BASIC TEXTILE OPERATION

NTQF Level - I

Learning Guide # 71

Unit of Competence: Perform Printing of Textiles and Garments

Module Title: Performing Printing of Textiles and Garments

LG Code: IND BTO1 M19 LO1-LG-71

TTLM Code: IND BTO1 TTLM 0919v1

LO 1: Set Up and Load Machine

Instruction Sheet	Learning Guide # 72

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics.

- Introduction to printing
- Printing techniques
- Styles of printing
- Receiving and checking printing paste
- Checking and receiving the screen
- Preparing and loading the screen
- Preparing fabric to be printed
- Connecting the printing paste with printing machine
- Cleaning work area and Carrying out printing

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide you will be able to:

- Receive and check the prepared printing paste
- Check and receive the prepared screen.
- Load the screen on the printing machine
- Load the fabric on the printing machine.
- Connect the printing paste with the printing machine
- Clean the work area.
- Make the machine ready for printing.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your teacher for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” in each information sheets.
5. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You may get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheets and LAP Tests if any”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity.
7. After you accomplish Operation sheets and LAP Tests, ensure you have a formative assessment and get a satisfactory result;
8. Then proceed to the next information sheet

Information Sheet-1	Introduction to Printing

1.1. Definition of printing

Textile printing is the process of applying color to fabric in definite patterns or designs. It is related to dyeing but, in dyeing proper the whole fabric is uniformly covered with one color whereas in printing one or more color are applied to it in certain parts only, and in sharply defined patterns.

1.2. History of Printing

The desire of adding color and design to textile materials is almost as old as mankind. Early civilizations used color and design to distinguish themselves and to set themselves apart from others. Textile printing is the most important and versatile of the techniques used to add design, color, and specialty to textile fabrics. It can be thought of as the coloring technique that combines art, engineering, and dyeing technology to produce textile product images that had previously only existed in the imagination of the textile designer. Textile printing can realistically be considered localized dyeing. In ancient times, man sought these designs and images mainly for clothing or apparel, but in today's marketplace, textile printing is important for upholstery, domestics (sheets, towels, and draperies), floor coverings, and numerous other uses.

The exact origin of textile printing is difficult to determine. However, a number of early civilizations developed various techniques for imparting color and design to textile garments. Batik is a modern art form for developing unique dyed patterns on textile fabrics very similar to textile printing. Batik is characterized by unique patterns and color combinations as well as the appearance of fracture lines due to the cracking of the wax during the dyeing process. Batik is derived from the Japanese term, "Ambatik," which means "dabbing," "writing," or "drawing." In Egypt, records from 23-79 AD describe a hot wax technique similar to batik. The early Egyptians also used ink-carved designs on the ends of wooden cylinders to print on fabrics as early as 400 AD. In Europe, the earliest evidence of textile printing is provided by a wooden block discovered in France dated to the end of the 14th century. The family name "Tuchdruckers" or "textile printers" was well known in Germany by 1440. In the United States, woodcut block printing was practiced in Massachusetts, New Jersey, and Pennsylvania by the 1770's. A tremendous breakthrough occurred in 1783 when James Bell, a Scotsman, invented engraved roller printing.

The development of screen-printing began in Japan in the middle of the 17th century. Early development involved the use of design stencils held together by fine silk threads or even human hair. The designs were laid onto textile fabrics and color was applied only to the areas outside of the designs. Since the silk threads were so fine, they were not apparent in the final fabric design. The Japanese technique was taken to France where modern flat screen printing was developed, initially using silk fabric stretched over a wooden frame.

Textile printing was introduced into England in 1676 by a French refugee who opened works, in that year, on the banks of the Thames near Richmond. Curiously enough this is the first print-works on record; but the nationality and political status of its founder are sufficient to prove that printing was previously carried on in France. In Germany, too, textile printing was in all probability well established before it spread to England, for, towards the end of the 17th century, the district of Augsburg was celebrated for its printed linens, a reputation not likely to have been built up had the industry been introduced later than 1676.

On the continent of Europe the commercial importance of calico printing seems to have been almost immediately recognized, and in consequence it spread and developed there much more rapidly than in England, where it was neglected and practically at a standstill for nearly ninety years after its introduction. During the last two decades of the 17th century and the earlier ones of the 18th new works were started in France, Germany, Switzerland and Austria; but it was only in 1738 that calico printing was first, practiced in Scotland, and not until twenty-six years later that Messrs Clayton of Bamber Bridge, near Preston, established in 1764 the first print-works in Lancashire, and thus laid the foundation of what has since become one of the most important industries of the county and indeed of the country. At the present time calico printing is carried on extensively in every quarter of the globe, and it is pretty safe to say that there is scarcely a civilized country in either hemisphere where a print-works does not exist.

1.3. Difference between Dyeing and Printing

Though the dyeing and printing are the coloration processes using the same classes of Dyes and other chemicals, they differ in the following aspects.

Table: 1.1. Difference between dyeing and printing

Dyeing	Printing
Uniform application on both sides of the fabric surface with single color only	Single or multicolor application on one side of the fabric at selected portions only
Dyes are applied in dilute form.	Dyes are applied in paste form
In fabric preparation, Half bleaching is enough.	full-bleaching with optical whitener is necessary
Color penetrates through the fabric.	Color is applied only on the surface
More time is required in batch application.	Not applied in batch process. Applied only by continuous process alone. Therefore requires less time.
Fabric need not be in dry condition.	Fabric should be in dry state
Require single machine and the Process is simple.	Require complex machinery and the process is also complex.
Dyeing consumes more water.	Printing consumes less water.

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Define printing means? ***(2marks)***
2. What is the relation of dyeing and printing? ***(2 marks)***
3. Explain about history of printing? ***(3 marks)***
4. Write the difference between dyeing and printing? ***(3 marks)***

Note: **Satisfactory rating - 6 points** **Unsatisfactory - below 6 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer

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Information Sheet-2	Printing Techniques

Textile printing can be done on printing ranges using different techniques, the most common ones being rotary screen printing, flat-bed screen printing, engraved roller printing, and heat transfer printing. Each technique has its own advantages and disadvantages.

2.1. Roller Printing

It is a high speed process capable of producing 6000 yards of printed fabric per hour. It is also called machine printing. Printing, originally a hand craft, developed into an industrial art requiring the contributions of a range of specialists, coordinated by someone with a clear vision of the desired end-product. The first of the specialists is the creator of the original design, which may already be suitable for reproduction but usually is not, and is sometimes little more than an idea. Another specialist is the engraver whose task is to convert the original design into a set of engraved rollers that will enable a printer to achieve an effective reproduction of the design on fabric. Sensitivity to the original design objectives and awareness of the printer's requirements are important as well as skill and accuracy. An original design must be put into repeat and the dimensions adjusted so that one or more repeats will fit accurately around the roller circumference. If the repeat is small it may be that the mill-engraving method should be used. This starts with the hand engraving of a few repeats on a small soft-steel cylinder, which is then hardened. The design is then obtained in relief by running the first cylinder (the die) under pressure in contact with a second soft-steel roller. This relief roller (the mill) is hardened and run in contact with the copper cylinder to obtain the desired depth of impression, and this is repeated across the cylinder until the full width is engraved. The raised copper around each groove must then be polished off.

In the roller printing process the print paste is applied over an engraved roller and the fabric is guided between this roller and a central cylinder. The pressure of the roller and the central cylinder forces the paste into the fabric. Approximately 26% of printed goods are printed using engraved roller printing.

2.1.1. Advantages of roller printing

- High design capability
- Fine detail
- Multiple tones

2.1.2. Disadvantages of roller printing

- copper cylinders very expensive

- not economical for short runs
- requires highly skilled workers

2.2. Screen printing

Screen-printing is the most flexible printing process. It can be used to print on a wide variety of substrates, including paper, paperboard, plastics, glass, metals, fabrics, and many other materials including paper, plastics, glass, metals, nylon and cotton. Some common products from the screen-printing industry include posters, labels, decals, signage, and all types of textiles and electronic circuit boards. The advantage of screen printing over other print processes is that the press can print on substrates of any shape, thickness and size.

An important characteristic of screen-printing is that a greater thickness of ink can be applied to the substrate as compared to the other printing techniques. This allows for various interesting effects that cannot be achieved through the other printing methods. Because of the simplicity of the application process, a wider range of inks and dyes are available for use in screen-printing than for use in any other printing process.

Utilization of screen printing presses has begun to increase because production rates have improved. This has been a result of the development of the automated and rotary screen printing press, improved dryers, and U.V. curable ink. The major chemicals used in screen-printing include screen emulsions, inks, and solvents, surfactants, caustics and oxidizers used in screen reclamation.

2.2.1. Advantages of screen printing

- large repeats
- Multiple strokes for pile fabrics

2.2.2. Disadvantages of screen printing

- Slow
- No continuous patterns

2.3. Heat Transfer Printing

Transfer printing is the term used to describe textile and related printing processes in which the design is first printed on to a flexible non textile substrate and later transferred by a separate process to a textile. It may be asked why this devious route should be chosen instead of directly printing the fabric. The reasons are largely commercial but, on occasion, technical as well and are based on the following considerations:

- Designs may be printed and stored on a relatively cheap and non bulky substrate such as paper, and printed on to the more expensive textile with rapid response to sales demand.
- The production of short-run repeat orders is much easier by transfer processes than it is by direct printing.
- The design may be applied to the textile with relatively low skill input and low reject rates.
- Stock volume and storage costs are lower when designs are held on paper rather than on printed textiles.
- Certain designs and effects can be produced only by the use of transfers (particularly on garments or garment panels).
- Many complex designs can be produced more easily and accurately on paper than on textiles.
- Most transfer-printing processes enable textile printing to be carried out using simple, relatively inexpensive equipment with modest space requirements, without effluent production or any need for washing-off.

The design on a paper is transferred to a fabric by vaporization. There are two main processes for this- Dry Heat Transfer Printing and Wet Heat Transfer Printing. In Conventional Heat Transfer Printing, an electrically heated cylinder is used that presses a fabric against a printed paper placed on a heat resistant blanket. In Infrared Heat Vacuum Transfer Printing, the transfer paper and fabric are passed between infrared heaters and a perforated cylinder which are protected from excessive heat by a shield. The Wet Heat Transfer Printing uses heat in a wet atmosphere for vaporizing the dye pattern from paper to fabric.

2.3.1. Advantages of heat transfer printing

- Easier handling of units
- Easier training of operators
- Better registration and clarity
- Fewer seconds
- Inventory in paper
- Pollution – free

2.3.2. Disadvantages of heat transfer printing

- Limited to synthetic fibers, mainly polyester

2.4. Jet Spray Printing

Designs are imparted to fabrics by spraying colors in a controlled manner through nozzles.

2.5. Digital printing:

In this form of printing micro-sized droplets of dye are placed onto the fabric through an inkjet print head. The print system software interprets the data supplied by academic Textile digital image file. The digital image file has the data to control the droplet output so that the image quality and color control may be achieved. This is the latest development in textile printing and is expanding very fast.

2.6. Photo Printing

The fabric is coated with a chemical that is sensitive to light and then any photograph may be printed on it.

2.7. Tie Dyeing

It is same as that of batik printing but here the dye is resisted by knots that are tied in the cloth before it is immersed in dye bath. The outside of the knotted portion is dyed, but inside is not penetrated if the knot is firmly tied. This gives a characteristic blurred or mottled effect.

2.7.1. Advantage

- Interesting design
- created on fabric
- No m/c cost is there

2.7.2. Disadvantage

- Costly
- Laborious
- Time taking
- Skilled labor required

2.8. Various techniques of printing

Duplex Printing: Printing is done on both sides of the fabric either through roller printing machine in two operations or a duplex printing machine in a single operation.

Stencil Printing: The design is first cut in cardboard, wood or metal. The stencils may have fine delicate designs or large spaces through which color is applied on the fabric. Its use is limited due to high costs involved.

Blotch Printing: It is a direct printing technique where the background color and the design are both printed onto a white fabric usually in a one operation. Any of the methods like block, roller or screen may be used.

Airbrush (Spray) Painting: Designs may be hand painted on fabric or the dye may be applied with a mechanized airbrush which blows or sprays color on the fabric.

Electrostatic Printing: A dye- resin mixture is spread on a screen bearing the design and the fabric is passed into an electrostatic field under the screen. The dye- resin mixture is pulled by the electrostatic field through the pattern area onto the fabric.

Differential Printing: It is a technique of printing tufted material made of yarns having different dyeing properties such as carpets. Up to a ten color effect is possible by careful selection of yarns, dyestuffs and pattern.

Warp Printing: It is roller printing applied to warp yarns before they are woven into fabric.

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. List at list five techniques of printing? ***(2.5 marks)***
2. What is the main process of heat transfer printing? ***(2 marks)***
3. Write the advantages and disadvantages of tie dyeing? ***(2.5 marks)***
4. Explain the mechanism of Stencil Printing? ***(1 marks)***
5. Which printing paste is the most preferable? And why? ***(3 marks)***

Note: **Satisfactory rating - 5 marks** **Unsatisfactory - below 5 marks**

Answer Sheet

Score = _____

Rating: _____

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Short Answer

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Information Sheet-3	Styles of printing

There are different Styles of prints, depending upon the printing method, the desired color pattern and the results to be obtained. Another approach to the printing Styles can depend upon the process and therefore upon the machine used (manual screen printing, conveyor belt, hand printing, hollow roller printing).

3.1. Direct printing

This type of printing is generally used for white or dyed cloths (usually dyed in pastel shades), by applying the sequence of all the colors, until the original pattern has been reproduced. This is the most common printing method and can be used with all the main color classes of dyes and on fabrics produced with any kind of fiber (some problems may only arise with blends).

The technical limits of this printing method appear with endless design patterns (particularly those obtained with screen printing methods, while no problems occur for roller printing). Some problems may also arise when printing on backgrounds dyed with pastel shades: in fact, this could create problems on several areas of the design to be printed in light shades, thus limiting the number of reproducible pattern variants. This method involves the steps of; printing, drying, steaming and washing

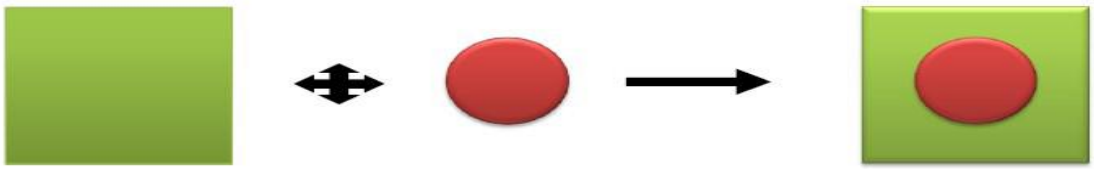

Fig: 3.1. Direct printing

3.2. Resist printing

With the old method of physical resist printing, (hydrophobic) products or printing pastes were applied to the fabric to avoid contact and penetration when the fabric was subsequently immersed in the dyeing liquor. This method is very similar to the ancient method of batik.

Now the most diffused printing system is the chemical resist printing carried out with different printing methods, using pastes containing chemicals, which avoid fixation of

background dyes (particularly for. Reactive on reactive applied on fabrics made of cellulose fibers). Some of the printing methods are detailed in the following:

- Resist printing on covered background: a pad dye is applied and dried; the printing is carried out with printing pastes containing products avoiding the fixing of background color (but they do not avoid the fixing of any brightener used). The fabric is then dried; steamed and washed (this is the most diffused resist printing method).
- Resist printing by over dyeing: the operations of the resist printing method previously detailed are carried out in inverse sequence; therefore the fabric is first printed and then covered.
- Resist printing by over dyeing: this method is similar to the previous one, but the covering operation is replaced with the roller printing of the background.
- Printing on polyester: polyester printing must be carried out applying the resist-discharge printing method. Printing pastes containing both the discharge and resist products applied on covered background must be used.

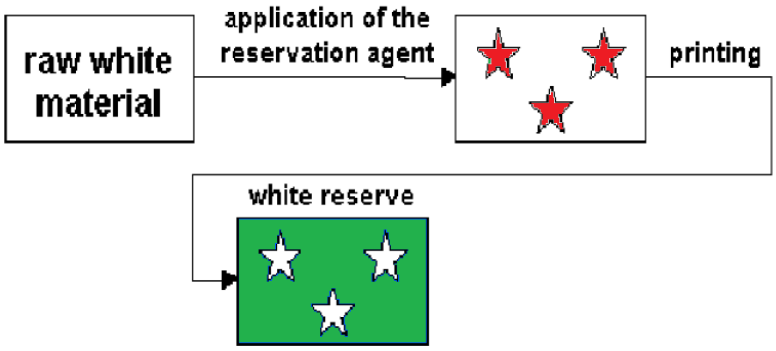

Fig: 3.2. Resist printing

Resist agents can be waxes, thickeners, surfactants-dispersing agents, organic acids, sulfites, oxidizing agents, or reducing agents. Dyes for resist ground shades are fiber reactive dyes and, to a lesser extent, direct and napthol dyes.

3.3. Discharge printing

Discharge Printing is also called Extract Printing. In this method, the fabric is dyed to the required ground color. Next, the fabric is printed with a chemical that selectively destroys the dye (a color-destroying agent, such as chlorine or hydrosulfite) leaves **a white "discharge" design** in the ground color. As an alternative along with the discharging agent, a dye, which is unaffected by the discharge agent, is printed onto the fabric. This yields special color effects of a colored discharge design surrounded by a stable ground color. The discharge

paste is printed on to the dyed fabric and, usually during subsequent steaming; the dye in the pattern area is discharged. Both discharge and resist printing have higher production costs than normal printing techniques. However, designs not easily achieved with other methods are produced this way. In the case of discharge printing, care must be taken to choose dyes that can be selectively destroyed without extraordinary means and without damaging the textile fabric. Discharge printing is routinely performed on cotton fabrics

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the styles of printing? ***(3 marks)***
2. Explain the way how to applying of each printing style? ***(5 marks)***

Note: **Satisfactory rating – 4marks** **Unsatisfactory - below 5 marks**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer

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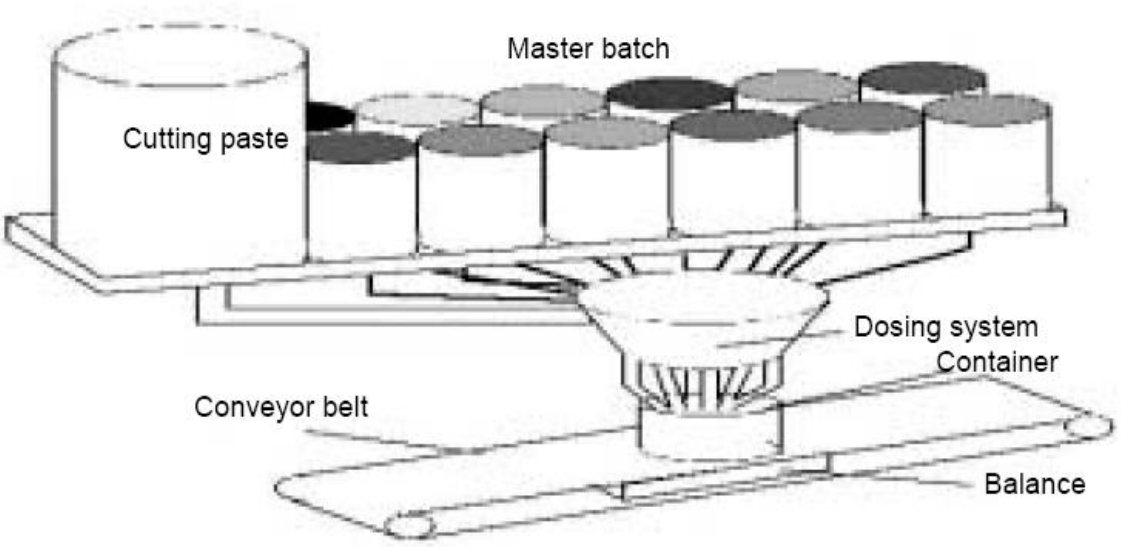
Information Sheet-4	Receiving and Checking Printing Paste

4.1. Properties and preparation of printing paste

The preparation of printing pastes greatly differs from the preparation of liquors: during the dyeing process the liquor is prepared directly when used, while printing needs a different approach passing through the preparation of "master batches" and .cutting" pastes. Master batches are printing pastes containing a high percentage of dye and all the necessary auxiliaries (except for specific cases where the auxiliary could alter the dye or the paste stability). Usually, for each dye class 12÷14 master batches are prepared with selected dyes so to reproduce the widest possible range of colors.

Therefore, combining the various master batches in specific quantities can reproduce any color. the master batches will be then suitably "cut" (diluted) with the cutting paste, made of a paste containing the same auxiliaries of the master batch (with the same or lower concentration), but without the dye. The color kitchen can be a manual system where all the operations for preparing the thickener, weighing the dyes and the auxiliaries, dissolving and preparing of master batches and cutting pastes is manually carried out by the operators working on the color kitchen. This approach to work entails some problems both for health protection and results; small inaccuracies, momentary distraction of the operator as well as different ways of working of various operators can compromise the reproducibility of results. Now many manufacturers use automatic color kitchens both for sampling and production purposes. In these color kitchens the various master batches and the cutting thickeners are stored in big containers from which they are automatically taken by means of pumps to be then used or to prepare the cuts. Special automatic distribution systems can reproduce the stored recipes (by recalling them by means of the keyboard) and accurately weigh, blend and mix the components.

In several color kitchens the balance incorporating the container for preparing the pastes is placed on a trolley, which is moved automatically under the dispenser nozzle of the containers (for cutting and blending the various master batches). In other color kitchens distribution nozzles are assembled all together above the balance. The products must be perfectly blended before use.



Scheme of a colour kitchen

Type of specific formulation used depends on the fiber, the colorant system used and to some extent the type of printing machine.

4.2. Typical ingredients used include:

- Dyes or pigments
- Thickeners
- Binders, cross linking agents
- Sequestering agents
- Dispersing agents
- Water retaining agents
- Adhesion promoters
- De-foaming
- Catalysts
- Hand modifiers

4.2.1. Dyestuff or pigments

Depending on the nature of the fiber on which the printing is done, suitable dyes or pigments are selected. Pigment color can be used for printing on all types of fibers. Reactive, vat colors are used for cotton; disperse dyes for polyester and acid dyes and basic dyes for wool and silk

4.2.2. Thickener

To make viscous paste of dyes in water, a thickener is used. For example: emulsion thickener, sodium alginate and starch etc. the thickener will be dependent on the class of dyes to be printed and the style of printing.

4.2.3. Wetting agent

It helps in obtaining a smooth paste of dyes without any lumps, for example: TRO and ethylene oxide condensator.

4.2.4. De-foaming agent

Formation of foam during print paste preparation and application is quite common but should be avoided. Foam may produce speck dyeing. The antifoaming agents help in foam generation.

4.2.5. Acid or alkali

Depending on the types of dyes used in printing, acid or alkali is used in the print paste. An acid liberating salt is commonly used, for example ammonium chloride and diammonium hydrogen phosphate. For reactive printing on cotton, sodium carbonate or sodium bicarbonate are used.

4.2.6. Oxidizing or reducing agent

They are used in printing with solubilised vat colors and also in discharge and resist printing. Discharging agents such as Sodium sulphoxylate formaldelyde (Rongalite) are used in the discharge printing.

4.2.7. Hygroscopic agents

The function of hygroscopic agents is to take up sufficient amount of water (moisture) during steaming to give mobility to the dyes to move into the fiber. For example Urea and Glycerin.

4.2.8. Dispersing Agent

Dispersing agents are necessary in the print paste to prevent aggregation of the dyestuff in the highly concentrated pastes. E.g. Diethylene glycol

4.2.9. Preservatives

Preservatives are used to prevent the action of bacteria and fungus to make it dilute.

Ex: Salicylic acid.

4.2.10. Binders

Binders are used in pigment printing as a thin film forming polymer.

Ex. Melamine formaldehyde resin

4.3. Types of thickeners

A thickener is made from hydrophilic high molecular weight compounds. It can be swollen by water and dissolved or dispersed in water to form homogenous thick colloidal solution. Thickening agents are necessary for all dyestuffs groups. The thickener adjusts the viscosity of the printing past. By this, a" flushing" of print is avoided: this means the sharpness of out line of the print is controlled.

They can be classified in to four groups

- Natural high molecular compounds and their derivatives
- Highdrophillic polymers
- Inorganic compound
- Emulsion thickener

Emulsion thickener and synthetic thickener are suitable for pigment printing. Thickeners used for Pigment printing should:

- Have low solid content.
- Be transparent and colors.
- Have leveling power.
- Give a clear and well-defined design.

4.4. Properties of printing paste

The property of printing past affects the quality and durability of printed fabric. The main properties of a printing past are**:**

4.4.1. Adhesively

Printing past on fabric should have certain adhesively to prevent the past from falling down and falling apart for roller printing. The past should be fixed tempo raring in the pattern of engraved roller by an adhesive force.

Adhesively of printing past depends on the chemical structure of thickener, solid content of the paste, appearance of fabric.

4.4.2. Wetting property

The past to be adhered on the fabric or temporarily on the engraved roller, the printing past should have suitable wetting power.

For hydrophilic fabric, the printing past has low viscosity, printing viscosity index and concentration. For hydrophobic fabric, the printing past has high viscosity, printing viscosity index and concentration. Printing past applied to flat screen and small design should have high viscosity, concentration and low printing viscosity index(PVI). For Roller printing, the printing past has high PVI but low viscosity and concentration. For light fabric, it is advisable to select printing past which has low viscosity, PVI and concentration.

4.4.3. Printing viscosity index (PVI)

Printing viscosity index (PVI) is the ration of two viscosity values measured by rotary viscosity meters at different string steps.

Factors which influence the viscosity of printing past are:

- Chemical structure and types of thickener.
- Degree of expansion of thickener in water.
- Concentration of thickener and temperature.

4.5. Thickener Selection

Reaction with cotton is the desired result but other similar molecules are often present, such as starch or sugar. The dyestuff will readily react with these contaminants. This makes selection of the thickener and other ingredients in the print paste a critical matter. Thickeners based on starch are inexpensive but cannot be used. Sodium alginate is a thickener obtained from seaweed (Kelp) and does not react with the dyestuff. Some of the Carbopol®2 polyacrylic acid based resin thickeners have also been used to print reactive dyes. There are some additional products that have been tested. The key reason for using sodium alginate is its 'rewetting' characteristic. It can be washed out after fixation. The synthetic thickeners are difficult to remove in washing due to poor rewetting characteristics. Sodium alginate is also stable to the electrolytes, or salts, present in the alkali, which is included in the print paste. Many synthetic thickeners, which are based on polyacrylic acids, experience a dramatic decrease in viscosity when electrolytes such as the alkali are added to the mix. More information on sodium alginate can be found in the Troubleshooting section.

4.6. Procedures of printing process

- Preparation of print paste
- Printing of fabric
- Drying
- Fixation of dyestuff
- Washing – off

4.7. Fixation methods

4.7.1. Atmospheric steam

Treatment at 212 degrees f with saturated steam used with

- Direct dyes
- Vat dyes
- Napthol dyes
- Acid dyes
- Cationic dyes

- Reactive dyes

4.7.2. Pressure steam

Treatment at 230 degrees f under pressure

- used with disperse dyes
- Turbo-autoclave most common equipment.

4.7.3. High temperature steam

Treatment with superheated steam at temperature up to 420 degrees f

- used with disperse dyes and pigments
- can also be used as an atmospheric steamer

4.7.4. Dry heat

Treatment with dry heat at temperatures up to 420 degrees

- Used with disperse dyes and reactive dyes.

Self-Check -4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Select at list six ingredients of printing paste and define them? (3 marks)
2. Write the function of binder in printing? (1 mark)
3. What are the procedures of printing (4 marks)

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

Answer Sheet

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Short Answer

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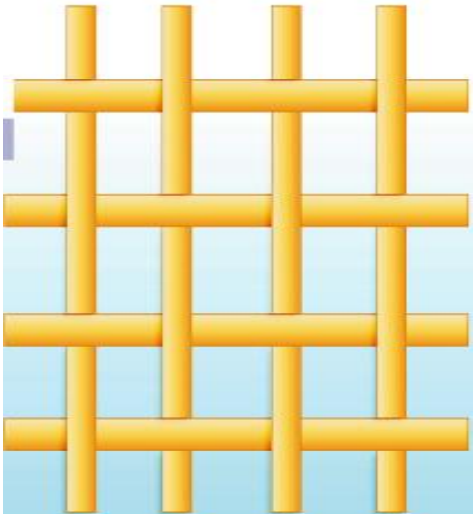
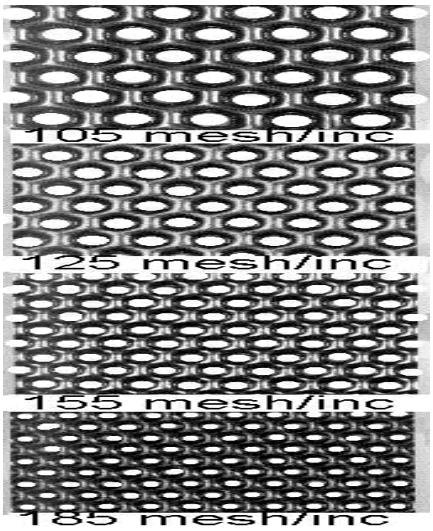
Information Sheet-5	Checking and Receiving the Screen

Fig: 5.1. silk screen(mesh)

Mesh can prepared from silk yarn/ polyester yarn/ very thin wires. Mostly silk mesh and polyester mesh are common in textile printing. There is different Screen printing mash regarding to its raw material, count, width, color etc. while receiving the screen checking the specification is essential.

5.1. Mesh count





Screen printing mesh count is a very important factor to be considered when setting up a job to screen print. The mesh count or number refers to the number of threads per inch. There is also a measurement for the diameter of the thread which also can be necessary to consider.

Here is a general screen printing mesh count guide chart for working with plastisol inks:

- Use a 30 mesh count for printing glitter inks. Always check with the manufacturer of the ink about this
- Use an 85 mesh count for athletic printing, opaque ink deposits, thick puff ink, and some shimmer inks.
- Use a 110 mesh count for heavy coverage on dark shirts, solid under base prints, puff, metallic, some shimmer inks, and for certain transfer printing.
- Use a 155 mesh count for general printing on white & dark shirts, prints on dark nylon jackets, and silver shimmer ink, or over printing on an under base on dark shirts.
- Use a 195 mesh count for multi-color printing on light shirts, light colored nylon jackets or over printing on an under base on dark shirts.
- Use a 230 mesh count for detailed multi-color printing on light shirts, light nylon jackets, or over printing on an under base on dark shirts.
- Use a 305 to 355 mesh count for process color on light shirts, or for overprinting a halftone on a white under base on dark shirts.

With water based this may be different due to the thinner water based inks. Generally print with lower mesh counts with plastisol inks and higher mesh counts for ***water based inks*** because they tend to be much thinner than plastisol.

Choosing the right screen printing mesh count guide will help you to better screen-print and produce better patterns.

5.2. DIMENSIONS

- **Material**: 100% polyester monofilament fiber.
- **Mesh counts**: 25 mesh to 420 mesh.
- **Weave method**: plain weave.
- **Color**: white or yellow.
- **Width**: 0.6–3.68 m
- **Length**: 30/50/100 m and customized lengths.

TECHNICAL DATA OF POLYESTER MONOFILAMENT SCREEN PRINTING MESH

Download Data

Specification	Mesh Count	ThreadDiameter	Aperture	Opening	Thickness	Ink Through Volume Theoretically	TensileStrength
	mesh/inch	micron	micron	%	micron	cm^3/m^2	n/cm
10-200	25	200	816	65	440	276	42
10-250	25	250	740	53	465	246	60
12-200	30	200	522	47	485	228	62
16-200	40	200	435	47	420	189	48
20-140	50	140	340	46	280	129	52
20-180	50	180	320	41	350	152	56
24-100	60	100	316	58	190	109	48
24-120	60	120	300	51	210	105	42

APPLICATIONS

- Textile screen printing
- Glass screen printing
- Ceramic screen printing
- PCB (Printed Circuit Boards) screen printing
- Solar panel printing
- Plastics & packaging
- Membrane switches

Glass screen printing

Textiles screen printing

Ceramic screen printing

Plastic screen printing

PCB screen printing

Solar panel screen printing

Self-Check -5	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. While receiving the screen what specification will be checked?(**2 marks)**
2. What is the relationship between printing paste and mesh count? ***(3 marks)***

Note: **Satisfactory rating – 3 marks** **Unsatisfactory - below 3marks**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____
   _____
   _____
   _____
   _____
2. _____
   _____
   _____
   _____
   _____

Information Sheet-6	Preparing and Loading The Screen

6.1. Screen Making Process

Silk screening is highly suitable for home printing, whether it is a series on paper, a set of T-shirts, team jackets or vinyl printing on plastic. It is possible to temporarily create a home print shop for a single project.

A silkscreen can easily be built and stretched and coated on a kitchen table. The sink or bathtub can be the rinse tub for the emulsion. A clothesline stretched from wall to wall can be a drying rack for the printed objects. A standard 150 watt light bulb can be the activating light source for the emulsion.

6.1.1. The Steps Necessary to Create a Silk Screen

A silkscreen begins with a photo positive of the image at its real size on a transparent sheet. Transparent sheets are available for ink jet or laser printers as well as photocopiers. When printing an image on a transparency from your computer, have it print in “registration” color, rather than black. Registration provides more ink on the sheet. When using a copy machine, make at least two copies which can be taped together for opacity. Often, without a professionally prepared transparent positive image, the printed image is not hardy enough to transfer clearly to the silkscreen. Always include registration marks on your art to insure proper alignment of multiple screens.

A few basic tools will be needed. Other tools can be improvised from household items

- **Photo Emulsion** Which emulsion you use depends on what you are printing -- consult our technical department.
- **Clamp Hinges** For registration of multiple screens
- **Rubber Glove**
- **Heavy Duty Stapler** For attaching fabric
- **Frame**
- **Scoop Coater** Helps you put an even coat of emulsion on your screen
- **Squeegee** -- For printing
- **Screen Fabric** Which fabric you use depends on what you are print consult our technical department. Image detail, printing ink and surface dictate the mesh count

i. Stretching the Screen

The first step is preparing the screen. The **inside** dimension of your frame needs to be 3" larger than your art on all sides to leave room for a clean stroke. The screen fabric is pulled tight across the frame and stapled to the frame. Staple at a slight angle so that your holes are not lined up with the mesh. Use enough staples, about one every half inch, so that there will be a uniform tension.

After you have stretched the screen, trim off excess fabric along the outer edge of the frame with a razor blade or matte knife.

After you have exposed your screen, you will tape over the staples for a smooth finish. Taping should also be done on the inside so that the ink does not build up between the screen and the frame.

ii. Coating with Emulsion

The scoop coater is designed to help in this process. Pour a little emulsion in the coater, maybe an inch worth, depending on screen size. You want a very thin coat, and you do not want the can of emulsion exposed to the light. The coater works as a holder for the emulsion and then as a squeegee to apply it.

Hold the scoop coater at an angle to apply a thin coat to the outside of the screen. Overlap strokes from the bottom to the top.

Allow the emulsion to dry to the touch. The time required, with a fan, should be about 20 to 30 minutes.

Repeat the coating process one more time. Only coat the outside of the screen.

iii. Exposing the Emulsion

When the emulsion has dried, the tape on your film will positive. If multiple screens are to be used, center the registration marks so that they will match the next screen.

Remember, you will be screening from the inside of the screen so your image will be backwards here.

Expose to light source. A 150 watt bulb can be used for 10 to 15 minutes. Exposure times vary. Do a test.

iv. Washing out the screen

You can wash out your screen in a bathtub or sink. The areas that were not exposed to the light will wash away, leaving open mesh for the ink to go through.

v. Fixing pin holes

Pin holes are openings that are not a part of the image. They are common and are easily fixed by brushing on a little sensitized emulsion. Hold your screen up to the light and see where they are. Again, use a very thin coating and be careful not to spill into open areas.

vi. Taping the screen

Taping the screen before printing will make your clean-up, after printing easier as well as add to the life of your screen. SRT Tape should be applied both inside and out.

vii. Printing

When printing, the most direct method is drawing the squeegee down across the image, pushing the ink ahead, supplying an even pressure, and completing the print in a single stroke. The hinge clamps will allow you to lift the screen up without shifting its positioning, to ensure accurate registration. Then draw the ink back up to the top for the next stroke. Hold the squeegee blade at a 45° angle to the screen when printing.

Different inks are available that have different characteristics -- see ink section. Check with the technical department to determine the appropriate hardness of the squeegee for the specific application.

Self-Check -6	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. List the tools which help to prepare the screen?
2. How long will expose the emulsion if the light source is 150 watt bulb?

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____
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   _____
2. _____
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   _____

Information Sheet-7	Preparing Fabric To Be Printed

7.1. Prepare fabric or garment for printing

It is the key for obtaining consistent high quality printing results. Cloth need to be washed, bleached, brushed, sheared by being passed over rapidly revolving knives arranged spirally round an axle which rapidly and effectually cuts off all knots, leaving the cloth perfectly smooth in order to promote maximum dye penetration for best color fastness properties.

If the color is off shade in a conventional dyeing process, it is often possible to over-dye the fabric to a darker color, thus preserving the value of the fabric. Unlike dyeing, printing cannot be reprocessed for poor quality printed fabric.

- Substrate is confirmed as meeting the requirements of the job specifications from the customer.
- The range of substrate depending on substrates used, consider – weave direction, correct side, affinity to ink.
- Substrate quantity, including oversize calculated and quantity issued is confirmed against the job specifications.
- Substrates are conditioned as necessary to avoid excess moisture content.

Self-Check -7	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Write ways of preparing fabric to be printed? ***(5 marks)***

Note: **Satisfactory rating – 3marks** **Unsatisfactory - below 3 marks**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____
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Information Sheet-8	Connecting the printing paste with printing machine

8.1. Printing-paste feeding system

A conventional paste feeding system for rotary-screen printing machines is represented in Figure -4. A suction pipe leads from the paste vat to a pump, from where a printing hose leads to the squeegee (dye pipe with squeegee).

From here the paste is directed inside the cylinder roller. The fill volume of this so-called printing paste input system is quite high and as a consequence the amount of paste residue that has to be removed at each color change is also fairly significant. Various systems have been introduced in order to lower the volume configuration of this equipment, which also reduces the amount of such wastes. Another possibility, which has also already been implemented in some companies, is to recover and re-use these residues for making up new recipes.

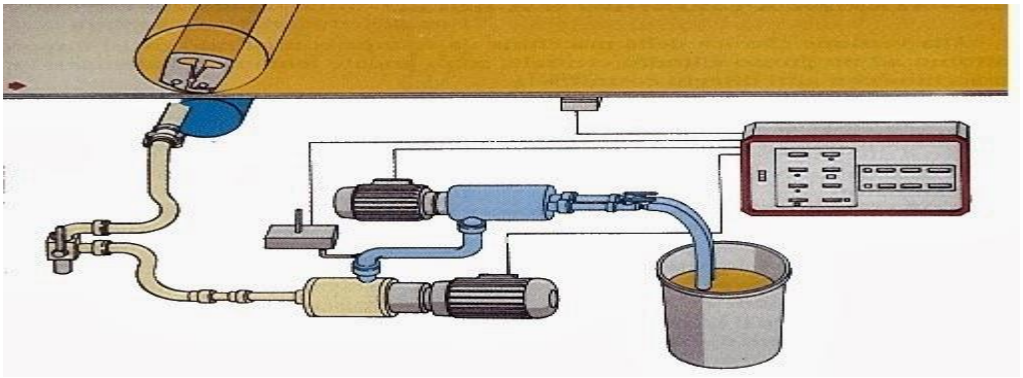

Fig: 8.1.Printing-paste feeding system for a rotary-screen printing machine.

8.2. Connect the printing paste with the printing machine

The paste is directed inside the cylinder roller. The fill volume of this so-called printing paste input system is quite high and as a consequence the amount of paste residue that has to be removed at each color change is also fairly significant.

Self-Check -8	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. How printing paste will feed to the printing machine? ***(2.5 marks)***
2. Writ the way of connecting paste with the printing the machine***? (2.5 marks)***

Note: **Satisfactory rating – 5 marks** **Unsatisfactory - below 5 marks**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____
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2. _____
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Information Sheet-9	Cleaning Work Area and Carrying Out Printing

9.1. Clean the work area

- Remove waste around the workplace
- Clean and sweep the floor space
- Daily Cleaning the work area
- Make ready the machine for printing

Self-Check -9	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Write some information/ ways of cleaning work area? ***(5 marks)***

Note: **Satisfactory rating - 4 marks** **Unsatisfactory - below 4 marks**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer

1. _____
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Operation Sheet 1	Preparing and loading the screen

Method of screen preparation

Step 1: design development

Step 2: frame preparing

Step 3: mesh stretching on the prepared frame

Step 4: preparing the photo emulsion (mixture of lacquer and sanitizer)

Step 5: coating photo emulsion

Step 6: drying

Step 7: exposing to light

Step 8: washing

Step 9: drying

Step 10: check the screen regarding to the design

Step 11: apply printing

.

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within --- hour.

Task 1: Apply a design on T- shirt using hand screen printing

Reference

1- Leslie WC miles, 2003, ***Textile Printing***, UK

2- John H. Xin, ***Total Color Measurement In Textiles***

3- ***www.intehopen.com***