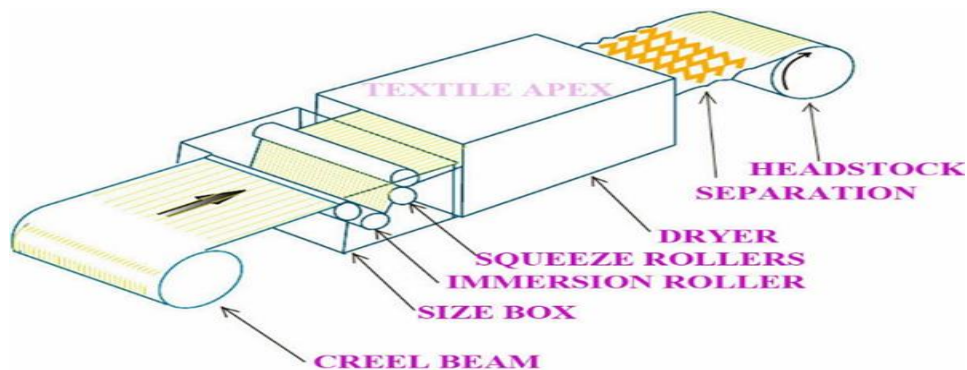


# Weaving and knitting Operation

## Level-II

Based on March 2022, Curriculum Version 1



**Module Title: - Perform Sizing operation**

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## 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).

## Acronym

1. **MRP:-** Material requirement of planning
2. **EPI :-** Ends per inch
3. **DC:-** Direct current
4. **HSWA:-** The Health and Safety at Work Act
5. **OSH:-** Occupational Health and Safety
6. **OSH** Occupational Health and Safety

## Introduction to the Module

The primary purpose of sizing an important step in preparation for weaving known as warp slashing is to attain optimum weaving efficiency. The process requires selection of sizing materials that are appropriate for the specific warp yarns, of formulations, and of processing conditions which are suitable for the equipment used. The evolution of sizing technology in the textile industry has a long history. The adhesion of the size to the yarn substrate is critically important. The tensile strength of a size film depends primarily on the molecular and supra molecular properties of the film-forming polymer. In a size film, lubricity is essential in order to minimize the effects of friction and wear between surfaces. Sizing is carried out before the weaving process to increase the strength and smoothness of the yarn, to reduce yarn breakages. Sizing is the process of applying protective adhesive coating on the yarn surface. This is the most important segment of weaving preparatory process. In the old age, sizing is the heart of weaving.

This module is designed to meet the industry requirement under the **weaving and knitting occupational** standard, particularly for the unit of competency: **perform sizing operation**

**This module covers the units :**

- Set up Warper beam
- Preparation sizing solution
- sizing process
- compilation of operations and Records and documentation

### Learning Objective of the Module

- Set up and select Warper beam
- Prepare sizing solution
- Perform sizing process
- Complete operations
- Complete records

## Module Instruction

For effective use this 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” given at the end of each unit and
5. Read the identified reference book for Examples and exercise



## Unit one: Set up Weavers Beam

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

- Maintaining clean and safe work area
- Sizing production plan
- Selection of warp beam and tools and equipment
- Creeling warping beam

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:

- Maintain clean and safe work area
- Prepare, check and select Correct sizing production plan
- select Correct Warper beam based weaving production plan
- load Warper beams onto sizing creel

## 1.1 Maintaining clean and safe work area

### Maintaining clean:

For operators of warehouses and factories of all shapes and sizes, maintaining clean and organized premises is one of the biggest struggles of the job. To help you out, we've put together this guide containing everything you need to know to keep the machines in your production line clean and in perfect working order

So, read on to find out exactly why you should make the cleanliness and tidiness of your factory or warehouse a priority and how to maintain an organized work environment with the minimum of hassle.

### The benefits of a clean and organized warehouse or sizing factory

While making sure your sizing factory or warehouse is always clean and tidy requires a bit of effort and forward planning, it can pay itself back several times over.

#### a. Increased productivity

Firstly, maintaining an organized working environment will make it easy for your staff to find the equipment and supplies they need, directly increasing productivity. It will also indirectly boost staff productivity if your employees know you dedicate company time and resources to making sure their working environment clean, safe, and efficient, they are more likely to take pride in their work.

#### b. Comply with Health and Safety regulations

As a warehouse or factory owner, it's particularly important that you maintain a clean and tidy working environment in order to comply with health and safety legislature. **The Health and Safety at Work Act (HSWA) 1974** requires all employers to ensure the health and safety of anyone affected by their work or in employment this includes controlling slip and trip risks as far as reasonably possible. Furthermore, under **the Management of Health and Safety at Work Regulations 1999**, employers must assess workplace risks including slip and trip risks and take action to address them wherever necessary. Lastly, the **Workplace (Health, Safety and Welfare) Regulations 1992** require the floors of your workplace to be suitable for the type of work that will be performed on it, in good condition, and free of obstructions.

Failing to comply with this health and safety legislation can not only put your employees in danger, but also lead to your business failing a check from a health and safety inspector, which could lead to a serious financial loss. Make the guidance in the government's **guide to preventing slips and trips at work** part of your regular warehouse or factory cleaning routine and you'll comply with all current health and safety laws, as well as provide your employees with the most productive working environment possible.

In short, maintaining a clean and organized warehouse or factory will lead to increased productivity and higher staff morale, as well as ensure your business complies with all the current health and safety criteria. On the other hand, dirty and messy premises will not only prevent your staff from working at maximum capacity, but also send out a bad message to your employees and any visitors to your site about the kind of business you run.

### **Making a factory or warehouse cleaning plan**

The type of work you perform on your business premises will affect how often it needs to be cleaned, but you should perform two kinds of cleaning routines: deep and regular cleaning.

#### **1. Deep cleaning**

Over time, the floor of your warehouse or sizing factory area is going to get dirty and your equipment is going to build up with dust and grime, both of which can seriously affect productivity. Your warehouse and sizing factory area needs to be deeply cleaned before it reaches this point. How long this will take depends on what kind of work you perform, and may be different for each section of your premises.

When you perform a deep clean of your warehouse or factory, you should set aside several hours to use heavy-duty cleaning equipment and supplies on every surface and piece of equipment on your premises.

If you'll be enlisting your staff to clean and tidy their own section, you should schedule the deep clean during a slow period if at all possible. If you're hiring outside help to perform the clean for you, you should schedule them to come in on an evening or weekend so you don't lose out on productive work hours.

If you're using your in-house staff to perform the deep clean, each employee should be designated an area of the premises. This area should be their responsibility and theirs only in

order to ensure accountability, and before you begin the clean, each member of staff should agree to the area they've been designated. This will prevent any miscommunication or arguments down the line.

Each employee should then be provided with the equipment and supplies they need to thoroughly clean everything in their designated area. You should also provide them with the training they need to use any specialist cleaning equipment and machine they require.

The first time you perform your factory-wide deep clean, you should ask each member of staff to note down approximately how long it takes to perform each process in the cleaning cycle they've been assigned. This will help you plan the next intensive clean even more accurately. You should also ask for them how they think the process could be sped up, as they may have some useful feedback that could improve the process.

While performing your deep clean, you should take the opportunity to get rid of any clutter that has accumulated since the last one. This can be particularly problematic in storage areas and communal work spaces, which often become cluttered and hard to manage. Organising these areas can help boost productivity for everyone within your business, making it well worth the effort.

### ***Deep warehouse or factory cleaning checklist***

- Schedule a regular date for a deep clean of your warehouse or factory.
- Designate each employee an area they're responsible for giving a thorough clean from top to bottom.
- Provide each employee with the equipment and supplies they need to deeply clean everything within the area they've been designated.
- Give each employee adequate time to clean all of the equipment within the area they've been designated to the required standard.
- Have your employees note down how long each process took them and solicit their feedback on how the process could be sped up.

## 2. Regular cleaning

In between your scheduled deep cleans, you should also instruct your staff to perform a regular maintenance routine to keep on top of things and extend the amount of time needed before your next intensive clean.

How often this routine should be performed and what it should entail depends on several factors, such as:

- What kind of work do you perform in your factory or warehouse? Do you use machines that create a lot of mess, dust, liquid(oil, water, grease) and debris?
- How often do your clients and suppliers visit your site? A messy work environment doesn't reflect well on your business and may have an impact on whether or not they want to continue working with you.
- Do you use equipment that requires a sterile environment to perform at its best? If so, your regular cleaning routine will need to be more intensive in order to maintain these levels of **cleanliness**.

Just like your intensive cleaning routine, your regular maintenance should be planned in whenever needed. As a rule of thumb, each work station should be left ready for the next person to come in and use straight away. Your staff should therefore be allotted 5 minutes at the end of each shift to clean and tidy their work station or the machine they were using so the next employee who needs to use it can come in the next day and start work without any delays.

If you have any equipment that is used infrequently, it should be given a quick clean every few weeks to prevent dust from building up and potentially affecting its performance.

Employees should also be instructed to clean up any spills, debris, or rubbish as they appear to prevent them from causing a health and safety hazard or obstructing a thoroughfare.

### Regular warehouse or factory cleaning checklist

- Provide employees with 5 minutes at the end of each shift to get their workspace clean and tidy so the next person can come in a use it straight away.
- Provide employees with the equipment and supplies they need to clean up any spills and messes as they happen and encourage them to be proactive in tackling mess in the workplace.

## Invest in the right factory or warehouse cleaning equipment

If you're committed to maintaining a clean and tidy factory or warehouse, it's crucial that you provide your employees with all of the equipment they need to perform their cleaning duties thoroughly and efficiently.

Each member of staff should be provided with basic cleaning equipment so they have the equipment they need to perform their regular cleaning routine.

If each of your employees has access to **cloth, dustpan and brush** (Polypropylene light cleaning brush trammel screen brush ) **and paper towels**, they're a lot more likely to clean up any spills or dirt as it appears. This will not only make your factory or warehouse a safer environment for your staff, but also give them more pride in their work environment.



*Figure 1.1: Cleaning equipment*

## How to make maintaining a clean warehouse or factory part of your company culture

The cleanliness and tidiness of your workplace has a big effect on employee morale and productivity, but it's impossible to maintain an organized warehouse or factory if your staff aren't on board. If you're planning on making a wholesale change in how you run your workplace, it's important that your employees are invested in the changes.

Here's how to make maintaining a clean and tidy warehouse or factory part of your company culture:

### Communicate the benefits to your staff

If you want your employees to buy in to your plans to maintain a clean and tidy workplace, it's crucial that you communicate the benefits the new systems you'll be putting in place will bring to them.

### **Lead by example**

Make sure senior management are pulling their weight and doing as much as anyone else, or your staff will follow your instructions grudgingly, if at all.

### **Provide them with sufficient cleaning time**

Above all else, you should make sure to dedicate staff time and resources to cleaning and organizing your warehouse or factory the resources you put into this will be paid back a hundred times over in improved productivity and staff morale. If your staff are expected to clean up their work space in their own time on top of their already full schedule, it's unlikely to get done to a very high standard, if at all.

### **Make sure they have access to the right equipment**

If your employees need specialist cleaning equipment to maintain a particular machine in their cleaning remit, then you need to make sure they always have access to it. Make sure you invest in all the necessary equipment and also make sure it's available to your staff at all times.

### **Give them the training they need**

Every so often, it can be a good idea to retrain your staff to make sure a high standard is maintained during your cleaning protocols. It can also be a good idea to have senior members of staff train new recruits to refresh their memory of best practice.

### **Keep them accountable**

Each member of staff should be given responsibility over their own area of the site, and they should be held accountable if it isn't being maintained to the required standard. This should apply to senior members of staff just as it does to those further down the chain of command.

Follow these steps and maintaining a clean and organized factory or warehouse will be as easy and hassle-free as possible. While setting this system up will require a bit of forward planning and trial and error, it will pay for itself several times over in increased productivity and staff morale.

### **Maintaining safe work area:**

Creating and maintaining a safe work environment should be a high priority for textile sizing. Indeed, under Occupational Health and Safety (OSH) law, employers have a responsibility to

create and maintain a safe workplace and comply with OSHA regulations. But putting up a few safety posters and running safety training sessions once a year is not enough.

Organizations need to actively foster and promote a strong culture of safety. This means not only making safety one of the organization's main values, it means taking concrete steps to make sure employees have a safe work environment and are constantly striving to improve safety in the workplace. In order to improve safety culture in an organization, there must be an ongoing commitment to communication. One popular method of promoting safety awareness is through workplace digital signage, which harnesses visual communication to promote messages.

### Essential Elements For Workplace Safety

- Management Leadership and Employee Involvement.
- Workplace Safety Analysis – Early & Often.
- Workplace Safety Hazard Prevention and Control.
- Safety and Health Training and Education

#### Considered a safe work environment

A safe work environment is about more than just preventing injuries or the spread of disease, it is about making employee well-being a priority. A safe workplace is one where employees feel secure and enjoy a safe space, company values, and a positive co-working environment that encourages respect for everyone.

### Core Elements of Successful Safety Programs

- Safety culture. ...
- Employee training and empowerment. ...
- Hazard identification and control systems. ...
- Focus on compliance. ...
- Continuous improvement. ...
- Leadership and organizational buy-in. ...
- The safety manager role.



## Why should you put the effort into improving workplace safety and health?

Work-related injuries, illnesses and deaths are costly to everyone. A safe and healthy work environment pays, in more ways than one. These are only financial costs. There's no way to know the value of the quality of life lost to injuries and illnesses.

a) For Workers

b) Work injuries and illnesses can affect every aspect of life for workers and their families.

For workers, injuries or illnesses can cause:

- Loss of life,
- Pain and suffering,
- Loss of income and financial well-being,
- Stress on relationships,
- Loss of job or career,
- Health-care costs **beyond** what is covered by insurance.

For a small business, one injury can mean financial disaster. Costs to a business include:

- Production losses
- Wages for work not performed
- Increased workers' compensation insurance costs
- Damage to equipment or machinery
- Hiring and/or training new employees
- Decline in product quality and worker morale
- Decline in worker morale
- High turnover and lost work time

The cost of workplace injuries, illnesses and deaths is much greater than the cost of workers' compensation insurance alone. Insurance is just the tip of the iceberg when it comes to these costs.

**c) Safety Pays for Everyone:**

- d) The cost of injury prevention is far less than the cost of an injury. A safe and healthy workplace attracts and retains quality employees. It's an asset to a community, operates more efficiently and enjoys a healthy bottom line. The business and the workers thrive in a safe, healthy, respectful and caring environment

Safe and healthy workplaces:

- Have more satisfied, productive workers who
  - ✓ Produce higher quality products and services
  - ✓ Return to work more quickly after an injury or illness
  - ✓ Feel loyal to the organization
- Are better places to work
- Retain employees
- Establish positive community relations

Following are six ways to ensure a safe workplace and promote a strong safety culture.

***Eliminate Potential Hazards***

Keep the workplace free from recognized physical and chemical hazards and make sure it is in compliance with **OSHA** standards, rules, and regulations. Use your digital signage systems to remind employees about proper body mechanics, forklift safety, safe backing, what **PPE** is necessary, and ways they can avoid slips, trips, and falls. Encourage workers to identify and report potential problems and safety violations and take immediate steps to have those issues resolved.

**Make Sure all Workers are Properly Trained**

The organization must provide all workers with safety training using language they can understand. This training should be given to all new workers, with refresher courses offered to (or required) for existing workers or when workers change jobs (within the company). Use your electronic message boards to reinforce safety training, serving it up in bite sized messages.

**Ensure Workers Have The Proper Equipment**

Make sure employees have and use safe tools and equipment and properly maintain this equipment. Workplace digital signage is an effective tool for reinforcing injury prevention. Raise awareness around proper handling of hazardous materials, lock-out tag-out, and machine guarding.

### **Provide Visual Safety Aids and Messages**

Use color codes, posters, labels, and/or signs to warn employees of potential hazards. Additionally, place **OSHA** posters in all work and recreational areas – and use digital signage to broadcast important safety information, updates, and messages. For example, employers can display their safety recordable using automated counters. This visual aide displays real-time data and reminds employees to stay safe.

Digital signage can be incredibly helpful in emergency situations as, unlike static posters, you can use it to instantly warn or notify workers of a situation in areas where mobile phones and computers aren't allowed. You can also use digital signage to post daily or weekly workplace “Safety Tips”, recognize employees who have demonstrated outstanding safety awareness and keep employees up to date on new rules and regulations.

### **Create a Safety Committee and Hold Monthly Safety Meetings**

Establish a workplace health and safety committee made up of workers from different departments, from senior management to shop-floor-based employees. The committee should meet at least once a month and keep employees and senior management informed about safety topics, inspections, injury and illness statistics, and other safety-related issues. Use your digital signage systems to share key safety updates with the entire workforce.

Similarly, hold departmental or company-wide safety meetings once a month or quarterly to solicit employee feedback. Getting regular feedback from employees is helpful because it opens managers' eyes to potential hazards that may have gone unnoticed, lets managers know how employees are doing/feeling, and makes employees feel valued, which improves mental health and productivity.

### **Make Safety Fun**

While safety is no game, one way to help incorporate safety into company culture is to make learning about safety fun. Use your workplace digital signage to create safety-themed trivia, quizzes, and videos of safety dos and don'ts. Friendly competition including prizes, and chances

for company-wide recognition are great motivators. By adding a little fun, there's a higher chance that employees will stay engaged, retain the information, and therefore help prevent accidents.

Generally "Safety and health has a tremendous value to it. ...You're not hurting the person on the job. When that person gets hurt, you have to replace him with somebody that might not be as well trained ...your production or your quality might suffer. You're not having the expense of workers comp and medical bills associated with that. It is certainly a better working environment if people aren't afraid of what they are doing.

## 1.2 Sizing production plan

### Material Requirement Planning (MRP):

Material Resource Planning (MRP) has become a centerpiece for all manufacturing system. The key to successful production and operations management in a manufacturing company or enterprises are the balancing of requirements and capacities to meet the needs of your customers. How? By having the product available when it is wanted. In production management, we do this by knowing planning to have the capacity available. Material requirements planning (MRP) a system of planning and scheduling the time phased materials requirement for production operations. Material requirement planning (MRP) is a system of planning and scheduling the time phased material requirements for releasing materials and receiving materials that enable the master production schedule to be implemented.

**Planning for Material Need:** In recent years, material requirements planning systems have replaced reactive inventory systems in many organizations. They also require a realistic master production schedule (MPS) to specify when various quantities of end items will be completed.

**Demand Dependency:** Demand dependency is an important consideration in choosing between reactive and planning systems. Demand dependency is the degree to which the demand for some item is associated with the demand for another items. Given this, with independent demand, demand for one item is unrelated to the demand for others.

**Production Schedule (PS):** The PS is initially developed from enterprise customer orders or from forecasts of demand before the MRP system. Designed to meet market demand, the PS identifies the quantity of each end product (end item) and when it needs to be produced during each future period in the production-planning horizon.

## Objectives of Production Planning:

1. Systematic planning of production activities to achieve the highest efficiency in production of simple textile products like woven, knitted and non-woven products.
2. To organize the production facilities like machines, men, etc., to achieve stated production objectives with respect to quantity and quality time and cost.
3. Optimum scheduling of resources.
4. Coordinate with other departments relating to production to achieve regular balanced and uninterrupted production flow.
5. To conform to delivery commitments.
6. Materials planning and control.
7. To be able to make adjustments due to changes in demand and rush orders.

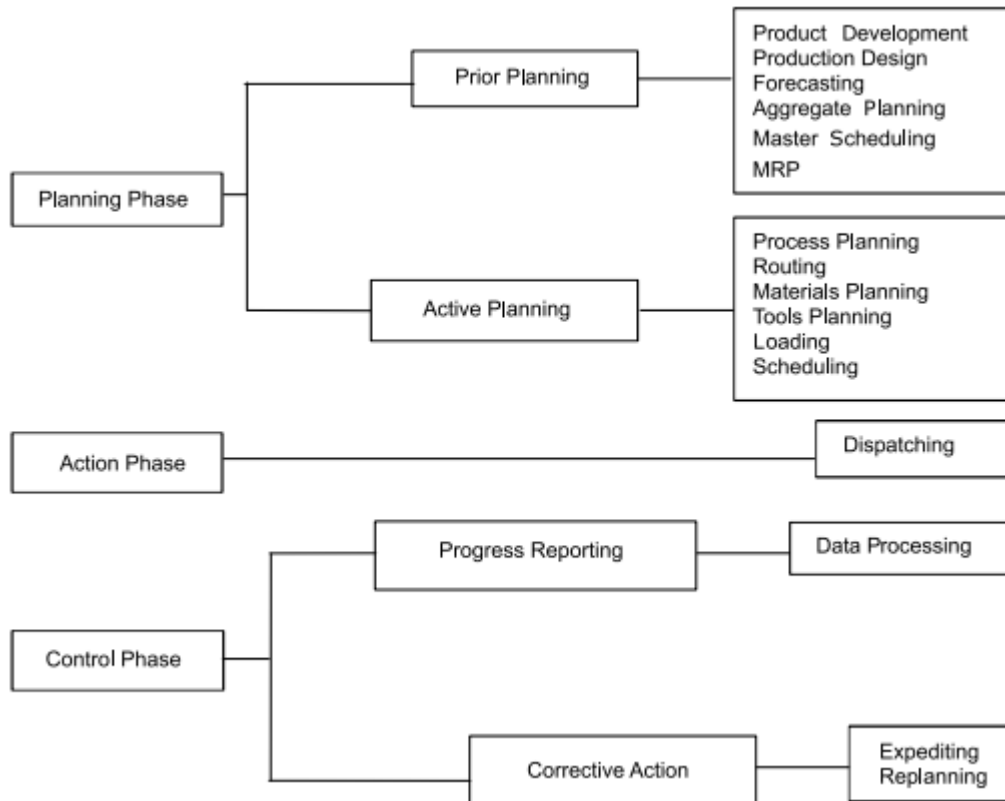
## Phases of Planning:

Production planning has three phases namely:

**A. Planning Phase**

**B. Action Phase and**

**C. Control Phase.** From which, under this level the teaching, training and learning material (TTLM) is mainly focused on planning phase.



**Figure: 1.2.** Phases of Production Planning

Production planning determines the optimal schedule and sequence of operations economic batch quantity, machine assignment and dispatching priorities for sequencing. It has two categories of planning namely.

1. Prior planning
  2. Active planning
1. **Prior Planning:** means pre-production planning. This includes all the planning efforts, which are taking place prior to the active planning.
  2. **Active Planning:** This kind of planning are Process planning and routing which, considers a complete determination of the specific technological process steps and their sequence to produce products at the desired quality, quantity and cost and also it determines the method of manufacturing a product selects the tools and equipment. Rather than this, it considers a materials planning that touches to various cost components like, carrying cost, ordering cost, shortage cost, and so forth including tools planning, loading, scheduling etc. for smooth running of the production process. Under this activity the planning function starts once the task to be accomplished is specified, with the analysis of **four M's**, i.e., Machines, Methods,

Materials and Manpower. This also considered the above process planning (routing) both short-term (near future) and long-term planning. Standardization, simplification of products and processes are addressed under consideration.

## **Scheduling System for Production:**

Planning and scheduling systems concern with the volume and timing of outputs on the manufacturing system in a given enterprise, the utilization of operations capacity at desired levels for competitive effectiveness. These systems must fit together activities at various levels, from top to bottom. Detailed scheduling determines start times, finish times and work assignments for all jobs at each work center. Calendar times are specified when job orders, employees, and materials (inputs), as well as job completion (outputs), should occur at each work center. By estimating how long each job will take to complete and when it is due, schedulers can establish start and finish dates and develop the detailed schedule.

The objective of capacity management (i.e., planning and control of capacity) is to match the level of operations to the level of demand. It is a simple task to plan the capacity in case of stable demand. However, in practice the demand will be seldom stable. The fluctuation of demand creates problems regarding the procurement of resources to meet the customer demand. Capacity decisions are strategic in nature. Capacity is the rate of productive capability of a facility. Capacity is usually expressed as volume of output per period of time.

- Sufficient capacity is required to meet the customers demand in time.
- Capacity affects the cost efficiency of operations.
- Capacity affects the scheduling system.
- Capacity creation requires an investment.
- Capacity planning is the first step when an organization decides to produce more or new products.

## Principles of Scheduling:

- a) **The principle of optimum task size:** Scheduling tends to achieve maximum efficiency when the task sizes are small, and all tasks of same order of magnitude.
- b) **Principle of optimum production plan:** The planning should be such that it imposes an equal load on all plants.
- c) **Principle of optimum sequence:** Scheduling tends to achieve the maximum efficiency when the work is planned so that work hours are normally used in the same sequence.

### 1.3 Selection of warp beam and tools and equipment

The selection, evaluation, and performance of the warp (yarn/size system) for any specific sizing process tools and equipment and the loom must be determined in the context of the developments and changes that have occurred in the spinning/winding/ warping and the slashing processes. The following is a brief discussion of a number of considerations that a textile technologist must be conversant with when making a decision regarding the appropriate yarn/sizing system

### Selection criteria:

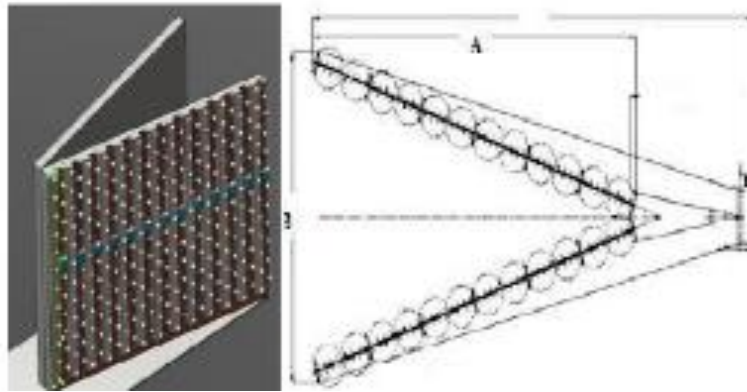
The selection of proper materials for sizing process is based on the objectives of minimum cost, availability of the materials, suitability of the materials for the working conditions in service, and cost of the materials. Based on the above factors, the selected materials for manufacturing of creel frame, sizing box frame, drying section frame and winding section frames are mild steel, which has a rectangular shape and standard mechanical properties of modulus of elasticity of, ultimate tensile strength of endurance limit of and hardness . Additionally, the selection of immersing roller in the size box and winding roller in winding machine is also mild steel which has a round cross sectional shape

#### 1. Design of machine parts

##### a) Analytical design of Creel

These machine parts have included two basic machine elements - the vertical and horizontal creel frame and vertical cone holder frame that arrange in a “V” shape and has an angle between 35° creel height of 240cm which carries 300 ends of cones of 2.5kg each with 25 top-to-bottom and 20 cm side-to-side apart and total creel length of 300 cm each





**Figure 1,3.: v-creel**

The analytical design of the creel is done by using detailed calculations and force analysis of the vertical creel frame and vertical cops holder. All parts are subjected to compression forces and the strength analysis of parts are done by using shear stress and bending stress of the vertical creel frame and vertical cops holder, which determine the bending moment and shear force

**b) Analytical design of size box**

Size box is the zone, which warp yarn is immersed into the boiled size paste and this machine has four main parts, are size box frame, guide roller, immersing rollers and squeeze rollers.

The size box frame is subjected to compression stress due to compression load applied to the frame. Also the size box frame is subjected to compression and bending forces and the movement at each node is calculated and based on its allowable bending stress and its ultimate bending stress, the length and strength of the machine are determined.

**c) Analytical design of drying section**

This section contains two main parts - drying section frame and drying parts. The function of the drying section frame is to carry the drying unit and the force and strength of the drying section frame are also analyzed by bending movement and compression stress.

Also the function of drying yarn is based on the methods of producing a rounder yarn. Non-contact methods were investigated by using a round stove which produces from clay and gypsum layered of radius of heat emitting is 30cm and this will convert direct electrical energy of 220 Volt and a current 4.54A to conduction, convection and radiation heat.

**d) Analytical design of weaver's beam**

The warp beam holds many thousands of individual warp yarns and this yarn winding machine contains two main parts - winding box frame and winding roller. The winding frame is subjected to stress by the winding roller and the number of yarn accumulated on the weaver's beam. The motion driving parts of winding roller is directly attached to the tips of winding roller, which directly drive manually by hand and it is attached and connected by a chain and sprocket mechanism from the guide and squeeze roller in the size box frame

## 2. Warp beam quality

The main points to be checked about quality of beam are smoothness and finish of the flanges, about the type of adapters, beam driving means in terms of fixing it on either warping machine or afterwards on sizing and loom. The aspect are to be considered separately for beams to be used for direct and indirect warping.

A higher warp brake rate affects the productivity of the loom, increases the work load of the weaver and also affects the quality of the fabric. During weaving, there are different forces which act on the warp which results in breakages. Some of the major forces are Abrasions, Extensions and Bending.

## 3. Warp Yarn Quality

Following is the list of requirements out of a warped beam which are likely to affect later on processes especially sizing and weaving.

1. It is important that all threads are to be wound with equal tension. The tension should be maintained at a uniform level throughout the length and across the width of the warp sheet.
2. The surface of the warp on the beam should be cylindrical, uniform and smooth with no ridges or sunken
3. The threads near flanges are likely to sink inside the layers. The warp threads near flanges should not be caught in to the layers.
4. Many times it is observed that the selvedge threads are wound at a lesser tension and are loose. One has to make sure that these threads are wound at the same tension as that of the rest of the threads.
5. The hardness of the beam should be same throughout the width.
6. There should not be any marks of higher pressure value throughout the length of the yarn on beam.

7. The edges of the flanges are to be smoothly finished and should not cause any abrasion on the yarn during winding and unwinding. Also flanges should have clean surface and should not soil the yarn.

#### 4. Warping length calculation

Warping calculation takes into consideration during sizing process. This is because the final process next to warpers beam this why the length of the warp beam is calculated.

- Total length of warp yarn in meters, = Total number of ends  $\times$  Tape length in meters. Or,  
= (Cloth length in meters + warp regain%)  $\times$  Total number of ends.

#### 1.4 Creeling warper beam

Creeling: Creeling is the removing of empty package and placement of the full package, in the feed region of the machine, ready to be unwound as part of the transfer process

Creeling is the process of placing full packages in such a place which is ready to be unwound as section of transfer operations. Simply, it is the removal of exhausted packages as well as their replacement with full ones. During Sizing : warped yarn is parallel unwinding of warp yarn from warper beam and pass through sizing process then winding on a weavers beam.

Ensuring equal number of lengths of warper beams are feed for one set, color shade variation, count variation,

## Self check-1

### Part 1: choose

1. Which types of yarns not need sizing?
  - A. Warp yarn
  - B. weft yarn
  - C. Yarn used for knitting
  - D. A&B
2. What are the type of work you perform on your business?
  - A. Deep cleaning
  - B. Regular cleaning
  - C. OHS practice
  - D. A&B
3. Which one of the following is cleaning equipment ?
  - A. Cloth
  - B. Dustpan
  - C. Brush
  - D. Paper towels
  - E. All
4. What are the not elements of cleaning?
  - A. Time
  - B. Temperature
  - C. Mechanical action
  - D. Chemical reaction
  - E. Procedures
  - F. All
5. What are the requirement of safe work area?

- A. provide clean floors and stairs, with effective drainage where necessary.
  - B. provide clean premises, furniture and fittings.
  - C. provide containers for waste materials.
  - D. remove dirt, refuse and trade waste regularly.
  - E. All
6. What Essential Elements For Workplace Safety?
- A. Management Leadership and Employee Involvement.
  - B. Workplace Safety Analysis – Early & Often.
  - C. Workplace Safety Hazard Prevention and Control.
  - D. Safety and Health Training and Education
  - E. All

## Part II: Short Answer

1. What is the best definition of cleaning?
2. What are the types of Cleaning? explain
3. What is cleaning in housekeeping?
4. What is considered a safe work environment?
5. Write down Core Elements of Successful Safety Programs?

## Operation sheet 1.1

### Operation title: maintain cleaning and safe work area

**Purpose:** To provide safe work area

**Instruction:** using the given materials and equipments shown in figure 1.4 below. You have given 5min -10Min for the task and you are expected to write the answer on the given line.



**Figure 1,4:** Cleaning Tools

### Tools and requirement:

- Cloth
- cleaning bathrooms, ovens, or swimming pools
- Dustpan
- Brush
- Paper towels
- Handling garbage

### Steps in doing the task

1. Identify the area to be cleaned
2. prepare materials and equipments
3. start to clean the area
4. make clean around the safe work area

5. finish cleaning
6. check the quality then documentation that means record and report

**Quality Criteria:** Maintain safe work area to increase high production quality and quantity

**Precautions:** Use Personal Protective Equipment (PPE) for occupational healthy and safety

## Lap test 1

Name\_\_\_\_\_ Date\_\_\_\_\_

Time Started\_\_\_\_\_ Time Finished\_\_\_\_\_

### Instructions

1. perform cleaning safe work area according OHS Practice .
2. Request your instructor for evaluation & feed buck

## Unit Two: Preparation of sizing solution

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

- .sizing material
- Requirements of Sizing chemicals
- Preparation of Sizing recipes and equipments
- . properties and elements of size boxes

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:

- Prepare .sizing material
- Require Sizing chemicals
- Prepare Sizing recipes and equipments
- Check properties and elements of size boxes



## 2.1 Sizing material

Sizing is the process of giving a protective coating on the warp yarn to minimize yarn breakage during weaving. Sizing is the most important operation in preparing warp yarn for weaving especially with cotton yarn.

Sizing is a complementary operation carried out on warps formed by spun yarns with insufficient tenacity or by continuous filament yarns with zero twists. In general, when sizing is necessary, the yarn beam is warped; therefore, all beams corresponding to the beams are fed, as soon as warping is completed, to the sizing machine where they are assembled. Sizing consists of impregnating the yarn with particular substances that form on the yarn surface a film to improve yarn smoothness and tenacity during the subsequent weaving stage.

### e) Objects Of Sizing

- To improve the weave ability of warp yarn.
- To maintain good fabric quality by reducing hairiness, weakness, and increasing smoothness and the yarn's strength.
- To increase the tensile or breaking strength for cellulose yarn.
- To increase the elasticity.
- To remove the projecting fibre.
- To reduce electrostatic formation for synthetic or blended yarn

### Factors affecting size pick up:

- Those belongs to the yarn particulars.
- Those that depend on certain properties of the size paste.
- Those due to some characteristics of the equipment and waxing of the sizing machine

### f) Different Techniques Of Sizing

- Hot melt sizing.
- Solvent sizing.
- Foam sizing.

- High-pressure sizing.
- Electrostatic sizing.
- Emulsion sizing.
- Combined sizing.
- Conventional sizing.

## 2.2 Requirements of sizing chemicals

A sizing process should fulfill the following requirements which are important for fabric production . they are.

- First sized warp must be sufficiently strongly smooth
- Secondly the sizing process must be ensure the application of the required amount of size on the yarn or the required size regain.
- Thirdly the tension of warp yarn at sizing must be regular and constant all the time of warp unwinding on the warp beam
- After that yarn strength and loss in elongation must be admitted limits
- Then the package i.e. the weavers beam produce must have cylindrical shape, necessary winding density and yarn strength.
- Lastly the sizing process must be efficient, economical and must ensure the production of high quality sized warp.

### g) Definition Of Sizing Ingredients

The chemicals to be used in the preparation of sizing liquor is called sizing ingredients. The sizing's fundamental objectives can be achieved only by impregnating the yarn with the appropriate size mixture consisting of various ingredients in suitable proportion. Each ingredient should impart a particular property to the yarn.



**Figure 2.1:** Different sizing ingredient

Sizing ingredients may be classified into two categories:

- Primary sizing ingredients
- Secondary sizing ingredients

#### **A. Primary sizing ingredients**

The primary ingredients are essentially required in the size paste, whereas the secondary ingredients may or may not be added to the size mixture according to the requirements. The primary ingredient is the main ingredient, and it helps to give additional strength to the yarn and improves its abrasion resistance

The names and their roles of primary sizing ingredients are given below:

#### **Adhesive agent:**

The main role of an adhesive agent in the sizing liquor is to form a thin layer (film) on the yarn surface. It is a very important ingredient. A major portion of sizing liquor consists of the adhesive agent. It penetrates inside the yarn and increases the yarn strength. The protruding fibres also bind with the yarn surface and help to increase yarn strength. The hairiness of the yarn reduces too. Film on the yarn surface improves the abrasion resistance and smoothness of warp yarn. Now, these days following types of adhesive agents are used in the sizing process.

- **Simple starch**

This is untreated starch powder. Mainly maize starch, sago starch, wheat starch, potato starch are used as adhesive agents in sizing. The viscosity of sizing liquor with untreated starch is always

high. It gives poor penetration in the warp yarn. This starch is suitable for sizing of a coarse count of yarn up to 20s count.

The viscosity of untreated starch can be improved by adding potassium per sulphate in it and improved viscosity of liquor allows to use it in the sizing of the medium count of yarn. It gives the best performance in weaving with the medium speed of loom. This is cost-effective. It helps to control the sizing cost per kilogram of warp.

- **Thin boiling starch.**

It is chemically treated starch. It has a lower viscosity than untreated starch. It easily penetrates the yarn. When warp count increases, the size pick-up percentage is also increased thus the concentration of liquor is also increases but the viscosity of liquor is kept almost the same by using thin boiling starch. It may be successfully used in the sizing of the medium count of warp yarn. It is a little expensive than untreated starch.

- **Modified starch**

It chemically modified starch. It has a very low viscosity. It gives the best penetration effect in the yarn. It is suitable for all types of yarn count. It can be used for sizing of warp of high-speed loom. Good quality of fabric results with this adhesive. Maximum efficiency can be achieved by using this adhesive. This is much expensive so that it is used in the sizing of a fine count of warp yarn only.

### **Binding agent:**

It is used to make the adhesive film enough strong. The adhesive film has brittleness. When it passes through various kinds of abrasive actions and jerks during weaving, the adhesive film becomes cracked and end breakage results during weaving. The binding agent provides strength to the adhesive film and prevents becoming a crack. There are many types of binding agents that are being used in sizing at present time. The widely using binding agents in today's sizing are given below:

- Guar gum
- Carboxy methyl cellulose (C.M.C.)
- Polyvinyl alcohol (P.V.A.)
- Polyester binder(R- bind, bilbind PS, eco size)

- Acrylic binder (rainsize excel).

Above binding agents are used individually or within combination according to requirement, quality and the warp count is always taken into consideration before the selection of binding agents.

### **Softening agent:**

It is used to make the adhesive film more soft and flexible. As we know that the warp yarn passes through different angles so that the adhesive film becomes crack due to the bending movement of the yarn. This problem necessitates that the adhesive film should be soft and flexible. The softening agent provides enough softness to the adhesive film. It also makes the yarn surface smooth. Following types of softening agents are used now these days:

- Vegetable fats (dalda, refined oil)
- Animal fats (mutton tallow)
- Synthetic softener (R-soft, textile wax)

A little amount of softener is used in the sizing liquor. It does not affect the costing of the sizing process on many scales.

### **B. Secondary sizing ingredients**

Secondary ingredients, give additional properties to the yarn such as feel, weight, appearance etc. The secondary sizing ingredients of sizing agents are given below:

### **Antistatic agent:**

It prevents the generation of electrostatic charge in the warp yarn during weaving. When the warp makes up and down movement during weaving, the ends rub to each other and generates an electrostatic charge in the warp. These electrostatic charges cause warp breakage during weaving. A very little amount of antistatic agent is used in the sizing liquor. The types of antistatic agents are given below:

- Sepcostate
- LV-40
- PAA-40

### **Antiseptic agent:**

It is used to prevent bacteria or mildew formation in the sized beam or fabric woven from a sized warp. When the sized warp or fabric remains unused, there are chances of bacteria or mildew

formation in humid conditions or rainy seasons. Some antiseptic agent is added to the sizing liquor to avoid this problem.

- Salicylic acid
- Zinc chloride
- Phenol
- Emulsifier
- Copper sulphate

### **Hygroscopic agent:**

The main role of the hygroscopic agent in the sizing liquor is to improve the moisture absorption capacity of warp from the air. Since we know that the strength of cotton increases by increasing moisture percentage when the warp absorbs the moisture during weaving, the warp breakage rate is reduced. The majorly using hygroscopic agents are given below:

- French chock
- China clay

### **Weighting agents**

These are also variously known as weighting agents, filling agents, fillers etc. They help add weight to the yarn to make the fabric get a feel or fullness. This is important when the cloth is to be sold in the grey state on a weight basis. Some of the well-known weighting agents are China clay, Gypsum, Talc or French chalk or soapstone, Barium sulphate, Epsom salt etc.

### ***Brightening/Bluing Agents***

These are colouring/whitening agents. Here too, just as in the weighting agents' case, these agents are required when the cloth is sold in a grey state. Cotton materials have natural colouring matter, which makes them dull or yellowish in appearance. Hence, to improve the material's aesthetic

look, they are generally made whiter or given a bluish tinge. Some of the well-known brightening/bluing agents used are Ultramarine blue, acid dyes, fluorescent brightening agents etc.

### ***Wetting Agents***

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In synthetic textile materials such as polyester, nylon etc., natural adhesives such as starch cannot wet the fibres, since they are hydrophobic in nature. Therefore synthetic adhesives will have to be applied with some suitable wetting medium. The wetting medium which is ideally suited for the purpose is Turkey red oil. Other oils such as P4 oil can also be used.

### **Antifoaming agents**

During the sizing, there is always the possibility of foam generation in the size box's size. The foam is generated by surface-active agents present in size paste such as soaps, Turkey red oil etc. Alkali foam is formed due to the churning action of the squeezing rollers. The foam that is carried by the warp sheets and causes smudging of the drying cylinders. Hence to reduce the foaming tendency of the size paste, anti-foaming agents are to be added. Some of the well-known anti-foaming agents used are amyl alcohol, turpentine, pine oil etc.

### **Sizing solution:**

Sizing is the process of applying different size solution on textile materials. In the textile industry, sizing solution is used on the twisted yarn (cotton, linen, and polyester) surface during weaving, so that the strength of yarn can increase and reduce the hairiness.

## **2.3 Preparation of Sizing recipes and equipments**

### **Receive formulation for sizing processing:**

To prepare size paste number of factors need to be considered, according to all those factors size paste can be suitable for warp ends.

Following are the descriptions of all those factors and their impact. How size ingredients are changed with those parameters is necessary to keep in mind before cooking the paste.

Recipe formulation for different counts of 100% cotton yarn

Table 2,1: **Recipe for 100% polyester or nylon or acrylic filament yarn**

Sr. No	Ingredients	10 <sup>^</sup> s or 20 <sup>^</sup> s Count Quantity (gm)	30 <sup>^</sup> s or 40 <sup>^</sup> s Count Quantity (gm)	80 <sup>^</sup> s or 100 <sup>^</sup> s Count Quantity (gm)
1	Adhesive- maize or tapioca	100	80	80
2	Softener- mutton tallow	10	8	4
3	Antiseptic- ZnCL2	3	1.6	1.60
4	Deliquescent- Urea	2	1.6	1.60
5	Wetting agents- china clay	30	8.24	8
6	Blueing agent- OBA	0.1	100	0.10.
7	Water	854.9	900.46	905.9
—	Total	1000 kg	1000 kg	1000 kg

**Table 2.2: Recipe for 100% polyester or nylon or acrylic filament yarn**

Sr. No	Ingredients	Quantity
1	Adhesive- PVA /CMC/Thin boiling starches	50
2	Wetting agents- TRO/Soap pine oil	0.5
3	Defoaming agent- soap/silicon oil	0.5
4	Antiseptic - soap/silicon oil	0.5
5	Water	949.5
—	Total	1000 Kg

Mixed yarns have different qualities than individual yarns, hence a wide range of materials is required to make a suitably blended yarn.

Because we have multiple blend ratios of polyester-cotton blended yarn and polyester Viscose blended yarn, the recipes for the various blend ratios are listed below

**Table 2.3: Recipe for polyester cotton blended yarn or polyester Viscose blended yarn**



Sr.No	Ingredients	80:20	65:35	50:50	35:65	20:80
1	Adhesive- PVA/starch	3 to 5	3	3	2	
2	Softener- mutton tallow		3	4	4	6
3	Antiseptic- ZnCL2		1	1	2	2
4	Weighting agent- TRO	0.5	0.5	0.5		
5	Defoaming agent- pine oil	0.5	0.5	0.5		
6	Antistatic agent	0.5	0.5	0.5		
7	Deliquescent- Urea			2	2	2
8	Blueing agent- OBA	0.5	0.5	0.5	0.5	0.5
9	Water	Remaining	Remaining	Remaining	Remaining	Remaining
10	Total	100%	100%	100%	100%	100%

## Factors affecting drying

### 1) System of drying

As we know various drying systems, the drying efficiency of different systems will be different. so, efficiency will decide the drying results. comparison between the efficiency of different systems -

A) Hot drying < Cylinder drying

B) Two-cylinder < Multiple cylinder

So, drying from the multiple cylinder roller will be the Fastest and have better results

### 2). Count of the yarn

For finer yarn count - Drying will be very fast due to its finer nature, yarn is having compact structure so, difficult to retain moisture resulting in very fast drying.

For Coarser yarn count - Drying requires time due to its coarser nature, yarn has a more amorphous region which helps to regain the moisture from the atmosphere hence, drying required more time.

### 3) Ends per inch ( EPI )

If EPI is more then the warp sheet density will be more hence the resultant area of contact of warp sheet with drying rollers will be more which requires more time to dry EPI is directed proportionally to warp sheet density and inversely proportional to the drying time required for drying warp sheet.

### . 4) Twist of the yarn

As the twist of the yarn increases the durability of the yarn will be lower The twist is directly proportional to drying time, as the twist increases the drying time will be more.

#### 5) **Concentration of liquor**

Higher is the concentration of size on the yarn then the dryability of the yarn will be less The concentration of size is directly proportional to the required drying time.

#### 6) **Size pick up percentage**

Higher the size pick up by yarn then it will take more time to dry hence, with higher size picks up the dry ability of yarn will be lower.

#### 7) **Humidity in the atmosphere**

If higher the moisture content in the atmosphere then yarn will continuously absorb moisture from the atmosphere which will increase the drying time. Higher the relative humidity the lower will be the ability to

dry as well as higher temperatures will be needed for drying.

Impact of sized yarn in loom

### **All Sizing Calculation Formula with Examples:**

- Total length of yarn sized, = Total length of warp  $\times$  Number of ends.
- Total weight of size on the warp, = Weight of sized warp – the weight of the unsized warp.
- The weight of size to be put on the warp, = Weight of unsized warp  $\times$  size% required to be put on the warp,

#### **Sizing calculation**

The parameters received from warping regarding the set are given below:

Total ends = 14640 ends

Reed space = 126.20 inches

Warp count = 40s

Set( warp) length = 5000 metres

Sizing waste = 70 metres per set length

Actual warp length before sizing = 4930 metres

Sized warp length = 5020 metres

Warper's beam = 2200 mm

Number of beams = 20.

**Now parameters required to size a beam are:**

1. Beam width =?
2. Denting order =?

**Beam width** = Reed space (inches) + 20 mm

$$= 126.20 \text{ inches} + 20 \text{ mm}$$

$$= (126.20 \times 25.4) + 20 \text{ mm}$$

$$= (3205.48 + 20) \text{ mm}$$

$$= 3225.48 \text{ mm (beam width)}$$

**Denting order:**

This is a very critical calculation in sizing. How to decide the denting order? When we group the warper's beams together, and we keep the zig-zag Reed in a downward position and initiate the sizing process, the width of the warp sheet is equal to the width of warper's beam. Now sizer brings the reed in an upward position. The pointed dents of the zigzag reed penetrate the warp sheet and the warp and automatically get passed through the dents of the reed. The ends density at both the selvedge and at the remaining sheet vary due to the difference of warper's beams alignment.

Here sizer needs to correct the denting order at both the selvedge.

Now a question arises, how to find the correct denting order?

The approximate number of dents used = number of reed stripes X dents per reed stripes

$$= 25 \times 60 \text{ dent}$$

$$= 1500 \text{ dents}$$

Denting order calculation sheet is given below:

$$\begin{aligned}\text{Ends per dent} &= \frac{\text{total ends}}{\text{number of dents used}} \\ &= \frac{14640}{1500} \\ &= 9.77 \text{ ends per dent}\end{aligned}$$

$$\begin{aligned}\text{denting order} &= \frac{10+10+10+9+10+10+10+9}{8} \\ &= \boxed{9.75 \text{ ends per dents}}\end{aligned}$$

correct denting order = 10,10,10,9,10,10,10,9

the difference of denting order is corrected by expending or reducing the width of zigzag reed

### Stretch % :

It is the ratio of the difference between sized warp length and warp length before sizing to warp length before sizing expressed in the term of percentage. Please note, the stretch% should be as minimum as possible.

$$\begin{aligned}\text{stretch \%} &= \frac{(\text{sized beam length} - \text{warp length before sizing}) \times 100}{\text{warp length before sizing}} \\ &= \frac{(5020 - 4930) \times 100}{4930}\end{aligned}$$

$$\boxed{\text{stretch \%} = 1.82}$$

### Warp Cover In Sizing:

The ratio of space occupied by yarn to total space occupied by warp sheet expressed in the term of percentage is called warp cover in sizing.

R f % or size concentration%:

The size liquor concentration is measured by refractometer so that it is also called refractometer value in term of %. The size liquor concentration is the ratio of solid contents

to the total volume of liquor after cooking expressed in terms of percentage is called size liquor concentration% or RF %. The calculation of RF % of sizing liquor is given below:

$$\text{water ( Ltrs) } = \frac{\text{solid content (kgs.)} \times 100}{\text{rf\%}}$$

sizing recipes  
 starch = 100 kgs.  
 liquid binder = 12 kgs ( 25 % concentration)  
 solid binder = 5 kgs.  
 softener = 2 kgs  
 rf % = 14  
 steam condensation% = 10 %  
 water = ? litres

$$\text{solid content in starch} = \frac{100 \times 95}{100}$$

= 95 kgs ( starch contains 5% moisture. it may vary too

$$\text{solid content ( liquid binder) } = \frac{12 \times 25}{100}$$

= 3 kgs

$$\text{total solid content} = 95 + 5 + 3 + 2$$

= 105 kgs.

$$\text{water ( ltrs) } = \frac{105 \times 100}{14}$$

= 750 litres

please subtract 5 + 9 + 105 from water quantity

$$\text{water ( ltrs) } = 750 - 5 - 9 - 105$$

= 631 ltrs

$$\text{net water required} = \frac{631 \times 90}{100}$$

**Net water required = 567.9 Litres**

please note, the rf% may vary due to variation in steam condensation%, please check the rf% by refractometer and correct the water quantity required accordingly.

### Tools and Equipments:

These tools & equipment's are mostly measuring tools. These are:

- Digital/weighing balance:** used to measure the amount of chemicals used in size preparation

Digital electronic weighing scale is a device used to measure mass or weight. It works with the use of a strain gauge load cell. If you see the analog scales, it uses springs to indicate the weight of the object, while digital scales convert the force of a weight to an electric signal

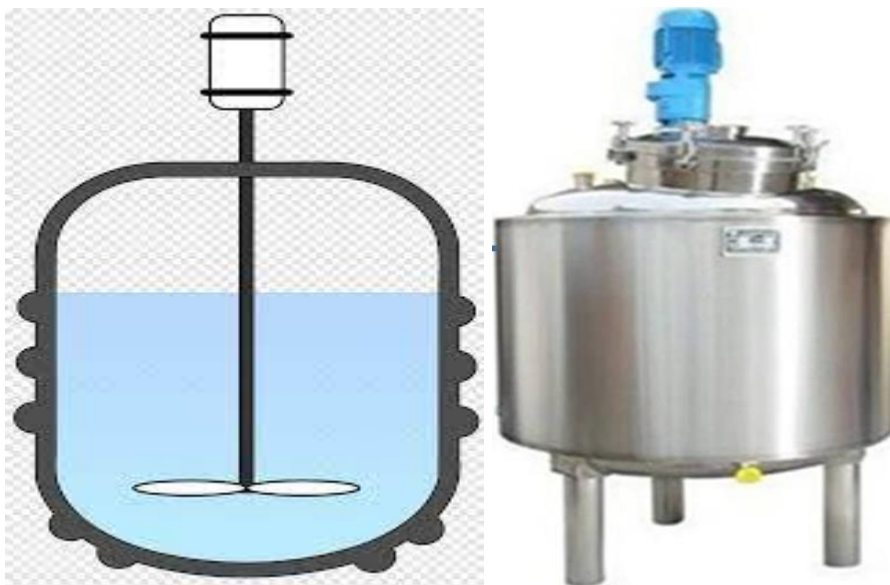


**Figure 2.2.:** Digital weighing balance

Wicking principles

The very basic principle that makes a balance a balance and not a scale is still the same: a counteracting force is created to be compared to the unknown mass. The weighing pan is attached to an electromagnetic coil, through which electric current is flowing. The coil floats in a magnetic field created by an amplifier.

**b) Stirrer & mixer:** Used to stir the chemicals after mixed each other



**Figure 2.3:** Stirrer and mixer sizing chemical

**c) Viscometer:** Measure the viscosity of the size chemical

Viscometer instrument for measuring the viscosity (resistance to internal flow) of a fluid. In one version, the time taken for a given volume of fluid to flow through an opening is recorded



**Figure 2.4:** Viscometer

**d) Thermometer:** Measure the temperature of the chemical at each steps of preparation

A thermometer is a device that measures temperature or a temperature gradient (the degree of hotness or coldness of an object). .



**Figure 2.5:** Thermometer

Mercury thermometers were once the only option available for taking temperature.

Due to safety concerns, they're no longer widely available and may even be illegal where you live.

### **Benefits**

- Mercury thermometers provide accurate temperature readings and can be used orally, rectally, or under the arm.
- They don't require batteries.

### **Drawbacks**

- Since they're made from glass, mercury thermometers may break easily, allowing toxic mercury to escape.
- They may also cause cuts or glass splinters if they break.
- Since they contain a hazardous substance, mercury thermometers must be disposed of properly and can't be thrown into the trash.
- They can be hard to read and must stay in place for 3 minutes



## Self check-2

### Part 1:

1. Which one is correct about the sequence of yarn sizing?
  - A. creeling, Drying ,Separating, Impregnating, beaming
  - B. Creeling, Impregnating, Separating, Drying, Beaming
  - C. Creeling, Impregnating, Drying, Separating, Beaming
  - D. Creeling, Drying, Impregnating, Separating, Beaming
2. Which of the following is not sizing chemicals?
  - A. .Gum
  - B. Softeners
  - C. .Antifoaming agent
  - D. PVA E. none
3. Why do you use preservatives in sizing chemicals?
  - A. To coat warp yarn with a film
  - B. To improve smoothness of yarn
  - C. To split starch in to small granules
  - D. To prevent the development of micro organisms on sized yarn or grey fabric
  - E. All

4. How starch molecules split in to Dextrin & glucose
  - A. By stirring
  - B. By sizing chemicals
  - C. By hot water
  - D. All
5. What is the aim of waxing?
  - A. To lubricate sized yarn
  - B. To improve water resistivity of sized yarn
  - C. To increase strength of sized yarn
  - D. A&B
  - E. All

## Part II: Matching

### “A”

- 1 Yarn need sizing
- 2 sizing chemicals
- 3 Taken place in sizing box
- 4 Piraymery sizing ingredients
- 5 Secondary sizing ingredients

### “B”

- A PVA
- B Warp yarn
- C Antistatic agent
- D Squeezing
- E Softening agent

## Part-II: Short answer

**Direction:** Give short answer to the following questions. Time allotted for each item is 3mniut and each question carry 5 point.

1. What is the recipe formula for the cotton threads sizing?
2. What are denting after sizing ?
3. Write the Piraymery sizing ingredients and explain?
4. Write the Secondry sizing ingredients and explain?
5. Requirements of sizing chemicals

6. What is the recipe formula for polyester or nylon or acrylic filament yarn sizing?

## Operation sheet 2.1:

### Operation title: preparing sizing solution

- **Purpose:** To prepare sizing solution for sizing process
- **Instruction:** Using the sizing recipe given and the given equipments. You have given 5min -10Min for the task and you are expected to write the answer on the given line.



**Figure 2.6:** Tools and Equipments

- **Tools and requirement:**

1. Sow box
2. Bicker
3. Stirrer
4. Weighing balance
5. Thermometer
6. Viscometer:

### Steps in doing the task

1. Pre-heated water (25C0 – 30C0)
  2. Pours (adds) starch
  3. The mixture is stirred (5min. – 10min.)
  4. Addition of dissolved chloramines in 3L-5L of warm water (30C0-50C0)
  5. Slightly mixing & steam is let in
  6. Sizes cooked (30-40min.) until there is no more reaction on chloramines
- **Quality Criteria:** the given viscometer and thermometer is measured constant sizing solution.
  - **Precautions:** use thermometer and Viscometer to Measure the viscosity of the size chemical and temperature control for maintaining constant liquid solution :

## Lap test 2

Name \_\_\_\_\_ Date \_\_\_\_\_

Time Started \_\_\_\_\_ Time Finished \_\_\_\_\_

### Instructions

Task-1:

1. Perform sizing solution
2. Request your instructor for evaluation & feed back

### Unit Three: Sizing process

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

- Parts and function of sizing machine
- Set up machine and Loading of warp beam
- Demonstration of size boxes
- Quality of sized yarn

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:

- Check and clean Parts and function of sizing machine
- Assist Set up machine and Loading of warp beam
- Demonstrate size boxes
- Check quality of sized yarn

### 3.1 Parts and function of sizing machine

#### 1. Warper's Beam Creel:

Creel is a very important portion of the sizing machine. The warper's beams are mounted on the creel. The beam mounting capacity of the creel depends upon the total number of ends required in the weaver's beam. Each beam rotates in between two rollers nips. The rollers are able to move freely.

The creel is a stand for holding the supply packages in the form of wound packages. It enables to hold the supply packages in proper position for warping and constitutes an important component of the warping machine. No individual type of creel can be suitable for all types of yarn, counts, set lengths and different applications. In other words no single type of creel can give the same beaming efficiency for different types of yarns or applications. Hence different types of creels are to be used for different purposes. The creels used in warping are of the following types:



**Figure 3.1:** Warpers beam cleer

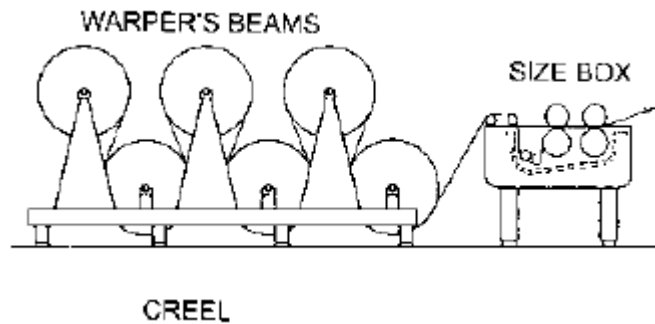
A braking system is attached to each pair of rollers. Beam tension is adjusted by loosening or tightening the hand wheel. The alignment of the beam is also done with help of this hand wheel. The yarn guiding rollers are fitted in the creel which guides the warp of each beam. Zigzag or vertical creel is used in the sizing machine. Zigzag creel occupies more space than vertical creel.



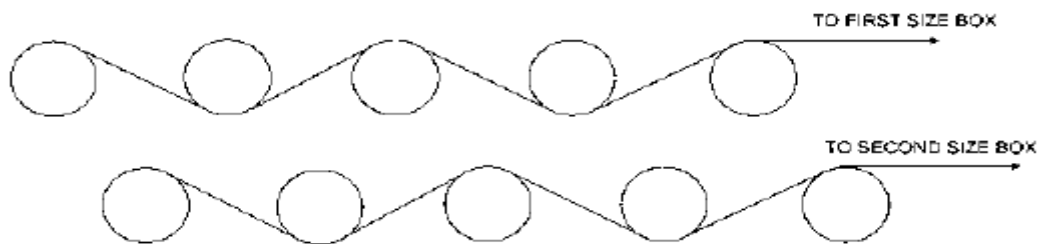
The major creel types housing multiple beams are

- Over/under
- Equitension
- Inclined
- Vertical stack

**a. Over/Under Creel.** In the over/under creel, as the name implies, the warp yarn passes over one beam, under the next beam, again over the next beam, and so on, as shown in Fig.3. This type of creel is most commonly used for slashing spun warp yarns of cotton and synthetic fibers. The threading pattern of warp from the beams in this type of creel varies depending upon the number of size boxes used. For heavy to medium construction fabrics, where two size boxes are used in industrial practice, all top beams in the creel may be threaded over and under and then straight to the first size box, as shown schematically in Fig.2. All bottom beams are threaded over and under and then straight to the second size box, as shown in Fig. 2.



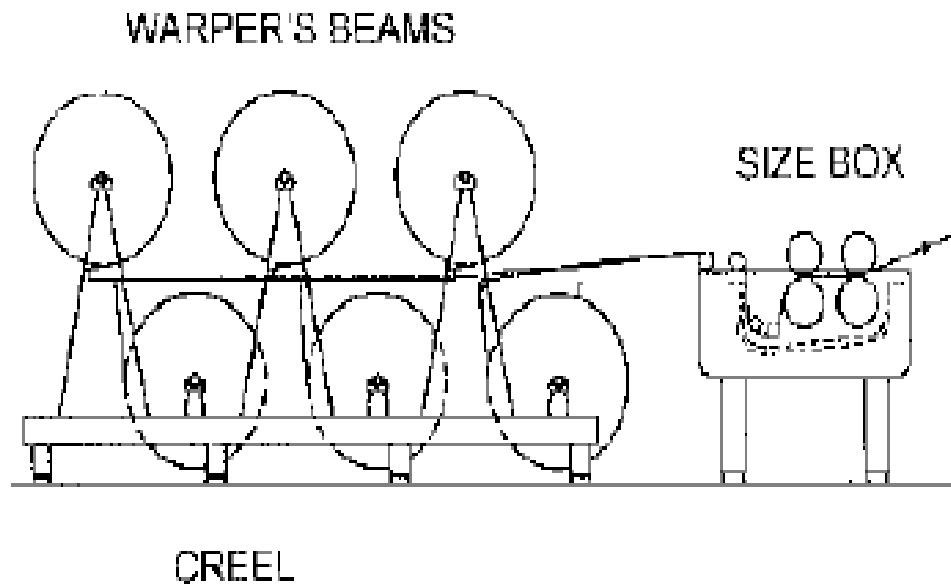
**Figure.3.2:** Over/under creel



**Figure 3.3** Over/under creel for two size box

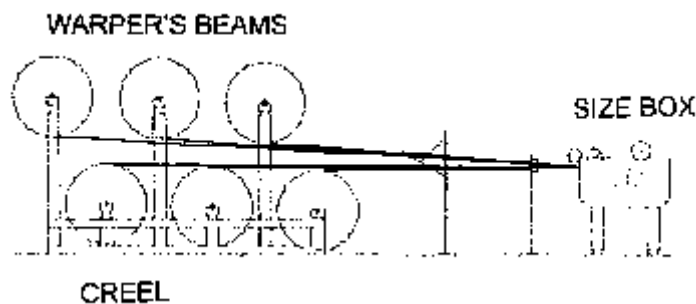
**b. Equitension Creel.** In this type of creel, the warp sheet is withdrawn from the individual beam and is passed over a guide roll mounted on the creel framework. Thus the yarn sheet from each

warper's beam is drawn individually and passed over a guide roll; it then joins the yarn coming from other beams of the top or bottom tier, respectively, and then passes forward directly to the size box, as shown in Fig.4. This type of creel is more useful for lightweight fabrics of open constructions.



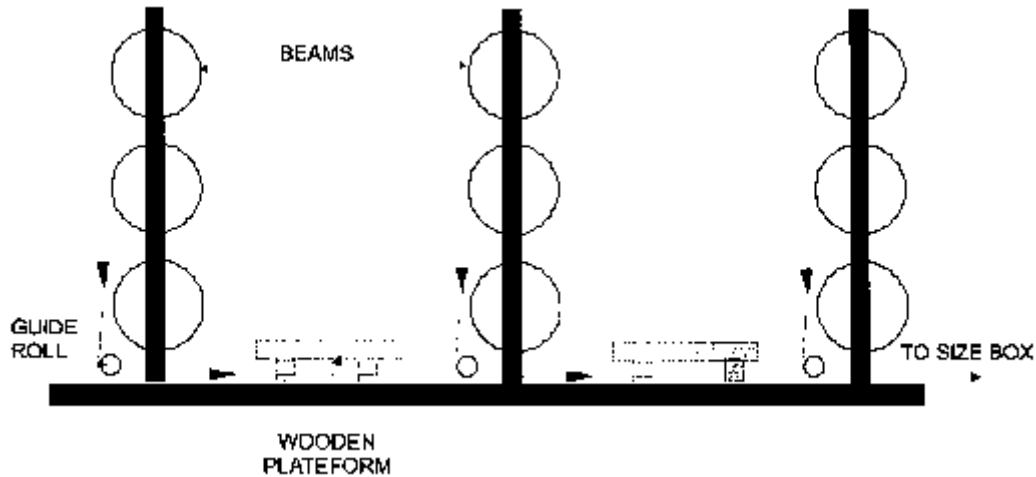
**Figure 3.4** Equitension creel

*c. Inclined Creel.* The inclined creel may be either double tier or single tier. Obviously, the single tier creel requires much greater floor space, and two tier creels are therefore more commonly used in the industry. The double tier inclined creel is commonly used for filament warps. As shown in Fig.5, the inclined creel allows a direct path of the yarn from each beam through the hook reed to the size box.



**Figure 3.5** Inclined creels.

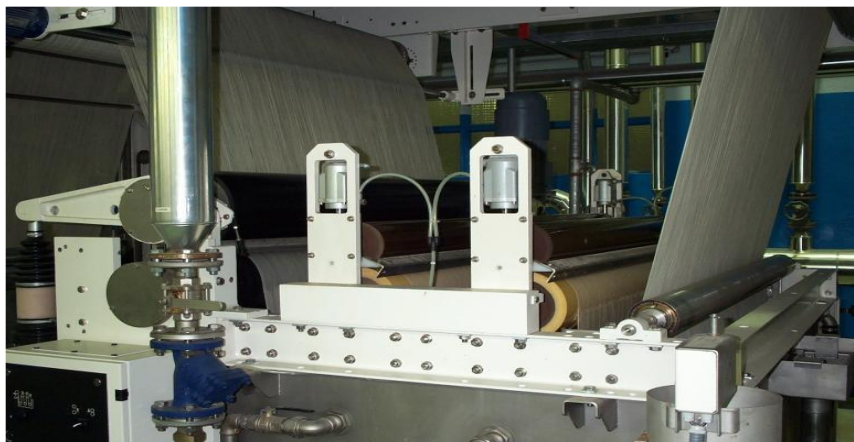
*d. Vertical Creel.* This type of creel is most suitable where a large number of warper's beams are used. This creel allows the operator easy access to all the warper's beams. The beams are supported on vertical stands in three decks in several modules, as shown in Fig.6. The passage between each pair of modules allows the operator to easily mend a break or correct a problem in a warp yarn leaving the warper's beam.



**Figure 3.6:** Vertical creel

## 2. Sow box:

It is the most critical and important portion of the sizing machine. Mainly it is responsible for size pick-up percentage in the warp during sizing process . The common parts and function of a sow box are given below



**Figure3.7:** Sow box

**Stainless steel tub:**

The sow box has a stainless steel tub. The sizing liquor is filled in this tub.

**Guide roller**

It is mounted just before the immersion rollers, it guides the warp sheet during the process

**Immersing rollers:**

The warp sheet passes under the immersion rollers. Two pairs of immersion rollers are used in a sow box, immersion rollers help to immerse the warp sheet into the sizing liquor. The warp sheet first passes under one pair of immersion rollers then between the nip of stainless steel and squeezing rollers. Now warp sheet again passes under another pair of immersion rollers and finally warp sheet passes between the nip of other stainless steel and squeezing rollers.

**Stainless steel rollers:** There are two stainless steel rollers in a sow box. Its function is to lift sizing liquor and to apply it on the yarn surface.

When a very low amount of size pick-up needs. only stainless steel rollers are used to apply the sizing liquor on the yarn surface. The yarn is not immersed into the sizing liquor in case of a very low size pick-up.

**Squeezing rollers:**

When the warp immerses into the sizing liquor, it has an excess amount of sizing liquor with it. There is a need to eliminate this excess amount of sizing liquor from the warp. The warp coming out of immersion rollers passes between the nips of the squeezing roller, which is mounted just over the stainless steel roller. Two squeezing rollers are used in a sow box. The squeezing roller applies the pressure on the warp sheet and eliminates the excess amount of sizing liquor from it.

**Perforated steam pipe:**

:This is mounted in the circulation box or tub. It is perforated and connected to the steam line. The main function of this perforated steam pipe is to maintain the temperature of sizing liquor in the sow box. A steam valve is fitted in the steam line which regulates the temperature of the sow box.

### **Pneumatic cylinder:**

The pneumatic cylinders are fitted at both ends of squeezing rollers. These cylinders perform up and down movement of squeezing rollers. The squeezing pressure is maintained by these cylinders. The compressed air is supplied continuously to these pneumatic cylinders.

### **Pressure gauge:**

A pressure gauge is fitted between the pneumatic cylinders and the air supply line. This pressure gauge reads the pressure during the process.

### **Pressure regulator:**

An air pressure regulator is used to control the squeezing pressure. By rotating the air regulator valve the squeezing can be increased or decreased according to requirement.

### **Temperature sensor:**

The temperature sensor is immersed in the sizing liquor. This sensor senses the liquor temperature and sends the signal to the control panel.

### **Liquor circulation system:**

The main function is to perform the mixing of sizing liquor in the sow box and to prevent the formation of a thick layer of sizing liquor in the sow box



**Figure 3.8:** Liquor circulation system

The circulation system mainly consists of a geared feeding pump. When the tub of sow box is filled with sizing liquor, it begins to fall into the circulation box. The liquor from here passes into

the inlet of the feeding pump. The outlet of the pump is connected to a sow box. The feeding pump continuously circulates the sizing liquor.

### 3. Drying unit and steam supply:

The main function of the drying unit is to dry the warp sheet after coming out of squeezing rollers. The Teflon coated steam cylinders are used in the drying unit. The steam is supplied to the drying cylinders which helps to heat the cylinder. When the wet warp sheet passes over the heated surface of drying cylinders, the moisture present in the warp sheet is evaporated from it and the warp sheet becomes dry. A main steam supply valve located in the main steam line can start or stop the supply of steam in the whole drying unit. In the sizing machine.



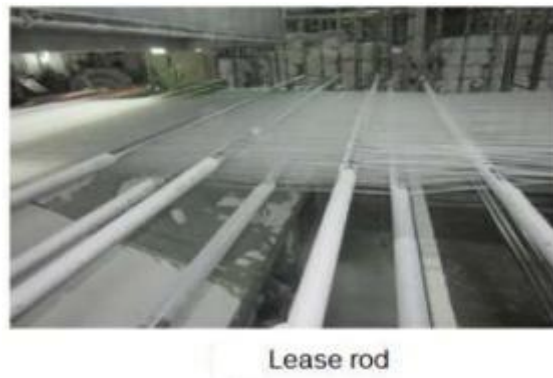
**Figure 3.9:** Drying unit and steam supply

some drying cylinders are driven negatively. These cylinders are revolved due to warp tension over the cylinder. The last three or four cylinders are driven positively. A steam trip is mounted on each cylinder which releases an excess amount of steam pressure. The steam valve fitted with each cylinder regulates steam pressure in the cylinder. The temperature sensors fitted with each cylinder reads the temperature of the cylinder and send the signal to the control panel.

### Yarn separator and its platform:

After the drying unit, a long platform is fitted just before the headstock of the machine. The yarn separator brackets are mounted on this platform. The yarn separators are kept on these brackets.

The main function of the yarn separator is to separate the ends from each other. When the dry warp sheet.



**Figure 3.10:** Yarn separator

Comes out from the drying unit, the ends are stuck to each other. The yarn separators are inserted into the warp sheet in a definite sequence. The number of yarn separators depends upon the number of warper's beams to be used. The number of yarn separators is always one short of a number of warper's beams. The yarn separators are fixed on their brackets. The warp sheet moves toward the headstock of the machine. This movement of the warp sheet helps to separate the ends from each other

#### **4. Headstock:**

This portion of the machine is located at the last of the machine. It consists of a drag roller, which is rubber-coated. It drags the warp sheet. There are two pressure rollers used to provide sufficient grip of the drag roller on the warp. The warp sheet first passes over the pressure roller, then it is passed under the drag roller.





**Figure 3.11.:** Headstock

The warp sheet again passes over another pressure roller. The pressure of these rollers is controlled by pneumatic cylinders. These cylinders also help to lift upward the pressure rollers. A metallic cover is mounted over the drag rollers which prevents to fall off any foreign material between the pressure roller and the drag roller. A protection grid is mounted just in front of the drag roller which protects the operator's hand.

#### **A. Adjustable reed:**

This reed is mounted just before the first pressure roller of the headstock. This is a zigzag reed. It fixes the number of ends per inch in the weaver's beam. This is an adjustable reed. Its width can be increased or reduced within the tolerance limit. A mechanism attached to this reed performs the adjusting of the action of this reed



**Figure 3.12:** Adjustable reed

A hand wheel is used to reduce or increase the reed width. The width can be adjusted by rotating the hand wheel in a clockwise or anticlockwise direction. There is another mechanism attached with this reed that helps to move it left and right direction.

### **B. Beam winding system:**

When the warp sheet comes out of the drag roller, it is wound on the weaver's beam. The pins of beam adapters are inserted in the holes of the beam driving mechanism. The beam is driven from one side. A winding motor transmit motion to a reduction gearbox, which is connected to the beam driving shaft. The surface speed of the weaver's beam is kept a little higher than that of the surface speed of the drag roller. This speed difference maintains the tension on the warp during beam winding.

### **C. Beam pressing system:**

The beam pressing system mainly consists of a pair of pressure rollers, two pairs of conical rollers, an iron beam and a pneumatic cylinder. The pneumatic cylinder is mounted in the trench under the weaver's beam. The piston of the pneumatic cylinder is connected to the iron beam. A pair of conical rollers are fitted at each side of the iron beam. These conical rollers move free on their pin and bearings. The beam pressing rollers mounted on these conical rollers. When a machine is in operation, the pneumatic cylinder lifts the pressure rollers. The pressure rollers touch the surface of the beam. When the air pressure in the pneumatic cylinder increases, the pressure rollers start to press the beam. The air pressure in the pneumatic cylinder is regulated by the air pressure regulator valve. The compactness of the beam is controlled by pressing rollers. It also levels the surface of the warp beam. The pressure rollers perform other work of beam loading and unloading.

### **D. Drive:**

An electric motor is used to drive the machine. This motor transmits the motion to the reduction gearbox. A vertical shaft is connected to the reduction gearbox. All the moving parts receive the motion through this shaft by means of chain sprocket and gears. In modern sizing machines, sow boxes, drying cylinders, drag rollers and beams are driven by individual motors. These motors are controlled by individual A.C. drive. The speeds of all the sections are synchronized accurately.

### E. PIV gearboxes:

When the machine is driven by a vertical shaft, PIV gearboxes are used to vary the speed of different sections. PIV boxes synchronize the speeds of various sections to each other. The sow box, drying cylinder and drag rollers have PIV boxes to adjust their speeds. The PIV box consists of a chain, two pairs of variable diameter toothed pulleys and a diameter adjusting hand wheel



**Figure 3.13:** PIV gearboxes

The one flanged toothed pulleys connected to the gear transmission system and the other end is connected through a chain sprocket to the receiving device. When the diameter of driver pulleys is increased, the diameter of driven pulleys reduces simultaneously. Therefore the speed of the motion receiving device is increased. When the diameter of the driver is reduced, the speed of the motion receiving device is decreased. The diameter adjustment is achieved by rotating the hand wheel.

### F. Control panel:

It is the electrical panel that controls all the electrical operations of the machine. There are many electrical contactors, relays, and printed circuit boards used in this panel. These devices switch on and off the supply according to signals received from various sensors located at different parts of the machine.

Automatic speed and moisture control system:

This system is very important for the efficient and accurate working of the sizing machine. In this system moisture percentage to have remained in the sized warp, the sheet is fed in the system. The main steam valve is opened and the temperature of different drying cylinders is adjusted manually. When the machine is running continuously, the speed of the machine varies automatically according to the moisture percentage fixed in the system. The machine speed is lowered to keep the moisture percentage constant when the steam pressure is reduced. When the

steam pressure increases, the speed of the machine also increases to keep the moisture percentage constant.

#### **G. Length measuring system:**

The machine is equipped with a digital length measuring meter. A metallic pin is mounted on the flange of the pressure roller of the headstock. This pin passes just in front of the proximity sensor during each rotation. Thus proximity sensor sends the signal of completion of each rotation of the pressure roller to the digital meter. The diameter of the pressure roller is fed into the digital meter. The digital meter converts the rotation into the metres. The required warp length can also be fed into the meter. When the required warp length reaches completion, the machine stops automatically. The operator cuts the beam and replaces it with a new one.

#### **H. Stretch control system:**

The ratio of difference of delivered length and feeding length to feeding length expressed in the term of percentage is called stretch percentage. The stretch percentage always appears in the display of the control panel. It ranges between 1 – 2 %. If it is not ranging between this limit, the tension between the sow box and drying cylinder, the tension between the drying cylinder and the drag roller is adjusted.

#### **5. Cooking unit:**

This is a vessel in which the sizing liquor is cooked. This is made of stainless steel and is capable to bear high pressure. A stirrer is fitted in the bottom of this vessel. This stirrer revolves with the help of an electric motor. An airtight door is mounted on the top of the vessel which is used to drop the sizing ingredients into this vessel. A water supply pipe is fitted in this cooking vessel to supply the water in the vessel.



**Figure 3.14:** Cooking unit

Steam is used to maintain the temperature in the vessel. A temperature meter and pressure gauge are fitted in this cooking vessel to read temperature and cooking pressure. Normally the volume of the cooking vessel is 1000 litres. One inch height of the cooking vessel contains 20 litres of the volume of liquor

#### **6. Liquor storage:**

A liquor storage vessel is used to store the cooking liquor. A stirrer is fitted to the vessel to stir the liquor. Steam supply maintains the liquor temperature.



**Figure 3.16:** Liquor storage

### **3.2 Set up machine and Loading of warp beam**

### **Checking production specifications:**

Product specification during warp preparation may include the right length of yarn on the package, the right package form, the right weight of yarn on the package and etc.

### **Checking yarn batch or job:**

For similar product specification, the warp yarn batch must be same. So each batch has similar parameters. Unknowingly warp yarn batch may be mixed; this will affect the fabric appearance. In order to avoid such the yarn must be checked and approved.

### **Reported non-conforming materials:**

Any non-conforming materials and others must be rectified to the concerned personnel.

### **Yarn preparation machine:**

Yarn preparation machines may produce yarns either for weaving or knitting operation. These machines include: winding machine, warping machine, sizing machine, waxing machine and etc.

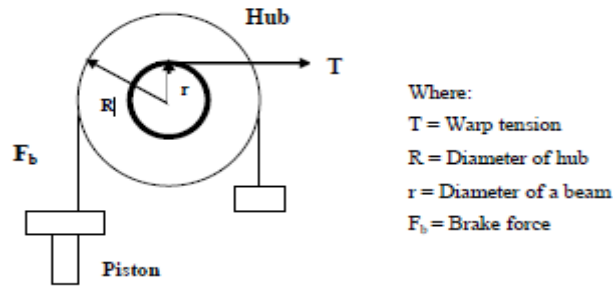
Loading warp yarn package is the process of placing the already prepared yarn package on either sizing machine weaving machine or knitting machine. These yarn packages may be in the form of cone or beam

During loading of warp yarn beam on the cleer of sizing machine the following are the requirements for the process

- ❖ Check Production specifications to identify requirements for yarn quantity, quality or color.
- ❖ Check Yarn batch or job to ensure conformity to specifications.
- ❖ Report Non-conforming materials to the concerned person
- ❖ Load Yarn package onto machine according to the specification procedure.

Sizing Creel is used to accommodate the warping beams and ensure that there is a uniformity of tension throughout the ends on the weaver's beam by strictly controlling the tension applied to the sheet of yarn from each back beam. It is also desirable that a creel should allow access to all parts of each beam so that repairs to broken threads can be carried out easily, and in some cases an economy of space might be necessary. The tension warp sheets can be maintained constant by the braking mechanism of the creel.





**Figure 3.17: Back beam**

When the brake is applied

$$T \times r = F_b \times R \Rightarrow F_b = \frac{T \times r}{R}$$

Since hub diameter is constant, as the package radius decreases, the braking force must be decreased pneumatically to maintain the tension of the warp sheets.

### Sizing process:

#### Operation involved in sizing Machine

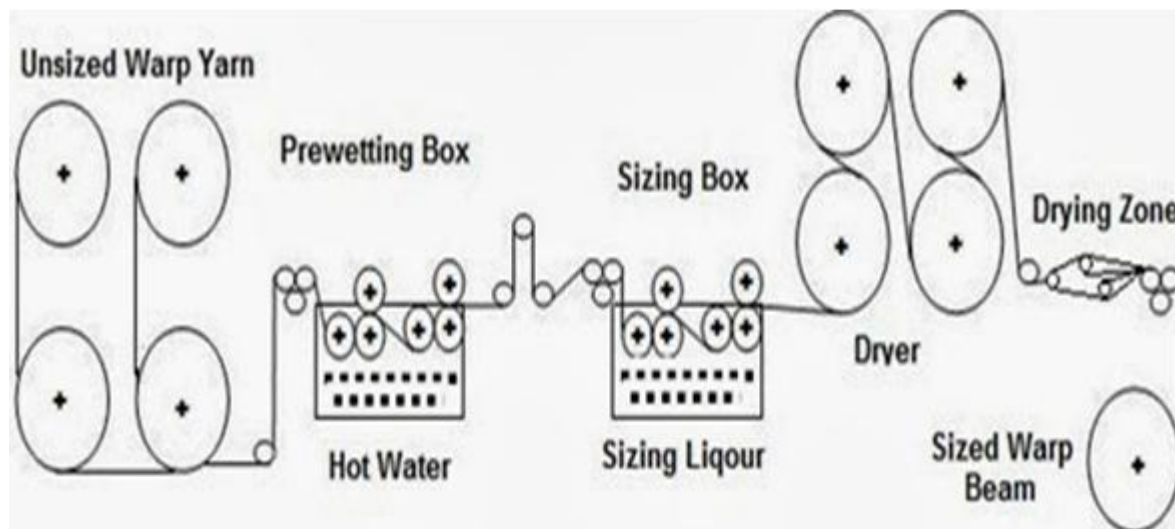
##### 1. Set changing

- Clean the sizing creel & the sizing machine after the run out of the previous program.
- Bring the warped beams for the next set to the sizing from the warping
- Creel the warped beams in the sizing creel as instructed
- Knot the ends from the creeled warped beams with that of the old warp sheet from the previous set.
- Paste tape on the warp sheet, so as to enable the lease to be applied
- Check with higher authority whether single sow box or double
- Show Boxes to be used for the next set.

##### 2. Adjustment of Sizing Machines

#### Definition Sizing Machines:

The sizing process consists of impregnating with the size the warp unwound from the warping beams, drying, separating the ends and beaming. Moreover, during the sizing process, the warp is marked for dividing it into pieces of predetermined length.



**Figure 3.18:** show the zone of sizing machine

Depending upon the arrangement of the drying section, all sizing machines may be classified as follows:

- **Cylinder sizing machine** – in which the warp is dried by contact with the hot surface of the cylinder;
- **Hot air sizing machine** – in which drying is effected in chambers with hot air;
- **Combined sizing machine** – in which the warp is dried by contact with the hot surface of the cylinders and bypassing through hot air chambers;
- **Special sizing machine** - in which the warp is dried by electric heating, high-frequency currents, by infra-red rays etc.

The main parts of a sizing machine are adjusted as ergonomically in the way of operating. These main parts are creels for the accommodation of the warping beams; the framework and drive; the sizing unit consisting of a size box and immersion and squeezing rollers; the drying section where the excess moisture is removed from the size and pressed warp ends; the headstock. A particular device is also provided therein for additional treatment, i.e. emulsification and waxing of sized warp, and automatic instruments for checking the sizing process.

### 3. Running the Machine:

- Pull warp sheet from the creeled warping beam according to the requirement of the sow box/ sow boxes,



- Clean the sow box/ sow boxes. before the knots reach the sow box/ sow boxes
- Switch on ‘size pump’ , ‘sow box steam volve’, ‘squeeze roller press revolve, moisture control etc. once the size is filled in the sow box/ sow boxes.
- Activate impression rollers
- Ensure that the size is not boiled in excess than required and splash in the warp sheet to avoid size patches
- Check the viscosity & refract meter reading for the size in the sow box/ sow boxes.
- Check the drying cylinders temperature quite often
- Apply ‘lease’ as advised
- Mend the ‘lappers’
- Activate hydraulic rollers, when the machine is running. to ensure the required pressure.
- Ensure that no space is left near the flanges in both the sides
- Ensure that no warp thread is overlapped, particularly near the flanges in both the sides
- Ensure that the “leasing area” .comb area” etc...are free from waste.
- Ensure moisture control & temperature control are properly functioning
- Weigh each & every beam on completion and check the size pick up & Correct the migration of ends
- Note down the lapper details, migration details etc. in the performance log note book.
- Check the Stretch Control

#### 4. Doffing Of Sized Beams

- Paste the gum tape on the beam just 2-3 metres before the end of each
- Paste the another tap on the beam after the completion of the beam
- Write the following details on the “ beam ticket” and the same has to be pasted in the flange outer of the beam after the completion of each Of the beam:-
  - ✓ Count
  - ✓ Set No.
  - ✓ Beam No.
  - ✓ Total Ends
  - ✓ Beam metres

- Note the following set details in the the “ sizing production register ‘after the completion of the Set, “
  - ✓ Count
  - ✓ Set No.
  - ✓ Beam No.
  - ✓ Total Ends
  - ✓ Beam Metres
  - ✓ Size Pick Up
  - ✓ No. Of Lappers
  - ✓ No of Migra

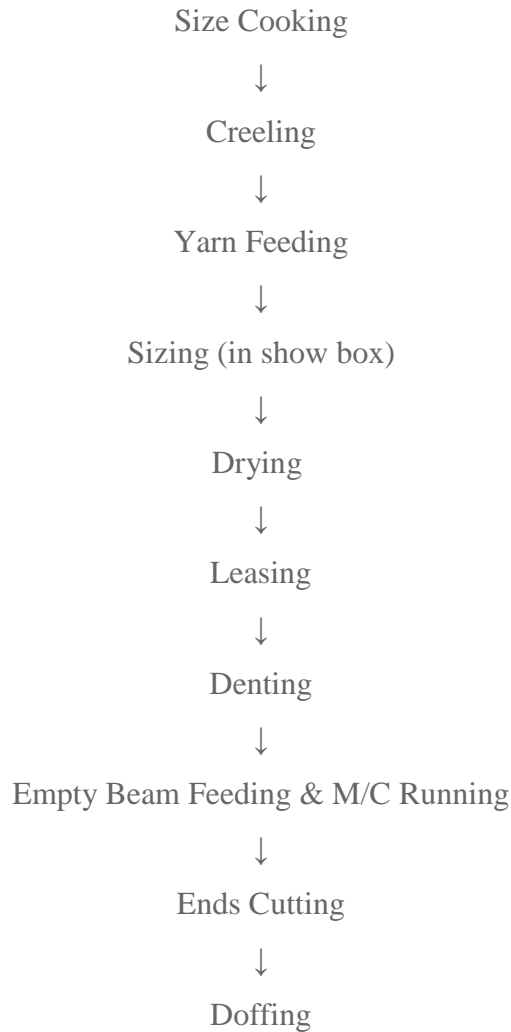
➤ **Other Work practices**

- Keep the “ lease rope”, ready so as to apply the lease, when required
- Not touch the machine, when it is running.
- Drench the gum tape in water before the tape is wasted, so that the tape doesn’t peel off, easily.
- Check with higher authority in advance ( before the set is completed) for the continuous use of the size in the sow box/ sow boxes or for the collection of the same in can/ cans
- Give preference to safety , should not enter the area, where he/ she is not allowed.& should not do a job in which training has not being given
- Ensure that no raw material/ cloth/ spare/ tool / any other material is thrown under/ near the machines or in the other work areas.
- Run the sizing machine in the speed, as advised
- Check for the reasons for the frequent breakages, the reasons that could be
- Corrected by himself/ herself should be corrected otherwise, the same has to be reported to the superiors
- Report immediately to supervisor for any machine faults

Sizing is the process of applying protective adhesive coating on the yarn surface. This is the most important segment of weaving preparatory process. Because sizing has direct influence on the weaving efficiency. Better the quality of sizing higher the weaving efficiency & vice versa. In fact without sizing, in most of the cases it is almost impossible to run the weaving process.

In the process of sizing operation the Flow chart of sizing are as follow

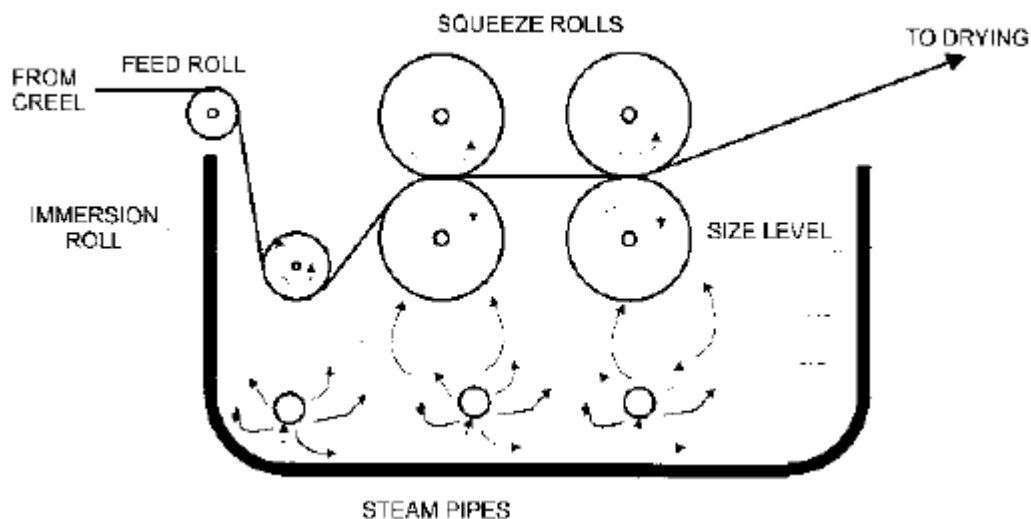
## Flow Chart For Sizing:



### 3.3 Demonstration of size boxes

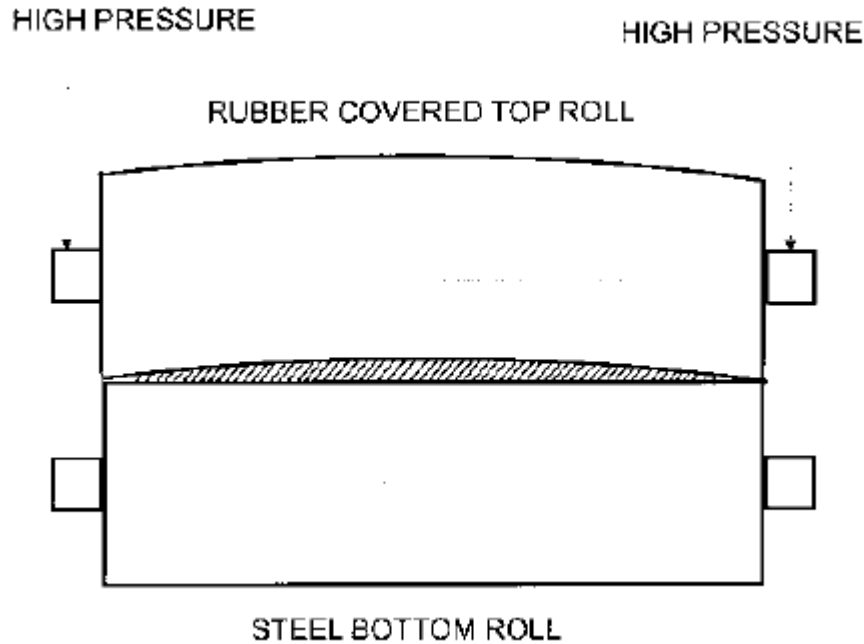
The size box and all parts that remain in contact with the size solution are made of stainless steel to prevent corrosion. The shape of the size box from the bottom is contoured with no sharp ends. The size liquor in the size box is normally heated by steam supplied through a steam coil placed at the bottom of the size box. The steaming coils placed in the size box should ensure uniform heating of the size liquor in the entire size box. The type and the design of the coil vary depending upon the size box manufacturer. The entry of the high pressure steam in the size box also creates a turbulence which results in the agitation of the size liquor. This is favorable in the

case of a starch-based size used for sizing spun yarns because the agitation prevents gelling and scumming of the size near the corners. For filament slashing, a size box with direct heating coils is not desirable as the agitation of the size liquor may disturb the filaments. Also, the bottom of the size box should have an outlet to the effluent disposal system so that the size box can be completely drained when cleaning is required. The configuration of size boxes is quite diverse and they are available in a variety of different forms depending upon the sizing machine manufacturer. However, the basic function of all size boxes is to impregnate the warp sheet in the size liquor at a predetermined application temperature and to squeeze out the excess size liquor before the yarn sheet reaches the drying zone. Most slashers are equipped with a single sizing box having two pairs of squeezing rolls and an immersion roll. Figure 15 shows a typical size box. A sheet of warp yarn is drawn from the warper's beams and fed to the size box over a pair of guide rolls with a slack rod or tension roll riding on the warp between the two guide rolls. The sheet of yarn is immersed in a size solution by one or two immersion roll(s). The immersion roll is normally movable. It is mounted on the size box with a rack and pinion mechanism so that it can be freely lowered and raised. The amount of size that will be picked up by the yarns will depend upon the depth of the immersion roll and the level of size liquor in the size box. At a given constant size level in the box, the lower the position of the immersion roll, the greater the pick-up of the size by the yarns, as it allows a longer time for the yarns to remain in the size liquor and vice versa. The yarn sheet with wet size on it then passes through one or two pairs of squeezing rolls, as shown in Fig. 15.



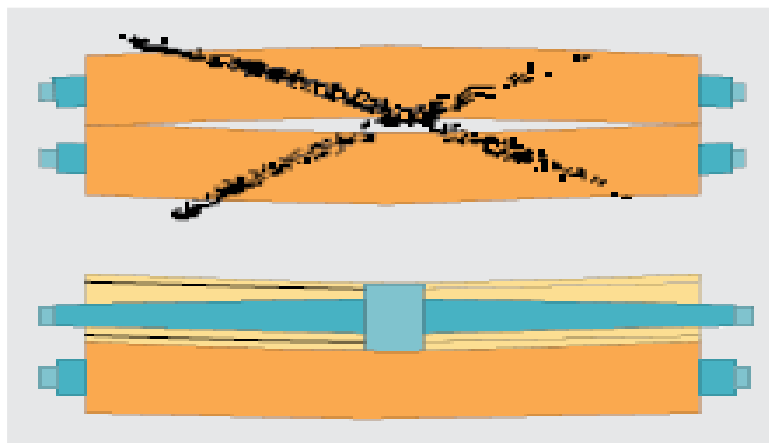
**Figure: 3.19:** Schematics of size box

The purpose of the *squeeze rolls* is to remove the excess size liquid from the yarns. For filament yarn sizing a single squeeze size box is usually used; however, in case of spun cotton and synthetic yarns where higher size add on is required, double squeeze size boxes are normally preferred. The bottom roll in a pair of squeeze rolls is made up of stainless steel and the top roll is made from cast iron material covered with rubber. The top roll is usually under pressure in addition to its own weight of around 180 to 250 kg. The pressure is usually applied by compressed air operating on pneumatic cylinders or pneumatic diaphragms. In modern slashers, the trend is to use a high squeezing pressure to save energy in drying and to make it possible to use higher concentrations of the size liquor to obtain the predetermined size add on. In high pressure squeezing, the squeeze roll loading is up to approximately 9000 kg (20,000 lb), which is about 15 times the loading used in a conventional size box. In high pressure squeezing, the quantity of water evaporating during the drying process will be lower, thereby allowing not only savings in drying energy, but also an increase in sizing machine productivity. The drawback of the high pressure squeezing is that the top squeeze rolls deflect or bend when loaded at such high pressure. This results in a nip size variation across the width of the roll, as shown in Fig. 16. An uneven nip zone width causes a variation of squeezing pressure across the roll width, resulting in variation in size add-on from the selvage to the center of the warp sheet. For narrow size boxes (1.4-m width of yarn sheet) West Point Co. research has found that the variation in size add-on due to top roll bending is not significant. Nevertheless, in the case of wider size boxes corrective action incorporating “crowned” squeeze rolls should be used to obtain a uniform nip width. A crowned squeeze roll is produced by grinding the rubber cover top roll to a slightly larger diameter in the center than at the ends. This compensates for the possible bending of the top roll while under high pressure and provides a reasonably uniform nip width and squeezing pressure across the entire width of the roll.



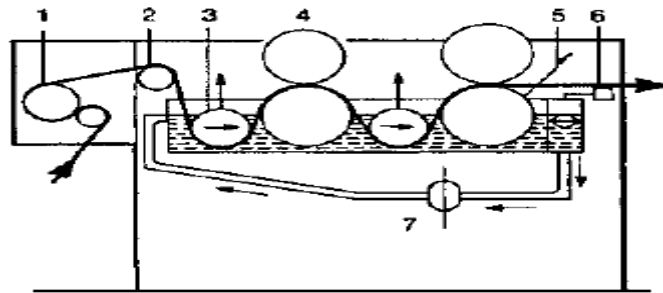
**Figure 3.20:** Schematics showing nip deformation in high pressure squeezing

***Uniform sizing over warp width and length.*** The sizing of warps demands an absolutely uniform squeeze pressure application over the entire warp width. Only in this way is it possible to guarantee a uniform size pick-up from the centre and the edges. Required for this is a special squeeze roller with a mathematically defined flexing characteristic. Simultaneously the application of the pneumatic squeeze pressure with air-cushion cylinders is indispensable. Small steps for the squeeze pressure regulation can only be achieved by a system with no friction losses. The programmability of the squeeze pressure curve, independent of crawl or production speed, ensures a uniform size pick-up.



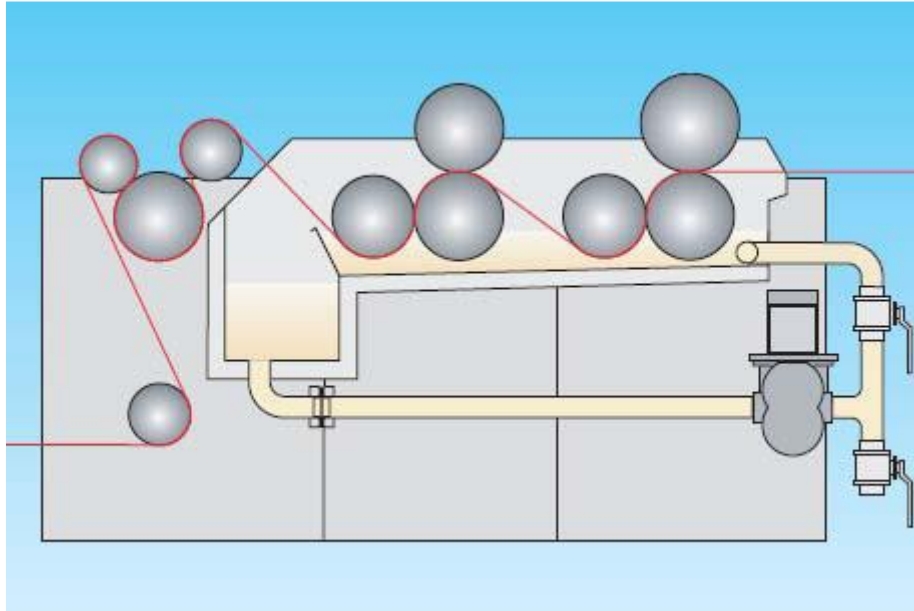
**Figure : 3.21:** Uniform sizing over warp width and length

A *double squeeze* size box with twin rolls is also used for slashing light and heavy warp sett spun yarns. The twin immersion rolls allow both sides of the yarns to be exposed to the size mixture, thus ensuring uniform coating and penetration of the size liquor. Both squeeze rolls are equipped with independent loading and lifting controls. This provides flexibility to the slashing operator in using either one or both rolls depending upon the requirement. A size box having double roller, double immersion with high pressure squeezing, as shown in Fig. 19, is also used. In such a size box, one set of immersion and squeeze rolls is followed by another set of immersion and squeeze rolls. A recent development is the Equi-Squeeze Size Box, shown in Fig. 20. In this system the top squeeze roll position is adjustable. A unique bracket and loading system allows the positioning of the roll to the rear 15 or 30 degrees off the top center position, as shown in Fig. 20. By moving the roll to the rear, the adherence of yarns to the roll as they leave the squeezing nip is minimized.



**Figure .3.22:** Schematic of double squeeze rollers, double immersion with high pressure squeezing

**Liquor consumption.** The liquor level in the size box is measured with a maintenance-free sensor, unsusceptible to contamination and regulated to the specified level. This measurement serves to measure liquor consumption and calculate the actual size pick-up.



**Figure. 3,23:** Modern size box

**Size box heating.** Two heating systems are matched optimally to one another. The indirect heating in the double bottom compensates the heat loss by radiation and the direct steam heating responds quickly and effectively. High circulation and low liquor level ensure an homogeneous liquor.

**True wet splitting.** With a high yarn density in the size box, there is less dust and less warp yarn hairiness when working with true wet splitting. A basic prerequisite for this is the large dimensioned, steam heated deflection rollers.



**Figure . 3.24** Wet Splitting Rollers

The sizing machine size box sizing control method. Method , concrete steps are as follows:



(1) yarn water is prewetted: warp thread is prewetted in the tank of prewetting of uniform temperature earlier before starching;

(2) force sprayed slurry: the warp thread after prewetting is forced starching by spraying out the slurries that have certain flow in the slurry jet pipe to the yam surface that is subjected to strong extruding;

(3) the squeezing roller level is forced pressure: can move horizontally squeezing roller and a fixing sizing roller by two and form and force pressing system, yarn is carried out the level extruding by squeezing roller and sizing roller.

The temperature of the described tank of prewetting is controlled at 80-95 °C.

### 3.4 Quality of sized yarn

**Highest warp quality when sizing** a modern weaving operation must be uninterrupted, assuring high efficiency, irreproachable quality and low-cost production. The foremost goal of the sizing department is therefore the production of top quality warps. The principle sizing factors influencing weaving efficiency are size pick-up, hairiness and yarn stretch. Through the use of advanced control and regulating technology, these parameters remain constant and optimal. The automatic monitoring of the machine ensures high reproducibility and the highest quality of the sized warps.

#### Highest quality

- ✓ Uniformly optimal sizing
- ✓ Low hairiness
- ✓ Low elongation
- ✓ Automatic section tension control
- ✓ High reproducibility

#### High productivity

- ✓ Simple attendance
- ✓ Automatic monitoring of all parameters

✓ Comprehensive recipe management

Warp yarns from warping beam placed in a creel are withdrawn and fed to the size box by a feed roll. The yarns are then impregnated in size liquor preheated to a desired application temperature. Then the yarns are passed through a pair of rolls, commonly known as squeeze rolls, to squeeze out excessive size before they are subjected to the drying cylinders of the drying zone. This is necessary to minimize the drying energy required to dry the warp yarns. The yarns wet with size solution are passed over and under the heated drying cylinders to dry the sheet of warp yarns to a desired level. The dried yarn sheet is then passed through a series of bust rods in the splitting zone to separate the yarns. In the final phase, the separated yarns are passed through a guide comb and wound onto a weaver's beam.

The following are the quality of sized yarn

1. Flexible squeeze rollers for uniform sizing
2. Air-cushion cylinder for hysteresis free pressure application
3. Textured or structured surface for reduced hairiness
4. Programmable squeeze pressure curve
5. Simple attendance at the size box
6. Clearly defined wet splitting per size box

## Self check-3

### Part 1:

1. Which one is the objective of sizing?
  - A. To change chemical properties of yarn
  - B. To improve mechanical properties of yarn
  - C. To increase the stress of yarn during weaving
  - D. All
2. Which one is correct about the sequence of yarn sizing?
  - A. creeling, Drying ,Separating, Impregnating, beaming
  - B. Creeling, Impregnating, Separating, Drying, Beaming
  - C. Creeling, Impregnating, Drying, Separating, Beaming
  - D. Creeling, Drying, Impregnating, Separating, Beaming
3. Which operation is not taken place in sizing box?
  - A. Immersion of yarn in sizing chemicals
  - B. Squeezing of Yarn
  - C. Drying of yarn
  - D. All
4. Why size cooker coated with asbestos & ceramics?
  - A. To avoid the burning of operators
  - B. To increase the temperature of cooker
  - C. To decrease the temperature of cooker
  - D. None
5. What is the aim of size storage?
  - A. To use it for the other time
  - B. To dispose the left size
  - C. To sell to the other company
  - D. All

## Part II: - Matching

### Column- A

- 1 Removal of end product from machine
- 2 The first step for sizing process
- 3 Quality of sized yarn
- 4 Types of sizing machine
- 5 Sow box

### Column- B

- A Cylinder sizing machine
- B Running machine
- C Sizing box
- D Doffing
- E Safety work area
- F Set changing
- G Flexible squeeze rollers for uniform sizing

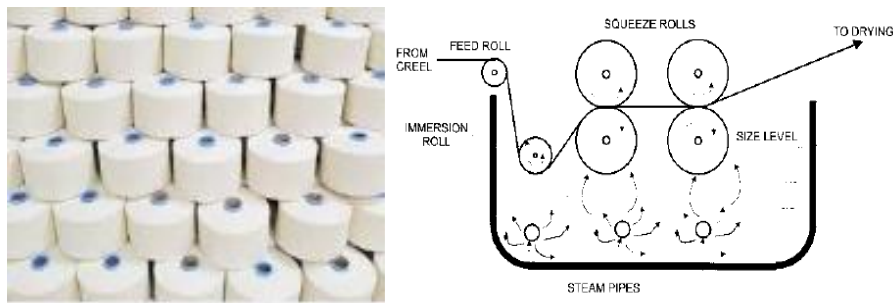
## Part II: - Short answer

1. Write down the process operation Flow chart of sizing ?
2. What Is Sizing?
3. What is sizing process?
4. What is doffing in sizing
5. Define sizing machine ?

## Operation sheet-3

### Operation title: performing sizing process

- **Purpose:** To perform sized yarn for weaving process
- **Instruction:** Using prepared sizing recipe, warp yarn and the given equipments. You have given 30min -1hr and the temperature  $80-95^{\circ}\text{C}$  for the task and you are expected to write the answer on the given line.



**Figure 3,25** Sizing process materials and Size box machine

- **Tools and requirement:**
  1. Cooking unit
  2. Control panel
  3. Stirrer
  4. Liquor storage with liquor solution
  5. Thermometer
  6. Size box
  7. Viscometer:

## 8. Steps in doing the task

1. Set change
2. Set sizing machine
3. Run the machine
4. Doffing the sized yarn package
5. Compilation of operation
6. Record and report documentation
7. Dispatching to the next process or to the ordered customer

- **Quality Criteria:** the given warp yarn produce quality sized and shaped yarn through the process
- **Precautions:** use OHS practice to maintain safe environmental work place

## Lap test 3

Name\_\_\_\_\_ Date\_\_\_\_\_

Time Started\_\_\_\_\_ Time Finished\_\_\_\_\_

### Instructions

1. Perform sizing operation.
2. Request your instructor for evaluation & feed buck

## Unit Four: Completion of operations and Completion records

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

- Doffing sized beam
- Dispatching empty beams and remnants
- Cleaning of area and disposal of waste
- Preparing report
- Maintaining records

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:

- clarify (date, time, count, length ...) doffed Sized beam
- Dispatch Empty beams and remnants
- Cleaning of area and disposal of waste completed to ensure work environment maintained in safe and productive manner.
- Prepare report
- Maintain records



## 4.1 Completion of operations

### 4.1.1 Doffing sized beam:

Any fabric-manufacturing machine consists of a cylinder, beam, roller or shaft and conveyer belt system. Inbuilt in shafts and act to separate the fabrics and arrange them in a parallel form. The doffing shaft or roller also remove the full beam or cylinder is the ‘doffing’ process. The doffing process also provides further opportunity for removal time reduction, safety and qualities of the same fabric

Paste the gum tape on the beam just 2-3 meters before the end of each Paste the another tap on the beam after the completion of the beam

Note the following set details in the “ sizing production register ‘after the completion of the Set,

- a. Set No.
- b. Count
- c. Beam No.
- d. Total Ends
- e. Beam Metres
- f. Size Pick Up
- g. No. Of Lappers
- h. No of Migra

### 4.1.2 Dispatching empty beams and remnants

Dispatching is the physical handing of a manufacturing order to the operating facility (a worker) through the release of orders and instructions in accordance with a previously developed plan of activity (time and sequence) established by the scheduling section of the production planning and control department

Dispatch function in production management executes planning function. Dispatching ensures that the plans are properly implemented. Dispatch function determines, by whom the job shall be done and it co-ordinates production. It is the key point of a production communications system. It creates a direct link between production and sales.

Dispatcher transmits orders to the various shops. A dispatcher is familiar with the productive capacity of each equipment. He always keeps an eye over the progress of orders which move at different speeds on different routes

### **Dispatching aspects which have to be taken care of:**

- a) All production information should be available beforehand.
- b) Various order cards and specification drawings should be ready.
- c) Equipment's should be ready for use.
- d) Progress of various orders should be properly recorded on the Gantt charts or display boards.
- e) All production records should be properly maintained

Dispatch function may be centralized or decentralized.

### **In a Centralized dispatch system:**

A central dispatching department, orders directly to the work station. It maintains a full record of the characteristics and capacity of each equipment and work load against each machine. The orders are given to the shop supervisor, who runs his machines accordingly. In most of the cases, the supervisor can also give suggestions as regards loading of men and machines under him.

A centralized dispatching system has the following advantages:

- A greater degree of overall control can be achieved.
- Effective co-ordination between different facilities is possible.
- It has greater flexibility
- Because of urgency of orders, changes in schedules can be affected rapidly without upsetting the whole system.
- Progress of orders can be readily assessed at any time because all the information is available at a central place.
- There is effective and better utilization of manpower and machinery.

### **In a Decentralized dispatching system:**

The shop supervisor performs the dispatch function. He decides the sequence of handling different orders. He dispatches the orders and materials to each equipment and worker and is required to complete the work within the prescribed duration.

In case he suspects delay, with due reasons, he informs the production control department.

A decentralized dispatching system has the following advantages.

- a) Shop supervisor knows best about his shop; therefore, the work can be accomplished by the most appropriate worker and the machine.
- b) Elaborate reports and duplication of postings can be avoided
- c) Communication gap is reduced
- d) It is easy to solve day-to-day problems
- e) It keeps the natural urge of a section to be self-sufficient.

The advantages of a centralized system, more or less give an idea about the disadvantages of the decentralized system and vice versa.

### **Forwarding sized yarn beam to weaving section**

The primary purpose of the weaving process is to obtain the sized yarns, most likely to be woven without major damages during the passage of yarn through the process.

As the warp beam wraps a predetermined amount of yarn; a lease yarn is inserted that helps to separate each yarn from each other during weaving .

The required length of the yarn which is winded onto wrappers beam depends on the length of the yarn on the weaving beam. During the sizing process, weaving beams

#### **4.1.3 Cleaning of area and disposal of waste**

A workstation is placed occupied by the worker when the work is performed. In case when large amount of volume where produced it needs more space. A well-designed workstation is important for productive work. Most workers in factories producing similar or different productions in a lot in efficient and quickly can result in greater productivity and reduce material handling. Designing for efficient workstation and produce good quality products are placing materials, tools and equipment on the appropriate manner. Any object that is frequently grasped or used should be located between 15 to 40 cm from the work surface.

Fixed location assists the workers develop good working habits and reduce their time. Generally, good workstation helps workers can doing their tasks more comfortably in the proper way.

Thus, in general the scope and objective of ergonomics is “designing for human use and optimizing working and living conditions”. Thus, human factors (ergonomics) discover and apply information about human behavior. Abilities and limitations and other characteristics to the design of tools, machines, systems, tasks, jobs and environment for productive, safe,

comfortable and effective human use. Ergonomics aims at providing comfort and improved working conditions so as to channelize the energy, skills of the workers into constructive productive work. This accounts for increased productivity, safety and reduces the fatigue.

## 4.2 Completion of documentation

In order to control, know, and easily transfer information about the past work all the activities are to be recorded and reported to the concerned person so as to have uniform flow of information, which intern facilitates the or ensures the continuity of the production. Most of the time the log books are used for these cases

### 4.2.1 Maintaining records

As its name implies, a completion report is written when a project has come to an end. The objectives, plan of work, and other items laid out in the proposal have been completed, and the final task is to write up the results of the project.

A description of the process by which the project was approved, and the business case for undertaking the project.

A summary of the project execution, including whether the project met its objectives or not.

### Progress of report

One of the most important project reports you'll generate over the course of executing a project is the progress report. It is a report that updates the information about your project, specifically if it's meeting the baseline set by the schedule and budget

### In the project completion report

- A review of the project story
- what happened,
- what was learned
- what went well and didn't go well, and
- measurements of the process and the product must reported

### What is report writing process?

- preparing to write.
- organizing the information;
- writing draft copy;

- editing the information; and revising the text.

### **How to write a work report**

- Identify your audience. ...
- Decide which information you will include. ...
- Structure your report. ...
- Use concise and professional language. ...
- Proofread and edit your report.

### **4.2.2 Maintaining records**

After all sizing activities are carried out; the operators need to record/write down all sizing output including amount of sized beam and any problems encountered in work place area. And the recorded data are kept for file in the future

Accurately, record production & other documentations. Production records are the amount of product produced in a given time. Other documentations includes: Records of faults & risks in a given time etc

Documentation is a set of documents provided on paper or online, or on digital or analog media, such as audio tape or CDs

### **Procedure and techniques of documentation:**

It is vary from sector to sector. In general these may involve documenting drafting, formatting, submitting, reviewing, approving, distributing, reposting and tracking, etc. it could also involve creating content from scratch. Documentation should be easy to read and understand.

### **How do you record project progress?**

Here are just a few effective ways of tracking project progress as a project manager.

- Create a Project Outline. Working with team members to create a project outline can be a great way of tracking project progress. ...
- Establish Goals and Milestones. ...
- Check in Regularly. ...
- Ask How You Can Help. ...
- Establish Clear Deadlines.

## Self check 4

### Part I: Multiple Choices

**Instruction:** Choose the best answer from the following alternative

1. the activity performed after sizing is completed known as
  - A. Unloading
  - B. Doffing
  - C. Dispatching
  - D. A&B
  - E. B&C
2. The physical handing of a manufacturing order to the operating facility (a worker) or the release of orders
  - A. Unloading
  - B. Doffing
  - C. Dispatching
  - D. A&B
  - E. B&C
3. One of the following written when a project has come to an end
  - A. Report
  - B. Record
  - C. Documentation
  - D. Completion
  - E. A&B
4. \_\_\_\_\_ are the amount of product produced in a given time.
  - A. Production record
  - B. Production report
  - C. Documentation
  - D. Completion
  - E. None
5. One of the following is dispatching aspects which have to be taken care of
  - A. All production information should be available beforehand.

- B. Various order cards and specification drawings should be ready.
- C. Equipment's should be ready for use.
- D. .All production records should be properly maintained
- E. All of the above

## Part II: Short Answer writing

Instruction: write short answer for the given question. You are provided 5 minute for each question and each point has 8PointS

1. What is Centralized dispatch system? Explain
2. What is decentralized dispatch system? Explain
3. Write the Procedure and techniques of documentation during recording.
4. What is report writing process?
5. Immediately after the doffing of the warped beams , what have been written on the warped beams using ?
6. What information are written After the compilation of doffing the warped beams ?
7. What is doffing ? explain ?
8. How do you record project progress?

## Part II: Matching

"A"	"B"
1 Loading	A Warp count
2 Unloading	B Record project progress
3 Information written on the complete pr.	C dispatching
4 Create a Project Outline	D By identify audience
5 How to write report	E creeling
	F doffing

## Operation sheet-4

**Operation title:** prepare schedule for dispatching production product planning

- **Purpose:** To maintain activity of work plan
- **Instruction:** Using the given materials and tools. You have given 30min -1hr

### Tools and requirement:

1. Paper,
2. Ruler,
3. Pencil.
4. Scale:
5. Scheduling template

### Steps in doing the task

1. Prepare the schedule for production plan and dispatched product scheduling plan
2. Identify customer order first in first out
3. Received the product production cost
4. If there is agreement prepare prepare transportation for dispatching product.
5. Finally forward the product according to customer need

- **Quality Criteria:** The dispatching quality of product satisfy the customer need
- **Precautions:** use the standard template to prepare production plan and deliver production goods



## Lap test 4

Name\_\_\_\_\_ Date\_\_\_\_\_

Time Started\_\_\_\_\_ Time Finished\_\_\_\_\_

### Instructions

**Task 1:** preparing schedules for production plan .

**Task 2:** preparing schedules for delivery of .product

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