tabletop LED Vacuum Exposure Unit with Digital Timer



- ❑ Light exposure unit with two methods of exposing screens: glass and vacuum blanket



- ❑ Large Format Screen Printing Exposure Unit

❑ COMPUTER to SCREEN Technology

- ❑ In addition to the classic approach of developing transparent films with black printed negatives of the pattern, new technologies of direct ink-jet printing on a photoemulsion coated screen are applied. In this case, the black pigment with which the pattern is printed also serves as a blockage of the passage of light during light exposure, which follows.



<https://www.fibre2fashion.com/machines/direct-to-screen-printing-machine-suppliers-20182003>

- ✓ All-in-one computer-to-screen (CTS) imaging and UV LED exposure system, for imaging and exposing screens for textile screen printing.
- ✓ **On the initial pass** over the screen frame, the system uses specially-formulated water-based UV-blocking ink and high-resolution CTS inkjet printer technology to quickly generate opaque images on emulsion-coated screens.
- ✓ **On the return pass**, the built-in high-output scanning UV LED light source exposes the emulsion, producing screens that can be taken directly to washout. CTS images are superior to traditional film positives, delivering greater detail and smoother halftone transitions.

❑ TRANSFER of PATTERN TO ROTARY SCREEN

- ❑ Since rotary stencils are made of thin, flexible metal perforated plates coated with nickel, they are an excellent base for the application of special emulsions for the application of lasers in the process of lighting or engraving. Namely, two methods can be applied to rotary templates: the **laser exposure method** and the **laser engraving method**.
- ❑ But basically, the transfer of the pattern to rotary screens does not differ in the process stages from the preparation of flat screen: **degreasing, coating, drying, exposing/engraving**.
- ❑ After **engraving**, the stencil is immediately ready for printing, while after **laser exposure** washing (development), drying and polymerization is carried out and only then the stencil is ready for use.



❑ Laser engraving machine for rotary screens



- ❑ The rotary screen is coated with a suitable emulsion, preferably according to the manufacturer's recommendation.
- ❑ Conventional emulsions are mixtures of polyvinyl alcohol (solvent-resistant but water-sensitive) and polyvinyl acetate (water-resistant but solvent-sensitive) resins.
- ❑ The “dual-cure emulsions” incorporate diazo as well as photopolymer technologies. These usually consist of polyvinyl alcohol/diazo sensitizer/acrylic monomer/photoinitiator compositions. The diazo sensitizer is usually added to the emulsion just prior to the screen preparations.
- ❑ Pure photopolymer stencil systems are referred to as PVA/SBQ (stilbazole quaternary). The system is based on photodimerizable resin, which is produced by reacting a styrylpyridine salt possessing a formal or an acetal group with polyvinyl alcohol. These polymers are water-soluble in uncrosslinked state.
- ❑ Emulsion coating of the rotary screen is carried out mechanically, which allows an even, continuous layer.



- ❑ Auto COATER for rotary screens coating



❑ CLIMATIZER

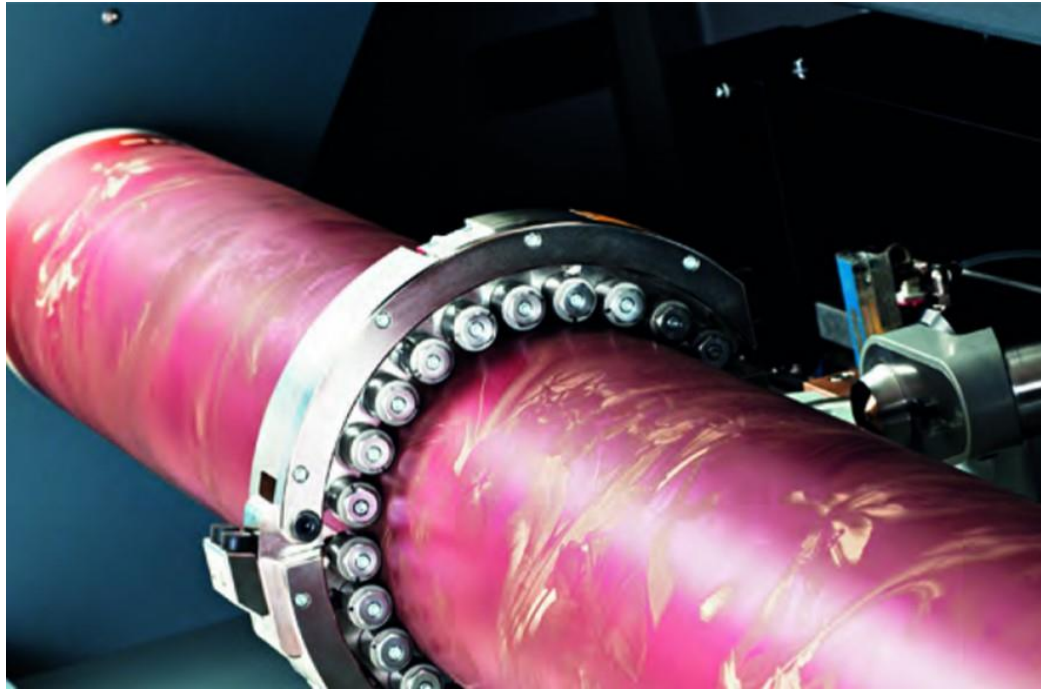


❑ POLYMERIZER

- ❑ After coating, the rotary screen dries, and goes to engraving or lighting. Drying is carried out in the so-called **climatizer**, and in the engraving process in which the polymerization and drying phases are required, a **polymerizer** unit is used, which serves for the final polymerization and fixing of the photo emulsion.



❑ Laser ENGRAVING



- ❑ Direct Laser Engraving is a single step dry process – simply engrave the coated screen with desired design and print.
- ❑ Laser exposing is wet process, containing several steps (exposing, developing, drying and polymerizing).
- ❑ The prepared design is transferred directly, by computer, to an engraving machine that burns a layer of coating (emulsion) in the contours and shapes of a given pattern with a laser beam.



CSK Digital Blue Ray UV Laser screen engraving system

