BASIC TEXTILE OPERATION

NTQF Level - I

Learning Guide # 68

Unit of Competence: carry out dyeing of textile material

Module Title: Carrying-out Dyeing of Textile Materials

LG Code: IND BTO1 M18 LO2-LG-68

TTLM Code: IND BTO1 TTLM 0919v1

LO 2: Operate and Monitor Dyeing Machine

Instruction Sheet	Learning Guide #68

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

- Understanding dyeing machineries
- Starting and stopping dyeing machine
- Monitoring dyeing operations or process
- Sorting waste
- Cleaning dyeing tank or machine
- Identifying, correcting and reporting minor faults
- Reporting major machine faults or incorrect dyeing

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

- Start and stop dyeing machines according to manufacturer requirement
- Monitor dyeing operation
- Sort waste and clean the machine
- Identify and correct minor faults
- Report major faults

Learning Instructions:

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

Information Sheet-1	Understanding Dyeing Machineries

1.1. Textile Dyeing Machineries

Textile Dyeing Machineries can be classified as follows:

1.1.1. According to textile materials:

Fiber dyeing(simplex dyeing machine , dress dyeing machine), yarn dyeing(hank dyeing machine, cop dyeing machine, cheese dyeing machine, warp dyeing machine) , and fabric dyeing(jet dyeing machine, jigger dyeing machine, pad dyeing machine, beam dyeing machine, winch dyeing machine, solvent dyeing machine).

1.1.2. According to dyeing process

Open dyeing and enclosed dyeing machines

1.1.3. According to material and liquor movement

Material move but liquor stationary (jigger dyeing machine, winch dyeing machine), material stationary but liquor movable (all package dyeing machines: cop dyeing machine, cheese dyeing machine, warp dyeing Mache), and both material and liquor moveable (jet dyeing machine).

1.2. Applying dyestuffs and machinery used

1.2.1. Package dyeing

Dyeing may take place at the yarn stage. Yarn dyeing is generally carried out on package dyeing machinery where the yarn is destined for sewing threads or knitting and weaving into striped or patterned fabrics. Yarn may also be dyed in the hank form. This form is most commonly used in the wool industry, particularly where the yarn is destined for carpet manufacturing. Package dyeing is a method of dyeing textiles in yarn form. The yarn is first wound onto perforated plastic tubes or spiral springs. In this form the yarn is known as a package. The undyed yarn packages are loaded onto a carrier ready for dyeing in a package-dyeing machine. When the carrier is full, the packages are compressed and secured. The carrier holding the yarn is lowered into the dye vessel via an overhead crane. The vessel is closed so that it can be pressurized. Premixed dye is added to a tank at the side of the machine. During the dyeing cycle, the dye liquor will circulate constantly through the vessel and tank until all the dye is used or exhausted. The perforations in the tube allow the dye to flow through the yarn package. One exhaustion is achieved, the carrier of colored

yarn is removed from the vessel. Excess water is removed for the packages in a large centrifuge. The yarn is then dried in an infrared drying oven.

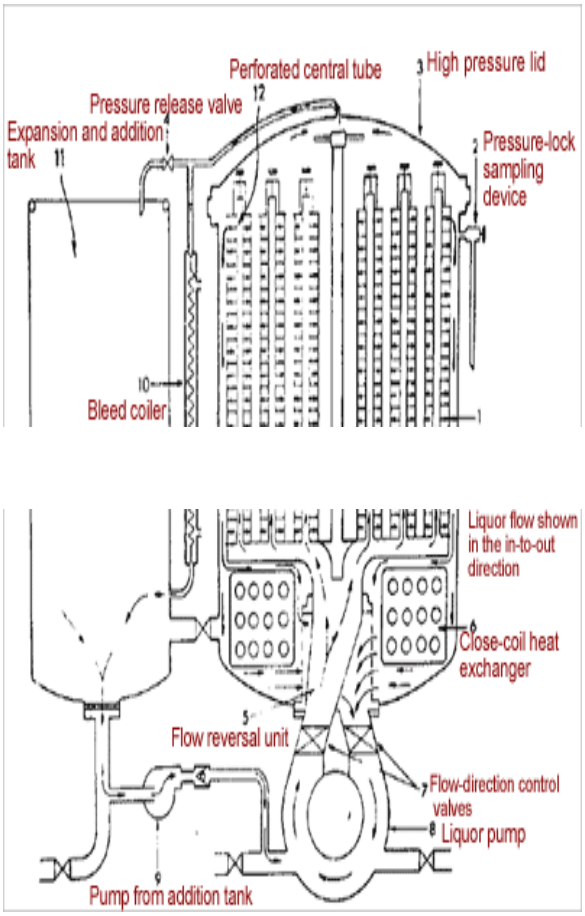


Fig: 1.1. Package dyeing machine

1.2.2. Winch dyeing

Winch dyeing machines are low cost design that is a simple to operate and maintain, yet versatile in application providing invaluable for preparation, washing or after treatments as well as the dyeing stage itself. In all winch dyeing machines a series of fabric ropes of equal length are immersed in the dye bath but part of each rope is taken over two reels or the winch itself. The rope of fabric is circulated through the dye bath being hauled up and over the winch throughout the course of the dyeing operation. Dyestuffs and auxiliaries may be dosed manually or automatically in accordance with the recipe method.

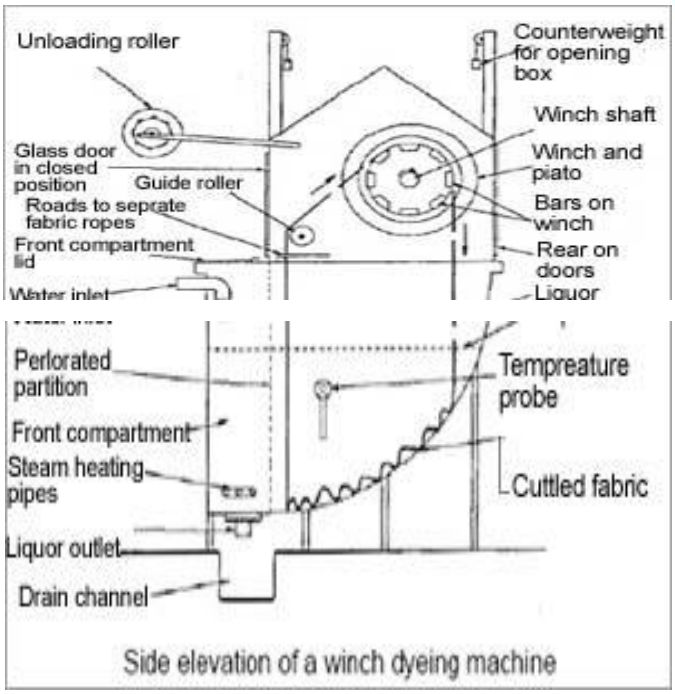


Fig: 1.2. Winch dyeing machine

1.2.3. Jet Dyeing

The jet-dyeing machine moves the fabric together with the dye liquor. This reduces the strain on the fabric. As it is fully enclosed, the jet dyer can be pressurized and heated up to 130^{o} C for dyeing polyester textiles and polyester blends with disperse dyes. The jet dyer uses less water- has a lower liquor ration than the winch and is therefore more economical of energy, water and chemicals. The more gentle treatments of fabrics are also on advantages for fine or delicate fabric constructions.

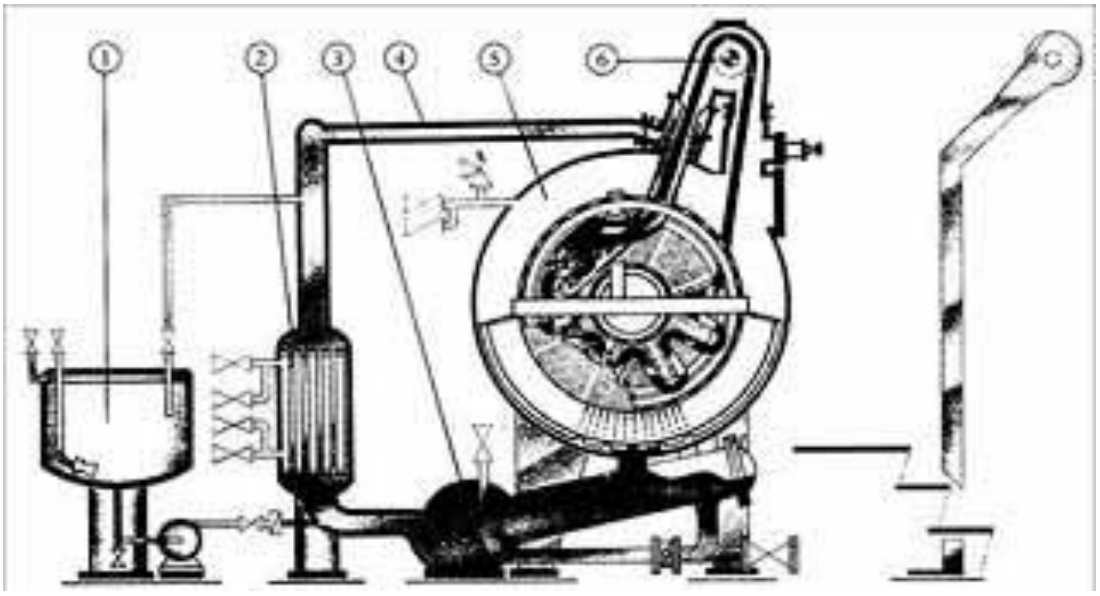


Fig: 1.3. Jet dyeing machine

1.2.4. Jig Dyeing

Jig dyeing is an effective technique for dyeing woven fabrics in open width to avoid creasing problems. A bath of fabric of one roller is gradually unwound and passes through a dye bath of relatively low volume. As it moves through the dye bath it is wound onto a second roller. When the second roller is full, the direction of fabric movements is reversed. In jig dyeing the duration of the process is normally counted in terms of the number of “ends” or passages of the fabric through the dye bath from roller to roller rather than in minutes. Atmospheric jigs operate at temperatures and pressures at atmospheric conditions. These machines are well suited to natural fiber goods. The high atmospheric jigs works in much the same way as the atmospheric jig but is a pressurized vessel designed to operate at 130 ^{o} C used for dyeing synthetic fiber woven goods with disperse dyes

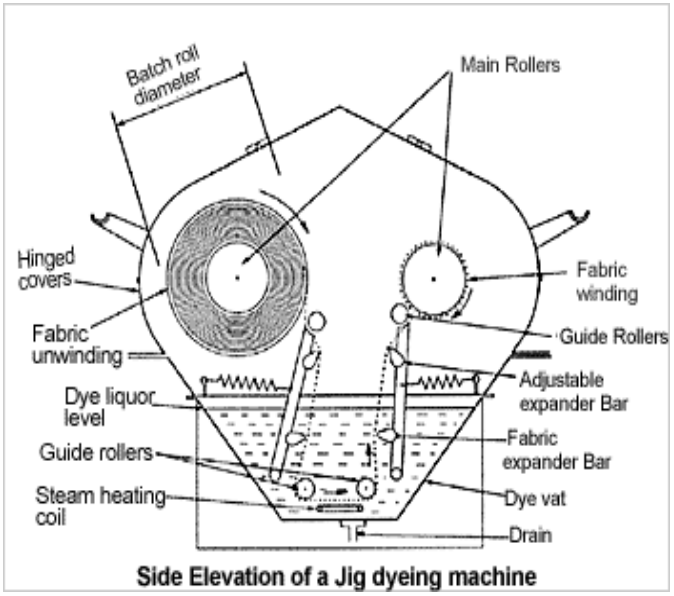
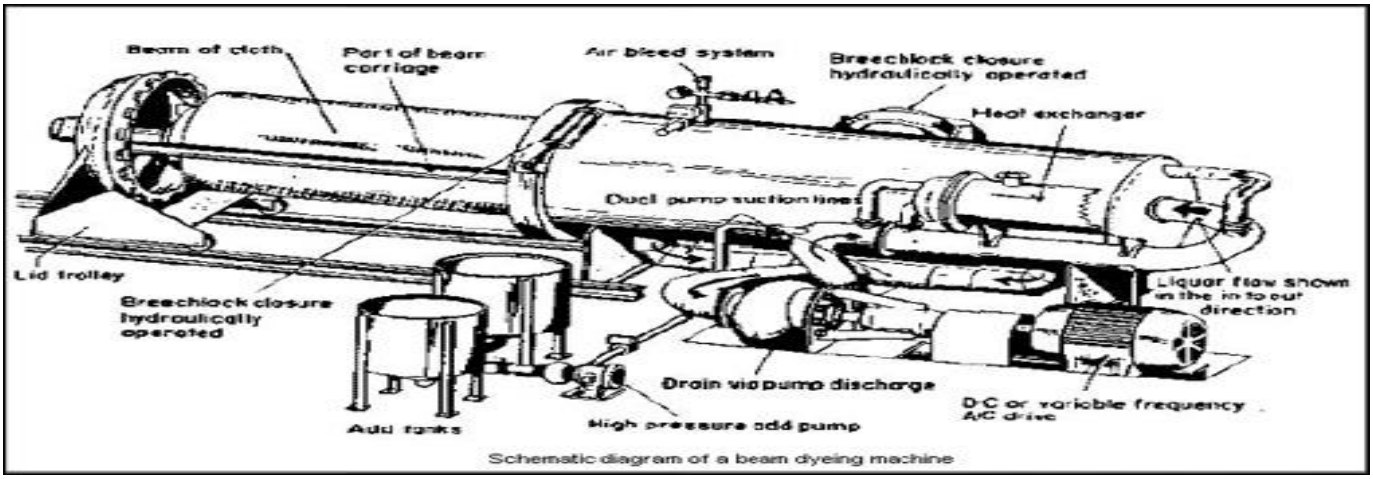


Fig: 1.4. Jet dyeing machine

1.2.5. Beam Dyeing

In beam dyeing, fabric is open width is rolled onto a penetrated beam. The beam is slid into a vessel that can be closed and pressurized. The dye liquor is circulated through the preformation in the beam and color thus impregnates the fabric.



Schematic diagram of a beam dyeing machine

Fig: 1.5. Beam dyeing machine

1.2.6. Padding

In cold bath padding fabric is passed through a dye bath in open width or tubular form and then through padding mangle which squeeze out the excess dye. It is important that the fabric picks up a constant amount of dye liquor otherwise the depth of shade will vary from one part of the fabric to the other. After padding the fabric in open width form is taken up on an A-frame, wrapped in plastic and left to rotate whilst migration and diffusion take place. Fabric in tubular form is lapped onto a stillage. The stillage is wrapped in plastic and left for up to 24 hours for diffusion and fixation to take place. One the dye is fixed, the fabric is washed to remove any unreacted dye molecules that may cause poor fastness is use. The cold pad batch padding system is most suited to the dyeing of cotton goods with reactive

dyes.Pad thermofixation is another method of padding. After padding, the dye is fixed by passing through a steamer or stenter to provide heat and energy for the dyeing process to take place. There may be an intermediate drying stage between padding and fixation.

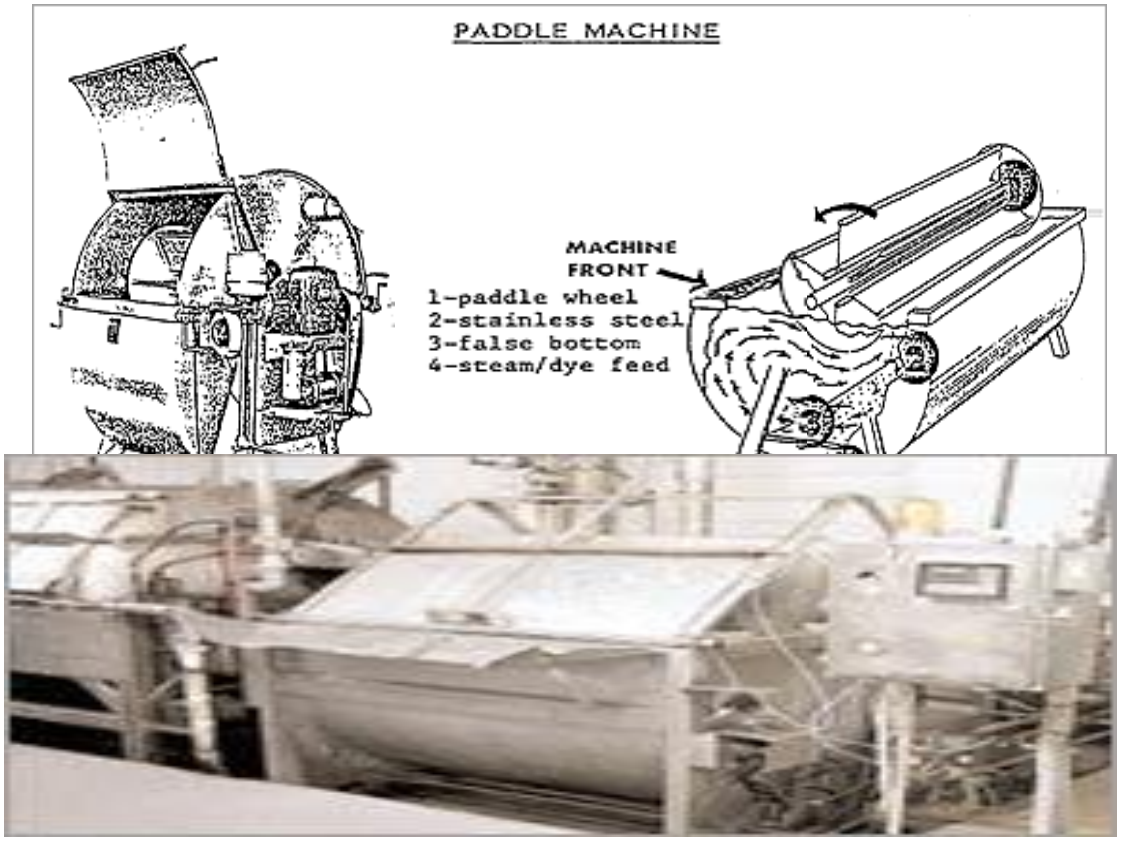


Fig: 1.6. Pad dyeing machine

Self-Check -1	Written Test

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

1. Write types of dyeing machine according to textile material?***(2marks)***
2. Classify dyeing machine according to dyeing process?(***2marks)***
3. List dyeing machine according to material and liqueur movement? ***(2marks)***

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____
2. _____
3. _____

Information Sheet-2	Starting and Stopping Dyeing Machine

Switching on the main power panel

Opening Steam, water and air valve

Selection of dye powder

weighing the dye powder

Mixing of dyes in chemical tank

Setting sequence of operation

Transportation of chemical

Preparation tank

Loading of fabric in winch

Dyeing in progress

After dying fabric is taken for rope opener and further drying

Fig: 2.1. Operating process flow of winch dyeing machine

- Understand and follow the instruction from lot card and program book.
- Switch on main power and then open compressed air, water valve and steam.
- Check the quality and lot number of the fabric before putting on the machine by checking the label.
- Transport the fabric to be run, to the inlet of winch dyeing machine using hydraulic hand puller or electric truck.
- Clean the entire machine and winch roll, load 10-15 meters of leader fabric.
- Ensure the processes to be done (ie) scouring/bleaching or dyeing or washing.
- Initially fill the water in the trough and clean the bottom of the trough thoroughly.
- Prepare the required chemicals approved by supervisor.
- Start loading the fabric in the winch machine.
- While loading ensure no entanglement of fabric is there.
- Observe for any defect in the fabric while loading.
- Set the important parameter in the machine:
    - ✓ Machine speed – 10-40 m/min
    - ✓ Fixed speed of loading and unloading –as per quality
    - ✓ Max. Temperature – 98 oC
    - ✓ Fabric tension in practice – NIL
- Check for various fabric defects like stains – dust, chemicals, rust, handling stains, crease, water dropping, oil, grease, etc.
- Check the fabric shade if dyeing process is carried out and whiteness index for bleaching process before unloading.

Self-Check -2	Written Test

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

1. Write the operating procedure of dyeing machine?***(2marks)***
2. What are the important parameters of dyeing?***(4marks)***

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____
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Information Sheet-3	Monitoring Dyeing Operations or Process

3.1. Key Point to Control in Textile Dyeing Process

A dyeing or printing process is complicated, since it involves fiber kinds, yarn or fabric structures, dye, chemicals and auxiliaries as well as dyeing technology. Then it needs monitoring on the following:

- **Textile materials**: fiber/yarn/fabric/garment
- **Dyes/ pigment**
- **Chemicals**: common salt, caustic, soda ash
- **Auxiliaries:** leveling agent, wetting agent, sequestering agent etc.
- **Machineries**
- **Utilities**: electricity, water, steam, compressed air, gass
- **Controlling parameter**: temperature, time, concentration of dye and chemicals, PH, MLR, pressure
- **Manpower**

Self-Check –3	Written Test

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

1. What are the key point which needs monitoring in textile dyeing industry?***(5marks)***

Note: **Satisfactory rating - 3 and above points** **Unsatisfactory - below 3 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____
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Information Sheet-4	Sorting waste

Waste sorting is the process by which waste is separated into different elements.[1] Waste sorting can occur manually at the household and collected through curbside collection schemes, or automatically separated in materials recovery facilities or mechanical biological treatment systems. Hand sorting was the first method used in the history of waste sorting. Waste segregation" means dividing waste into dry and wet. Dry waste includes wood and related products, metals and glass. Wet waste typically refers to organic waste usually generated by eating establishments and are heavy in weight due to dampness. Waste can also be segreg-economic concern.

Self-Check –4	Written Test

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

1. What is sorting? And how it can be cried out?(***3marks)***

Note: **Satisfactory rating - 2 points** **Unsatisfactory - below 2 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____
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Information Sheet-5	Cleaning Dyeing Tank or Machine

5.1. Machine and area cleaning

Cleaning means that, the process of removing unnecessary things; dust fluff, dirty etc. Machine and work area can clean after, before or/and while working according to its necessity by using fun, air or sweeper. In roller cleansing, workers usually dip a sponge or cleaning cloth to a container of cleansing solvent that is left open all the time.

In fact, a spring-loaded plunger can be used to facilitate such work without the harmful effect of solvent vapor. Upon pressing the plunger, the required amount of solvent is drawn up, and the surplus liquid drains back to the reservoir. Besides preventing inadvertent spills, the design ensures that the solvent is confined except when the plunger is pressed.

5.2. Cleaning in Winch dyeing machine

- Remove regularly accumulated dust and dirt from the machine.
- Clean the machine while loading and unloading the fabric.
- Transport the dyes and other chemicals safely and avoid spillage of chemicals.
- Collect all the waste and store them at designated place.

Self-Check –5	Written Test

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

1. What is cleaning? ***(2 marks)***
2. When cleaning will be carried out? ***(3 marks)***
3. How cleaning is carried out? ***(2 marks)***

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____
2. _____
3. _____

Information Sheet-6	Identifying, Correcting And Reporting Minor Faults

6.1. Dyeing Faults

Major dyeing faults which occur during dyeing process are mentioned below:

- Uneven Dyeing
- Batch to Batch Shade variation
- Patchy dyeing effect
- Roll to roll variation or Meter to Meter variation
- Crease mark
- Dye spot
- Wrinkle mark
- Softener Mark

6.2. Uneven Dyeing:

Causes:

- Uneven pretreatment (uneven scouring & bleaching).
- Improper color dosing.
- Using dyes of high fixation property.
- Uneven heat-setting in case of **synthetic fibers.**
- Lack of control on **dyeing m/c**

Remedies:

- By ensuring even pretreatment.
- By ensuring even heat-setting in case of synthetic fibers.
- Proper dosing of dyes and chemicals.
- Proper controlling of dyeing m/c

6.3. Batch to Batch Shade Variation:

Causes:

- Fluctuation of Temperature.
- Improper dosing time of dyes & chemicals.
- Batch to batch weight variation of dyes and chemicals.
- Dyes lot variation.
- Improper reel speed, pump speed, liquor ratio.
- Improper pretreatment.

Remedies:

- Use standard dyes and chemicals.
- Maintain the same liquor ratio.
- Follow the standard pretreatment procedure.
- Maintain the same dyeing cycle.
- Identical dyeing procedure should be followed for the same depth of the Shade.
- Make sure that the operators add the right bulk chemicals at the same time and temperature in the process.
- The pH, hardness and sodium carbonate content of supply water should check daily.

6.4. Patchy Dyeing Effect:

Causes:

- Entanglement of fabric.
- Faulty injection of alkali.
- Improper addition of color.
- Due to hardness of water.
- Due to improper salt addition.
- Dye migration during intermediate dyeing.
- Uneven heat in the machine, etc.

Remedies:

- By ensuring proper pretreatment.
- Proper dosing of dyes and chemicals.
- Heat should be same throughout the dye liquor.
- Proper salt addition.

6.5. Roll to Roll Variation or Meter to Meter Variation

Causes:

- Poor migration property of dyes.
- Improper dyes solubility.
- Hardness of water.
- Faulty m/c speed, etc

Remedies:

- Use standard dyes and chemicals.
- Proper m/c speed.
- Use of soft water.

6.6. Crease Mark

Causes:

- Poor opening of the fabric rope
- Shock cooling of synthetic material
- If pump pressure & reel speed is not equal
- Due to high speed m/c running

Remedies:

- Maintaining proper reel sped & pump speed.
- Lower rate rising and cooling the temperature
- Reducing the m/c load
- Higher liquor ratio

6.7. Dye Spot

Causes:

- Improper Dissolving of dye particle in bath.
- Improper Dissolving of caustic soda particle in bath.

Remedies:

- By proper dissolving of dyes & chemicals
- By passing the dissolved dyestuff through a fine stainless steel mesh strainer, so that the large un-dissolved particles are removed.

6.8. Wrinkle Mark

Causes:

- Poor opening of the fabric rope
- Shock cooling of synthetic material
- High temperature entanglement of the fabric

Remedies

- Maintaining proper reel sped & pump speed.
- Lower rate rising and cooling the temperature
- Higher liquor ratio

6.9. Softener Mark

Causes:

- Improper mixing of the Softener.
- Improper running time of the fabric during application of softener.
- Entanglement of the fabric during application of softener

Remedies:

- Maintaining proper reel sped & pump speed.
- Proper Mixing of the softener before addition.
- Prevent the entanglement of the fabric during application of softener

Self-Check –6	Written Test

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

1. List at list five defect of dyed fabric?***(2.5 marks***)
2. What is the cause and remedies of softener mark?***(3 marks)***
3. What is the cause of dye spot?***(2marks)***

Note: **Satisfactory rating – 4 points** **Unsatisfactory - below 4 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____
2. _____
3. _____

Information Sheet-7	Reporting major machine faults or incorrect dyeing

7.1. Fault reporting

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

7.2. 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.

7.3. Benefits of fault discovery

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.

7.4. 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 outage

Self-Check –7	Written Test

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

1. How can maintenance reduce cost?***(3 marks)***
2. What is the benefit of fault discovery? ***(3marks)***
3. What are the actions of maintenance requirement?***(3marks)***

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

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3. Peter J. Hauser, ***Textile Dyeing***