UNIT IV

Various styles of printing – direct – discharge – resist styles. Methods of printing – screen printing – automatic screen printing – roller printing – rotary printing – transfer printing.Fixation and after treatment.

AIMS AND OBJECTIVES

We here discuss about in general instructions on pricing, its strategies and methods of settings price. After going through the unit, it will be easy to

i. Know about various types of printing.
ii. Understand different steps in printing.
iii. Describe the after treatment for printing.

INTRODUCTION:

Printing is the process of transfer of a design or) art work on to textile materials, providing a decorative look. Printing can also conceal many of the fabric defects. The chemical principles are generally the same (viz. dye-fibre fixation mechanism, medium etc.,) for printing and dyeing. Excepting for the method of application, printing can be called as a localized dyeing. This is achieved by controlled application of colors to the respective areas as per design (single color or multicolor) by the use of thickened printing paste. The application method may be by manual, block, stencil, screen (or) transfer printing and the styles could be of direct, discharge, resist (or) other styles.

The fabric is generally dried after printing, following by dye, fibre color fixation by steaming (or) dry heat as per fibre class and dyes. The fixation treatment is followed by washing in order to remove unfixed colors, gums and other residues from the substrate.

STYLE OF PRINTING

Printing is a process of producing attractive designs on textile fabrics using one or more dyestuffs.

In printing, dyes and pigments are applied locally or discontinuously to produce the various designs on textile fabrics, so printing is also called as “Localized dyeing”

Some differences exist in dyeing and printing.

1) The purpose of printing is to produce multi colored designs on textile fabrics; on the other hand the purpose of dyeing is to produce a solid, allover, single color.

2) In printing a fairly concentrated dyestuff solution is used in contrast to dilute dyestuff solutions used in dyeing.

3) In general printing processes are more complicated than those concerned with dyeing and the machinery employed is much more elaborate and demands a higher capital outlay.

4) Because of the basic difference existing between dyeing and printing techniques, different types of machines are used in these two processes of textile. Where as in dyeing, jiggers, winches and padding mangles as well as beam dyeing machines are commonly used. Blocks,

screens, stencils and rollers are used as the instruments of printing followed generally by steaming of the printed fabrics to affect the dye transfer into the fabric.

There are different ways by which a desired pattern or design can be colored on the textile fabrics. These are usually known as “styles of Printing”. There are four styles of printing. They are

1. Direct or steamed style
2. Dyed style
3. Discharge style
4. Resist style.

1. Direct or steamed style:-

This is the most important of all the style. The design is printed directly on the fabric by the application of color and is fixed on the cloth by a subsequent process of steaming. This style is also referred steamed style.

2. Dyed style:-

In this style the design is printed net by any color but by certain salts known as mordents, which are fixed on the cloth. The cloth is then put in a bath containing the dye solution. It will be found that only those portions that were printed with the mordant are colored.

3. Discharge style:-

In this style the cloth is first dyed by any of the conventional dyeing methods (using a jigger or a padding mangle) followed by dyeing printing is done by a thickened solution of an oxidizing agent or a reducing agent and steaming, when these agents present at the printed areas destroy (by oxidation; or areas (i.e., the ground) unaffected, so that a white design is produced on colored ground. This is known as White discharge printing. When another dye, which resistant to the discharging action (oxidation or reduction) of the discharging agent, steamed, a colored design may be produced on a differently colored ground. This is known as colored discharge printing. In both these (white discharge and colored discharge styles0 the ground color should be easily and completely dischargeable, otherwise pure white effects or pure colored effects cannot be obtained.

4. Resist style:-

In this style the effect is similar to that of discharged style, but reverse methods is employed to secure the object. The cloth is first printed with a paste containing certain agents such as wax, resin etc., which resists or prevents the fixation of color on the cloth. The cloth is then dyed or suitably treated to obtain the ground color. For example, the development of solubilisedvat dyes (Indigo sols) required acidic, oxidizing conditions. In this case, the cloth is first padded with solubilised vat dye solution in the presence of an oxidizing agent and an acid librating agent.

After dyeing, the fabric is printed with a suitably thickened solution of an alkali and/or a reducing agent and steamed. During streaming, the acidic and oxidizing chemicals are destroyed by the alkali and reducing agents respectively present in printed portions thereby preventing the development of the solubilised vat dye, while the ground is fully developed. After washing, a white design is seen on a colored ground. Since vat dyes need

alkaline and reducing conditions for vatting and fixation of the dyes, colored resist effects with these dyes on solubilised vat ground can easily be produced.

In this case the alkali and reducing agent required for the prevention of the development of the solubilised vat dyes, brings about the vatting and fixing of the vat dyes at the printed portions of the cloth. Thus colored resist effects can be produced on a differently colored ground. In this case, ground color is getting by using solubilised vat dyes and design color is getting by using vat dyes. So colored design is produce on a differently colored ground. (Colored Resist Printing)

The essential ingredients of printing paste are selected from the following:-

1. Pigment or dyestuff
2. Wetting agents
3. Solvents, solution acids, dispersing agents and humectants
4. Thickeners
5. Deforming agents
6. Oxidizing and reducing agents
7. Catalysts and mild oxygen carriers
8. Acids and alkalis
9. Carries and swelling agents
10. Miscellaneous agents.

Each of the print paste ingredients is described further in the following:-

1. Dyestuffs and pigments depending on the fibre to be printed, a selection can be made from the dyestuff. For example reactive dyes for cotton disperse dyes for polyester andacid and metal complex dyes on wool and silk the pigment colors can be applied to almost all kinds' fibres with good fastness properties.

2. Wetting agents:

The use of a wetting agent is beneficial in dissolving dyestuffs, for example Turkey red oil (TRO) is the commonly used wetting agent for naphtha and vat dyes, sodium salts of sulphate vegetable and animal oils and ethylene oxide condensates are examples of wetting agents.

3. Solvent solution acids, dispersing agents and humectants**:**

Solvents a dispersing agents are used to prevent aggregation used solvents included action diethyl glycol and triode, ethylene glycol, glycerin A (BASF) and glycogen (ICI) are commercial products based on thiodiethylene glycol.

4. Thickeners:

Thickeners used in textile printing are high molecular weight compounds giving viscous pastes water. Their main function is to hold or adhere the dye particles in design on the fabric until the transfer of the dye into the fibre and fixation are complete, products of natural origin such as cerebis (starch), plant exudates (gum Tragacanth), Roots (Locustbeam gum) sea weeds (sodium alginate) and emulsified products such as CMC (Carboxylmethyl cellulose), British gum, gum indalca and fully synthetic products such as acrylic polymers give wide scope for selection of thickeners.

5. Deforming agents:
In case of roller printing the use of a wetting agent in the printing paste, coupled with continuous agitation of the paste occurring in the color box produces foam, which leads to defects in printing. Silicone and pine oil derivatives can be used as deformers for this purpose. Silocolapse (ICI) and Perminal KBI (ICI) are commercial products of deforming agents.
6. Oxidizing and reducing agents:
In order to develop the final color in steaming or in the subsequent after treatment as in solubilised vat dyes some oxidizing agent are used in the printing paste, examples are sodium nitrite and resist salt. The reducing agents such as Rangolite C (sodiumsulphoxylate or maldehyde) and stannous chloride are helpful as discharging agents for discharge style of printing.
7. Catalysts and Oxygen carries:
In order to accelerate the development of color through oxidation such as aniline black potassium Ferro cyanide and ammonium van date are used as catalysts.
8. Acids and alkalis:
Whenever acidic conditions have to be created during streaming and acid-liberating agents added to the printing paste. The acid is needed during the curing stage of fixing of the pigments and hinders in pigment printing. Ammonium chloride and diammonium hydrogen phosphate are examples. The usage of alkalis like sodium carbonate, sodium bicarbonate and sodium silicate is necessary for fixing reactive colors in printing. Alkali and acids are useful in chemical resisting agents in resist style of printing.
9. Carriers and swelling agents**:**
Certain hydrocarbon and their derivatives and as swelling agents for polyester fibre and these can be helpful in fixing the prints.
10. Miscellaneous Chemical**:**
Various products for special properties can be used are used in the print paste.

METHOD OF PRINTING

HAND BLOCKS PRINTING:

Hand block printing is the simplest of all the methods of printing and generally considered to be the most artistic. The hand-block-printing is used in the cottage industry, but not in the textile mills.

For this method of printing the accessories required are, the block containing the design, a printing pad which can be suitably and comfortably accommodate the block and a printing table of convenient size having a resilient surface usually by laying a few layers of a thick variety of cloth.

For producing multi-color designs many blocks (as many as the number of colors used) are employed each of them providing a part of the final design. Each block is used for printing one color of the design. Naturally each color of the design requires separate pads.

For making a block for printing, a wooden block is selected. It should be noted that the surface of the block should have no knots. The surface is made even and smooth. It

should have length and breadth sufficient to hold the design comfortably in it. It is usual to provide four nail points at the four corners.

In a multi color design, these four nail points will be in exactly the same position in all the blocks. The design is transferred into the surface of the block usually by means of carbon paper. The unwanted portions are then nearly card away so that only the design portions project from the surface of the block.

This projection should be limited to a maximum of ¼". It is very difficult to have fine lines because they easily break. In such circumstances it is usual to use metal strips to form these lines. Now the block is ready for use.

Printing is generally carried out on very heavily built tables, preferably with stone or concrete tops. The printer may work in a standing position; the height of table varies accordingly. The printing table used is not of any definite size but it is better to have width more than the width of a normal cloth usually being printed and length suitable to the convenience. It is usual to cover the rigid surface with a resilient material. First several thick layers of blanket are carefully laid on the table, and the whole is then covered with a sheet of water proof fabric. The cloth to be printed is spread out on the table and kept in place either by pinning it on to a back gray (back cloth) or by gumming it down directly on to the water proof cover. It is essential that no movement of the cloth occurs during the printing operation. The cloth is wound round a wooden tube, called a shell. British Gum or Gum Senegal paste is then placed at the end of the table and spread along it in as thin a film as possible using a rubber squeegee. The roll of cloth is unrolled along the table so gummed, and lightly pressed into place either by hand or by careful ironing.

The printing pad is charged with the color paste so that it spreads evenly throughout the pad. It should be noted that the pad should not contain too much color. If too much color is contain in the pad then excessive color to be taken up by design parts of block and while printing this might flow down, thus spreading the design beyond the limit and a sharp edge will not be obtained. The block is placed on the pad with design touching the color 2 or 3 times so that every part of the design gets an even charge of the color. Now the block is placed on its respective position on the cloth.

Holding the block firmly with the left hand, the block is tapped on its top once or twice with the right hand or in some cases a wooden hammer. The cloth in held with one hand and with the other hand the block is lifted. Care should be taken to see that the cloth is not lifted along with the block. The block is again placed on the color pad and placed on the cloth at the next repeat to go inside correctly. The success of the block printing is how correctly the repeats can be made so that the repeats cannot be easily detected. After printing the block should be immediately washed.

PRINTING OF MULTI COLORED DESIGN USING BLOCK PRINTING METHOD

For producing multi-colored prints many blocks (as many as the number of colors used) are employed each of them providing a part of the final design. The first block has traced upon it all those parts of the pattern (design) which are to be printed with the same colored first color. Those parts of the block not used for this pattern are cut away so as to

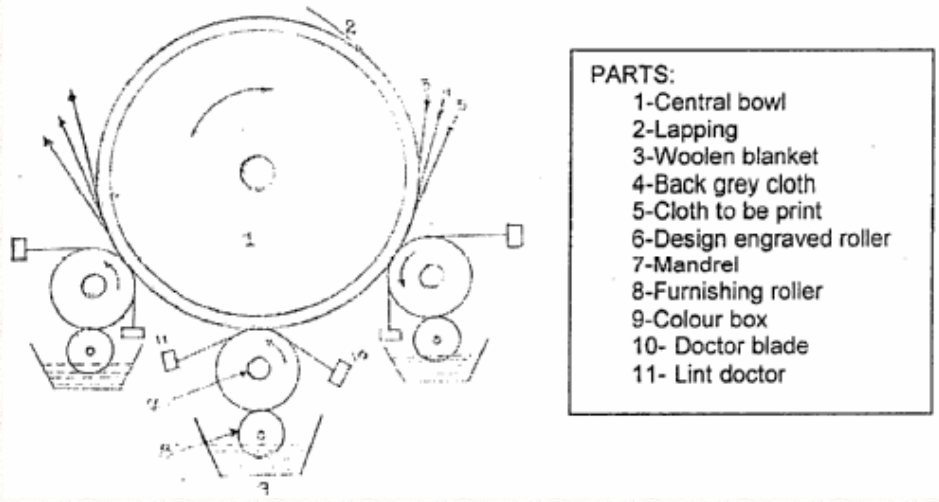
leave the pattern standing out it relief. This block is pressed upon a colored pad or smeared with color paste so as to leave coloring adhering only to the pattern and is then pressed upon the fabric to leave the desired colored impression. In the same way another block are prepared for other parts of the pattern to be printed in a second color and this is impressed on the fabric to cover the same area as the first block. While printing a multicolored design it is better to print the whole cloth with one color first and then print with the second color, then with the third color and so on. This can be repeated using a many blocks as they are colors in the pattern and thus a multi-colored pattern may be bully up on the fabric.

The degree of perfection in the printed pattern will depend on the accurate registration of each block so that there is no over lapping of the color boundaries and also on the general levelness of the color impression. It is usual to give some after treatments to the cloth after printing. These after treatments will vary according to the group of color being applied Steaming is one after treatment, which is generally applied to almost all printing

This method is a laborious and time-consuming, since a very large number of impressing have to be made to print the whole design on the entire cloth. As a result the production is low. However, no special printing machines are required in block printing.

ROLLER PRINTING

Roller printing or machine printing is the most economical and fastest way of printing. The output of this machine cannot be compared by any other method of printing. Designs with up to 16 colors can print without any problem in roller printing. Roller printing is the most commonly used method in most of the textile mills. In this case printing is done continuously. Further all the required colors are printed during a single passage of the cloth through the machine. Printing speeds of UPTO 90 METERS PER MIUTE are possible in roller printing machine.



Roller printing machine consists of a central pressure cylinder or bowl (1), suitably wrapped with layers of the cloth called lapping (2), around which an endless woolen blanket (3), a back grey (4), and the cloth (5) to be printed circulate in contact with each other. An engraved copper roller or shell (6), mounted on a steel shaft or mandrel (7) revolves in contact with the pressure bowl above and a furnished roller, (8) below which partly dips in

the printing paste kept in the color box (9). A sharp edged steel blade called color doctor (10), rests on the engraved roller on one side and a brass blade is called lint doctor (11) rests on the other by suitable weights and levels

Operation:-

The design engraved roller is first supplied with the printing paste by the furnishing roller (it is so called because it furnishers or supplies the paste to the engraved roller). This paste is deposited on the engravings as well as applied on the smooth surface (unengaged porting). When the engraved roller rotates it comes into correct with the color doctor, which scrapes the excess color pastes from the smooth surface and allows the paste deposited in the engravings to remain there. At this stage the engraved roller should (design portions) properly filled with printing color and the plane parts of the roller should be perfectly clean, that is free from color paste.

The cloth to be printed in held at the back of the machine, usually in the form of a roll wound upon a wooden roller, and is unwound as the printing proceeds. The cloth to be printed, in along with back grey and woolen blanket, passing in a continuous manner between printing rollers and the central pressure cylinder. When the cloth comes into contact with the engraved roller, the engraved roller makes an impression by depositing the color in the engravings. During the further rotation of the engraved roller, it meets the lint doctor with is placed at an angle against the rotation of the roller.

The lint doctor remove any loose threads or fibres that may have attached themselves to the surface of the engraved rollers, if allowed to pass into the color box, would mingle with the color and eventually cause streaks or “snaps”. It also prevents color picked up from the fabric surface of a multi color print being carried into the color for the roller being cleaned. The engraved roller continuousness its rotation, picks up the paste from the furnishing roller and the cycle repeats.

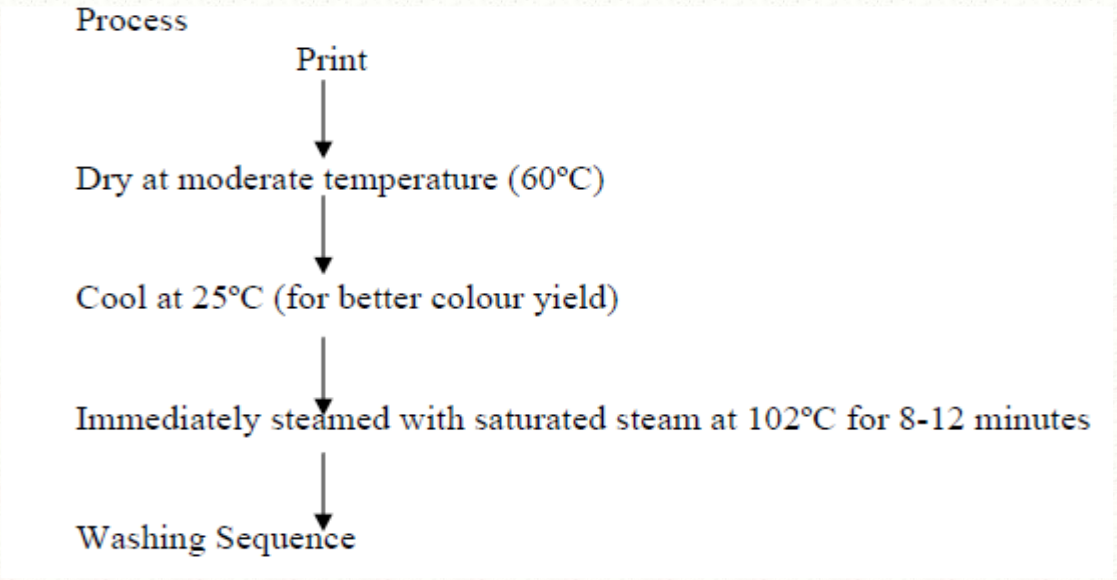
In multi color roller printing machine, a number of engraved rollers provided with furnishers, color boxes and color lint doctors are placed around the central pressure bowl. So that by a single passage of the cloth through the machine all the colors required in the design are printed, each roller, supplying a part of the design Six – color roller printing machines, an eight color roller printing machines are normally used into textile mills. In six color roller printing machine, six design engraved copper rollers are provided around the central pressure cylinder. Each printing roller has its own color box, lint and color doctors and furnisher, on each printing roller are engraved all those parts of the design having the same color.

The drive in all conventional rollers printing machine is transmitted through a large crown wheel, to the actual printing rollers, by toothed wheels (box wheels) which are fitted to one end of the mandrel of the printing rollers. The central pressure cylinder is not positively driven, but it is driven by the frictional forces between it and the engraved rollers, acting through the cloth and the back gray. Multi-color printing machine is provided with arrangement to adjust the printing rollers so that each printing roller is accurate and makes an impression. For this purpose the engraved roller must be capable of lateral movement and also one or both the ends of the roller must be capable of being raised or lowered. The engraved roller must be capable of independent rotation to achieve the initial register and to make corrections.

Preferred Thickeners Self or mixtures of modified starches (Dextrin's, British Gums), Modified guar gum, Crystal gums or Gum Tragacanth.Rongalite – C (Sodium Sulphoxylate Formaldehyde) is the reducing agent available as flakes is powdered well before dissolution.

Color Preparation

The thickening after cooking is mixed with potassium carbonate (predissolved) and glycerin and after cooling to 40ºC, Rongalite – C is added.



1) Cold overflow wash (Removal of gum, reducing agent and unfixed color & other complexes)
2) Oxidation bath with H2O2 or Sodium per-borate 1-2 gpl at 60ºc
3) Hot wash at 60 ºC – 80 ºC
4) Hot soaping with 1-2 gpl non-ionic detergent at 80 ºC-90 ºC
5) Hot Wash at 60 ºC – 80 ºC
6) Cold Wash
7) Dry

DISCHARGE STYLE OF PRINTING

It is the production of a printed pattern on a pre-dyed cloth, with a paste containing a suitable reducing agent, which destroys (strips) the ground color dye during subsequent steaming at the printed portions. Thus discharge style is nothing but a localized stripping.

White Discharge

If the ground color on the printed area is destroyed by the reducing agent, leaving a white pattern on the printed area it is called as white discharge printing.

Color Discharge

A color discharge is the one in which a new color unspool by the reducing agent, is Printed on a dischargeable dyed ground. During steaming the ground color is destroyed, Whereas the non-dischargeable color in the printed portion is developed at the same time,

Giving a colored pattern on the pre – dyed cloth. The discharge resistant dye added to the print paste is also called as an illuminating dye. Thus color discharge is the process in which the pre – dyed ground color is destroyed and replaced by a new color.

Advantages

• It enables light, brighter colors to be obtained on a dark ground.
• Very sharp features like fine outlines, dots, raster etc., can be produced with total clarity, without ant smudging (due to overlapping of contact colors) or outfitting problems normally faced by direct style of printing.
• Tinting of white pattern on colored ground (In case of direct style) is avoided by discharge printing.
• The effect, clarity, distinction, richness and aesthetic appeal obtained add value for discharge printing.
• Level ground shades are best obtained by dyeing than blotch printing
• Open ground (flat screen printing) joint marks can be eliminated by discharge printing

Dis advantages

• It is an expensive process
• Two stage application involved in dyeing or padding and discharge printing.
• Limited choice of ground and motif colors.
• Requires rigid process care that any default will lead to damages

SCREEN PRINTING

The screen printing principle is almost the same as that of stenciling. Hand screen printing is the oldest of the screen printing methods. Hand screen printing is a slow process- almost as laborious as block printing- but it offers many advantages and is still an important part of the industry. Among the contributing factors:

1. The number of colors in a pattern can be unlimited
2. Large repeats are possible
3. Color reproduction is excellent and
4. There is a low financial investment

Production in screen printing is much greater than in block printing of very fine lines depends on the degree of perfection achieved in preparing the screens. Screen printing has certain advantages over roller printing also. Thus it can offer a convenient method of producing large repeats than those possible in roller printing and hence it provides greater scope in styling especially in furnishing fabrics. Because of the manual operations minimum more intense and brighter prints can be produced in screen printing than in roller printing. The printer is able to print very short runs economically in screen printing whenever the fabric to be printed too small for roller prints and too big block printing.

Screen printing provided by way of remunerative production of appropriate yardages at relatively at low capital cost.

A screen printing department requires sufficient space to hold a number of tables which are at least 50 to 65 yards long. In India usually the tables which are 75 to 85” feet longhand about 55” wide (for printing a maximum width of 45”). The table top is an angle of up to 45 to facilitate scrapping. The table has a height of 30 to 36”.Wood is the most commonly used

material for the construction of the table, but other materials like concrete may also be used. Concrete has the advantages of steadiness and such tables do not suffer from the disadvantages of wrapping (bending) as in the case of wood. Any hard seasoned wood (teak, rose, deader etc) which does not warp or bend with changes in weather should be used. The top of the table is generally covered with 2 to 3layers of blanket and finally with water – proof cover like Rexene. In order to permit gumming down of the cloth before printing rubber plastic or cloth sheets are used.

The following are the best known adhesives.

1. Rubber solutions, dextrin, cellulose derivatives
2. Polyvinyl alcohol solution, War fixes (CIBA) and paraffin wax.

The screen is placed on the cloth in such a way that the end of the screen is in close contact with the wooden frame fixed to the table and the projection on the screen frame is in contact with projection (stops) top end of the screen, and by means of the wiper drawn to the bottom and back again to the top. The color paste is pressed through the openings of the organdy cloth. As many number of screens are required as the number of coloursemployed to form the final design. Thus each screen provided as part of the design and when these are aligned properly as a perfect over all design is produced. After impression with one color is made, the second color is applied only after the first is dried (for which purpose on electrical or other device is provided below the table.

In order to ensure the continuity of the design, the screen has to be moved by a distance equal to the width of the design (which is smaller that the over all width of the screen including the screen frame) after the first impression is made. However when the screen is moved by this distance, a portion of the screen frame rests on a part of the previously printed portion, and it can pick up some paste. When the screen is taken to the third place this part of the frame produce an impression on the second place. In order to eliminate this difficulty, first, third fifth, Places are printed one after another and when theyare dried second, sixth, places are printed.

In the hand block printing and hand screen printing, the rate of production is very low and a more time is required for printing the cloth especially in multi colors.

In the hand block printing and hand screen printing, the rate of production is very low and a more time is required for printing the cloth especially in multi colors. Continuous process, using precisely calibrated movements which are electronically controlled in which the cloth moves along a table where the colors are applied by automatic squeezes. The squeegee moves across the cloth screen, lifts off the cloth and the cloth advances to the pattern repeat position and the print cycle is repeated.

The machine is built with as many as sixteen frames each of the can apply a different color, if needed and the operation of each can be adjusted for pressure, rate of lowering and rising separately. When the machine is running, all frames operate simultaneously and the cloth moves forward one frame-width between each application of color. The process therefore is equivalent to continuous printing of up to sixteen colors at one time. Length of design repeats can be up to 45cm to 250 cm (80”). Two men using this machine can print from 500 to 600 meters of fabric per hour.

The machine consists of a long platform over which on endless rubber apron moves intermittently. Screens are fixed on pipes and other arrangements to hold the screens on both sides of the platform. The cloth enters under tension and it is guided and freed from creases before being guided to the endless apron. The fabric is temporarily fixed on the endless apron by means of the thin film of gum applied to the apron just at the point where the cloth enters the machine. A soft roller presses the cloth on the apron and fixes it so that the cloth does not move out of position during printing process. The cloth moves along with the apron intermittently, one screen-repeat distance at a time.

This brings the cloth in its respective positions below each screen. During the time the apron stops between each movement, the screens got lowered and the wipers wipe the color up and down and immediately the screens lift. Now the apron moves one screen repeat distance and stops. The screens are again automatically lower and print the cloth. In this manner the whole of the fabric is printed. When the fabric approaches the turning point of the blanket, it is pulled off and passes into a dryer. The soiled blanket is washed and dried its return passage on the under-side of the machine. Thus cloth is printed on automatic flatbed screed printing machine.

ROTARY SCREEN PRINTING:

Rotary screen printing machines have been developed recently. It combines the advantages of both roller printing as well as screen printing together with a combination of the accuracy of production which is associated with flatbed machine. Different countries have marketed their machines with different names and some of them which are popular all over the world are (a) Stork, b) Zimmer and (c) Baser. Fully automatic flat-screen machines cannot be described as continuous because of their intermittent printing action. In rotary screen printing, continuous rotation of a cylindrical screen while in contact with the fabric ensures continuous printing. Print paste is fed into the inside of the screen and during printing is forced out through the design areas with the aid of a stationary squeegee. This is, of course the converse of flat-screen printing where the screen remains stationery which the squeegee moves.

A typical rotary – screen printing machine is shown in figure. The design of most machines follows the pattern established for fully-automatic flat-screen machines with an endless driven blanket, screen positions along the top and blanket washing and drying affected underneath during the return passage. In rotary screen printing machine the clothes secured to a continuous blanket by means of an adhesive and together they pass under the rotary screens. Rotary screens are made up of nickel, mostly 640mm circumference.

As the moving cloth comes in contact with the rotary screen color is forced through its mesh openings by a squeegee. After the completion of the last screen of the print pattern, the cloth is peeled away from the blanket and enters in the dryer. In rotary printing a round squeegee is pulled down into the screen, and fabric by a magnetic force generated by electro magnets located under the blanket. The application of color is similar to that of flat bed screen printing, except in this case the screen revolves the squeegee is stationery; The rotary screen printing machine is working with adjustable printing speed from 10 to100 meters/min. depending on the design and the fabric quality.

ADVANTAGES ROTARY SCREEN PRINTING**:**

1. This method of printing as the term implies combines some of the advantages of both roller printing and screen printing.
2. The rotary screen, which are generally made from pure nickel, rather than fabric or synthetics are extremely light weight are also considerably less costly than copper rollers.
3. Rotary printing is continuous just as roller printing, and thus the rate of production is higher than that attained by the flat bed method which necessitates stopping and starting again at intervals.
4. A wide range of fabric surfaces and textures can be printed.
5. Allowing the designer and printer to produce limited quantities of printed fabric not economically feasible where the financial investment demands large volume runs as in the case of roller printing

TRANSFER PRINTING

Transfer printing is a dry printing process, which employs a preprinted paper pattern from which a design can be transferred to almost all synthetic or man made fabric by a simple heat transfer or calendaring operation. The design is printed on the paper with sublimely dyes (Disperse dyes), which convert directly from solid to gas above a certain temperature. The dyes are transferred at 195 to 210ºC in 20 seconds on polyester woven fabrics.

Transfer printing process is known under different names like vapor phase, dry-heat, sublimation, sublistatic, colourstatic processes

The conditions which are needed for the transfer printing processes are:

(1) A range of dye that sublime at high temperature, preferably in a narrow range, and have substantively for synthetic fibres to be printed but little or no affinity for there-printed paper.
(2) The synthetic fiber fabrics should have the necessary physical, chemical and thermoplastic properties to withstand the high processing temperatures.
(3) A means of printing the paper to meet the high quality of textile design.
(4) A method of transferring the design from the paper to the fabric. Several methods are available for producing heat transfer printing papers. The following methods are generally used:-

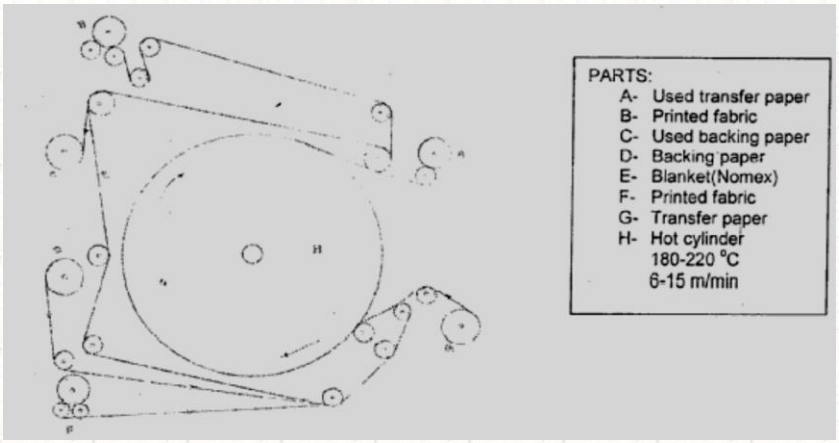
1) Gravure Engraving: This is the most versatile method, which produce consistent results under high speed working conditions. The design is engraved on a copper roller and the ink flow is controlled by doctor blade as in roller printing.

2) Lithographic printing: This method may have limitations when used for textile transfers, though it is capable o producing the finest art-work reproductions on paper.

3) Flexor graphic printing: Uses raised image areas (in relief) in rubber. It produces satisfactory transfer papers and can give heavy deposits of ink but the quality of ink transferred to the paper is difficult to control and may lead to variations in depth.

4) Silk screen method: This method can be used for paper transfer in sheet form only. It’s used in the printing short runs with exclusive designs.

5) Rotary screen printing method: Also used for priority transfer papers. Rotary screen-printing transfers the color through holes in a nickel-plated screen by squeegee pressure with one dryer available after the entire color has been applied...



CONTINUOUS TRANSFER PRINTING MACHINE

Continuous transfer printing machine is used for printing pre-batched fabrics. In this case, the printing technique consists in transferring a design on already printed paper on to fabric by the application of heat and pressure. After printing the fabric does not require fixation or wet treatments.

In the actual operation the pre-printed paper (Transfer paper) is laid into the continuous machine and brought into contact with the fabric to be printed and pressed against a large heated cylinder (maintained at 20 to 230ºC by an endless blanket for about 30 seconds.Nomex fabric (high temperature resistant nylon produced by Dupont Company) is commonly used as blanket material. A backing paper (like the back grey of the roller printing machine) ensures that no dye is wasted on the blanket. The speed of the machine varies between 6 M/min and 15 M/min, depending on the diameter of the heated cylinder.

The cylinder is heated by circulating hot or by means of electricity. After leaving the unwinding devices, the printing paper (Transfer paper), the fabric to be printed and the backing paper meet in one layer at the nip of the blanket and the cylinder. Three winders are provided at the back of the machine to batch exhausted paper (used transfer paper) Backing paper and the printed fabric separately. A tensioning device alters the pressure applied to the layers against the cylinder by introducing tension in the blanket. Polyester and cellulose triacetate fabrics are ideally suitable for transfer printing.

Fixation Methods after Printing:

After printing with disperse dyes the dyes is fixed on the fabric by one of the following dye- fixation methods, namely-

1. Thermo fixation
2. Super-Heated Steaming
3. High Pressure Steaming

1. Thermo fixation:

The features of this method of dye fixation are mentioned below:-

a) No steam is used.
b) Dye is fixed by subjecting the print to hot air at 2100C for 1 minute.
c) The fixation is carried out in a backing oven or in a setter where heat setting can also be done simultaneously.
d) The process productivity is high.
e) The dyes which have good sublimation fastness are subjected to this thermo fixation process.
f) There is 10-15% loss of color in thermo fixation, so the shade becomes dull.
g) It is a continuous process of dye fixation which gives high production.

2. Super-Heated Steaming:

The features of this method of dye fixation are mentioned below:-

a) It is a continuous process of dye fixation.
b) This method is the best of the three methods.
c) Dye is fixed at 1000-1800C for 2-1 minutes by radiators.
d) Higher productivity.
e) No loss of color.
f) Dyes with medium sublimation fastness can be applied.
g) The fabric handle is very soft.

3. High Pressure Steaming:

The features of this method of dye fixation are mentioned below:-

a) Discontinuous process of dye fixation
b) Low productivity.
c) Dye fixation is done by high pressure steam.
d) Low production so costly process.
e) Dyes with low sublimation fastness can be applied.
f) It gives good Color yield and bright print & smoothness.

POINTS TO BE REMEMBER:

- Printing is the process of transfer of a design or) art work on to textile materials, providing a decorative look.
- Printing is a process of producing attractive designs on textile fabrics using one or more dyestuffs.
- In printing, dyes and pigments are applied locally or discontinuously to produce the various designs on textile fabrics, so printing is also called as “Localized dyeing”
- The design is printed directly on the fabric by the application of color and is fixed on the cloth by a subsequent process of steaming. This style is also referred steamed style.
- In this dyed style the design is printed net by any color but by certain salts known as mordents, which are fixed on the cloth.

EXPECTED QUESTIONS:

Section A

1. Dyeing is the process of coloring textile materials by immersing them in an aqueous solution of dye, called _____.
   a. Dye liquor b. printing paste c. Both a & b d. none
2. _____ dyes are the salts of organic bases
   A. basic b. direct c. vat d. none

Section B

1. Define printing?
2. What are the different types of printing?

Section C

1. Write about classifications of printing?
2. Write about the different types printing methods.
3. What are the fixation and after treatment for printing?
4. Discuss about the garment dyeing machines?