Textile Processing Technology

Level-II

Based on March 2022, Curriculum Version 1

Module Title: - Printing Operations

Module code: IND TPT2 05M 0222

Nominal duration: 80 Hours

Prepared by: Ministry of Labor and Skill

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Ababa, Ethiopia

Table of Contents

Acronyms

TVET: technical vocational educational training

OS: occupational standard

CM: curriculum

TTLM: teaching training and learning material

OHS: occupational health safety

SOP: standard operation procedure

PPE: personal protective equipment

WHS: work health safety

PVI: printing viscosity index

UV: ultra violet radiation

Acknowledgment

Ministry Of Labor And Skills Wish To Extend Thanks And Appreciation To The Many Representatives Of TVET Instructors And Respective Industry Experts Who Donated Their Time And Expertise To The Development Of This Teaching, Training And Learning Materials (TTLM)

Introduction to the Module

A Textile Processing Technology Is Essential For The Practice Of Textile Coloration Like Printing, Dyeing And Finishing Textile Material. It Is a Great Responsibility that the printing Operation Must Environmental Friendly. The Purpose of Textile printing is 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.

This Module Is designed to meet the Industry Requirement under the Textile Chemical Processing Occupational Standard, Particularly for the Unit of Competency: Pretreatment Operations manner.

This Module Covers The Units:

- Job Requirements
- Printing Processes
- Printing Machines And Equipment
- Operate And Monitor Printing Equipment
- printing operations

Learning Objective of the Module

At The End Of This Session, The Students Will Able To:

- Determine job requirements
- Understand Printing processes
- Set up and load machine
- Operate and monitor printing machine
- Complete printing operations

Complete printing operations for effective use these modules trainees are expected to follow the following module instruction:

1. read the information written in each unit
2. accomplish the self-checks at the end of each unit
3. perform operation sheets which were provided at the end of units
4. do the “lap test” gi ver at the end of each unit and
5. read the identified reference book for examples and exercise

Unit One: Job Requirements

This learning unit is developed to provide the trainees the necessary information regarding the following content coverage and topics:

- standard operating procedures (SOPS)
- work health and safety (WHS)
- personal protective equipment (PPE)
- job specifications

This unit will also assist you to attain the learning outcomes stated in the cover page. specifically, upon completion of this learning guide, you will be able to:

- Follow standard operating procedures (sops).
- comply with work health and safety (WHS) R
- use appropriate personal protective equipment (PPE)
- identify job specifications

1.1 Standard Operating Procedures (Sops)

A. standard operating procedure (sop) is a set of written instructions that document a routine or repetitive activity followed.) sop is a procedure specific to your operation that describes the activities necessary to complete tasks in accordance with industry regulations, provincial laws or even just your own standards for running your business.for processes involving hazardous substances, hot liquids, pressurized equipment, and any other processes that may incur risks to safety and health, hazard information and risk control measures should be stated clearly in the respective standard operating procedures and made known to the employees concerned.

1.2 Work Health and Safety (WHS)

Work health and safety (WHS) sometimes called occupational health and safety (OH&S) involves the management of risks to the health .You must put health and safety practices in place as soon as you start your business. Under Australian WHS laws your business must ensure the health and safety of your workers and not put the health and safety of other people at risk. You will be able to:

- provide a safe work environment
- provide and maintain safe machinery and structures
- provide safe ways of working
- ensure safe use, handling and storage of machinery, structures and substances
- provide and maintain adequate facilities
- provide any information, training, instruction or supervision needed for safety
- Monitor the health of workers and conditions at the workplace.

People working in your business have WHS obligations to themselves and others at work. They must:

OHS Practices

- Be Aware
- Maintain Correct Posture
- Take Breaks Regularly
- Use Equipment Properly
- Locate Emergency Exits
- Report Safety Concerns
- Practice Effective Housekeeping

- take care of their own health and safety
- take care not to do anything that could hurt others
- follow WHS instructions
- Follow the workplace's WHS policies and procedures

Act – outlines your broad responsibilities.

Regulations – set out specific requirements for particular hazards and risks, such as noise, machinery, and manual handling.

Codes of practice – provide practical information on how you can meet the requirements in the Act and Regulations.

Regulating agency (regulator) – administers WHS laws, inspects workplaces, provides advice and enforces the laws. Check their website for WHS information and resources.

A. **Hazard Identification and Control**

Identify hazards and risk factors that have the potential to cause harm (hazard identification). Analyze and evaluate the risk associated with that hazard (risk analysis, and risk evaluation). Determine appropriate ways to eliminate the hazard, or control the risk when the hazard cannot be eliminated.

Safe material handling seated is a survey of the methods used to study the safety of materials handling. An analysis of crane accidents revealed that focusing attention on this section sets forth the program requirements for safe materials handling including storage for construction materials and hazardous.

B. Risk Assessment

- Risk is defined as the combination of chance or frequency or probability of occurrence of an accident and its damage consequences to life and property. So risk has two parameters.
- Risk assessment is the determination of quantitative or qualitative value of risk related to a concrete situation and a recognized threat.
- Hazard Control Measures A Hazard Control Program Consists Of All Steps Necessary To Protect Workers From Exposure To A Substance Or System, The Training And The Procedure Required.

C. **Implementation of Risk Reduction Measures**

Housekeeping containers - use robust containers with a close able lid for storage. However, repeated removal and replacement of container lids and opening and closing of bags can also generate more dust. Plan to dispose of containers safely, bags especially can cause problems and are best placed into disposal sacks at the workstation. Also plan how you will deal with damaged containers and how to dispose of unwanted chemicals and other substances. Areas where chemicals and other substances are handled should be easy to clean, with walls and floors that are sound and smooth rounded corners are easier to clean shelving and workbenches should be easy to clean too or else covered with impervious, disposable covering. They should have a lip to retain spills, cleaning and dealing with spillages - dry vacuum cleaning, using a piped system or a type h industrial vacuum cleaner, is best for larger dry spillages and most cleaning tasks. Wet vacuuming or other wet cleaning methods may be appropriate in some situations or for smaller spillages. Don't use brushes or brooms or compressed air, as these will simply spread the dust into the air.

1.3 Personal Protective Equipment (PPE)

Personal protective equipment (PPE) is used to protect an individual from hazards associated with their work tasks or environment. Specific types of personal protective equipment include protective clothing, eyewear, respiratory devices, protective shields, gloves, and hearing protection. Personal protective equipment is not a substitute for engineering controls such as chemical fume hoods and biosafety cabinets, or for administrative controls and good work practices.

Personnel protective equipment is used in conjunction with these controls to provide safety and maintain health.Chemical Resistant Clothing: Protective apparel designed to provide a barrier against a variety of chemical hazards. Chemical resistive clothing may be required for tasks where chemical splashing is anticipated or large volume transfers are conducted.

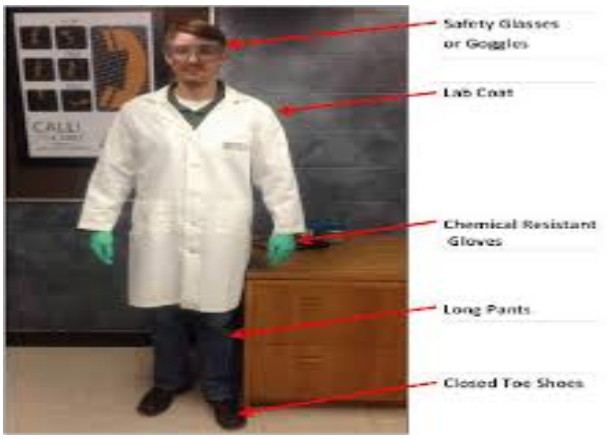

Fig 1.1 PPE wears personal protective materials such as over coat, glove, eye glass etc.

1.4 Identifying job specifications

i. Ergonomic Arrangements of Workplace a Comfortable Work Space Can Help You Feel You're Best. Give Your Sitting Work Area A Makeover With This Visual Guide To Office.

ii. Reporting Accidents And Incidents In The Case Of Serious Injury, An Immediate Telephone Notification Is Required. Other Incidents Must Be Reported Using The Gas Accident/Incident Report Form.

Self-check 1

Part 1 Chose

Instruction: chose the best answer

1. Which one of the following is WHS working obligation in your business?

A/maintain incorrect posture

B/did not locate emergency exist

C/use equipment improperly

D/practice effective house keeping

2. Which one of the following is PPE?

A/chemical resisting cloth

B/ear and hearing protection earplug & muffs

C/laboratory apparel& scurf suits

D/all

Part 2 matching

Column A	Column B
1. Act	A/provide practical information
2. Regulation	B/outline your broad responsibilities
3. Codes o practice	C/set out specific requirements

Part 3 Short answer

Instructions write short & prices answer

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

Unit Two: Understand Printing processes

This Unit To Provide You The Necessary Information Regarding The Following Content Coverage And Topics:

- printing processes
- printing processes technologies
- Interaction of Chemicals, and pigments with & textiles.
- functions of pigments, Chemical & auxiliaries
- Select chemical, auxiliaries and printing Pigments
- Prepare chemical, pigments recipe formulation and set process parameter

This Guide Will Also Assist You To Attain The Learning Outcomes Stated In The Cover Page. Specifically, Upon Completion Of This Learning Guide, You Will Be Able To:

- Understand printing processes
- Understand printing processes technologies
- Interaction of Chemicals, and pigments with & textiles.
- Identify the functions of pigments, Chemical & auxiliaries
- Select chemical, auxiliaries and printing Pigments
- Prepare chemical, pigments recipe formulation and set process parameters s

2.1 Printing Processes

Each printing process is divided into prepress, press, and post press steps.

- Prepress operations encompass steps during which the idea for a printed image is converted into an image carrier such as a plate, cylinder, or screen. Prepress operations include composition and type setting, graphic arts photography, image assembly, and image carrier preparation.
- Press refers to actual printing operations.
- Post press primarily involves the assembly of printed materials and consists of binding and finishing operations.

A. Types of Printing Processes

- Offset Printing.
- Lithography.
- Digital Printing.
- Gravure.
- Screen Printing.
- Flexography

There are three main printing processes: relief, intaglio, and planography, which includes lithography and screen printing. Each process has a unique mark or characteristic because of the way the matrix is created.

When it comes to professional printing processes there are three main types: Offset litho printing, Digital Printing and Screen printing.

B. **methods of printing**

- Offset Lithography.
- Flexography.
- Digital Printing.
- Large Format.
- Screen Printing.
- 3D Printing

Offset lithography

Offset printing is still the most commonly used method of printing and is often called offset lithography.

Printing styles Classified as direct, discharge, or resist. In direct printing, coloured pastes are printed directly on the cloth. For discharge printing, the cloth is first dyed with a background color, which is destroyed by reagents, or reducing agents, carried in a print paste.

Digital printing differs from traditional, analog printing methods such as offset printing because digital printing machines do not require printing plates. Instead of using metal plates to transfer an image, digital printing presses print the image directly onto the media substrate.

Modern printing processes. Of the newer printing processes, and is thought by some to be unexcelled in the re- production of photographs-but this is quite debatable. There are essentially only two steps in letterpress printing; the setting of the type or making. of cuts for illustrations and then printing from them.

Inkjet printers are best suited for small, image heavy documents, like photos and school projects. But, if you're looking for a printer that can handle heavy volumes of text based documents, a laser printer is the more efficient and economical choice.

Analogue printing creates copies of the original image, which is created on an image carrier such as a plate; the copies are made from a fully formed representation of the original image, which can be described by its physical dimensions (such as its height and width

2.2 Printing Processes Technologies

Machines used for printing the fabrics are explained in the fourth coming section. Fabric is printed conventionally using the table screen printing machines manually. More perfection and production can be achieved using as modern automatic flatbed screen printing machine. Today's most important development in printing machinery lies in rotary screen printing machines. Before we go into the details of the printing machinery, let us discuss about the preparation of the screens used for flat bed and rotary screen printing.

A .Roller Printing Machine

It is the machine method of printing designs on cloths by engraved rollers. The design is engraved on the surface of a metal roller, to which dye is applied, and the excess is scraped off the roller's surface, leaving dye in the engraved sections. When it rolls across the fabric the dye on the roller will transfer to the fabric.

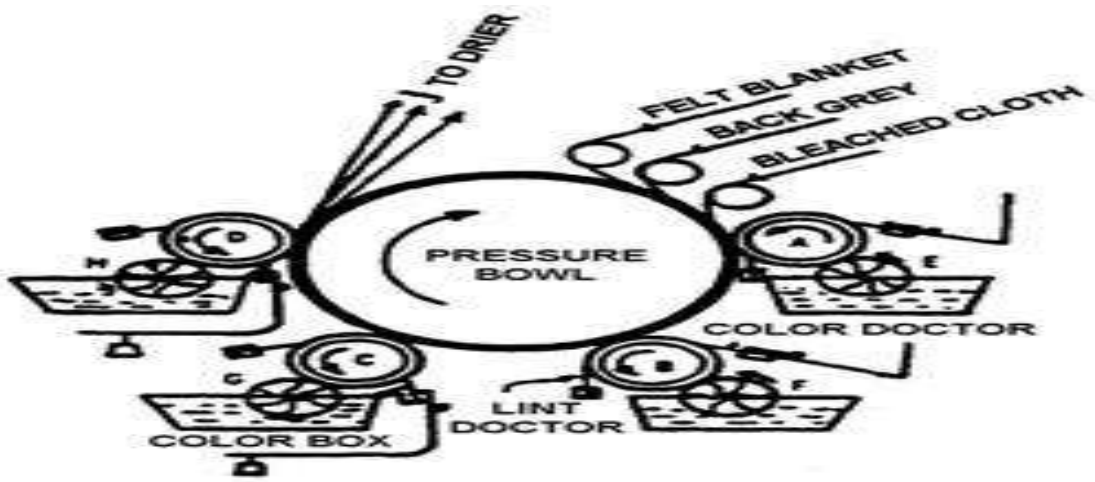

Fig: 2.1 Roller printing machine

Screen printing machine

Fig: 2.2 Screen printing machine

B. Hand screen printing machine

In Hand Screen printing the fabric is stuck to the printing table, which is covered with a resilient felt, wax cloth or rubber material. Each screen is placed on the fabric in turn, the paste applied to one end of the screen and the squeegee drawn by hand through the paste and across the screen, forcing it through the open mesh areas on to the fabric beneath, Guide rails along the edges of the table ensure each screen is applied in register. Although the highly skilled printer can produce good quality prints by a hand screen technique, the production rates are extremely slow. It is wooden printing tables (1), with metal legs, usually 40 to 80 m long and 1 to 2 m wide; they are covered with a felt coating on which a resin cloth is laid (2) - possibly covered with a polyethylene film coated with the adhesive which causes it to adhere to the fabric and prevent the cloth from moving during the printing process (3). An upright rail (4) is fixed on the edge of the printing table, where some blocks (5) are arranged to

lock the frames, keep the pattern ratio and maintain the precise position on the table for proper registration and alignment. The printing paste is accurately applied to the fabric, by spreading it on the cloth (7) of the screen (6), by means of squeegees (or paddles) (8)

The screen centering is obtained by means of three screws; two screws are arranged on one side of the screen in contact with the rail (they lift, lower or rotate the screen) and the remaining one is arranged on one side in contact with the block (it moves the screen lengthwise).The squeegee is moved manually.

Nowadays, this type of printing is used only for high quality products and for small lots, or it is carried out on small tables (8-10 m.) for sampling purposes. The material is dried directly on the printing tables (30-50° C) heated by means of resistances positioned under the cloth¸ with hot air jets (40-50° C.) directed on the printed cloths laid down on the table, or removed and hung above the printing table to air-dry.

Fig: 2.3 Manual or hand screen printing machine

C .Flatbed screen printing machine

The printing operation in a flatbed screen printing machine can be made fully automatic by standardizing the stages of preparation and producing the print including screen holding, addition of print paste, pressing the paste on to the cloth, lifting the screen and carrying the cloth forward to the next screen printing screen position. The automation of these stages makes the reproduction of printing results quite easy. The fabric is suitably fed to the machine in a crease free manner. The print pattern is registered on the fabric by pressing the printing paste through the specially engraved portions on the flat screens. There are as many numbers of screens as the number of colors in the print pattern. The fabric to be printed is conveyed, i.e. carried forward, with each color, register by register, while the flat engraved screens continuously rise and come down, at each repeat of the color pattern are printed at the same time, but on different printing places of the cloth. The entire colored pattern

will be printed only when the far end screen completes its printing operation.Good quality nylon gauzes with superfine construction fulfill all the demands made on the screens by the automatic screen printing machines. These demands can be summarized as follows: Very thin application of the dyestuff paste on the screen; Optimum color permeability in relation to the fabric; Minimum number of squeegee strokes; Maximum mechanical resistance on the part of the screen gauze to the high squeegee strokes.In other fully mechanized machines all the colors are printed at the same time. A number of stationary screens (from 8 to 12, but some machines are equipped with up to 24 different screens) are placed along the printing machine. The screens are simultaneously lifted, while the textile, which is glued to a moving endless rubber belt, is advanced to the pattern-repeat point. Then the screens are lowered again and the paste is squeezed through the screens onto the fabric. The printed material moves forward one frame at each application and as it leaves the last frame it is finally dried and it is ready for fixation.

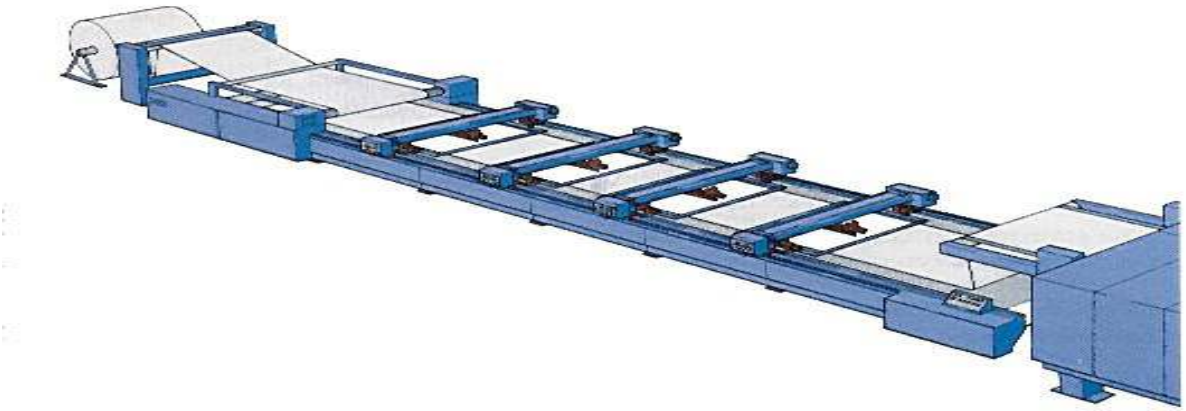

Fig: 3.4. Flat-screen printing machine

In this machine the continuous rubber belt, after pulling away the fabric is moved downward in continuous mode over a guide roller and washed with water and rotating brushes to remove the printing paste residues and the glue, if necessary. After this, the belt is sent back to the gluing device. In some cases the glue is applied in liquid form by a squeegee, while in other machines the belts are pre-coated with thermoplastic glues. In this case the textile is heated and then it is squeezed by a roller or simply pressed against the rubber-coated belt, causing the glue to soften and instantly adhere. A piece of nylon bolting cloth or metal gauge (phosphobraze) is stretched and nailed to a strong wooden frame, strengthened by metal brackets at the corner. The frames are usually 26” x 55” (measured externally) and 23” x 52” (measured internally) for printing 45” wide cloth. When metal frame is used for making the screen, the bolting cloth may be fixed to the frame by using a solution of polyvinyl acetate in a suitable solvent. Photochemical method is the most widely used method for preparing screen. This is based on the principle that when a coating of solution ammonium dichromate – gelatin

or ammonium dichromate – polyvinyl alcohol is dried and exposed to light, insolubilization takes place. The photosensitive coating may be given to the bolting cloth, fixed to the screen frame, dried and exposed to light after keeping in contact with a positive film and after in solubilisation of exposed portion, the unexposed photosensitive coating may be given to the bolting cloth, fixed to the screen frame, dried and exposed to light after keeping in contact with a positive film and after insolubilisation of exposed portion, the unexposed photosensitive coating is washed out leading the locking of the interstices of the cloth at the exposed portions and keeping them open(for forcing of the print paste later while printing) at the unexposed portion. The sensitizing solution may be prepared as follows:

Chrome – Gelatin Solution

Solution A

200 g pure gelatin

500 g boiling water

Solution B

70 g Ammonium dichromate

150 g boiling water

80 g liquor ammonia

Solution A and Solution B are mixed in dark room.

Chrome-polyvinyl alcohol solution

600 g polyvinyl alcohol (15% solution)

120 ml ammonium dichromate (33% solution)

240 ml cold water

1 liter with cold water

After applying the solution to the screen cloth, it is dried in the dark room at room temperature. The positive of the design is placed on a glass-topped table and the dried photosensitive screen is placed over it. The exposure is started from under the glass table using mercury vapor lamp or fluorescent tube lights with uniform intensity of light all over the screen. The screens are then washed in the dark, first with hot and then with cold water. The hardening of the insolubilised chrome-gelatine complex is done by placing the screen in a solution containing.

50 g chrome alum

50 g formaldehyde

25 g sodium dichromate

1 liter

For 5 minutes at room temperature, washed with cold water and dried. In the case of chrome-polyvinyl alcohol complex, the hardening is done in a solution containing,

50 ml acetaldehyde

50 ml Isobutyraldehyde

80 ml water

20 ml sulphuric acid (168 Tw)

1 liter with cold water

It is boiled at 15 to 25 degree C for 1 to 2 hours. It is then washed with cold water and dried.

D. **Rotary Screen Printing**

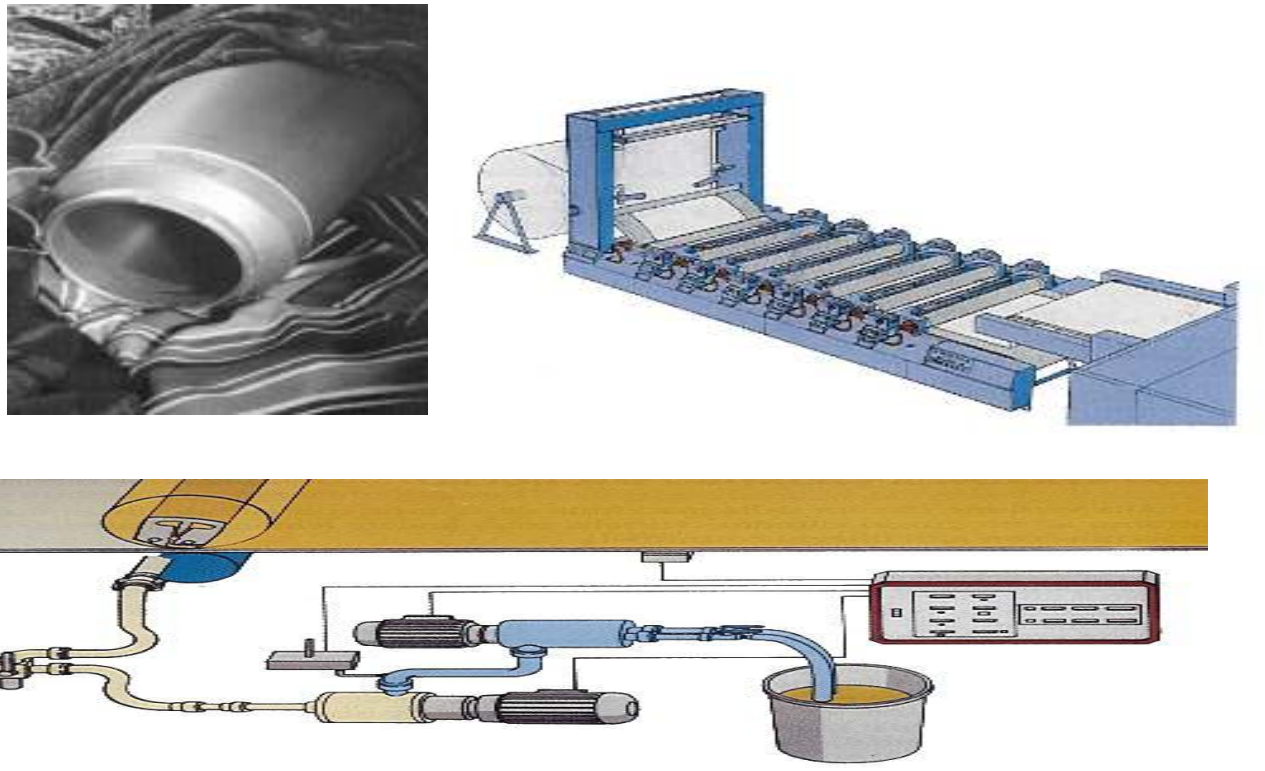

Fig: 2.5. Rotary screen printing roller with flange

Due to the semi-continuous process, low productivity, and non-continuous patterns of flat-bed screen printing, inventive machine makers developed rotary screen printing. The idea was first proposed in 1947 in Portugal, but the initial commercial machine was first introduced by Stork (Holland) show in Germany in 1963. In concept, the idea is to take a flat screen and simply shape it into a roll by sealing

the ends of the flat screen together. The simple modification converts a semi-continuous process to a continuous one. However, initially there were many technical hurdles to overcome before rotary screen machines became practical. In basic operation, rotary screen and flat screen-printing machines are very similar. Both use the same type of in-feed device, glue trough, rotating blanket (print table), dryer, and fixation equipment. The process involves initially feeding fabric onto the rubber blanket. As the fabric travels under the rotary screens, the screens turn with the fabric. Print paste is continuously fed to the interior of the screen through a color bar or pipe. As the screen rotates, the squeegee device pushes print paste through the design areas of the screen onto the fabric. As in flat-bed screen printing, only one color can be printed by each screen. After print application, the process is the same as flat screen printing.

By converting the screen-printing process from semi-continuous to continuous, higher production speeds are obtained. Typical speeds are from 50-120 ypm (45-100 mpm) for rotary screen printing depending upon design complexity and fabric construction. Initially, no continuous patterns such as stripes were available with this method due to the seams in the rotary screens. However, with the development of seamless screens, continuous patterns such as linear stripes or plaids became possible. Rotary screen machines are more compact than flat screen machines for the same number of colors in the pattern. Therefore, they use less plant floor space. Also with rotary screens, the size of the design repeat is dependent upon the circumference of the screens. This was initially seen as a disadvantage, because the first rotary screens were small in diameter. However, with today's equipment, screens are available in a range of sizes and are no longer considered design limited. The fact is that today's rotary screen machines are highly productive, allow for the quick changeover of patterns, have few design limitations, and can be used for both continuous and discontinuous patterns. Estimates indicate that this technique controls approximately 65% of the printed fabric market worldwide. The principle disadvantage of rotary screen printing is the high fixed cost of the equipment. The machines are generally not profitable for short yardages of widely varying patterns, because of the clean-up and machine down time when changing patterns. Flat screen printing is much more suitable for high pile fabrics, because only one squeegee pass is available with rotary screen. However, rotary machines are used for carpet and other types of pile fabrics.Rotary screen printing involves a series of revolving metal cylinder, each with revolving screens, each with a stationary squeegee inside which forces the print paste onto the fabric. Twenty or more colors can be printed at the same time. The process is much quicker and more efficient than flat screen printing.

E. **Heat Transfer printing**

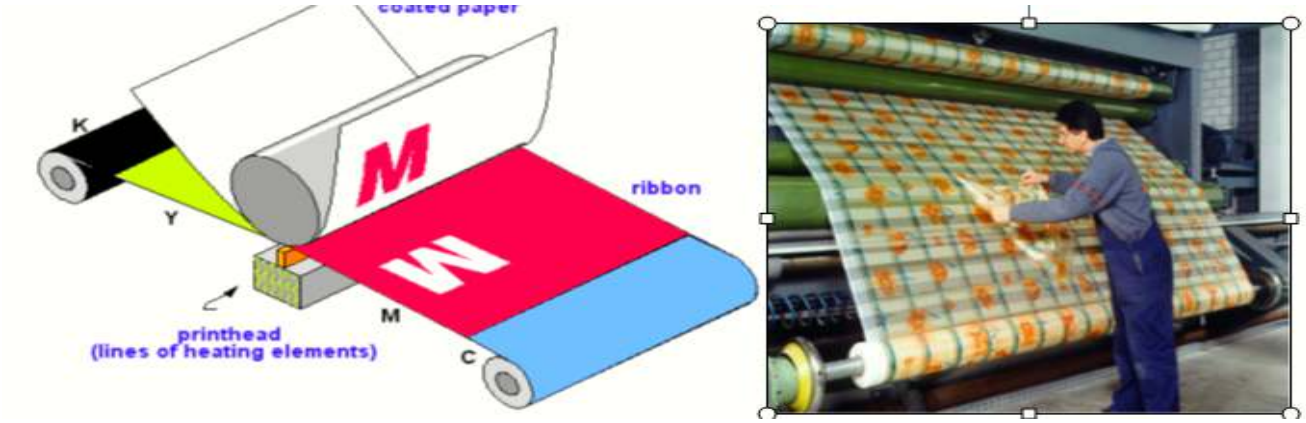

Fig: 2.6. Heat transfer printing

It is an indirect method of printing in which dyes are transferred from paper to a thermoplastic fabric under controlled conditions of temperature, time and pressure. The image is first engraved on a copper plate. Then pigment is applied on these plates. The image is then transferred to a piece of paper, with a layer of glue applied. This is then placed on the fabric and heat and pressure applied which fixes the print onto fabric.

F. **Digital printing**

Fig: 2.7. Digital printing machine

The newest printing method for textiles is digital ink-jet printing. From a technical standpoint, this process is identical to the ink-jet printer used with nearly every desktop computer. However, for fabrics, these machines are 60-84 inches wide. Digital printing offers tremendous design capabilities. Designs of photographic image quality are possible with this technique. Of course, the method uses a

CAD system with digitized image data. It presents the opportunity to change from one design to another immediately without any printed fabric waste. This method has been used in conjunction with body-scan data to produce printed fabrics that are custom fitted for the individual. It has also been used to rapidly produce trial prints for sale or evaluation. Many individuals foresee this method as a technique for the future. There are technological shortcomings associated with this method. The current top printing speeds range from 30-70 yards per hour for flat fabrics compared with a rotary screen machine output of 50-120 yards per minute. The limiting factor on printing speed is the technology of the printing heads. Reports indicate that these production speeds will not increase unless there is a breakthrough in the mechanics of the printing heads. Other printer hardware limitations include cost of the printer heads, ink-jet nozzle clogging, ink recycle, reuse systems, and machine width limitations. In addition to these hurdles, there are color depth and colorfastness issues with many of the dye systems currently available. Generally, the fabric to be printed must be pretreated with a material such as sodium alginate and alkali, so the printed dye will not bleed and smear before fixation. Ink-jet pigment inks have been developed, but from a commercial viewpoint, ink viscosity, pigment colorant particle size, and print durability are limiting factors. Regardless of the technical limitations, digital ink-jet printing is a viable commercial alternative technique for small runs (50 yards and under) of highly styled premium fabrics as are used in scarves and ties. Currently, numerous organizations are researching ways to overcome the problems of ink-jet printing of textile fabrics

G. **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. 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).

H. **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

I. **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.

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.

J. **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.

2.3 Interaction of Chemicals and pigments with textiles

Interactions with fabrics of some UV-absorber and direct dyes, such as in coloring of cellulosic fibers, are non-covalent, i.e. include van der

Leveling agents to achieve uniform dyeing on fabric, it is essential to add a suitable leveling agent in the dye baths. However, it is quite difficult to Pigments have no intrinsic substantivizes for the textile substrate .Pigments are white or colored chemicals that can be aromatic organic, organometallic

2.4Functions of Chemicals & Auxiliaries

The characteristics of printing and dyeing chemicals and how auxiliary substances can assist in achieving outstanding dyeing and printing performance these activities include dissolution of raw materials, mixing, synthesis/reaction or calcination, washing, drying, milling/grinding (wet or dry), sieving Chemicals and Auxiliaries used in Textile Wet Processing.

Auxiliary chemicals are substances that assist in the production of narcotics and psychotropic substances. Auxiliaries help by speeding up these processes or carry out the processes in a more efficient manner.

2.5Select dye Chemicals & pigment

Pigment offers for coatings from suppliers around the globe all in one place. Fast and easy product overview of pigment offers from global suppliers. Chemical Pigment widely used in ceramic, glass, plastics, coating, and building material.

2.6Chemical Recipe formulation

Textile chemicals -Dyes and pigments Textile dyes and pigments are chemical substances used to color fabrics. The main difference between both is that dyes are soluble in water and pigments are not. Coloring or the fixation of a dye to fabric fibers is a complex chemical process. Not all the dyes and pigments themselves but additional, auxiliary chemicals are necessary for dying textiles.

No single class of dye can dye all fibers, an overview dyes classes and the possible fibers are shown in the table below:

Fibers	**Suitable type of dyes and pigments**
bast (linen, flax, hemp, jute, ramie)	acid, direct, (disperse), reactive, vat, solubilized vat
Cotton	azoic, basic, direct, mordant, oxidation, reactive, sulfur, vat
elastomers (Glospan, Lycra)	acid, disperse, reactive, (wool), vat
polyacrylonitrile (Acrilan, Courtelle, Orlon)	basic, disperse, pigment
polyamide (nylon, Perlon, Rilsan)	acid, disperse, mordant, pigment, reactive
polyester (Dacron, Terylene)	disperse, pigment
polyolefines (Meraklon, Propene)	Disperse
polyvinyl chloride (Envilon, Thermovyl)	basic, disperse
secondary acetate	Disperse
Silk	acid, basic, direct, mordant, (reactive), (solubilized vat)
Triacetate	Disperse
Viscose	direct, mordant, pigment, reactive, sulfur, vat, solubilized vat
Wool	acid, basic, mordant, reactive, (solubilized vat)
Wool blends (wool-cotton, wool-viscose, etc.)	acid, direct, mordant, reactive

Table: 2.1 Chemical Recipe formulation

Self-check 2

Part 1 chose

Infraction: chose the best answer

1. Which one the following is division of Printing Processes

A/ Prepress operations encompass steps during which the idea for a printed image is converted into an image Carrie.

B/Press refers to actual printing operations.

C/ Post press primarily involves the assembly of printed materials and consists of binding and finishing operations

D/all

Part 2 matching

Column A Column B

1. Stencil Printing A/ adye- resin mixture is spread on a screen bearing the design and the fabric is passed into an electrostatic field under the screen.

2. Blotch Printing B/ the background color and the design are both printed onto white fabric.

3. Electrostatic Printing C/ The design is first cut in cardboard, wood or metal

Part 3 short answer

1. What is the most popular printing process?

2. List at list five techniques of printing?

3. What is the main process of heat transfer printing?

4. Write the advantages and disadvantages of tie dyeing?

5 Explain the mechanism of Stencil Printing?

6. What are the styles of printing?

7. Explain the way how to applying of each printing style?

Unit three: Set up and load machine

This unit to provide you the necessary information regarding the following content coverage and topics:

- Receive and check printing paste and screen machine
- load print paste on screen printing machine
- perform and ready the machine printing
- Clean working area

This guide will also assist you to attain the learning outcomes stated in the cover page. specifically, upon completion of this learning guide, you will be able to:

- Receive printing paste and screen printing machine
- Loading the print paste on the screen printing machine
- performing and ready the machine for printing
- Perform Cleaning working area

3.1 Receive and check printing paste and screen machine

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

B. 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 modifier

C. 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

D. **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.

E. **Wetting agent**

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

F. 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.

G. 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 di ammonium hydrogen phosphate. For reactive printing on cotton, sodium carbonate or sodium bicarbonate are used.

H. Oxidizing or reducing agent

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

I. 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.

i. Dispersing Agent

Dispersing agents are necessary in the print paste to prevent aggregation of the dyestuff in the highly co ncentrated pastes. E.g. Di ethylene glycol

ii. Preservatives

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

Ex: Salicylic acid.

iii. **Binders**

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

Ex. Melamine formaldehyde resin

J. **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 outline of the print is controlled.

They can be classified in to four groups

- Natural high molecular compounds and their derivatives
- High drop hillic 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

K. 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**:**

i. 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.

ii. 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.

L. **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.

M. **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 poly acrylic 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.

i. Procedures of printing process

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

ii. Fixation methods

iii. Atmospheric steam

Treatment at 212 degrees f with saturated steam used with

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

iv. Pressure steam

Treatment at 230 degrees f under pressure

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

v. 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

vi. Dry heat

Treatment with dry heat at temperatures up to 420 degrees

- Used with disperse dyes and reactive dye

3.2 Load print paste on screen printing machine

A. Checking and Receiving the Screen

Fig: 3.1 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.

B. Mesh count

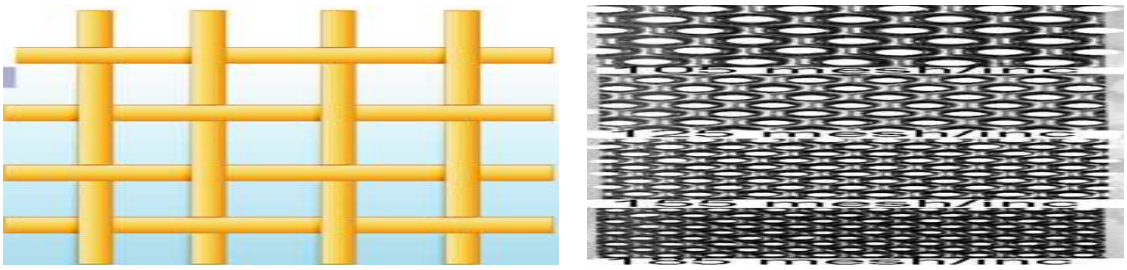

Fig. 3.2 Mesh

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.

c. Dimensions

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

3.3 Preparing and Loading the Screen

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 asingle project.

A silk screen 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.

2. **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

3. **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. Taping should also be done on the inside so that the ink does not build up between the screen and the frame.

4. **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.

5. **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.

6. **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.

7. **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.

8. **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.

9. **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.

10. **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.

11. 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.

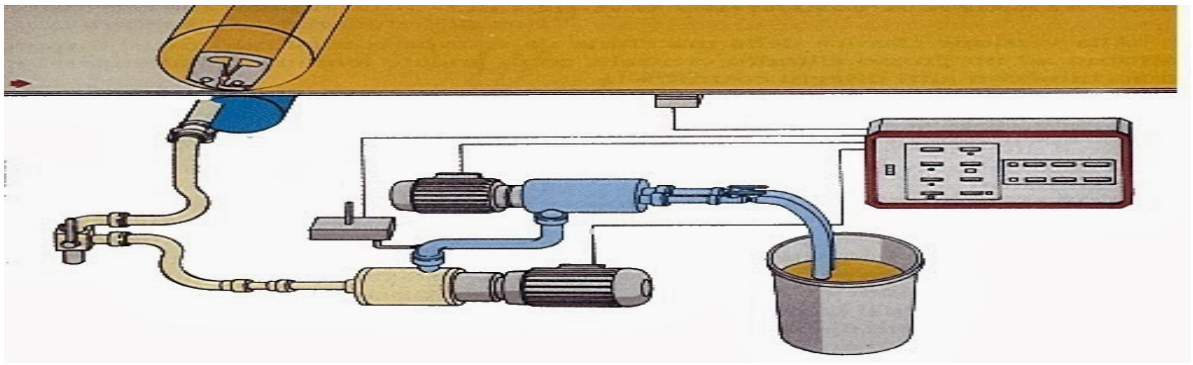

Fig: Printing-paste feeding system for a rotary-screen printing machine.

3.4 Cleaning Work Area and Carrying Out Printing

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

12. **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

Self-Check - 3

Part 1.chose

1. Which one of the following are not the factors that influence the viscosity of paste?

A/chemical structure of thinker

B/degree of expansion of thinker in water

C/concentration of thinker and temperature

D/ none

Part: 2 matching

Column A	column B
1. Preservative	A/ adjust the viscosity of the printing past
2. Binder	B/ to prevent the action of bacteria & fungus
	C/ used to pigmenting thin film forming polymer

Part 3: Short answer

1. Write the function of binder in printing?
2. What are the procedures of printing?

3. How printing paste will feed to the printing machine?
4. Writ the way of connecting paste with the printing the machine**?**
5. Write ways of preparing fabric to be printed?
6. Write some information/ ways of cleaning work area?
7. While receiving the screen what specification will be checked
8. What is the relationship between printing paste and mesh count?
9. List the tools which help to prepare the screen?
10. How long will expose the emulsion if the light source is 150 watt bulb?
11. While receiving the screen what specification will be checked?
12. What is the relationship between printing paste and mesh count?
13. Write ways of preparing fabric to be printed?
14. What is unloading means?
15. Consider as you are an operator of winch dyeing machine and what will you assure while unloading the product?

Operation sheets 3

OPERATION TITLE: : screen silk screen preparation

PURPOSE: To create different design on the screen

To satisfy a customer demand

conditions or situations for the operations:

The operation process can be performed by following the procedure and steps.

Equipment, tools and materials : OHS practice, silk fabric, wooden frame, hammer , nil, dark room, light transparent paper, printer machine, black body, lacquer, synthesizer chemicals

PROCEDURE:

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

PRECAUTIONS: avoid any light during squeeze of screen by lacquer with synthesizer chemicals.

The operation can be performed by applying standard occupational health and safety rules.

QUALITY CRITERIA: perform proper design outcome.

Lab test 3

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: prepare silk screen /mish?

unit four: operate and monitor printing equipment

This unit to provide you the necessary information regarding the following content coverage and topics:

- Operating printing machine
- Monitoring printing operations
- Identifying and correcting minor faults
- Reporting Machine Faults or Incorrect Printing

This guide will also assist you to attain the learning outcomes stated in the cover page. specifically, upon completion of this learning guide, you will be able to :

- Start, operate and stop printing machine.
- Monitor Printing operations.
- Identify and correct Minor Printing operations faults.
- Report the Major machine or printing faults

4.1 Operating printing machine

After the necessary things of printing (fabric, design, paste and other tools are prepared operating according to manufacturer's specification, operating is followed and after the process has been carried stopping is followed.

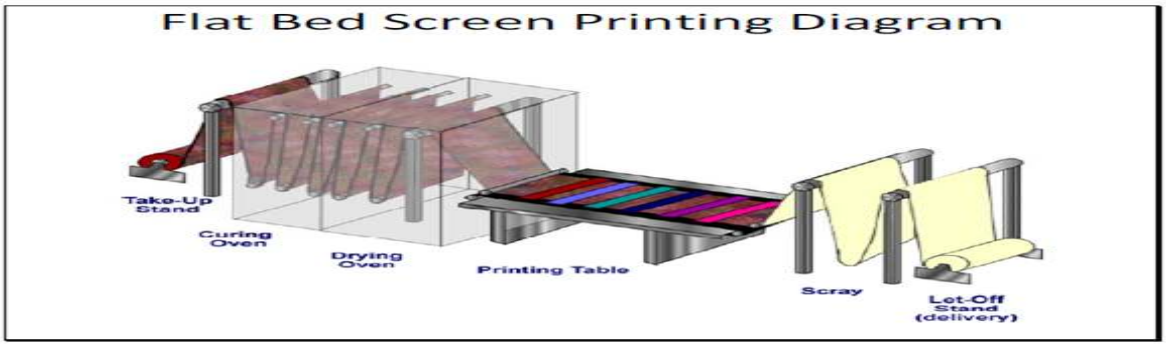

Fig4.1.Printing machineries

A. Manual printing machines

It is one of printing machine which can be printed manually or by human power. The design is prepared manually.

1- Garment printing machines

This type of printing machine imparts prints to already constructed garments. Other printing machines and methods are beyond this level, this includes: Stencil printing, Roller Engraving, heat transfer, Digital printing.

2- Procedure of printing process

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

4.2 Monitoring printing operations

a. Printing

During printing the operator need to control the screen registration and the depth of printing color in the fabric.

b. Drying

It is removal moisture from printed fabrics.

c. **Fixation or curing by steaming**

After printed fabric is dried, it under goes chemical reaction with the printing chemicals/ specifically colorants

d. **Drying and Fixation**

Immediately after printing, the fabric is dried by evaporating water from the printing paste and it leads to an increase in dye concentration. And then the prints are fixed mainly with steam or hot air by undergoing chemical reaction with the substrates. Fixation can also be achieved by storage at 20 °C for a few days).

e. After-Treatment

This final operation consists in washing and drying the fabric (it is not necessary for printing with pigments and transfer printing).

4.3 Identifying and correcting minor faults

1. Fault

Fault means a defect or imperfection. Major problems/faults/defects of screen printing are pointed out below:

- migration of past out of the design area
- blocking of the design
- marking
- contamination
- creasing
- Choking of screens
- Miss fitting of the design
- Stains
- Conveyor stain
- Blanket stain
- Misprint or no print on selvedge
- Design not washed out properly
- Slippage on the cloth
- Pinholes
- Pilling of the lacquer
- Placement
- Consistencyof placement
- Color correctness
- Color consistency
- Color smear
- Dye migration
- Scorching
- Improper curing
- Fibrillation or frosting
- Fibrillation or frosting
- Distortion
- Opacity
- Poor wash fastness
- Registration
- Hand
- Color out
- Scrimps

13. Causes and Remedies of Screen Printing Defects

1. Choking of screens

High viscosity of printing paste, improper profile of squeeze blades, improper cleaning of screens, deposition of thickening agent under or over the screens and frequent stoppages of printing are the normal reasons for choking of screens.

2. Miss fitting of the design

Improper tension of screens, worn out thermoplastic coating, deviations in blanket guide controlling system, loose end rings, and pressure roll not working, insufficient quantity of color in the screen, defective working of printing head, magnetic clamps and inadequate temperature are the normal reasons for misfit of the design.

3. Stains

Stains on the garment can be caused by a variety of factors. The printer could get a little over zealous about his inking or the folders could have a Java disaster or the mill could leak a bit of machine oil during the sewing process. Stains are clear defects and the printer should be informed about even subtle dis colouration on the garment. The solutions include good work practices, wiping the machine and floor thoroughly after oiling, ensuring that workers keep their hands clean, using of dry lubricants wherever feasible, keeping the work area always clean and covering the materials with clean covers

4. Conveyor stain

Improper drying, improper cleaning of conveyor, improper speed synchronization between the machines and the dryer, unclean nozzles and strainers are the normal reasons for this defect.

5. Blanket stain

Failure of water supply or the washer pump, uneven thermoplastic coating or lines on thermoplastic are the normal reasons for this defect.

6. Misprint or no print on selvedge

Improper setting, defective guiders, and uneven width of the fabric at stitches are the reasons for misprint on selvedge.

7. Design not washed out properly

Positive permeable to light rays, too warm a drying before exposure, insufficient contact pressure, too long a delay before exposure, copying emulsion too cold and exposure time too long are the reasons for design not getting washed out properly.

8. **Slippage on the cloth**

Frames not properly roughened, adhesive not evenly applied causing bubbles on the surface and cloth strip not applied properly to avoid water or color penetration.

9. **Pinholes**

They are tiny breaks in the emulsion that coats the screen and appear as small dots of ink where there ought not to be any. They can be removed, (except in garment dyed shirts), with a spotting gun. Unfiltered photo emulsion in use, dust in the working area, insufficient light source and low concentration of hardener are the normal reasons for pinholes. Verify the screen thoroughly before taking it for printing.

10. **Pilling of the lacquer**

Too thick an emulsion coating, improper degreasing and wrong proportion of hardener are the normal reasons for this defect.

11. Placement

There are general rules for placement of an image on a garment, but since all garments are of varying dimension and proportion, exact placement can be a judgment call. It also depends on the size and shape of the image itself. The rules of thumb are; full front- 3-4 inches down from the collar, full Back- 4-6 inches down from the collar and left chest-bottom aligned with bottom seam of sleeve. All of these are general rules, however, in the end the decision on the part of the printer considering aesthetic look is important. If there is an intended placement that deviates significantly from the above guidelines then one should make it clear to the customer before printing. A normal practice is taking a photocopy of the image at full size and sticking it onto the shirt to see how it looks. If you determine that it needs to have an unusual placement then send your ‘mock-up’ to the printer.

12. Consistency of placement

Minor deviations are found in the placement from shirt to shirt. The printer generally loads the shirt onto the platen the same way every time but shirts can be quite irregular dimensionally. Hence often the printer must make a judgment. If you have exceedingly specific criteria for placement consistency you should make this clear from the outset.

13. Color correctness

Because the gamut for process printing on garments is much smaller than most other printing methods colors do not match exactly. A carefully engineered separation and a skilled inker should be able to deliver a pleasing print that captures the essence of the range of tones and the levels of contrast in the original. Often touch plates are used to achieve colors that are out of range. Process printing on dyed shirts yields a much narrower range than on white shirts. For spot printing the range of colors is similar to offset. Specifying colors from any of the standard matching systems, including pantone, focoltone and true match shall help the printer. It also helps if their ink department and print areas have a good graphic standard 5000k light source to match colors.

14. Color consistency

Maintaining color consistency in halftone printing is a challenge. Hues in process are determined by the proportional densities of the 4 process colors. These proportions can be disrupted by many factors that determine the amount of ink flowing through a particular screen. The most common cause is uneven level of platens which changes the critical off contact distance, often causing a visible shift in the hues. Process colors are difficult to match from run to run if all of the critical variables are not recorded and controlled. The tools necessary to control this myriad of interrelated parameters are not standard equipment in the vast majority of screen print shops. The absence of tools such as delta scopes, colorimeters, off contact gauges, and print pressure meters will indicate to the prospective shirt buyer that the shop may not be capable of the consistency. The solution include color matching from run to run by employing a structured color matching system, presence of a quality digital scale and a catalogue of achievable ink colors.

15. Color smear

In printing the color gets smeared by distorted patterns. Proper color paste, applying required pressure while printing and avoiding lateral movement of screens while placing on fabric for printing or removing after printing can prevent this problem.

16. Dye migration

This is an effect generally seen on shirts containing polyester. Since the dyes used for garments don’t readily bind themselves to polyester fibers the color can affect the printed area. This effect can be seen immediately after curing or can appear weeks after. Red shirts with white ink are the most notorious for this effect but many other combinations can also give trouble. Selection of

dyes compatible with polyester and strictly adhering to process parameters and timings is very important.

17. Scorching

Scorching is caused by improper heating of the shirt between colors on press in the flashing stage or in the main dryer during curing. Scorching can evidence itself in a range of hues, from almost undetectable yellow to a Cajun blackened. Plastisol inks are the most durable but require heat to cure. Large areas of yellow or brown as well as brittle fibers are indications of a scorched shirt. A delicate balance of temperature and time to properly gel or cure the inks is to be made and if diligent measurements are not taken shirts can be easily torched. Occasionally, this phenomenon can be caused by sizing left in the shirts from the mill. Under normal curing conditions this sizing can create a light, yellowish cast.

18. Improper curing

Improper curing can be seen as inks loose much of their vibrancy or opacity after washing. This should not be confused with fibrillation. One of the most carefully monitored factors in screen printing with plastrons is the curing process. The ink must reach a certain temperature to completely cure.

19. Fibrillation or frosting

This effect occurs on light shirts and is often confused with improper curing. The effect is visible on prints employing transparent inks using the whiteness of the shirt to achieve certain bright hues. When these inks are washed the lack of a heavy plastic coating allows some of the unprinted fibers to break through the ink layer and dull out or “frost” the image. This has recently become more of an issue as market is demanding heavier weight shirts that feel smoother. The fibers in these super heavyweight garments are the most susceptible to this effect. Process printing is vulnerable to frosting as all of the inks used, except black, are transparent. Adhering strictly to the process as designed while developing the sample, and training the people adequately is very important to avoid this problem.

20. Distortion

The flexible nature of fabric can yield a distorted image if not loaded correctly. The adhesive that is used to hold the panel on the platen can catch part of the garment when it is being loaded and pull it out of shape. There are loading techniques that can alleviate this effect but certain shaped prints, such as hard geometric boxes, will show distortion much more than others. Training the operators adequately is the solution for this problem.

21. Opacity

There is no specific benchmark for opacity. In halftone printing it is especially problematic to balance dot gain and opacity considerations. On light shirts one should not be able to see the weave pattern of the shirt thorough the ink, even under minor stretching. On dark shirts the problem is compounded by the need to cover the shirt color with a thick enough layer of opaque lighter colors without making the shirt stiff. In most cases the level of acceptability is a judgment and one should know poor coverage when seen. The solutions include training the operators adequately and educating the customers on basic concepts can reduce the grumbling.

22. **Poor wash fastness**

Improper curing of ink leads to poor wash fastness. Adhering strictly to the process as designed while developing the sample, and training the people adequately is essential to overcome this problem.

23. Registration

The registration tolerances of the various presses used by screen printers range wildly, any gap between colors that are visible from more than a foot or two away are generally not accepted. A well trained operator with decent well-tuned equipment should be able to make product with very little or no visible error. The best way to achieve a pleasing graphic image is to butt register the separations, which requires nearly-perfect registration to print successfully.

24. Hand

This term describes the amount of ink on a shirt. In certain printing styles, such as athletic, a heavy deposit is acceptable and even, to a degree, expected. In most other styles of printing any large ink area that stiffens the fabric is objectionable. In extreme cases the weight of the ink can be felt and the print will not breathe, causing a nasty adhesive effect on the wearer's chest on summer days. Developing a library of techniques to achieve decent coverage is suggested.

25. Color out

While printing, if the color paste runs low in the reservoir resulting in blank skips in the print pattern it is called as color out. Continuous monitoring of the level of the color pastes can overcome this problem.

26. Scrimps

Scrimp is a printing defect characterized by lengthwise strips of fabric that are unprinted. This can happen because of the folding of fabrics length wise and not getting spread properly on the printing table.

4.4 Reporting Machine Faults or Incorrect Printing

Fault Reporting is a maintenance concept that increases operational availability and that reduces operating cost through three mechanisms**.**

- Reduce labor-intensive diagnostic evaluation
- Eliminate diagnostic testing down-time
- Provide notification to management for degraded operation

Maintenance requires three actions.

- Fault discovery
- Fault isolation
- Fault recovery

Fault discovery requires diagnostic maintenance, which requires system down time and labor costs. Down time and cost requirements associated with diagnostics are eliminated for every item that satisfies the following criteria.

- Automated diagnostic
- Instrumented for remote viewing
- Displayed in the viscidity of supervisory personnel

A. Implementation

Fault reporting is an optional feature that can be forwarded to remote displays using simple configuration setting in all modern computing equipment. The system level of reporting that is appropriate for Condition Based Maintenance are critical, alert, and emergency, which indicate software termination due to failure. Specific failure reporting, like interface failure, can be integrated into applications linked with these reporting systems.

Other kinds of fault reporting involves painting green, yellow, and red zones onto temperature gages, pressure gages, flow gages, vibration sensors, strain gages, and similar sensors. Remote viewing can be implemented using a video camera.

B. Benefit

The historical approach for Fault discovery is periodic diagnostic testing, which eliminates the following operational availability penalty.

- Fault reporting eliminates maintenance costs associated manual diagnostic testing.
- Labor is eliminated in redundant designs by using the fault discovery and fault isolation functions to automatically reconfigure equipment for degraded operation.
- Maintenance savings can be re-allocated to upgrades and improvements that increase organizational competitiveness.

C. Detriments

Faults that do not trigger a sustained requirement for fault isolation and fault recovery actions should not be displayed for management action.

As an example, lighting up a fault indicator in situations where human intervention is not required will induce breakage by causing maintenance personnel to perform work when nothing is already broken.

As another example, enabling fault reporting for Internet network packet delivery failure will increase network loading when the network is already busy, and that will cause total network out age

Self-check 4

Part 1.choice

1. Which one of the following are the defects of printing?

A/ no contamination B/ color in

C/ migration of paste of the design area

D/fitting of the design

2. What does the operator do during printing?

A/the operator did not control the screen registration

B/ the operator did control the depth of printing in the fabric

C/ the operator did control the removal of moisture from printed fabric

D/ all

Part 2 marching

Column A	column B
1. Fixation	A/ removal of moisture from printed fabric
2. Blanket	B/ even thermoplastic coting
3. Drying	C/ a chemical reaction of printed fabric with colorants
	D/ un even thermoplastic coting

Part 3: short answer

1. How printing paste will feed to the printing machine?
2. Writ the way of connecting paste with the printing the machine**?**
3. How printing paste will feed to the printing machine?
4. Writ the way of connecting paste with the printing the machine**?**
5. List printing machines?
6. Write down types of screen printing machines?
7. Select three printing machines and write the difference among them?

Operation sheets 4

OPERATION TITLE: silk screen printing operation

PURPOSE: To creates different design on a given fabric.

Instructions: The paste liquor ratio must optimum and Treated fabric is necessary.

Equipment, tools and materials: OHS practice, printing paste, treated fabric,

PROCEDURE: Procedure of printing process

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

PRECAUTIONS: avoid high viscosity of paste and high temprature

QUALITY CRITERIA: perform proper design outcome on the give n fabric

Lab test 4

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 silk screen printing

unit five: remove and dispatch product

this unit is developed to provide you the necessary information regarding the following content coverage and topics:

- product quality standards
- remove & dispatch product
- maintain safe and productive manner
- documentation

This unit will also assist you to attain the learning outcomes stated in the cover page. specifically, upon completion of this learning guide, you will be able to:

- check product quality standards
- unload and dispatch product
- maintained in a safe and productive manner
- complete documentation

5.1 product quality standards

A. Apply Quality Standards

What is a quality standard? Quality standard is a set of specific, concise statements and associated measures. It will be reflected in the new commissioning outcomes framework and will inform payment mechanisms and incentive schemes. Such as:

- The quality and outcome framework &
- Commissioning for quality and
- Innovation payment framework.

Quality standard is the core, they inform the other key aspect of the framework, Stakeholders are encouraged to work towards continuous improvement through engagement in process of planning and evaluation centers should be in place in centers while allowing to local flexibility in the way stakeholders choose to achieve standards.

B. Understanding Quality:

We all have needs, wants; requirements, and expectations, needs are essential for life to maintain certain standards or essential for products and service, to fulfill the purpose for which they have been acquired. These needs determine quality of products or services we acquire and are fulfilled by the individual purchasing, renting or leasing. Most of our lines are department in many ways on individual products such as our shelter, nutrition, work, communication, health care, recreation. One basic aspect of products of this type is that they must be fit for use /purpose. Failure in this respect can lead to death, injury, discomfort or economical loss. As user of these industrial products, we all value their price, quality and delivery. We require products of a given quality to be delivered by or be available by a given time and to be of a price that reflects value for money. The work quality has been defined as:

- Fitness for purpose
- Conformance with requirements
- The degree to which a set of inherent characteristics fulfill requirements.

C. Benefits of implementing quality management system:

1. Internal benefits

- Improved management
- Improved awareness of company objectives

- Improved communications
- Responsibilities and authorities are adequately defined.
- Improved traceability to root causes of quality problems.
- Improved utilization of resources.
- Fewer reject therefore, less repeated work & warranty costs.
- Errors rectification at the earliest stage & not repeated.
- Continuous improvement, increase productivity.
- Increase profits and company growth.

2. External Benefits

- Easy access to international market through demonstration of competence and improving competiveness.
- Improved customer satisfaction
- Consistency in quality of products and service.
- Customer confidence (reduce the amount of inspection).
- Improved company image

5.2 Remove and dispatch products

Product dispatching is activity that is performed after the product is doffed and checked to confirm the required standard. So product dispatching is simply distributing the prepared product to the next line process or customers for use.

Dispatching is the routine of setting productive activities in motion through the release of orders and necessary instructions according to pre-planned times and sequence of operations embodied in route sheets and loading schedules. In other words, once a job is in an area where an operation is to be performed, it has to be determined when and by whom the job will be processed and also the sequence of waiting orders to be processed. The decision of assigning the various jobs to different machines and equipment is called Dispatching. Unloading means removed the printed product which may be fabric or garment from the printing machine by using load shifting equipment or manually after the process has been done. While unloading we assure that the using of OHS and following of machine manufacturer‘s procedure

1. **Functions of Dispatching**

- To check the availability of input materials and ensure the movement of material from store to first process and then from process to process.

- To ensure the availability of all production and inspection aids.
- To obtain the requisite drawings, specifications and material lists.
- To assign the work appropriate machine, workplace and men.
- The issue of job orders authorizing operations in accordance with dates and times previously planned and entered on load charts and route sheets.
- The issue of time tickets, instruction cards and other required items to the workers who are to perform the various activities.
- The issue of inspection orders after each operation in order to determine result regarding the quality of products if excessive spoilage occurs, to find out its causes.
- Clean up on jobs, collection of time tickets, blueprints and instruction cards and their return to appropriate section of production control depth.
- To ensure that the work is forwarded to next depth. Or storeroom etc.
- To record the beginning and completion times of jobs on time tickets for calculation of time interval. To forward time ticket to accounts deptt for preparing wages.
- To record and report idle time of men and machines and request for corrective action required.
- The companies provide suitable transportation vehicles like trucks to ensure the safety and timely delivery of the goods. They are the experts as they know how to place the goods in the transportation vehicle so that goods don't get damaged while the vehicle is moving.
- The service should be highly systematic, organized and reliable without causing any anxiety to the customers.
- The functional separation concept should continue during transportation of clean textiles to the customer.
- Transport clean and soiled output in containers that functionally separate them from other output in the vehicle.
- Consider cleaning and packaging. Reusable bags, containers, or carts used to transport the product must be properly cleaned before they are used to transport clean or soiled linen in order to maintain functional separation.
- Hand sanitizer dispenser should be available for use in all delivery trucks.
- Spill Kits should also be available for use when necessary.

5.3 complete documentation

1. Production records

Record means that compile a data or datum of something; either production, quality, raw material, absenteeism, faults or other. And it can be recorded indifferent ways. Let see the following hourly production record interims of table.

- record the quality of product
- record the amount products
- record specification of product against to standards
- record the limitation of products
- record the strength and weakness of products
- confirm the products against to all quality parameters

2. **Record information**

All forms (example: narrative, graphic, data, computer memory) of information registered in either temporary or permanent forms so that it can be reproduced or preserved. It is a record of all criminal court appearances for a particular individuals and serious violations.

3. **Record Service Process and Outcomes**

Make sure that customers are constantly happy on successfully establishing and maintaining and effective team, achieving customers' retention & assessing service levels for continual improvement. Translate organizational service values and systems in to appropriate service delivery actions. Communicate effectively with colleagues to identify service team purpose, goals, plans, objectives, and each member's role and responsibility. Quality of service refers to resource reservation control mechanisms rather than the achieved service quality, quality service is the ability to provide different priority to different applications, users, or data flows, to guarantee a certain level of performance to a data flow.

The user service performance indicators are to demonstrate the performance levels being achieved with software asset management.

5.4 Complete Documentation

Documentation: up loading was created to be an easy to implement solution for multiple file uploaded.

1. Maintaining and recording of work quality

What is the definition of quality record? A document recording specific information that relates to a procedure or work instruction. Quality records are proof that an organization is complying with its procedures and policies, quality i.e. confidentiality, integrity and availability information systems are decomposed in three main portions:

- Hardware and software, communications with the purpose to identify and apply information security industry standards.
- Confidentiality is necessary (but not significant) for maintaining the privacy of the evaluate policies, standards, training, physical, security, quality physical control monitor and control the environment of the workplace.
- Recommendations are formulated to bring order and maintain a certain level of quality standard for recording work.
- Maintaining a quality of work life at a home can be just as challenging as working outside of your residence.

Self-check 5

Part 1 choice

4. Which one of the following is different from the others

A/ record the quality of product

B/ Improved awareness of company objectives

C/record the amount products

D/ record specification of product against to standards

5. What are the best quality standards?

A/ set of specifications

B/concise statements

C/ associated measurements

D/ all quality standards

Part 2 short answer

1. Explain, what dispatching means?

2. How does dispatching will be carried out?

3. What is production record means?