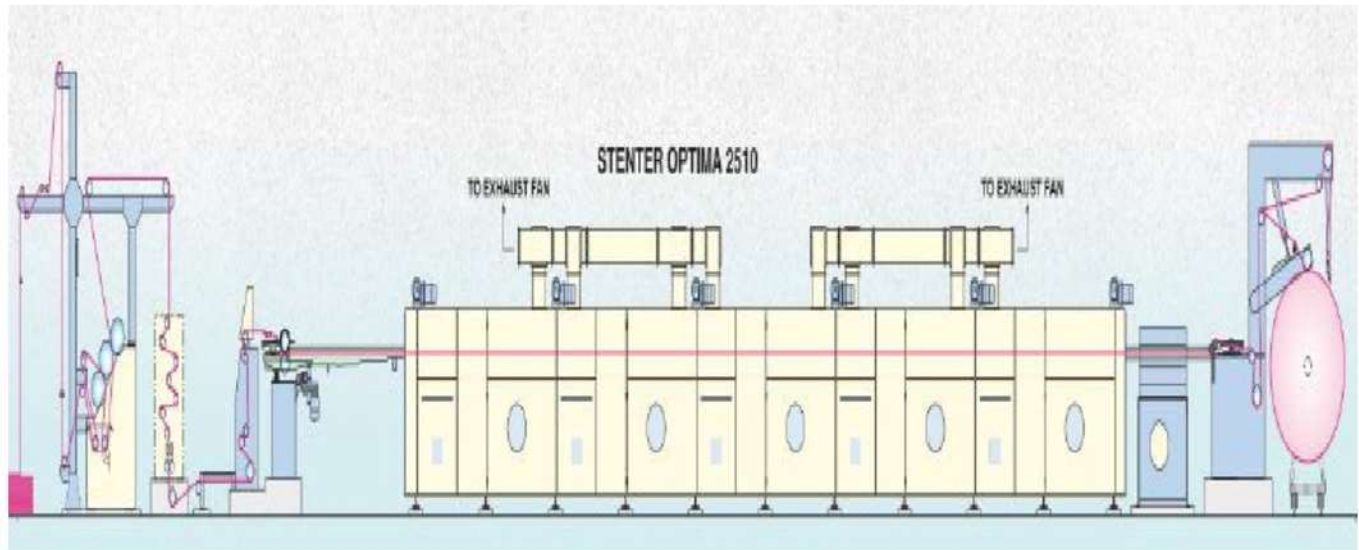


Introduction

Stenter is an open width fabric finishing machine in which the selvages of a textile fabric are held by a pair of endless traveling chains maintaining tension. The attachment of fabric may be by pins or clips. Such machines are used for drying, heat setting of thermoplastic material, fixing of dyes and chemical finishes, chain mercerizing, controlling fabric width etc.



Functions of Stenter Machine

- i) Controlling the width of the fabric by adding or releasing tension in its selvages.
- ii) To give the fabric some chemical finishes as required.
- iii) Fixing the dyes or chemical finishes over the fabric.
- iv) Drying the fabric after dyeing or wet chemical finish processes.
- v) Heat setting of the Thermo Plastic material.
- vi) Chain mercerizing.
- vii) To have the fabric in roll or other suitable package form in the delivery section of the m/c which then can be dispatched to the customers.

Basic Working Principal of Stenter:

The stenter line has units: 2 padders, 1 weft straightener, 1 tenter and drying chambers. There are also steaming, selvedge degumming and curing arrangement. At least padder is simply wash with water. The squeeze pressure normally 5 bars.

In two padder the fabric is treated with softener. The fabric is passed through tenter. There are two steams along fabric width that apply steam from below fabric. There are gumming unit before drying chamber. In stenter, fabric enters in drying chambers by gripping with chain pin and with over feed/ under feed that is with more controlled conditions. The drying chamber has 7 units. Generally temperature kept about 150 – 200 °C.

The fabric comes out form chamber by tenter chains grip-ping with pins. Before delivery the fabric is removed from the tenter chains by unpinning rollers and then the cutting units cut the additional fabric from the gummed sides. Now at delivery side there is an antistatic arrangement to remove static electricity from heated fabric.

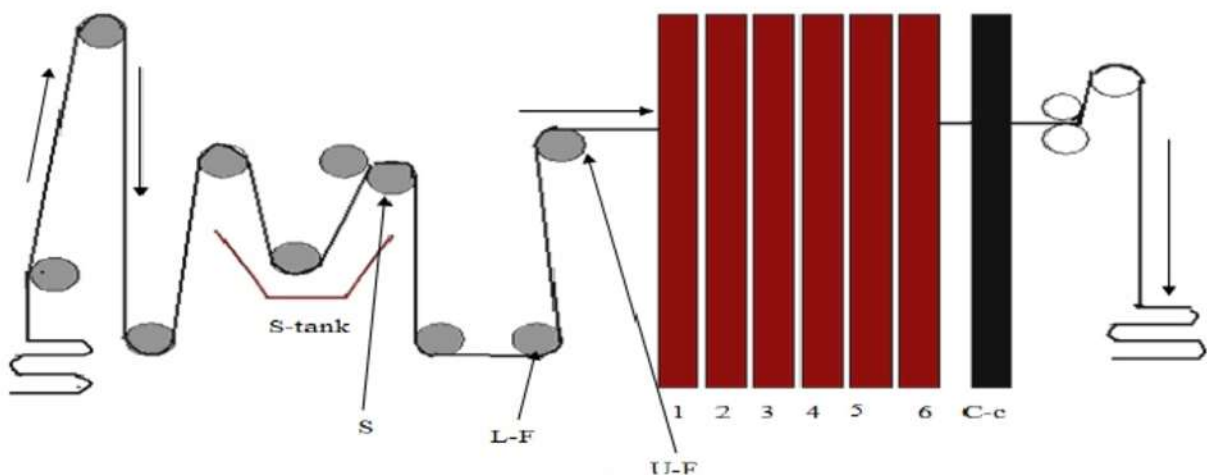


Fig: Flow path of Stenter (BRUCKNER)

(1-6) = Heating chamber.

S-tank = Softener tank

U-F = Upper feeder roller

L-F = Lower feeder roller.

C-c = Cooling chamber.

S = Squeezer roller

Heat Setting:

The purpose of heat setting is to dimensionally stabilize fabrics containing thermoplastic fibers. Blended polyester/cotton fabrics are produced in large quantities. These fabrics may shrink or distorted either during wet processing or in the consumer's hands. Heat setting is a way of reducing or eliminating these undesirable properties. The process is relatively simple - pass the fabric through a heating zone for a time and at a temperature that resets the thermoplastic fiber's morphology memory.

The new memory relieves the stresses and strains imparted to the fiber by the yarn-making and weaving processes, and makes stable the configuration it finds itself in flat smooth fabric. The time and temperature needed for the heat treatment depend on fabric density and previous heat history of the polyester. Usually 15 - 90 seconds at temperatures of 385 - 4150 F will sufficient. The heat setting equipment can be hot air in a tenter frame or surface contact heat from hot cans.

Temperature: Normal – 130-150°c

Heat-Set – 180-210°c

Heating Arrangemen: For Gas Stenter: Rotamatic Burner

For oil Stenter: Thermo-oil

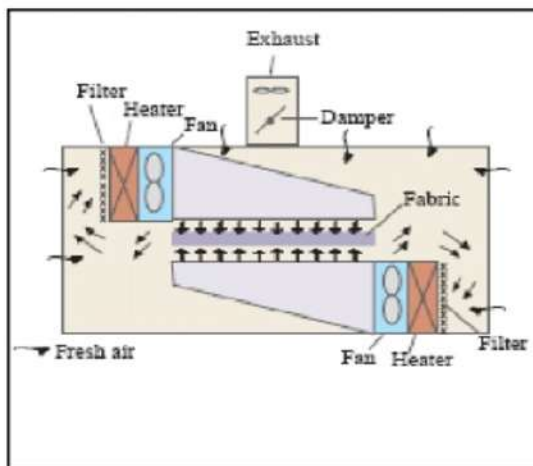
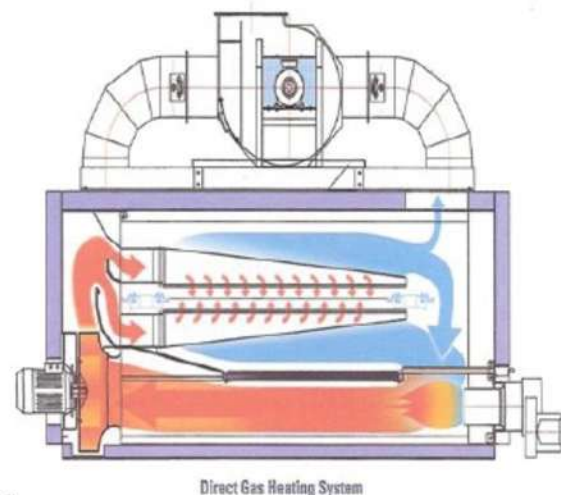
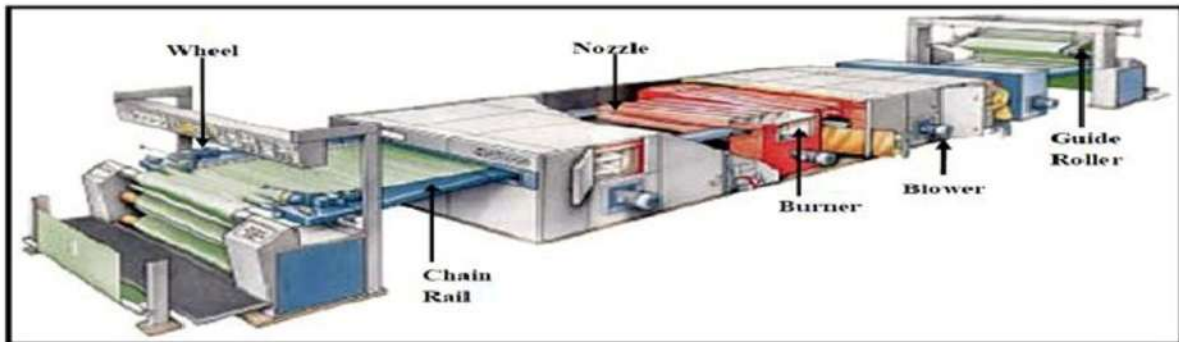


Fig. – Schematic diagram of air flow in stenter



Stenter Machine



Important parts of stenter

- Burner (12)
- Exhaust air fan (16)
- Over feed roller
- Suction fan (12)
- Nozzle
- Chain arrangement.

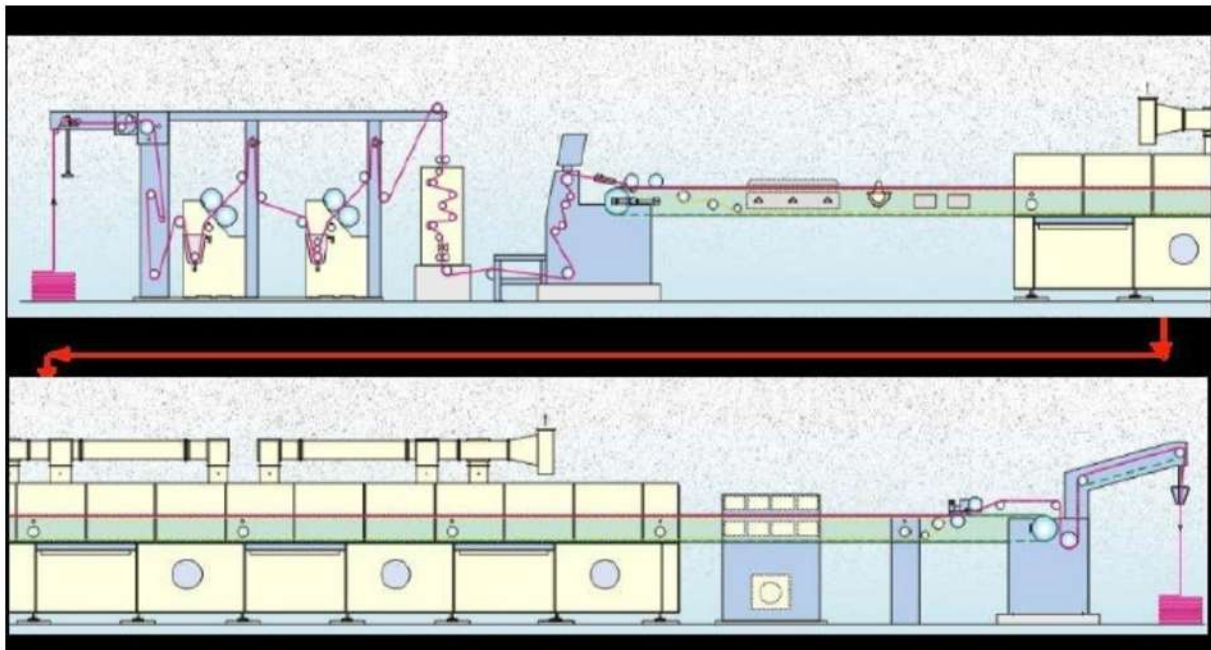
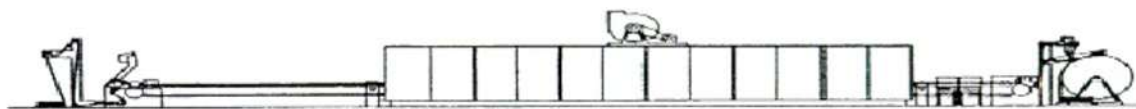


Fig: Diagram of a Stentering Machine with Fabric Path

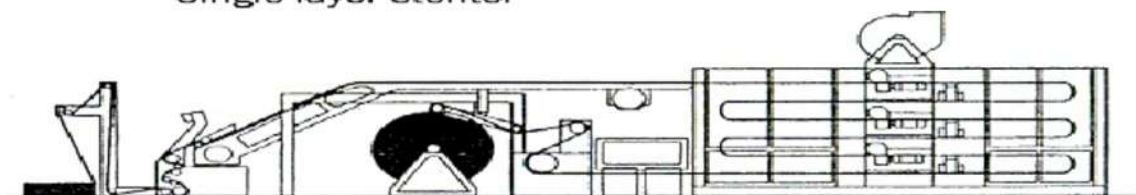
Main parts of the machine:

- ✓ Feed zone
- ✓ Centering device
- ✓ Chemical padding zone
- ✓ Squeezing roller
- ✓ Chemical tray
- ✓ Bowing control zone
- ✓ Bowing roller (rubber roller, no of roller -2)
- ✓ Sensor (no of sensor -6)
- ✓ Uncurling roller
- ✓ Chain entry zone
- ✓ Uncurling device (both side of the chain entry)
- ✓ Sensor (both side of the chain entry)
- ✓ Brush roller (for attaching the fabric with the pin of the chain, no of brush roller -4)
- ✓ Selvedge gumming device with gum box under the chain entry
- ✓ Drying zone
- ✓ Gas rotamatic burner (10)
- ✓ Cooling zone
- ✓ Delivery zone
- ✓ Relax R/r
- ✓ Padder
- ✓ Pin roller
- ✓ PLC profivassleeve converter.
- ✓ Plaiter roller
- ✓ Take up roller
- ✓ Wheel

TYPES OF STENTER



Single-layer stenter



Multi-layer stenter

Working Process :

Basket

⇓

Spindle R/r

⇓

Centering R/r

⇓

Spindle R/r

⇓

Water Padder

⇓

Squeezer (1) (4 PSI)

⇓

Dancing R/r

⇓

Spindle R/r

⇓

Softener Padder

⇓

Squeezer-2 (3PSI)

⇓

Dancing R/r

⇓

Bowing control R/r

⇓

Under feed R/r

⇓

Over feed R/r

⇓

Brush wheel

⇓

Endless Pin Chain

⇓

Steam BOx

⇓

Burner Chemicals

⇓

Cooling Fan

⇓

Take-up R/r

⇓

Planter

⇓

Delivering Basket

DIFFERENT SECTIONS OF STENTER MACHINE

- **Padder Section:** In the padder section the fabric is treated with chemicals specially with softener and acid in two tanks.
- **Weft Straighter:** The main function of Weft Straightner is to control the bowing & Skewness of the fabric.
- **Width Setting Chamber:** This Chamber control the width of the fabric by clip of pin.
- **Heating Chamber:** This chamber controls the shrinkage and the G.S.M of fabric.

Temperature Range:

Cotton-- 150⁰C~170⁰C

Polyester-- 165⁰C~185⁰C.

With Lycra -- 175⁰C~190⁰C.

- **Cooling Chamber:** This chamber cooled the hot fabric before reach to delivery zone.
- **Exhaust Motor:** This specific part used to exit the steam produced in the chambers and also exit the extra temperature from the machine.
- **Delivery Zone:** This zone delivered the fabric in a folded form. In this zone the fabric has to pass through several rollers in order to prevent the formation of crease mark in the finished fabric.

Fabric Feeding

The In-feed system can be supplied suitable to take up fabrics either from batches or loose folds. The machine can be applied with an Accumulator for continuous operation.

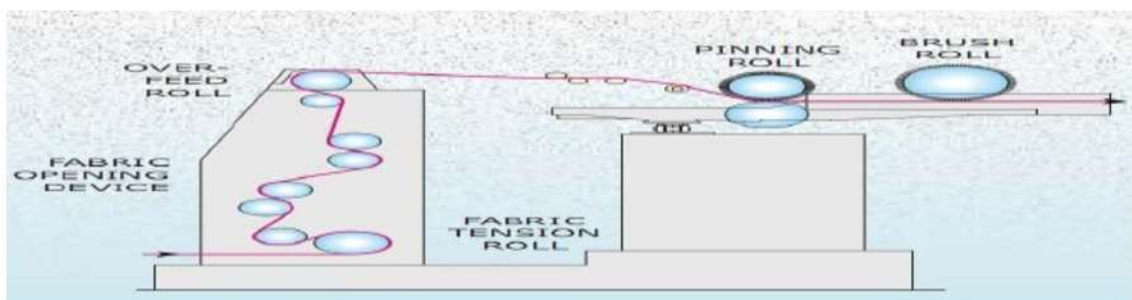


Fig: Fabric Feeding Zone

Over Feed Zone

A simple and accurate over-feed system using Variable Frequency Drives with AC Geared Motors ensures perfect and precise Selvedge Tension rollers.

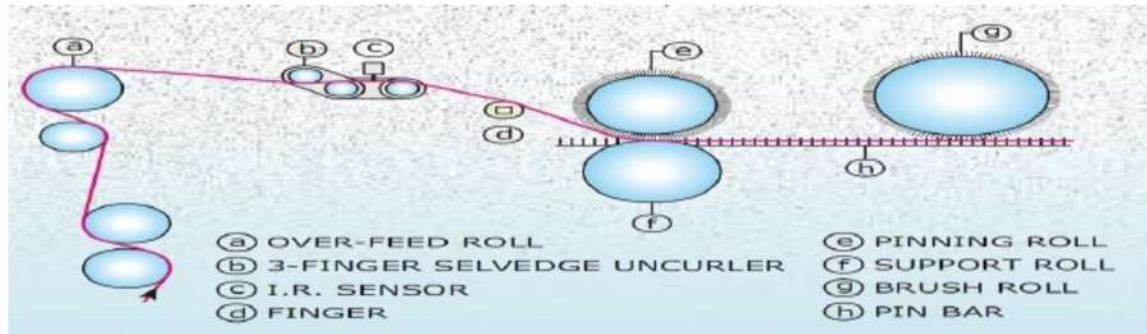


Fig: Over Feeding Control Zone

Technical Parameters

Machine Parameter	Set Up Value
Padder Pressure	Bar (depends on the pick up requirement of the fabric).
Temperature Setting	90-180 C (according to the shade, quality and process of fabric).
Blower Fan Setting	Low or high (according to the quality of fabric).
Exhaust Fan Setting	Manual.
Width of Machine Chain Setting	110 cm up to 260 cm (according to the required fabric width of fabric).
Over Feed	60% (as per the required weight of fabric).
Burner Gas Pressure	30-50 m/bar.
Machine Speed	60 up to 60 m/min (according to the quality of fabric).
Light Weight (100-140) gm	14-18 m/min
Heavy Weight (190-250) gm	10-150m/min

Parameters for cotton Fabric:

Fabric Type	Overfeed %	Temperature°C		Speed (m/min)	Stretch (%) Inch
		Light Color	Deep Color		
Single Jersey	30 % to 45%	150-155°C	160-165°C	25~28	Depend on fabric G.S.M
Single Lacoste	30 % to 42%	150-160°C	160-165°C	22~26	Depend on fabric G.S.M
Polo Pique	30% to 45%	150-160°C	160-165°C	20~25	Depend on fabric G.S.M
Interlock	30 % to 40%	165°C	165-170°C	22~24	Depend on fabric G.S.M

Maintenance Points of a Stenter Machine

- Fabric Feeding
- Over Feed Zone
- Chemical Finish by Padder Roller
- Weft Correcting Zone
- Drying & Curing Zone
- Lubrication
- Others

Machine requires proper maintenance for smooth operation. Maintenance of stenter machine is done in three ways.

- **Breakdown maintenance:** where machine is repaired in its broken or failed point.
- **Preventive maintenance:** where the machine is under check up on timed schedule.
- **Predictive maintenance:** where measuring actions detect the degradation of machine, allowing casual stressor to be eliminated or controlled prior to any significant deterioration in the component physical state.

But in our country the mostly followed way is the first one.

Maintenance:

- **Motor rpm:** motor rpm should check to maintain the proper revolution as we need.
- **Proper movement of roller:** every free roller should move freely as required. We need to ensure the free movement of these rollers.
- **Proper gearing and fabric path:** proper gearing should maintain to maintain proper speed and proper fabric path should maintain to ensure uniform tension through out the machine.
- **Temperature:** proper temperature through the machine should maintain constantly and should rise and lower evenly with the gradient as require.
- **Proper fan speed:** the fan of the Stenter machine is more important parts. So we have to maintain its proper speed
- **Proper width adjust:** control of fabric width should adjust considering the shrinkage of the fabric.

Conclusion

As a finishing machine, stentering machine plays a vital role to make the fabric suitable for delivering to the customers having demanded criteria. A single processing fault in this machine can cause the whole fabric making process to be unworthy & a humiliate loss of time, moey & energy. Therefore proper functioning of each portion of this machine has to be proper & as desired. To assure this, scheduled and proper maintenance of the machine is obvious.

Drying:

Drying is defined as a process where the liquid portion of the solution is evaporated from the fabric. In Relax dryer machine in BKL containing 2 Gas burner, 2 Chamber, 8 Blower and 2 Conveyer net.

Dryer Machine

Dryer machine is used for removing the residual water contained in the fabric after squeezing by applying heat on the fabric. In this machine the fabric is fed on the drying net at low over feed speed and the humidity is continuously measured. Drying is done by applying heat through burner nozzles. During drying the total heat passed through the machine is extracted by the exhaust fan

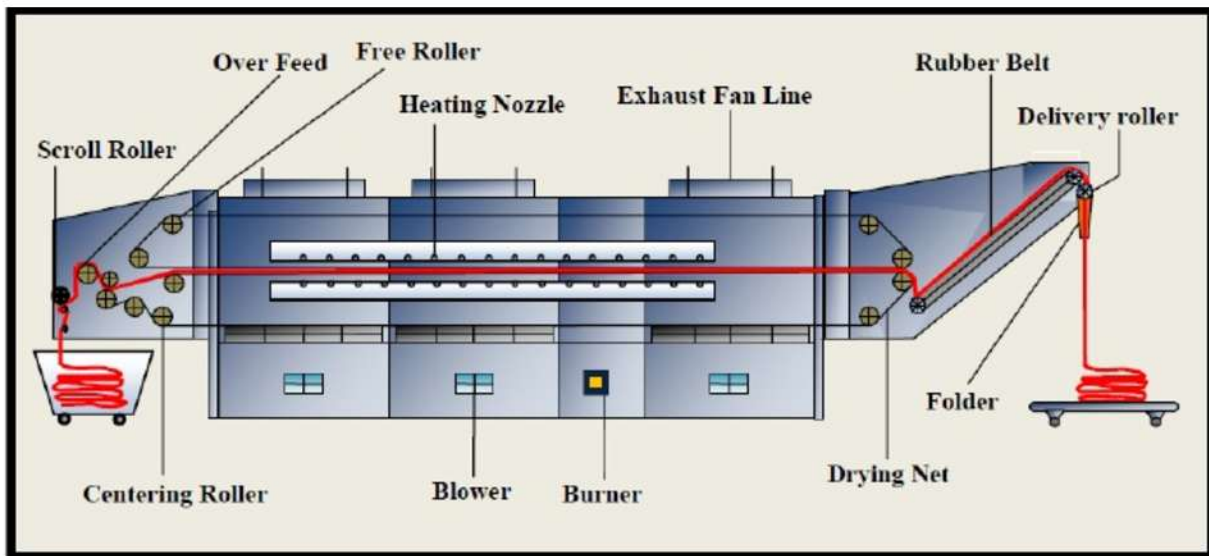


Fig - Schematic Diagram of a Dryer Machine

Functions:

- ✓ To dry the fabric with the help of blower and burner.
- ✓ To control the shrinkage of the fabric.
- ✓ To prepare the fabric for next subsequent process.
- ✓ To dry fabric without tension.
- ✓ To remove residual water containing in the fabric

Key Accessories

- Measuring tape.
- Die-cutter.
- Electronic Balance.
- Expander.
- Scissors.
- Trolley.

Standard Operating Procedure

- ✓ To clean the machine properly.
- ✓ To clean the tray for every chamber.
- ✓ To check the proper activity of burner.
- ✓ To check over feeding and vibrating.
- ✓ To check the conveyor belt.

Working principle of dryer:

The fabric pass through the dryer after dewatering.

The main function of the dryer is given below:

- To dry the fabric
- To control the overfeed system.
- To control vibration which increase the GSM.

The m/c contain two chambers. two mesh endless conveyors are placed lengthwise to the chamber named conveyor net and filter net . each chamber contain aburner, which supply hot air. This hot is guided through he ducting lin by suctionfan. there are a nozzel placed in btnfilter and conveyor net. when fabric pass through on the conveyor net, hot air is supplied to the wet to dry it. There are exhaust fan which such he wet air and deliver to tea to through the ducting line.

The speed of dryer depends on the temp of the m/c & GM of the fabric. If the m/c temp is high& m/c speed also high and the m/ c temp. is low then mc speed also low. The vibration speed of the m/c for heavy fabric is 730m/min and normal fabric is 480m/min.

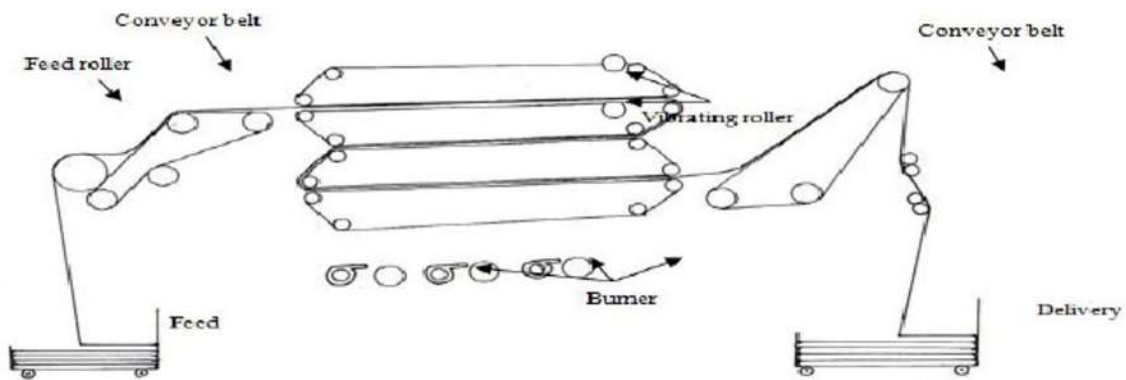


Fig-Schematic Diagram of a Dryer Machine

Machine Setting

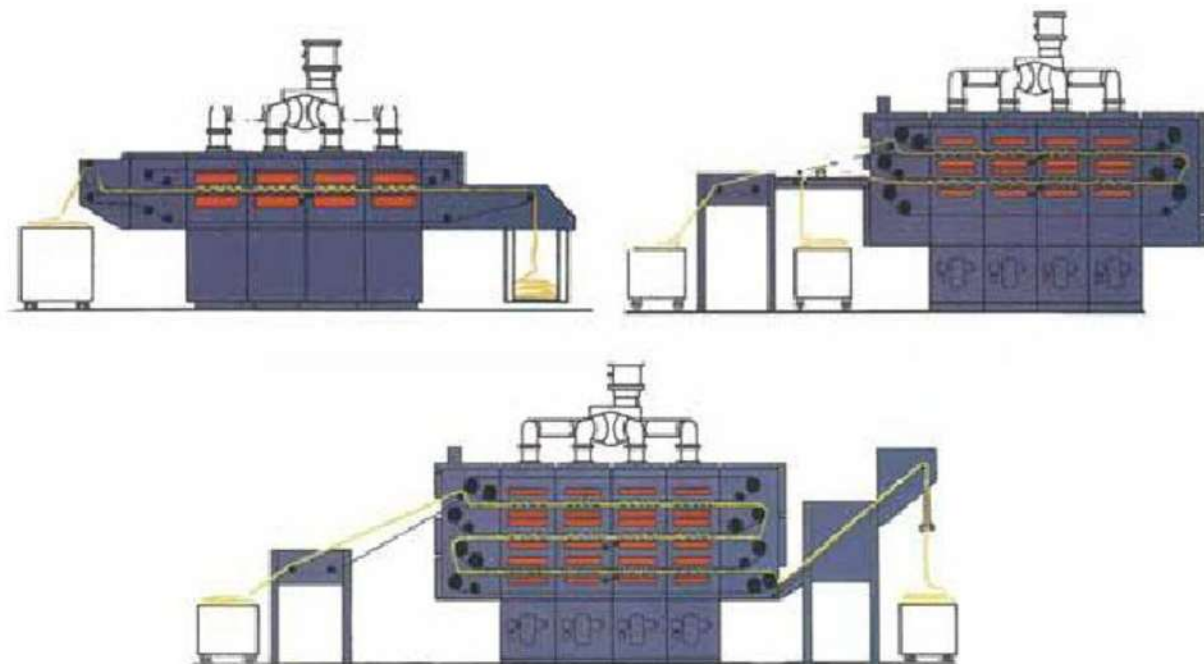
Machine Parameter	Set Up Value
Temperature Setting	(100-120) for white shade, (120-130) for light shade, (130-140) for dark shade, (150-170) for curing.
Blower Fan Setting	Auto
Exhaust Fan Setting	Auto
Machine Speed	3-35 m/min (depends on quality).
Over Feed	0-40% (depends on construction).
Width of Expander Setting	45-114 cm (depends on the required width of fabrics).
Burner Gas Pressure	10-15 M/Bar.

PARAMETERS USED FOR DIFFERENT CONSTRUCTED FABRIC

For cotton fabric:

Fabric Type	Overfeed %	Temperature ^o C		Speed (m/min)		Folder Speed (m/min)	Vibration
		Color	White Color	High G.S.M	Low G.S.M		
Single Jersey	30 % to-40%	150-160 ^o C	130-150 ^o C	15-20	20-25	2~3	As Required
Single Lacoste	30 % to-35%	160-165 ^o C	130-150 ^o C	15-20	20-25	2~3	As Required
Polo Pique	30 % to-40%	155-160 ^o C	130-150 ^o C	15-20	20-25	2~3	As Required
Interlock	30 % to-40%	165-170 ^o C	130-150 ^o C	14-18	22-24	2~3	As Required
Grey Mélange	30%-40%	155-160 ^o C	130-150 ^o C	10-18	20-22	3~4	As Required

Types of dryer



Santex Dryer

- Dryer- (multifunctional)
- Band name:- Santex
- Origin: – China
- M/C Type- Santashrink progress.
- Year of construction- 2008
- Chamber: -4
- Com.no: 6960/2600(mm)
- Elect-Voltage: 3×400/50(Volt/Hz)
- Connected Load: 193/435(KW/A)



Function of Santex dryer m/c:

- ✓ To dry the fabric.
- ✓ To control the hand Feel
- ✓ To control the Twist
- ✓ To control the shrinkage + Dia + Gsm

Main Parts of the Machine:

1. Drying Net.
2. Heating Chamber:
3. Blower.
4. Burner.
5. Free Roller.
6. Centering Roller.
7. Scroll Roller.
8. Folder.
9. Rubber Belt for fabric delivery.
10. Exhaust fan.

Controlling points of dryer:

1. Overfeed .
2. Temperature .
3. Padder pressure .
4. Speed

Heating arrangement:

- ❖ Heating chamber: 4
- ❖ No of burner: 4

Checking points of Dryer:

1. Shade check
2. Width check
3. Fabric faults (color spot, uneven, hole, Dia, mark, ec).

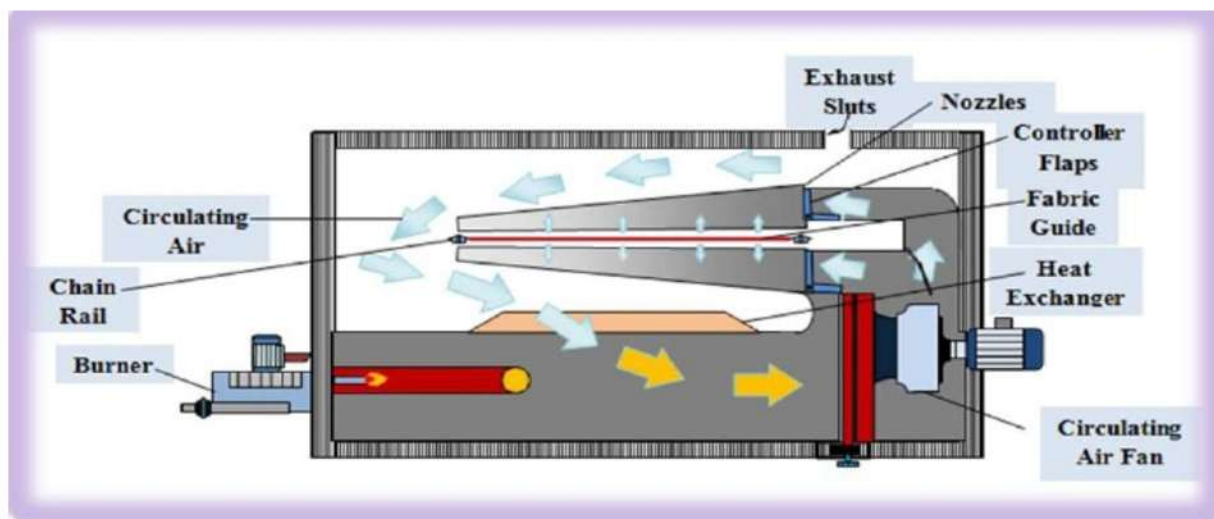
Checking parameters:

1. Overfeed (%) : It depends on fabric structure & GSM
2. Temperature: It depends on color & GSM.(normally for single jersey - 1600C, for high GSM, like-fleece, it may be 2500C)
3. Speed: It depends on fabric GSM. For higher GSM, lower the speed.

GSM	Over feed
Up to 120	14-15%
120-140	12%
140-200	7-8%
200-250	5-6%

Hot Air Circulating System of Dryer

In Dryer machines air is recirculated which passes from the exhaust sluts and air controller flaps. Then the air is passed over the nozzles through which fabric is passed and routes it over to the heat exchanger which lets the air to be heated by the burner. The circulating air fan allows the hot air to pass uniformly through the nozzles to the fabric where the air controller flaps control the upper and lower nozzle air and thus the fabric is heated. Finally the used hot air is passed on to the exhaust air duct.



Operation parameter

Temperature: Set the temperature between 130⁰c -150⁰c for white and
150⁰c -170⁰c for color fabric.

If GSM increase than the temperature is increase Or, if moisture content increase than temperature is also increase.

Standard Operating Procedure:

- Machine should be cleaned
- Padder should be cleaned
- Stenter pin should be checked
- Tray of each chamber should be cleaned
- Function of auto chamber should be checked
- Padder pressure should be adjusted
- Function of burner should be checked
- Overfeeding speed should be checked
- Conveyor belt should be checked
- Dancing roller should be checked

Limitations and faults of the machine and advise for removing these.

- Selvedge drying system is not properly functioning.
- Maximum over feed of the machine is +60%.
- When the steam temperature is 1000C-1200C, then delivered fabric temperature is 45-500C. But there is no cooling zone in this machine to reduce the excess temperature. So a cooling zone in delivery zone can be attached.