RESIDUAL MOISTURE MEASUREMENT AND CONTROL SYSTEM IN STENTER

PALI TEXTILE CLUSTER

BEE, 2010

Detailed Project Report on Residual Moisture measurement and Control system in Stenter

Textile SME Cluster, Pali, Rajasthan (India)

New Delhi: Bureau of Energy Efficiency;

Detail Project Report No.: **PAL/TXT/MCS/10**

For more information

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We have received very encouraging feedback for the BEE SME Program in various SME Clusters. Therefore, it was decided to bring out the DPR for the benefits of SMEs. We sincerely thank the officials of BEE, Executing Agencies and ISTSL for all the support and cooperation extended for preparation of the DPR. We gracefully acknowledge the diligent efforts and commitments of all those who have contributed in preparation of the DPR.

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List of Abbreviations

- BEE - Bureau of Energy Efficiency
- DPR - Detailed Project Report
- DSCR - Debt Service Coverage Ratio
- FD - Forced Draft
- GHG - Green House Gases
- IRR - Internal Rate of Return
- MoP - Ministry of Power
- MSME - Micro Small and Medium Enterprises
- NPV - Net Present Value
- ROI - Return On Investment
- SME - Small and Medium Enterprises
- TFH - Thermic Fluid Heater
- CERs - Certified Emission Reduction

EXECUTIVE SUMMARY

Pali has evolved as one of the most important production centers in the Textile Dyeing and Finishing sector despite there being nothing favorable for proliferation of a cluster. The place lacks all possible resources, from raw materials to fuels, Dyes & Chemicals and above all water which is the most important for processing of textiles. Today there are over 350 units in Pali alone and the production of all of these combined together crosses 5.5 million meter per day mark.

All the Industries in Pali cluster are in SME sector. These Industries process Manmade Fiber, Natural Fiber and blends. The units mainly process lower value clothes and the quality of fabric used is less than 100 gm per RM. Few units have their own brand. Most of the units do job work for traders and the job works are also done process wise. Thus there are different units specializing in a particular process.

The process adopted by the units can be divided into three major classes –

a. Pre treatment

b. Dyeing and Printing

c. Finishing

The majority of units mainly do hand processing and a few (less than 20%) units do power processing. However, the output of the power process units far exceeds those of hand processing units.

Energy forms a major chunk of the processing cost with over 30% weightage in the cost basket. As per the preliminary and detailed energy audit findings, there exists potential of saving over 20% electricity and 30% fuel in the applications in power process industries with over all general pay back period of less than one year. Hand process industries are very less energy intensive, though, there also exists a saving potential of over 20%. The payback period in these industries is higher due to their working schedule and lower utilization of facilities.

The units in Pali cluster use disperse dyes for coloration of Polyester fabric or polyester contained in blends. Heat setting is necessary in these textiles and also finishing after Dyeing – Washing or Printing – Dye Fixation – Washing processes. Stenter is used for the two processes and this is very energy intensive process. Going by connected load and also by the absolute electricity consumption in textile dyeing and processing units, stenter happens to have a share upwards of 50%.

During Energy Audit, major flaws were observed in process control of Stenters. None of the units were found to be equipped with automatic process control facilities leading to large scale deviation from process parameters causing wastage of energy. The basic process parameters for the stenters are Residual Moisture, Humidity in Exhaust, Temperature of the fabric, Dwell Time for Heat Setting and Velocity of Air Jet etc. However, none of these are controlled and setting is done on manual estimation basis which has possibility of error.

Typically one stenter consumes between 40 to 55 kWh per hour electricity and 50 to 60 kg per hour RPC. The implementation of Fabric Residual Moisture Control would help save 28.08 MT RPC per year.

This DPR highlights the details of the study conducted for assessing the potential for installation of retention moisture control system in Stenter , possible Energy saving, and its monetary benefit, availability of the technologies/design, local service providers, technical features & proposed equipment specifications, various barriers in implementation, environmental aspects, estimated GHG reductions, capital cost, financial analysis, sensitivity analysis for three different scenarios and schedule of Project Implementation.

Total investment required and financial indicators calculated such as monetary saving, IRR, NPV, DSCR and ROI etc for proposed technology is furnished in Table below:

S.No	Particular	Unit	Value
1	Project cost	₹ (in Lakh)	1.00
2	Fuel Saving (RPC)	MT/year	28.08
3	Monetary benefit	₹ (in Lakh)	2.11
4	Debit equity ratio	Ratio	3:1
5	Simple payback period	Month	6
6	NPV	₹ (in Lakh)	6.62
7	IRR	% age	156.64
8	ROI	% age	31.25
9	DSCR	ratio	8.45
10	CO_2 saving	tonne	76
11	Process down time	Days	1

The projected profitability and cash flow statements indicate that the project implementation will be financially viable and technically feasible.

ABOUT BEE'S SME PROGRAM

Bureau of Energy Efficiency (BEE) is implementing a BEE-SME Programme to improve the energy performance in 25 selected SMEs clusters. Pali Textile Cluster is one of them. The BEE's SME Programme intends to enhance the energy efficiency awareness by funding/subsidizing need based studies in SME clusters and giving energy conservation recommendations. For addressing the specific problems of these SMEs and enhancing energy efficiency in the clusters, BEE will be focusing on energy efficiency, energy conservation and technology up gradation through studies and pilot projects in these SMEs clusters.

***Major activities in the BEE -SME program are furnished below*:**

Activity 1: Energy Use and Technology Audit

The energy use technology studies would provide information on technology status, best operating practices, gaps in skills and knowledge on energy conservation opportunities, energy saving potential and new energy efficient technologies, etc for each of the sub sector in SMEs.

Activity 2: Capacity Building of Stake Holders in Cluster on Energy Efficiency

In most of the cases SME entrepreneurs are dependent on the locally available technologies, service providers for various reasons. To address this issue BEE has also undertaken capacity building of local service providers and entrepreneurs/ managers of SMEs on energy efficiency improvement in their units as well as clusters. The local service providers will be trained in order to be able to provide the local services in setting of energy efficiency projects in the clusters

Activity 3: Implementation of Energy Efficiency Measures

To implement the technology up gradation projects in clusters, BEE has proposed to prepare the technology based detailed project reports (DPRs) for a minimum of five technologies in three capacities for each technology.

Activity 4: Facilitation of Innovative Financing Mechanisms for Implementation of Energy Efficiency Projects

The objective of this activity is to facilitate the uptake of energy efficiency measures through innovative financing mechanisms without creating market distortion.

1.0 INTRODUCTION

1.1 Brief Introduction about Cluster

Pali is the District Head Quarter of the Pali District situated at a distance of approx. 300 kms from Jaipur and 70 kms from Jodhpur. Pali can also be reached from Ahmedabad via Abu Road and has direct train connectivity to Ahmedabad and Mumbai. The nearest airport having commercial flights plying is at Jodhpur. The map depicting Pali district and its distances from various towns is produced in Fig. 1 below:

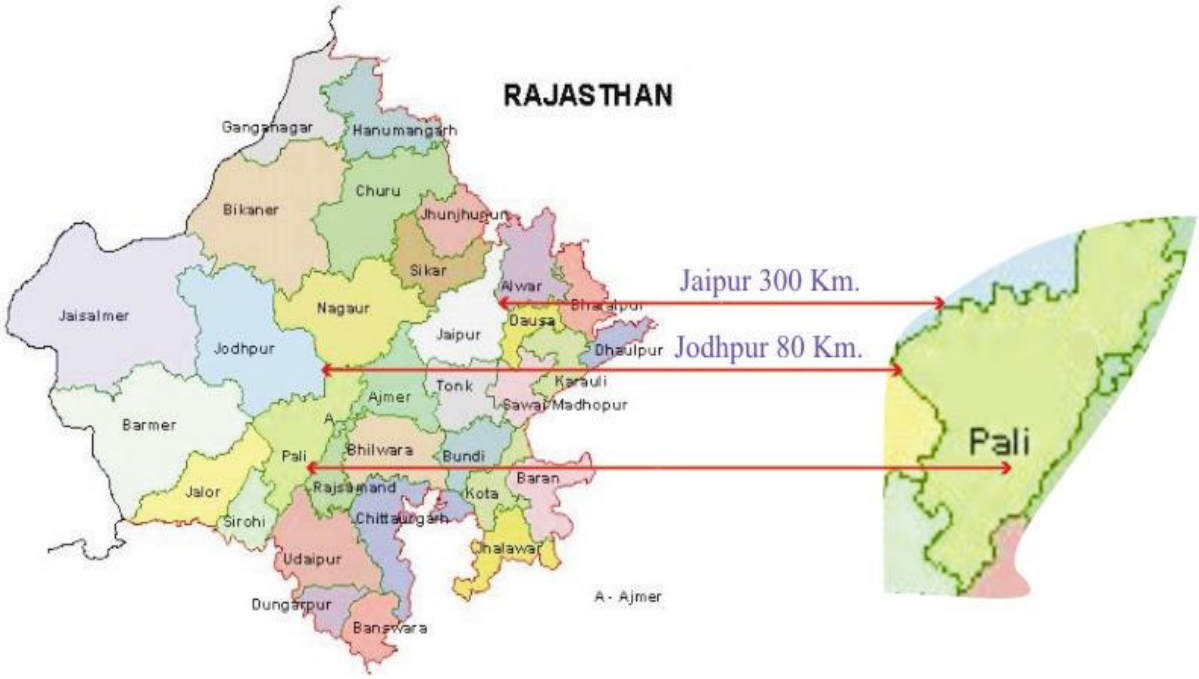


Fig. 1.1 – Pali – Geographical Map

Pali District is rich in minerals and the abundance of limestone deposits has made it home for 5 cement companies. There are several other SME units producing various lime based products. Despite there being non availability of requisite resources like raw material and consumables locally, a dense population of textiles dyeing and processing units has sprung up at Pali.

The Pali textile cluster is one of the biggest SME textile clusters in India having over 350 industries. The units in the cluster are mainly located in two Industrial Areas namely Industrial Area Phase I & Phase II and Mandia Road Industrial Area. Some of the units hitherto functioning in residential colonies are in the process of shifting to a new Industrial Area named Punayata Road Induatrial Area. Over 150 industries are in the process of setting up their facilities in the Punayata Road Industrial area.

Balotra, Jodhpur and Bhilwara are other textile clusters in Rajasthan. These clusters work on more or less similar processes and use same machines, though their output differs. Details of energy consumption scenario at Pali textile cluster are furnished in Table 1.1 below:

Table1.1 Details of annual energy consumption scenario at Pali Textile Cluster

S. No	*Type of Fuel*	*Unit*	*Value*	*% contribution (KLOE)*
1	Electricity	MWh /year	51.3	16.6
2	Firewood	MT/year	2716l	25.6
3	Steam Coke	Tonne/year	2967	5
4	Lignite	MT/year	16635	15.7
5	Diesel	kilolitre/year	89.6	0.3
6	Residual Pet Coke	MT/Year	11820	36.6

1.1.1 Energy usages pattern

Electrical energy Usage

The Cluster has two types of units – Hand Process and Power Process. Hand Process units mainly process cotton and consume very less electricity. These units consume electricity in the range of 4000 kWh to 5000 kWh per month. The hand process units outsource the finishing to other power process units. Power process units are energy intensive units and consume electricity in the range of 1,00,000 kWh to 3,00,000 kWh per month. Various Electricity consuming equipments in the hand process units are Fans, Tube Lights, and Computers etc. Power Process units have Stenter, Jet Dyeing Machine, Loop Agers, Boiler and Thermopac auxiliaries, Flat Bed Printing Machines etc. Stenter happens to be the biggest Electricity guzzler.

Thermal Energy Usage

Hand process units in the cluster are mainly involved in Table Printing, Kier Boiling and Jigger dyeing. Heat for the process is obtained from direct burning of wood. Some units also have open type stenter wherein heating is done by directly burning wood beneath the clothes. Power Process units mainly use Thermal Energy Stenters, Kiers, Jet Dyeing Machines, Sanforizers, Loop Agers, Mercerisers, Scouring, Reduction and Clearance etc. These units use Residual Pet Coke, Lignite, Coal and Wood in Boilers and Thermopacs to make heat usable in machines. Typical Power Process Units use 100 MT to 300 MT RPC

(85 MTOE to 256 MTOE) per month. The hand process units use 3 MT to 15 MT wood per month.

1.1.2 Classification of Units

The Textile units in the Pali Cluster can be categorized into two types based on availability of machinery in the units –

- Hand Process Units and
- Power Process Units

Pali Textile Cluster mainly consists of hand process units and over 250 out of a total population of 350 units are hand process units. These units are mainly owned by artisans or traditional colormen (Rangrej).

On the basis of type of cloth processed, the units can be classified as

- Cotton (Natural fiber) Processing Units
- Synthetic clothes (Manmade fibers) Processing Units

Based on output, the units can be classified as

- Dyeing Units
- Printing units
- Finishing Units

Scale of Operation

Most of the units in the Pali textile cluster are micro units. All the units are in Micro, Small or Medium sector with none of the units being in large scale sector.

Products Manufactured

Different types of products manufactured in Pali Textile Cluster. The marketed products are:

- ✓ Sarees (Lower Price Range)
- ✓ Rubia Blouse Clothes
- ✓ Lungies
- ✓ Turbans
- ✓ African Prints

1.1.3 Production process of Textile dyeing and finishing

The process adopted in Textile Dyeing and Finishing depends upon the fabric processed. The processes are different for Cotton, Polyester and Blended fabrics. The process flow chart for different processes depending upon fabric processed with location of stenter in the process are drawn below –

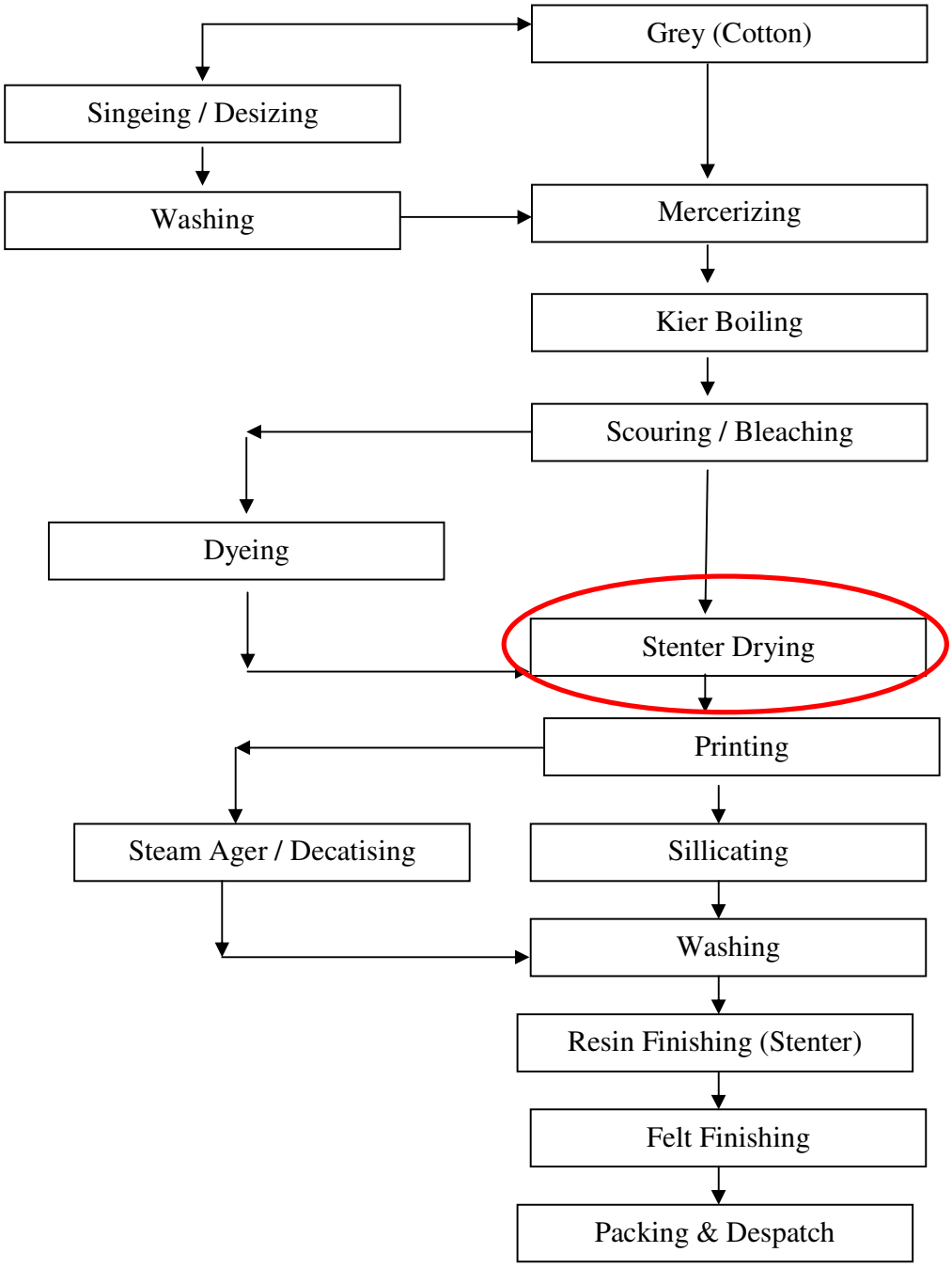


Fig. 1.2 – Process Flow Diagram of Cotton Dyeing and Printing

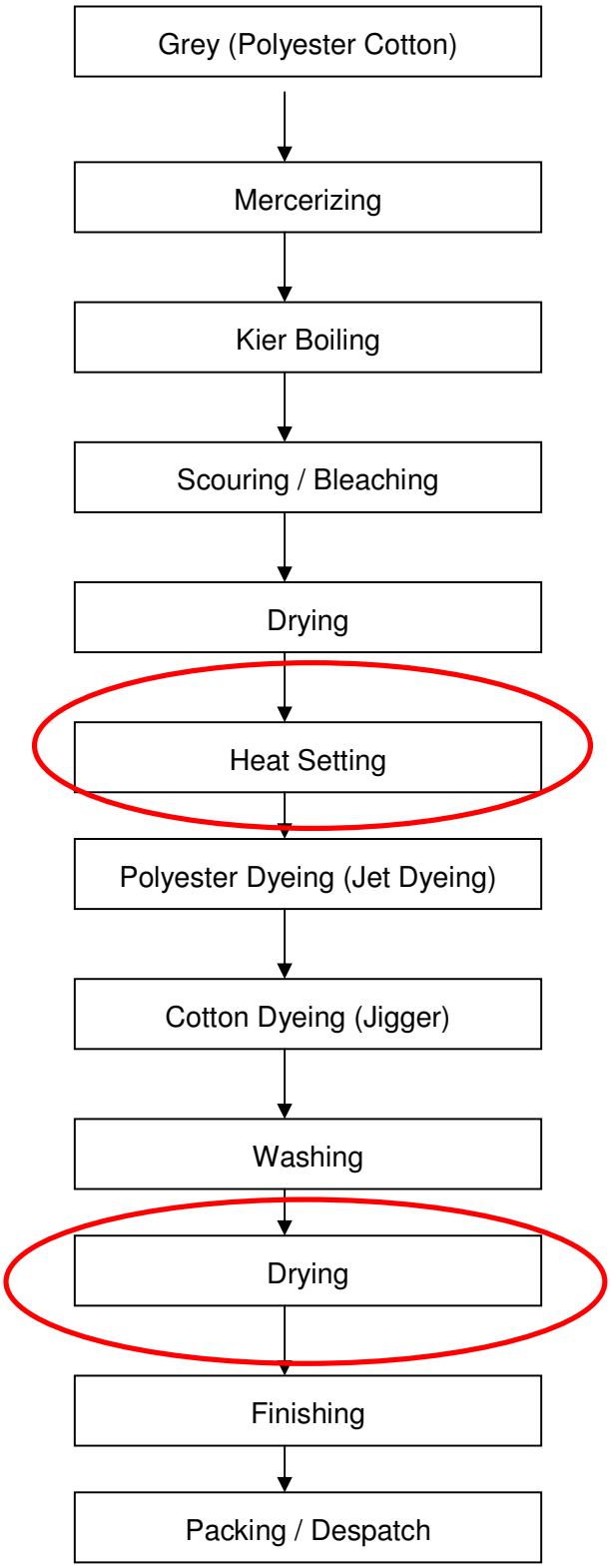


Fig. 1.3 – Process Flow Diagram of Polyester Cotton Dyeing and Finishing

Cluster Manual - Pali Textile Cluster

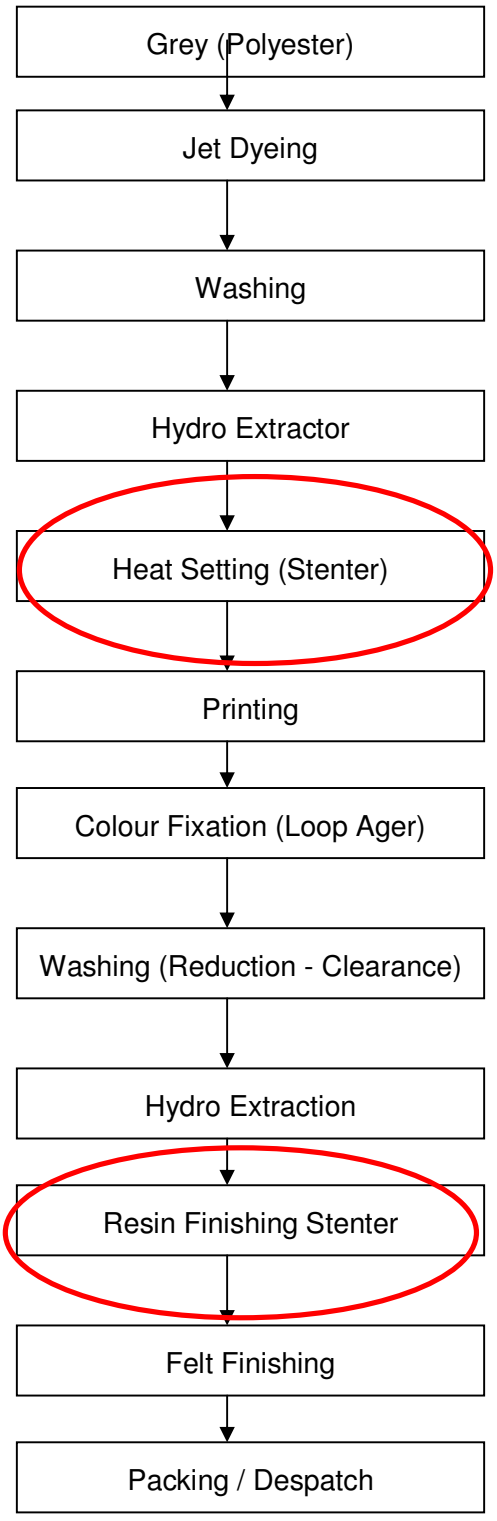


Fig. 1.4 – Process Flow Diagram of Polyester Printing and Finishing

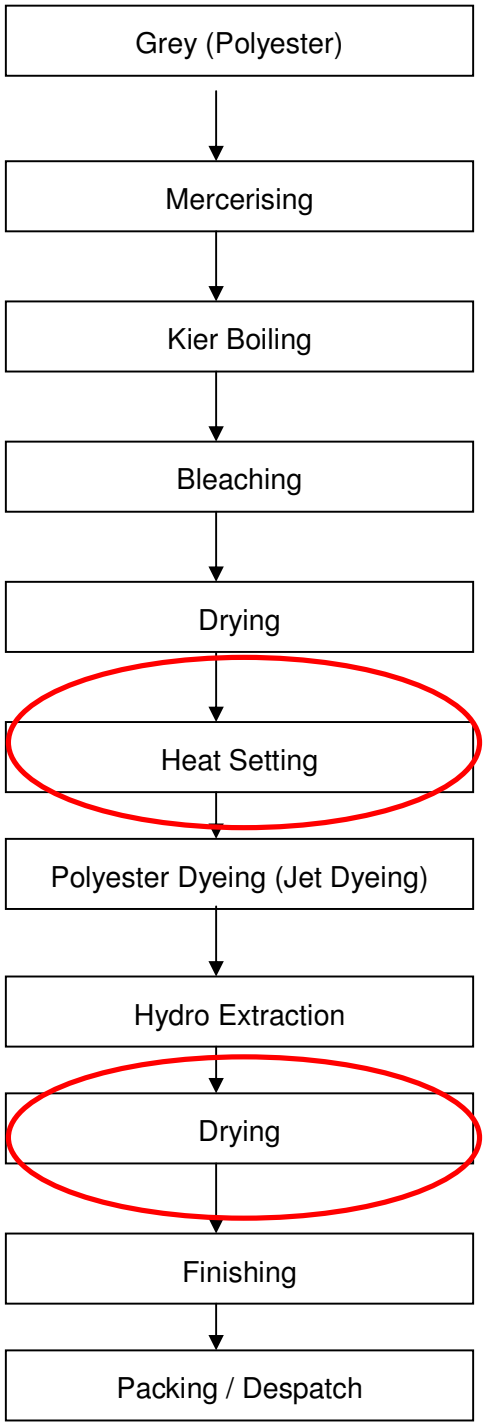


Fig. 1.5 – Process Flow Diagram of Polyester Dyeing and Finishing

1.2 Energy performance in existing situation

1.2.1 Average production

A typical unit works 5 days a week and the daily production of these units are in the following Table 1.2 below:

Table 1.2 Annual productions from a typical unit

Type of product	*Production (RM/Day)*		
Scale of Unit	**Small**	**Medium**	**Large**
Finished Fabric	10000	30000	100000

1.2.2 Fuel consumption

Energy consumption both electrical and thermal by a typical textile dyeing and processing unit in Pali cluster is given in Table 1.3 below:

Table 1.3 Annual energy consumption

Energy	*Electricity (kWh per year)*			*Thermal Energy (MTOE per year)*		
Scale of Unit	Small	Medium	Large	Small	Medium	Large
Consumption	48000	360000	2400000	30	100	300

1.2.3 Specific Energy Consumption (SEC)

The benchmark available for different processes in textile dyeing and processing industry in UK is given in Table 1.4 below:

Table 1.4 Specific Energy Consumption Values

S.No.	*Machine*	*Process*	*Energy Required (GJ/Te)*
1	Desizing Unit	Desizing	1.0 - 3.5
2	Kier	Scouring/Bleaching	6.0 - 7.5
3	J-Box	Scouring	6.5 - 10.0
4	Open Width range	Scouring/Bleaching	3.0 - 7.0
5	Low Energy Steam Purge	Scouring/Bleaching	1.5 - 5.0
6	Jig / Winch	Scouring	5.0 - 7.0

S.No.	Machine	Process	Energy Required (GJ/Te)
7	Jig / Winch	Bleaching	3.0 - 6.5
8	Jig	Dyeing	1.5 - 7.0
9	Winch	Dyeing	6.0 - 17.0
10	Jet	Dyeing	3.5 - 16.0
11	Beam	Dyeing	7.5 - 12.5
12	Pad / batch	Dyeing	1.5 - 4.5
13	Continuous / Thermosol	Dyeing	7.0 - 20.0
14	Rotary Screen	Printing	2.5 - 8.5
15	Steam Cylinders	Drying	2.5 - 4.5
16	Stenter	Drying	2.5 - 7.5
17	Stenter	Heat Setting	4.0 - 9.0
18	Package / Yarn	Preparation / Dyeing(Cotton)	5.0 - 18.0
19	Continuous Hank	Scouring	3.0 - 5.0
20	Hank	Dyeing	10 .0- 16.0
21	Hank	Drying	4.5 - 6.5

SOURCE – CARBONTRUST UK

SEC at Pali Cluster

For the units involved in Processing of Polyester and printing it to make Saree, the Specific Energy Consumption was observed and furnished in Table 1.5 below:

Table 1.5 Specific energy consumption

S.No	Particulars	SEC
1	Average Specific Electricity Consumption	1.2 kWh/kg (Best Observed Value – 0.95 kWh/Kg)
2	Average Specific Thermal Energy Consumption	15000 kCal/kg (Best Observed Value – 10932 kCal/Kg)

1.3 Identification of technology/equipment

1.3.1 Description of technology/ equipment

Pretreatment of textiles and also Dyeing, Printing, washing etc. involve use of water which needs to be removed from fabric before undertaking final finishing or thermosol process or heat setting. Stenters are mainly used in textile finishing for heat-setting, drying, thermosol processes and finishing. Thus Stenter is one of the most common machinery found in a textile dyeing and finishing industry.

It can be roughly estimated that, in fabric finishing, each textile substrate is treated on average 2.5 times in a stenter. Pali has a population of more than 100 stenters installed in industries. The stenters available in Pali are both open and closed type. These stenters are used for assigning requisite finish, temperature stability and dye curing.

In Cotton Dyeing, stenter is used after pretreatment and dyeing as a finishing process. In Cotton Printing, Stenter is used before printing but after pretreatment. In case of Polyester or PC Dyeing, stenter is used twice, once for heat setting and then again for final finish. Similarly, in case of Polyester and PC Blend Printing, stenter is used twice, once for heat setting and then for final finishing after dye curing.

Stenter happens to be the largest Energy Consuming Machinery available in a textile Dyeing and Finishing Industry. For a 5 Chamber Stenter, the connected load is approx 90 HP and the Thermal Energy Consumption rating is 4.0 lakh kCal per hour. The major Electrical Energy load happens to be that of 10 no. of fans provided for circulation of hot air having motor rating of 7.5 HP each.

Thermal Energy required for stenters is supplied by Thermopac. The hot thermal fluid at a temperature of 235°C to 300°C is pumped to the stenter with the help of a continuous running pump. The blowers blow air onto a grid of heat exchanger tubes containing hot thermic fluid which then is guided onto the fabric through nozzles. The blower motors are generally two speed motors for controlling speed of the blower. Some of the new Stenters have been provided with VFD for control of speed. Some units have installed VFD as retrofit to the stenter blower motors.

The temperature in each compartment is controlled in modern stenters with the help of a motor operated flow control valve which bypasses hot fluid if temperature in a chamber exceeds preset temperature. Varying the speed of the motor rotating the endless chain can also vary the speed of the fabric.

To give a –surely rough - assessment energy consumption of energetic optimized stenters is in the range of 3500 - 4500 kJ per kg of textile. However energy consumption depends strongly on the process that is carried out.

A typical stenter is depicted in the following photograph:-

Fig. 1.6 – Photograph of Stenter

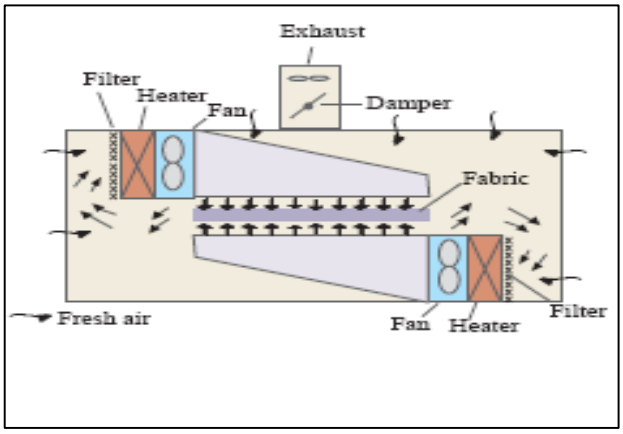


Fig. 1.7 – Schematic diagram of air flow in stenter

1.3.2 Role in process

Textile stenters have two main purposes – convection drying so as to remove the moisture in the fabric and secondly to provide fabric width control. During the previous stages of processing the fabric is subjected to length wise tension to varying degrees resulting in shrinkage in width. In the stenter, width control is achieved with the aid of a series of clips or pins mounted on a pair of endless chains. Apart from these functions, stenters are also used for the following purposes:

a. Dry-heating process like, heat setting of synthetic fabrics and their blends

b. Dry curing process namely, resin finishing with built-in catalysts

In Pali, Stenter is used for drying as well as finishing of Cotton and also for Heat Setting as well as Finishing of Polyester and PC Blend. Stenter is indispensable for Dyeing and Printing of polyester and Blends. Cotton fabric is processed on open stenter. Stenter is generally not used for Drying purpose as drying is done in open air by hanging the fabric in sun. Mechanical dewatering process is also used in case of Polyester and PC Blend. All the stenters are equipped with 3 bowl mangles for dewatering which is used if any chemical is applied with water as carrier.

Analysis of cost of ownership of stenter as per PLEVA given in Table 1.6 below reveals that there is a saving potential of 27% minimum.

Table 1.6 Life Cycle Cost Analysis of stenters

S.No.	*Cost Head*	*% age Weightage*
1	Machine Cost	16
2	Labor Cost	11
3	Heat energy	23
4	Electricity	12
5	Maintenance	6
6	Spare Parts	3
7	Others	2
8	Potential of Energy Savings	27

Energy Consumption details

Energy break up for Heat setting in a stenter is as given in Table 1.7 below:

Table 1.7 Energy break up for Heat setting in a stenter

S.No.	Component	Energy Content (GJ/Te)	% age
1	Evaporation	0.2	4.3
2	Air Heating	3.55	76.2
3	Fabric	0.25	5.4
4	Case	0.23	4.9
5	Chain	0.1	2.1
6	Drive	0.33	7.1
7	Total	4.66	100

Energy break up for a typical stenter is shown in Table 1.8 below:

Table 1.8 Energy break up for a typical stenter

S.No.	Component	Energy Content (GJ/Te)	% age
1	Evaporation	2.54	41
2	Air Heating	2.46	39.7
3	Fabric	0.29	4.6
4	Case	0.39	6.3
5	Chain	0.09	1.5
6	Drive	0.43	6.9
7	Total	6.2	100

As is obvious from above table, only 5.4% of heat given to stenter is utilized in heating the fabric in case of Heat Setting. Heat gained by fabric in any typical stenter operation is 4.6% only. It is further evident that approx. 95% stenters is used for the purpose of moisture evaporation, released to atmosphere or wasted.

Typical Sankey diagram for a stenter having no Energy Conservation Measures is as below:

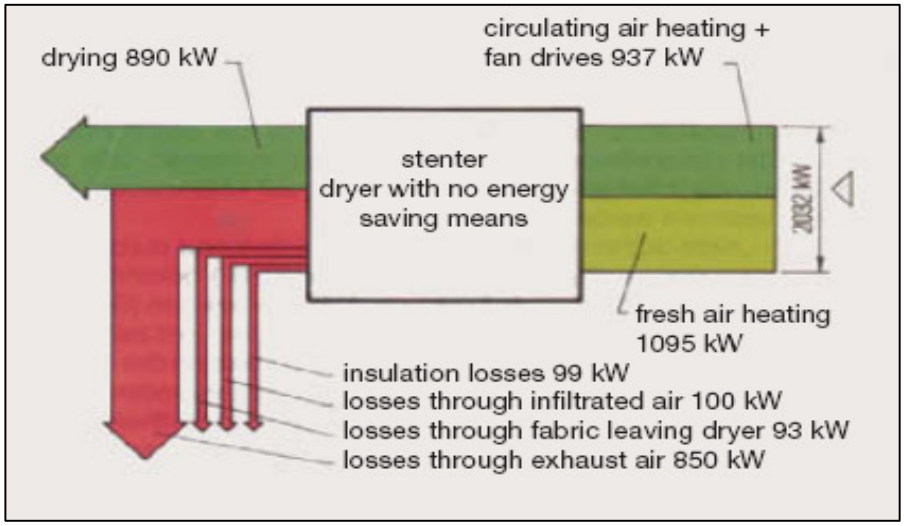


Fig. 1.8 – Sankey diagram for a stenter without Energy Conservation Measure

Typical Sankey Diagram for a stenter with Energy Conservation Measures is as below:

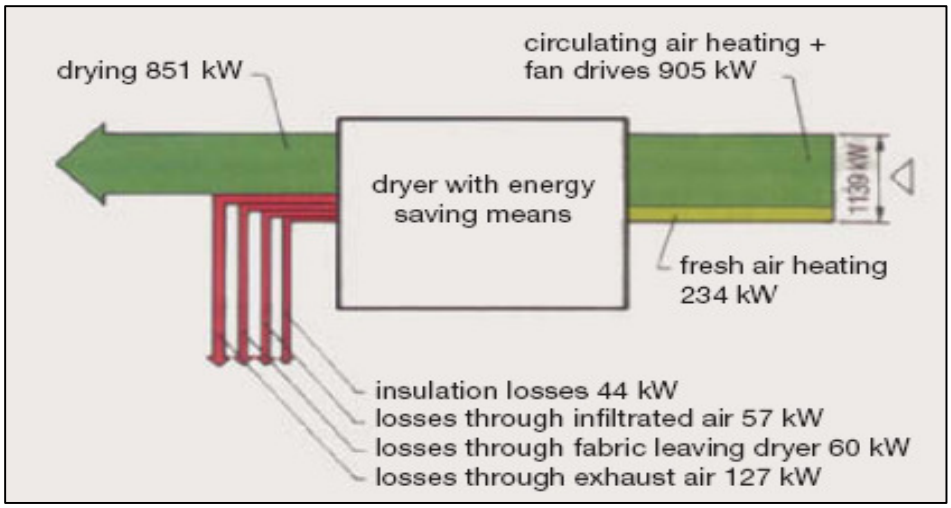


Fig. 1.9 – Sankey diagram for a stenter with Energy Conservation Measure

1.3.3 Energy audit methodology

The following methodology was adopted to evaluate the performance of Stenters which is shown in Fig. 1.10 below:

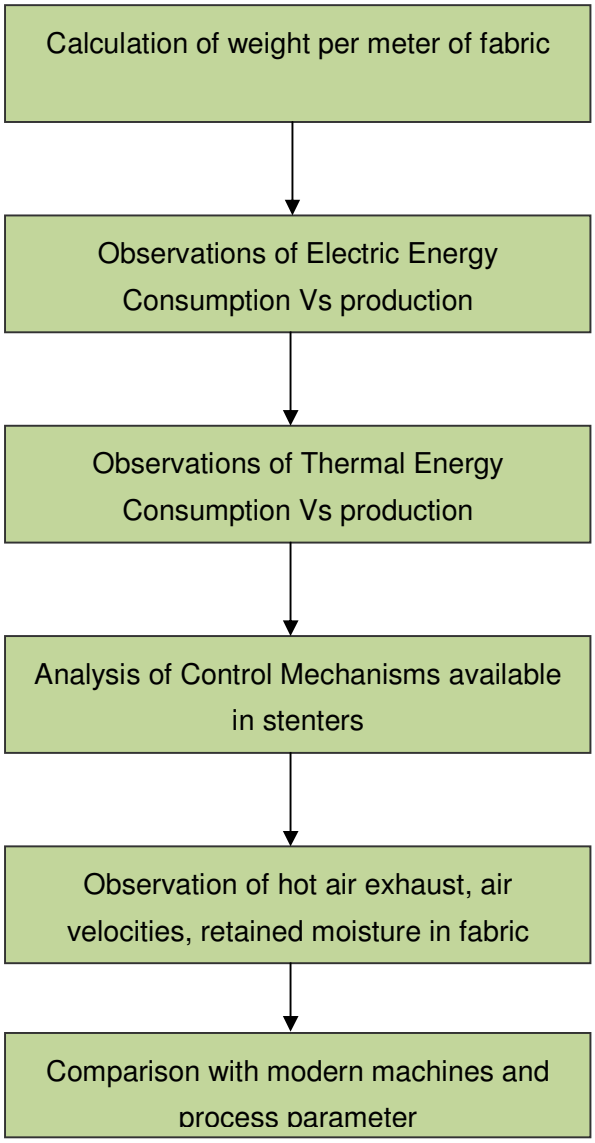


Fig. 1.10 Energy Audit methodologies

1.3.4 Design and operating parameters specification

Norms for exit moisture percentages or retained moisture percentage in various fabric at 20°C temperature and 65% RH is as given in table 1.9 below:

Table 1.9 Operating parameters specification

S. No	*Material*	*Exit Moisture Percentage (Regain Value)*
1	Cotton	7.0
2	Polyester	0.4
3	Nylon	4.5

4	Viscose	12.5
5	Wool	16.0
6	Polyester Cotton Blend (2:1)	2.5
7	Polyester Wool Blend (2:1)	5.5

It is obvious from the above that retained moisture percentage in cotton has to be 7% and that for Polyester has to be 4%. Only one stenter in Pali has system to ensure that retained moisture percentage is as per the norms. In all other stenters, the retained moisture percentage was observed to be less than the norms indicating that the fabric is getting over dried.

1.3.5 Operating efficiency analysis

As is obvious from Table 1.8, 41% of total energy given to stenter is utilized in evaporation of moisture. Thus 1% over drying would mean 2.5% more heat requirements and 4% more fuel requirements (considering Thermopac efficiency to be 70% and distribution losses to be 10%).

1.4 Barriers in adoption of proposed technology/equipment

BEE promoted SME programme has the unique distinction of addressing all the identifiable barriers in adoption of Energy Efficiency Improvement technologies in SME sectors. Following actions have been taken in Pali Textile Cluster to remove the barriers:-

- Kick off Seminar to create awareness
- Energy Audit (Detailed and Preliminary) in over 78 units
- Capability building and involvement of institutional financers, local service providers and also domestic equipment manufacturers.
- Design and distribution of dissemination material containing most of the measures.
- Design and distribution of Cluster Manual containing technology gap assessment and cost benefit analysis of proposed Energy Conservation measures.
- Involvement of Industry Association, Department of Industries and local administration.

However, for the sake of identifying possible barriers to adoption of the proposed technologies, the following may be considered.

1.4.1 Technological Barrier

- The proposed technology, being generic in nature, is readily available.
- Non-availability of technology or aversion to adoption for any other reason does not seem to be the case here as most of the units in power process segment in Pali are already having VFDs in ID Fans, Stenter Fans etc. It is only lack of knowledge and comfort of proven guaranteed results that has been keeping the entrepreneurs away from adopting this technology.
- Stenter manufacturers are offering the proposed technology as a standard add on to new systems. Even agencies working in optimization and control system for textile sector offer the product. However, the proposition is not being presented with guaranteed cost benefit analysis to the entrepreneurs. The entrepreneurs are in Micro, Small and medium sector and they do not have trained or educated manpower.
- There is a severe paucity of quality technical consultants in the cluster. This also inhibits adoption of technology as there is nobody to convince the entrepreneurs.
- Non availability of local after sales service provider for the equipments is a major obstacle to adoption of any new and modern technology involving electronics.
- The majority of the textile unit owners / entrepreneurs do not have in-depth technical expertise nor do they have technically qualified manpower. This is a major barrier in acquiring knowledge about any innovation in the sector.
- The entrepreneurs in the MSME sector are averse to investment risks and tend to invest in proven technology only. Adoption of technology is higher in bigger units and these bigger units also become agents for demonstration and hence replication. Lack of any bigger unit in the cluster also is an impediment to adoption of newer technology.

1.4.2 Financial Barrier

- The applicability of the proposition is in power process units only. These units have very healthy financial position. Lack of finances is not the reason for non adoption of the proposed technology. However, availability of easy finances and also financial incentives would trigger and also accelerate adoption of the technology.
- Implementation of the proposed project activity requires approx ₹ 1.0 lakh investment per machine and can be managed by internal resources. However, the units have upto 4 Stenters and hence investment of ₹ 4 lakh in one go would be a problem.

- The investment decisions normally favour creation of additional facility and investment for Energy Efficiency Improvement features last in the priority of entrepreneurs. Consequently, interventions like the one undertaken by BEE are necessary for promoting adoption of technologies.
- The subjective approach of the banks in deciding on grant of loans to entrepreneurs and also lack of pre declared formalities required for availing loan is the biggest impediment. On adherence to a time bound dispensation of the loan application is also an obstacle as the a new document is asked for ever time the entrepreneur visits the bank and the bank would refuse in the last moment citing untenable reason leaving the entrepreneur in the lurch. Facilitating delivery of finances is more important than packaging the finances.
- Most of the units in Pali textile cluster are debt free enterprises and the situation is ideal for any bank or financial institution to do advances. With end to economic slow down within sight, the demands are likely to pick up and the units would require scaling up their operations and also perking up their facility to meet enhanced demand. The inherent benefit of increase in profitability by precise process control is also up for taking.

1.4.3 Skilled manpower

The cluster very badly needs skilled manpower. There is no trained Dye Master, no trained electrician, no trained boiler operator or no trained maintenance man. The existing manpower has grown by on the job learning and has learnt the traditional methods of dyeing and processing. Propagation of learning of new technology is absolutely necessary.

1.4.4 Other barrier (If any)

Creation of Energy Champions is necessary to trigger large-scale adoption of proposed technologies. This is possible by sponsoring adoption of such technologies through financial help and also mitigation of investment risks through a mechanism that guarantees the savings. An ESCO can as well be involved in the process.

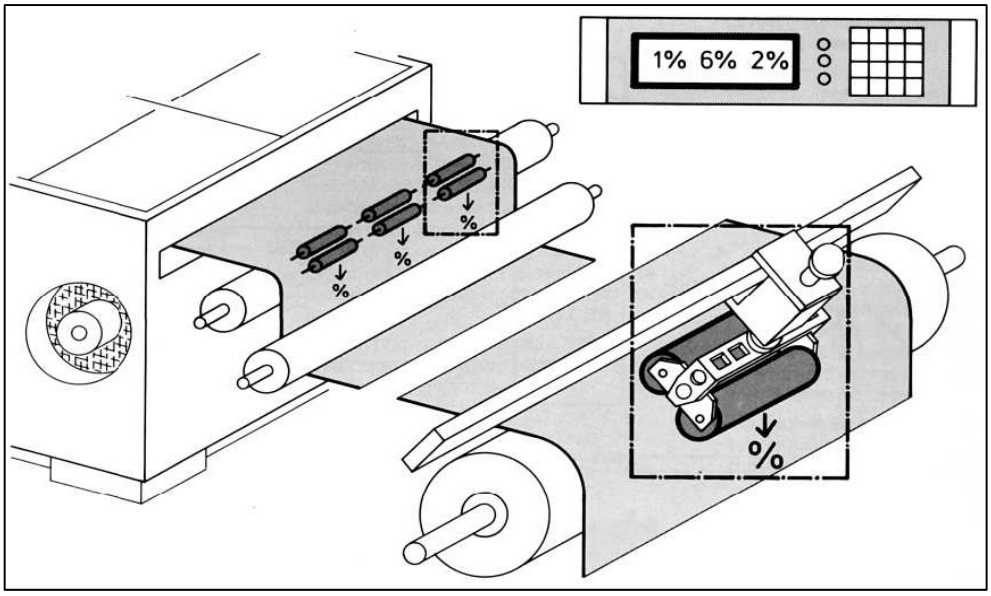
2.0 PROPOSED EQUIPMENT

2.1 Detailed description of technology proposed

Background

Background

All but one stenter in the whole Pali cluster has installed retained moisture control system. Over drying was observed in almost all the stenters as the processing is being done by manual estimation and precise control is not possible by this method. A typical system is depicted below



By installing the proposed system, the moisture percentage required to be present in the finished fabric is set and speed of the fabric is varied so as to attain exact moisture percentage. Fig. 2.1 depicts the relationship between residual moisture and speed of fabric in a stenter.

As per the real life experience of the unit where the proposed mechanism is already installed, a minimum saving of 5% was observed. The fuel savings calculation considers only 3% increase in speed of the fabric as a result of installation of the proposed system is furnished in Annexure 5.

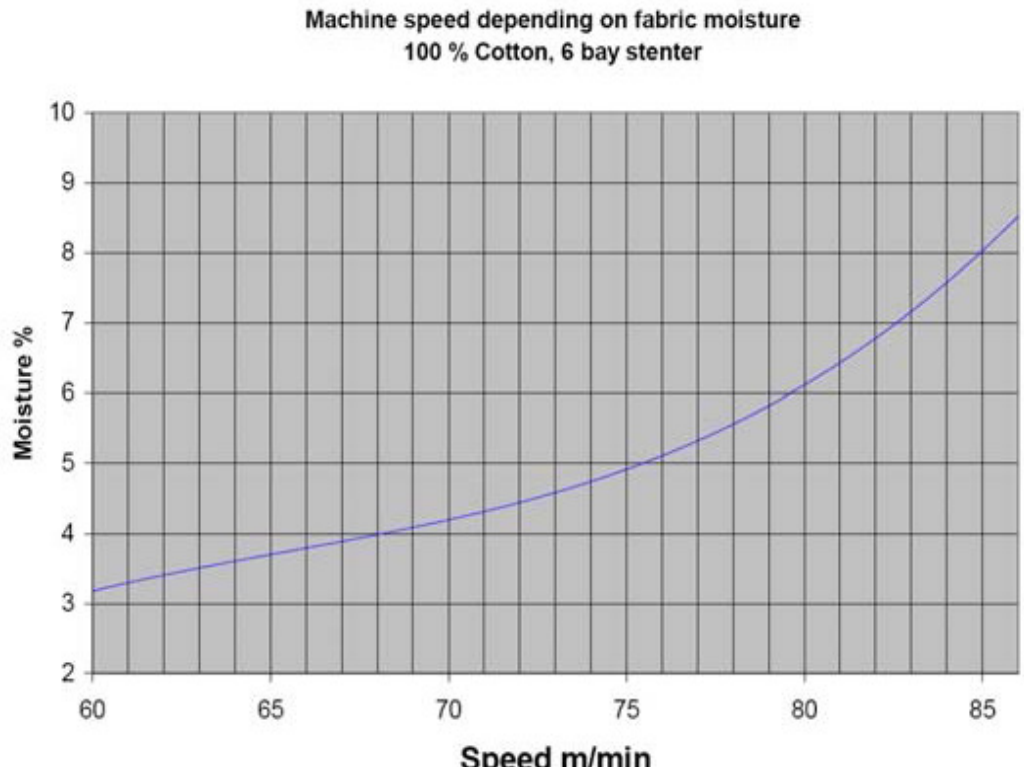
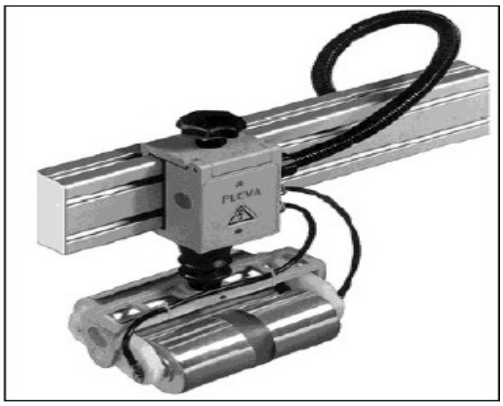


Fig. 2.1 Relationship between residual moisture and speed of fabric

Description of equipment

The residual moisture meter is a contact measurement of running fabrics. The measurement is based on measurement of electrical resistance. This increases exponentially as the residual moisture decreases. The system consists of a roller sensor shown below installed at multiple locations at the exit of the stenter so as to measure online residual moisture content in the fabric. There is a monitor for display and control of residual moisture. The required moisture can be set in the programmable monitor and the controller varies speed of the fabric depending upon the moisture content so as to ensure required values.



Roller sensor for residual moisture measurement

Fig. 2.2 Residual moisture measurement and control system installed in a stenter

2.1.1 Equipment specification

A complete brochure of the equipment is placed at Annexure 1.

2.1.2 Suitability over existing equipment

The proposed system can be retrofitted to existing Stenters Machine without any modification to existing Machinery.

2.1.3 Superiority over existing equipment

The system would improve precision of control on the existing process and hence would yield better results on productivity as well as quality fronts.

2.1.4 Availability of equipment

The system can be delivered within 3 to 4 weeks of placement of order through manufacturers in Ahmedabad.

2.1.5 Source of equipment

This technology has already been implemented in one of the textile process house at Pali and the results have been as per projections. Brochure from the same vendor has been enclosed. The equipment is readily available indigenously without any complications related to patent or copyright.

2.1.6 Technical specification of equipment

Technical specification of proposed technology is attached at Annexure 1.

2.1.7 Terms and conditions in sales of equipment

No specific terms and conditions are attached to sale of the equipment.

2.1.8 Process down time during implementation

The proposed system is independent of existing system and integration would need work as much as that needed to make an electricity connection. However, tuning of the system and performance monitoring would take maximum one day.

2.2 Life cycle assessment and risks analysis

The unit consists of Sensors, VFD, PLCs, connections, contactors etc. There are no moving parts and hence deterioration is not a problem. However, bad power quality may lead to failure of the system. Being an electronic device, no problem is anticipated and the unit would go on working perpetually if better ambient is made available.

2.3 Suitable Unit for Implementation of Proposed Technology

The proposed system can be implemented in over 25 no. out of 100 no. of Stenters. Total potential for energy saving would be 700 MT per year if the proposition is implemented in all the machines.

3.0 ECONOMIC BENEFITS FROM PROPOSED EQUIPMENT

3.1 Technical benefit

3.1.1 Fuel saving

The proposition would help save 28.08 MT RPC fuel per year in every stenter. A detail of fuel saving calculation is given in Annexure 5.

3.1.2 Electricity saving

No electricity saving is envisaged out of implementation of the proposed system.

3.1.3 Improvement in product quality

The system comes with precision process control protocol and hence product quality would certainly improve.

3.1.4 Increase in production

Precise process control will certainly improve production; however, the quantum of improvement will depend upon extant level of inefficiency.

3.1.5 Reduction in raw material

Raw material consumption is same even after the implementation of proposed technology.

3.1.6 Reduction in other losses

None

3.2 Monetary benefits

The monetary saving arising out of implementation of proposed technology in one Stenter would be ₹ 2.11 lakh per year. A Detail of monetary saving is furnished in Table 3.1 below:

Table 3.1 Details of monetary saving

S. No	*Particular*	*Unit*	*value*
1	Daily processing of Cloth with stenter speed @ 60mtr/min	mtr/day	86400
2	Content of moisture at stenter entry	% age	70
3	Standard Moisture Regain Value	% age	7
4	Moisture Content now	% age	6
5	Fuel Saving (7.5% of total consumption)	MT/year	28.08
6	Cost of fuel	₹/MT	7500
7	Monetary saving	₹/year	2,10,600

3.3 Social benefits

3.3.1 Improvement in working environment in the plant

Proposed equipment reduces the GHG emission by reducing fuel consumption.

3.3.2 Improvement in workers skill

Not contributing to any improvement in skill sets of workers. However, the automation would eliminate human intervention in precision control of process thereby reducing workload of the frontline workers. No retrenchment of labor is envisaged because of implementation of the proposed system.

3.4 Environmental benefits

3.4.1 Reduction in effluent generation

The fuel saving will have equivalent mitigation in terms of SPM and other pollutants otherwise likely to be released in the atmosphere.

3.4.2 Reduction in GHG emission

The equivalent saving in GHG emission for every Stenter would be 76 per year as per UNEP GHG Calculator.

3.4.3 Reduction in other emissions like SO_X

NIL

4.0 INSTALLATION OF PROPOSED EQUIPMENT

4.1 Cost of equipment implementation

4.1.1 Equipments cost

Cost of the project is about ₹ 0.85 lakh (0.5 lakh + Excise +Taxes and Cartage) as per the quotation from M/s SEMITRONICS attached as Annexure 2. Also cost of VFD @ ₹ 0.35 lakh can be added.

4.1.2 Erection, commissioning and other misc. cost

Erection & commissioning cost is ₹ 0.15 lakh and miscellaneous cost.

Table 4.1 Details of proposed equipment installation cost

S.No	*Particular*	*Unit*	*cost*
1	Equipment cost	₹ (in Lakh)	0.85
2	Erection & Commissioning cost	₹ (in Lakh)	0.15
3	Interest during implementation	₹ (in Lakh)	0.00
4	Other misc. cost	₹ (in Lakh)	Nil
5	**Total cost**	₹ (in Lakh)	**1.00**

4.2 Arrangements of funds

4.2.1 Entrepreneur's contribution

Entrepreneur will contribute 25% of the total project cost which is 0.25 lakh.

4.2.2 Loan amount.

Remaining 75% cost of the proposed project will be taken from the bank which is 0.75 Lakh.

4.2.3 Terms & conditions of loan

The interest rate is considered at 10% which is SIDBI's rate of interest for energy efficient projects. The loan tenure is 5 years excluding initial moratorium period is 6 months from the date of first disbursement of loan.

4.3 Financial indicators

4.3.1 Cash flow analysis

Profitability and cash flow statements have been worked out for a period of 8 years. The financials have been worked out on the basis of certain reasonable assumptions, which are

outlined below. The cost of equipment considered is inclusive of hot water storage tanks also.

The project is expected to achieve monetary savings of ₹ 2.11 lakh per annum.

- The Operation and Maintenance cost is estimated at 4% of cost of total project with 5% increase in every year as escalations.
- Interest on term loan is estimated at 10%.
- Depreciation is provided as per the rates provided in the companies act.

Based on the above assumptions, profitability and cash flow statements have been prepared and calculated in Annexure-3.

4.3.2 Simple payback period

The total project cost of the proposed technology is 1.00 lakh and monetary savings due to reduction in Electricity & Fuel consumption is 2.11 lakh hence, the simple payback period works out to be around 6 months.

4.3.3 Net Present Value (NPV)

The Net present value of the investment at 10% works out to be ₹ 6.62 Lakh.

4.3.4 Internal rate of return (IRR)

The after tax Internal Rate of Return of the project works out to be 156.64%. Thus the project is financially viable.

4.3.5 Return on investment (ROI)

The average return on investment of the project activity works out at 31.25%.

Details of financial indicators are furnished in Table 4.2 below:

Table 4.2 Financial indicators of proposed technology

S.No.	*Particular*	*Unit*	*Value*
1	Simple payback period	Months	6
2	NPV	₹ (in lakh)	6.62
3	IRR	% age	156.64
4	ROI	% age	31.25
5	DSCR	ratio	8.45

4.4 Sensitivity analysis

A sensitivity analysis has been carried out to ascertain how the project financials would behave in different situations like when there is an increase in fuel savings or decrease in fuel savings. For the purpose of sensitive analysis, two following scenarios has been considered

- Optimistic scenario (Increase in fuel savings by 5%)
- Pessimistic scenario (Decrease in fuel savings by 5%)

In each scenario, other inputs are assumed as a constant. The financial indicators in each of the above situation are indicated along with standard indicators.

Table 4.3 Sensitivity analysis in different scenario

Scenario	*IRR (% age)*	*NPV (₹ in lakh)*	*ROI (% age)*	*DSCR*
Pessimistic	149.35	6.25	31.13	8.04
Realistic	156.64	6.62	31.25	8.45
Optimistic	163.90	6.99	31.37	8.86

4.5 Procurement and Implementation Schedule

Total time period required for implementation of this technology is about 6 weeks and their details are given in Annexure 4.

Annexure -1: Information Brochure of equipment

MOISTURE INDICATOR AND AUTOMATIC CONTROLLER

FOR

❍ GINNING, SIZING AND STENTER MACHINE ❍ DRYING RANGE
❍ DRIER FOR GRAIN PROCESSORS ❍ PAPER & BRICK MANUFACTURERS

FOR
CONSISTENT PRODUCT QUALITY
AND
ELIMINATION OF :
❍ Wastage of heat energy due to over drying
❍ Human or manual error and labour

SEMITRONIK

moistron

MOISTURE INDICATOR AND AUTOMATIC CONTROLLER

Increase the production by automatic control of speed of the sizing, stenter & drying machines.

Eliminates :

- **Wastage of energy**
- **Re-process**
- **Human error & labour to the extent that investment can be recovered in less than a year.**

Control moisture to pre-set level by controlling :

- **Speed of dryer of any make & type**
- **RPM of air circulating fan of last chamber of stenter machine.**
- **Temperature of dryer to meet specific requirement.**

MOISTRON range of instruments work on the principle of measurement of resistance of yarn or fabric/paper etc. which is a relative logarithmic function of moisture content.

The equipment can be installed on sizing machine, stenters, drying machines where moisture content at the exit end is required to be kept uniform.

THIS INCREASES THE PRODUCTION & ELIMINATES WASTAGE OF ENERGY, ENSURES QUALITY OF THE PRODUCT.

Besides textile industry these instruments find application in jute, paper, tobacco, tea, coffee, agriculture & food processing industries also.

MOISTURE INDICATOR AND AUTOMATIC CONTROLLER indicates % moisture content and controls it by controlling speed of the machine steam pressure applied to drying machine. Indication and controlling actions are indicated by flashing of the impulse lamps. When the system is installed on machine one has to only set the required moisture content on the setting keyboard, leaving the control to the instrument.

The operating speed of the machine will be controlled in such a way that the material leaving the drier emerges with the desired amount of moisture.

Changes in drying conditions due to fluctuations of steam pressure or other external factors are accounted for.

The automatic control system enforces highest efficiency to be reached i.e. to maintain maximum operating speed under given conditions with optimum results as to have minimum specific energy consumption.

The frequency of the impulses is a function of the difference between the measured value and desired value.

Thus great deviation from desired value implies a rapid series of impulses, whilst a small deviation causes the signals to be set out at a low frequency (proportionate regulation).

In order to avoid moist warps or fabrics safely, control is working faster in the direction of 'DRY' than in the direction of 'WET'. Besides the actual measuring value its derivative is effective.

Thus regulation is accelerated when the measured value is leaving the set value, but slowed down when approaching the set value (derivative action).

FEATURES

- Digital indication of moisture content in percentage.
- Flashing lights to show the DRY, NORMAL or MOIST condition of fabric or yarn.
- CONTROL proportional to speed of the machine by techo-feed back.
- Progressive, deviation dependent step-type control system with PID characteristics.
- Continuous and accurate modulation over a wide range of machine speeds, thereby adapting to differing dwell times at various speeds.
- Adaptability to all standard types of dryer.
- System available with suitable measuring range and measuring electrodes for measurement of moisture content with or without automatic control for **paper/food processing/ceramic/ sanitary ware/agriculture/gum mfg. plant and other chemical processes to suit applications.**
- Backed by performance guarantee and efficient after-sales-services.

TECHNICAL DATA

Supply : Single phase 230V AC, 50 Hz.
Power consumption : 100 watts.

MOISTURE RANGES

Cotton:3.5 to 20 % or 10 to 30 %;
Wool:10 to 40 %; Jute:7 to 32 %;
Rayon:7 to 32 %;
Staple Fibre:7 to 40 %; Silk:6 to 30 %;
Nylon:3 to 17 %; Acrylic:1 to 5 %;
Glass & Olefin:0.1 to 0.5 %;
Polyester:0.5 to 2.25 %;
Paper, Ceramic, Tea, Wood, Sand.

CONTROL

PID characteristic with :

- Two relays with contact rated of 1 Amp. non-inductive load OR
- 4-20 mA or 0-10 V output.

SETTING REQUIRED MOISTURE

By keyboard only.

CALIBRATION

Internal standard provided for periodic check.

LIGHT INDICATION

AMBER :
Light FLASHES to show DRY condition.
GREEN :
Light GLOWS to show NORMAL condition.
RED :
Light FLASHES to show MOIST condition.
All conditions are with respect to SET-POINT, required moisture content.

STANDARD ACCESSORIES

These are supplied alongwith the instruments

- Sensing system with THREE SENSOR ROLLERS with side sockets/brackets.
- Moisture measuring sensor for knitting or hosiery fabric for drier/calendar/compactor machine.

ALSO AVAILABLE

- Feedback system with a TECHO-GENERATOR.
- Special cable for connection of measuring section.

ADDITIONAL ACCESSORIES

Supplied at additional cost.

- PLC or serial interface RS 485 with computer.
- Non-contact type infra-red sensor with mounting arrangement.

REQUIREMENTS FOR INSTALLATION

- Continuously variable speed drive with push buttons for increasing & decreasing speed of the machine.
- A metallic roller at the exit of drier for moisture measurement.

MODELS AVAILABLE

MOISTURE INDICATOR
MODEL FMIM-101
Only moisture indicator.
Dimensions : 390 x 180 x 280 mm

MOISTURE INDICATOR WITH FLASHER
MODEL FMIF-101
To measure and indicate dry-normal-moist condition of fibre/fabric with respect to the SET-POINT.
(i.e. required moisture content).
Operator has to maintain desired normal level by adjusting steam supply or speed of the machine.
Dimensions : 390 x 180 x 280 mm

MOISTURE INDICATOR AND AUTOMATIC CONTROLLER
MODEL FMC-101
For moisture indication & control for any processing/drying machine.
Dimensions : 390 x 180 x 120 mm

System also available with non-contact type sensing arrangement based on infra-red sensor to measure and control moisture in different forms of material under process.

For further details, contact

SEMITRONIK

Since our policy is of continuous development and improvement, we reserve the right to supply product which may differ from those illustrated & described in this publication.

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ENERGY IS LIFE
BEE
CONSERVE IT

ANNEXURE 2 – Quotation

OUR REF._____DT._____

SPECIFICATION & ESTIMATE
FOR
MOISTURE INDICATOR AND AUTOMATIC CONTROLLER
FOR
STENTER / DRIER OR SIZING MACHINE

DESCRIPTION	PRICE NET EX.WORKS PER UNIT

THE SYSTEM FOR MOISTURE INDICATOR & AUTOMATIC CONTROLLER MODEL FMC/101 Consisting of :

1. CONTROL UNIT (FMC -1/2) : Complete Micro controller – electronics with plug in type PCBs housed in a sturdy cabinet with :

   DISPLAY : 1" character LED display to indicate :
   # Actual Moisture
   # Set value and other programmed parameters.

   KEY BOARD : For Data entry such as :
   # Required set moisture
   # Control parameters
   # Auto/manual operation etc.

   CONTROL : with PID control characterisic
   i) Relay contact rated with 1 amp. non-inductive load for increase or decrease the moisture %. (OPTIONAL)
   ii) 4 – 20 mA or 0 – 10 volts to control speed of inverter.

   MEASURING RANGE : One of the following range can be selected for one of following fibre and moisture measuring range.

MOISTURE MEASURING RANGE

1.	Cotton	3.5 – 20%
2.	Staple fibre	7 – 40%
3.	Wool	10 – 40%
4.	Jute	7 – 32%
5.	Rayon	7 – 32%
6.	Silk	6 – 30%
7.	Nylon	3 – 17%
8.	Polyester	0.5 – 2.5%
9.	Acrylic	1 – 5%
10.	Polyester / Viscose with blend ratio of: 30-70%	4.5 – 19%
11.	Polyester / Viscose with blend ratio of: 50-50%	3.5 – 14.9%
12.	Polyester / Viscose with blend ratio of: 70-30%	2.5 – 10.6%

Cont… 2

DESCRIPTION	PRICE NET EX. WORKS PER UNIT
	MOISTURE MEASURING RANGE
13. Polyester / Cotton with Ratio of: 30-70%	2.5 - 10.8%
14. Polyester / Cotton with Ratio of: 50-50%	2 - 8.6%
15. Polyester / Cotton with Ratio of: 70-30%	1.5 to 6.5%

2. SENSOR

(A) TO MONITOR MOISTURE ALONG THE WIDTH OF THE FABRIC OR WARP SHEET:

Consisting of:
1. Rollers 3 Nos. (FMC-2(a)/
2. Square bar of **2000mm width** (FMC-2(b)/2),
3. 2 Nos. Side Socket (FMC-2(c)/2)
4. 2 Nos. Side brackets (FMC-2(d)/2)
5. Special cable (FMC-2(e)/2)with
6. Plug (FMC-2(f)/2)

OR

(B) SUITABLE FOR KNITTED FABRIC OR WARP SHEET :

Consisting of:
1. 2 Nos. Guide Roll FMC H-2(a)2 having 1600MM (FMC-2/2) Width & 80 mm Diameter
2. Pedestals 2 Nos. FMC H-2(b)2 and suitable connectior arrangement.

OR

(C) SENSOR WITH FACILITY TO MEASURE MOISTURE ON SELVAGES AND CENTEF PORTION WITH SELECTOR SWITCH ALONG THE WIDTH OF FABRIC (WOVEN OR KNITTED) OR WARP SHEET:

A) **One no. guide Roll with 2000 mm width & 60 mm dia with mounting arrangement.**
B) Consisting of:
3 nos. Teflon spacer of 40mm width along the width to measure moisture along the width i.e. on selvages and center with operation of selector switch to know variation in moisture content between selvage and center portion of fabric / warp sheet

4) MOTORIZED POTENTIOMETER (10K) (Optional) : For control of % same is required when Inverter is used without PLC for variation of RPM or Speed of AC motor.

3. SERIAL INTERFACE (Optional) : For computer interface for Data management software packages (common upto 32 machines)

4. SOFTWARE PACKAGE (optional) : For Data Management Information to have recording of moisture % along with entire set / lot with respect to length & time.

Cont... 3

		DESCRIPTION	PRICE NET EX. WORKS PER UNIT
PRICE OF THE SYSTEM	:	(TWO MODELS ARE AVAILABLE IN THREE DIFFERENT VERSION AS DETAILS GIVEN BELOW)	
A)			
1. MODEL FMC/101	:	**RESIDUAL Moisture Indicator and automatic controller** with sensor **Type (A)** with square bar of **2000 mm width** and with 3 Nos. Rollers moisture measuring range for one of the fibre stated above. **NOTE:** While placing order please advice moisture measuring Range required.	
			: RS. 41450/-p.pc
	=	Additional price for every additional **200 mm** additional width of the square bar.	: RS. 995/-
2. MODEL FMI/101	:	**Residual Moisture Indicator only** For Delivery end of Dryer and stenter or sizing machine - other details as stated above in **A-1.**	: RS. 26450/-p.pc
3. MODEL FMF/101	:	**Residual moisture indicator with flashing** light Indicator to indicate LOW - NORMAL - HIGH status of moisture content compare to set value of desired moisture content for Delivery end of Dryer and stenter or sizing machine - other details as stated above in **A-1.**	: RS. 29000/-p.pc
B)			
1. MODEL FMC / 102	:	System same as Model FMC-101 but with additional facility to measure & control moisture content in running fabric or warp sheet with moisture measuring and controlling facility for following fibres with operation of selector switch. 1. Cotton : 3 TO 15% 2. Polyester / cotton with blends combination of: a) 30-70% b) 50-50% c) 70-30% 3. Polyester Viscose with blends combination of: a) 30-70% b) 50-50% c) 70-30%	
			: RS. 49950/-p.pc
2. MODEL FMI/102	:	System same as Model FMC/102, for **Residual Moisture Indication only** - other details as stated above in **No: B-1**	: RS. 34950/-p.pc

Cont... 4

DESCRIPTION	PRICE NET EX. WORKS PER UNIT
3. MODEL FMF/102 : System same as Model FMC/102 for **Residual moisture indication with flashing** light to indicate DRY-NORMAL-WET status of moisture content COMPARE TO SET MOISTURE CONTENT - other details as stated above in **No: B-1** :	RS. 39950/-p.
C) MOTORIZED POTENTIOMETER (10K) :	Rs. 5,150/-
D) In case if you wish to communicate this data stated of **Model A) FMC -101 OR Model B) FMC - 102** with computer and if you do not have provision with your computer for RS232 TO RS485 Converter then you need RS232 TO RS485 Converter to be installed on your computer to hook-up above system. You can hook-up such 32 nos. of systems to your computer for different applications with this Converter RS232/RS485. (Same you can buy yourself from your source if you wish)	
E) price for Converter RS232/485... ..... :	RS. 4950/-
F) Software package for Management information .. :	RS. 49450/-

Other terms and conditions as per attached sheet.

SPECIAL NOTE : While placing order please advice :
If your Inverter is with PLC then to control RPM or Speed of AC Main Motor, system with 4 - 20 mA or 0 - 10V output will be required hence while placing order please clarify the details of your output requirement for controlling the RPM or Speed of Main Motor.

Annexure -3: Detailed financial analysis

Assumption

Name of the Technology	**RESIDUAL MOISTURE MEASUREMENT AND CONTROL SYSTEM**		
Rated Capacity	**NA**		
Details	***Unit***	***Value***	***Basis***
Installed Capacity			
No of working days	Days	300	
No of Shifts per day	Shifts	3	(Assumed)
Capacity Utilization Factor	%age		
Proposed Investment			
Equipment cost	₹ (in lakh)	0.85	
Civil works, Erection and Commisioning	₹ (in lakh)	0.15	
Other cost	₹ (in lakh)	0.00	
Total Investment	₹ (in lakh)	1.00	
Financing pattern			
Own Funds (Equity)	₹ (in lakh)	0.25	
Loan Funds (Term Loan)	₹ (in lakh)	0.75	
Loan Tenure	years	5	Assumed
Moratorium Period	Months	6	Assumed
Repayment Period	Months	66	Assumed
Interest Rate	%age	10.00%	SIDBI Lending rate
Estimation of Costs			
O & M Costs	% on Plant & Equip	4.00	Feasibility Study
Annual Escalation	%age	5.00	Feasibility Study
Estimation of Revenue			
Fuel saving(RPC)	Tons/year	28.08	
Cost	₹/tons	7500	
St. line Depn.	%age	5.28	Indian Companies Act
IT Depreciation	%age	80.00	Income Tax Rules
Income Tax	%age	33.99	Income Tax

Estimation of Interest on Term Loan

₹ (in lakh)

Years	***Opening Balance***	***Repayment***	***Closing Balance***	***Interest***
1	0.75	0.06	0.69	0.09
2	0.69	0.12	0.57	0.06
3	0.57	0.14	0.43	0.05
4	0.43	0.15	0.28	0.04
5	0.28	0.16	0.12	0.02
6	0.12	0.12	0.00	0.00
		0.75		

WDV Depreciation

₹ (in lakh)

Particulars / years	1	2
Plant and Machinery		
Cost	1.00	0.20
Depreciation	0.80	0.16
WDV	0.20	0.04

Projected Profitability

₹ (in lakh)

Particulars / Years	1	2	3	4	5	6	7	8
Fuel savings	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11
Total Revenue (A)	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11
Expenses								
O & M Expenses	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.06
Total Expenses (B)	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.06
PBDIT (A)-(B)	2.07	2.06	2.06	2.06	2.06	2.05	2.05	2.05
Interest	0.09	0.06	0.05	0.04	0.02	0.00	-	-
PBDT	1.98	2.00	2.01	2.02	2.03	2.05	2.05	2.05
Depreciation	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
PBT	1.93	1.95	1.96	1.97	1.98	2.00	2.00	2.00
Income tax	0.40	0.63	0.68	0.69	0.69	0.70	0.70	0.70
Profit after tax (PAT)	1.53	1.32	1.27	1.28	1.29	1.30	1.30	1.30

Computation of Tax

₹ (in lakh)

Particulars / Years	1	2	3	4	5	6	7	8
Profit before tax	1.93	1.95	1.96	1.97	1.98	2.00	2.00	2.00
Add: Book depreciation	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Less: WDV depreciation	0.80	0.16	-	-	-	-	-	-
Taxable profit	1.18	1.84	2.01	2.02	2.03	2.05	2.05	2.05
Income Tax	0.40	0.63	0.68	0.69	0.69	0.70	0.70	0.70

Projected Balance Sheet

₹ (in lakh)

Particulars / Years	1	2	3	4	5	6	7	8
Liabilities								
Share Capital (D)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Reserves & Surplus (E)	1.53	2.85	4.12	5.40	6.69	8.00	9.30	10.60
Term Loans (F)	0.69	0.57	0.43	0.28	0.12	0.00	0.00	0.00
Total Liabilities (D)+(E)+(F)	2.47	3.67	4.80	5.93	7.06	8.25	9.55	10.85

Assets	1	2	3	4	5	6	7	8
Gross Fixed Assets	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Less Accm. depreciation	0.05	0.11	0.16	0.21	0.26	0.32	0.37	0.42
Net Fixed Assets	0.95	0.89	0.84	0.79	0.74	0.68	0.63	0.58
Cash & Bank Balance	1.52	2.77	3.96	5.15	6.33	7.56	8.92	10.27
TOTAL ASSETS	2.47	3.67	4.80	5.93	7.06	8.25	9.55	10.85
Net Worth	1.78	3.10	4.37	5.65	6.94	8.25	9.55	10.85
Debt Equity Ratio	2.76	2.28	1.72	1.12	0.48	0.00	0.00	0.00

Projected Cash Flow

₹ (in lakh)

Particulars / Years	0	1	2	3	4	5	6	7	8
Sources									
Share Capital	0.25	-	-	-	-	-	-	-	-
Term Loan	0.75								
Profit After tax		1.53	1.32	1.27	1.28	1.29	1.30	1.30	1.30
Depreciation		0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Total Sources	1.00	1.58	1.37	1.33	1.33	1.34	1.35	1.35	1.35
Application									
Capital Expenditure	1.00								
Repayment Of Loan	-	0.06	0.12	0.14	0.15	0.16	0.12	-	-
Total Application	1.00	0.06	0.12	0.14	0.15	0.16	0.12	-	-
Net Surplus	-	1.52	1.25	1.19	1.18	1.18	1.23	1.35	1.35
Add: Opening Balance	-	-	1.52	2.77	3.96	5.15	6.33	7.56	8.92
Closing Balance	-	1.52	2.77	3.96	5.15	6.33	7.56	8.92	10.27

IRR

₹ (in lakh)

Particulars / months	0	1	2	3	4	5	6	7	8
Profit after Tax		1.53	1.32	1.27	1.28	1.29	1.30	1.30	1.30
Depreciation		0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Interest on Term Loan		0.09	0.06	0.05	0.04	0.02	0.00	-	-
Cash outflow	(1.00)	-	-	-	-	-	-	-	-
Net Cash flow	(1.00)	1.67	1.44	1.38	1.37	1.37	1.36	1.35	1.35
IRR	156.84								

NPV	6.62

Break Even Point

₹ (in lakh)

Particulars / Years	1	2	3	4	5	6	7	8
Variable Expenses								
Oper. & Maintenance Exp (75%)	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04
Sub Total*(G)*	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04
Fixed Expenses								
Oper. & Maintenance Exp (25%)	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Interest on Term Loan	0.09	0.06	0.05	0.04	0.02	0.00	0.00	0.00
Depreciation *(H)*	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Sub Total (I)	0.15	0.13	0.12	0.10	0.09	0.07	0.07	0.07
Sales (J)	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11
Contribution (K)	2.08	2.07	2.07	2.07	2.07	2.07	2.07	2.06
Break Even Point (L= G/I)	7.19%	6.11%	5.56%	4.94%	4.22%	3.34%	3.20%	3.24%
Cash Break Even {(I)-(H)}	4.65%	3.57%	3.01%	2.39%	1.67%	0.79%	0.65%	0.68%
Break Even Sales (J)*(L)	0.15	0.13	0.12	0.10	0.09	0.07	0.07	0.07

Return on Investment

₹ (in lakh)

Particulars / Years	1	2	3	4	5	6	7	8	Total
Net Profit Before Taxes	1.93	1.95	1.96	1.97	1.98	2.00	2.00	2.00	15.78
Net Worth	1.78	3.10	4.37	5.65	6.94	8.25	9.55	10.85	50.49
									31.25%

Debt Service Coverage Ratio

₹ (in lakh)

Particulars / Years	1	2	3	4	5	6	7	8	Total
Cash Inflow									
Profit after Tax	1.53	1.32	1.27	1.28	1.29	1.30	1.30	1.30	8.00
Depreciation	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.32
Interest on Term Loan	0.09	0.06	0.05	0.04	0.02	0.00	0.00	0.00	0.27
Total (M)	1.67	1.44	1.38	1.37	1.37	1.36	1.35	1.35	8.58

DEBT

Interest on Term Loan	0.09	0.06	0.05	0.04	0.02	0.00	0.00	0.00	0.27
Repayment of Term Loan	0.06	0.12	0.14	0.15	0.16	0.12	0.00	0.00	0.75
Total (N)	0.15	0.18	0.19	0.19	0.18	0.12	0.00	0.00	1.02
	0.09	0.06	0.05	0.04	0.02	0.00	-	-	0.27
Average DSCR (M/N)	8.45								

Annexure -4: Details of procurement and implementation

S. No.	Activities	Weeks					
		1	2	3	4	5	6
1	Order Placement						
2	Fabrication & Transportation.						
3	Installation and commissioning						

Annexure 5: Detailed equipment assessment report

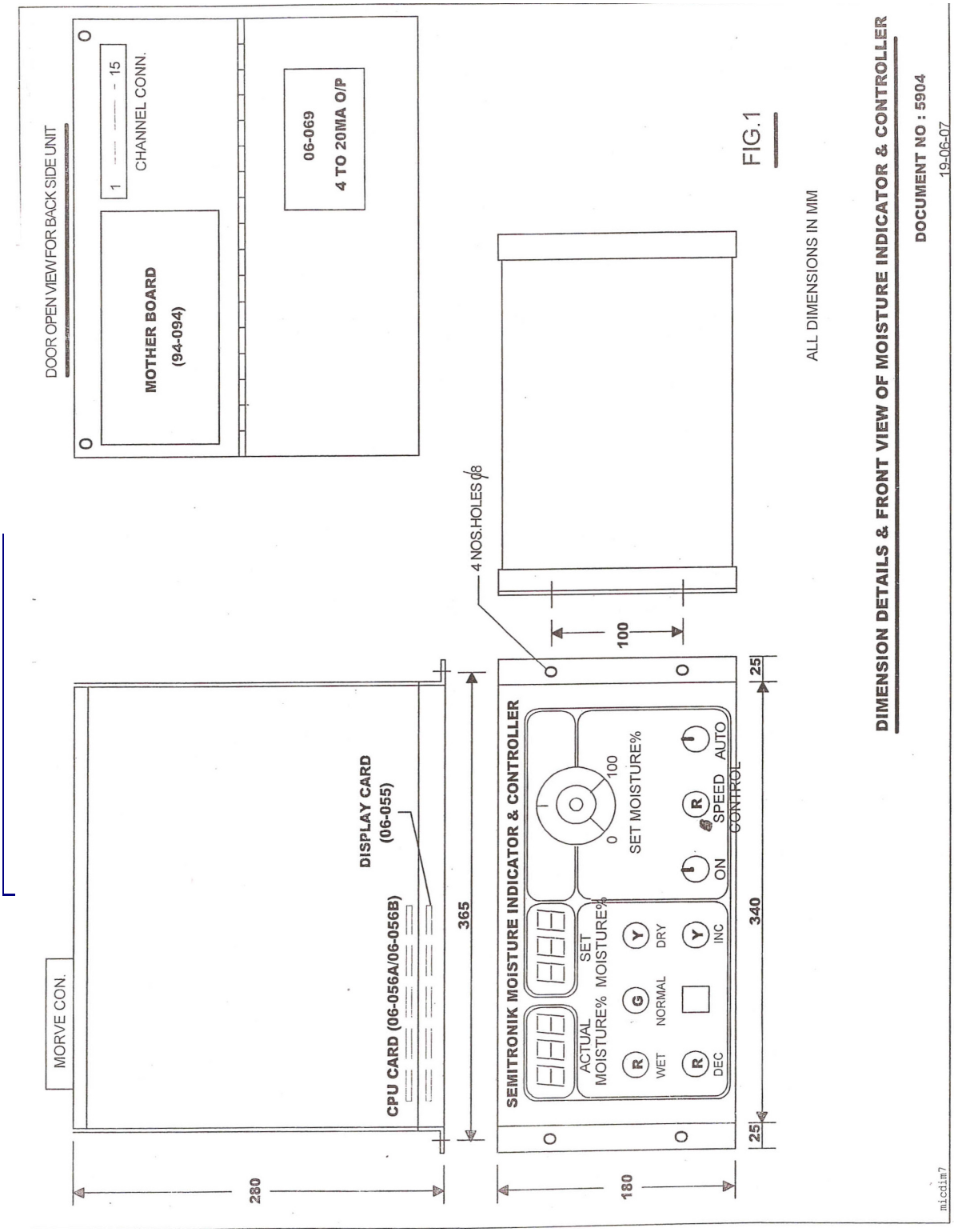
Calculation of Energy Saving Potential

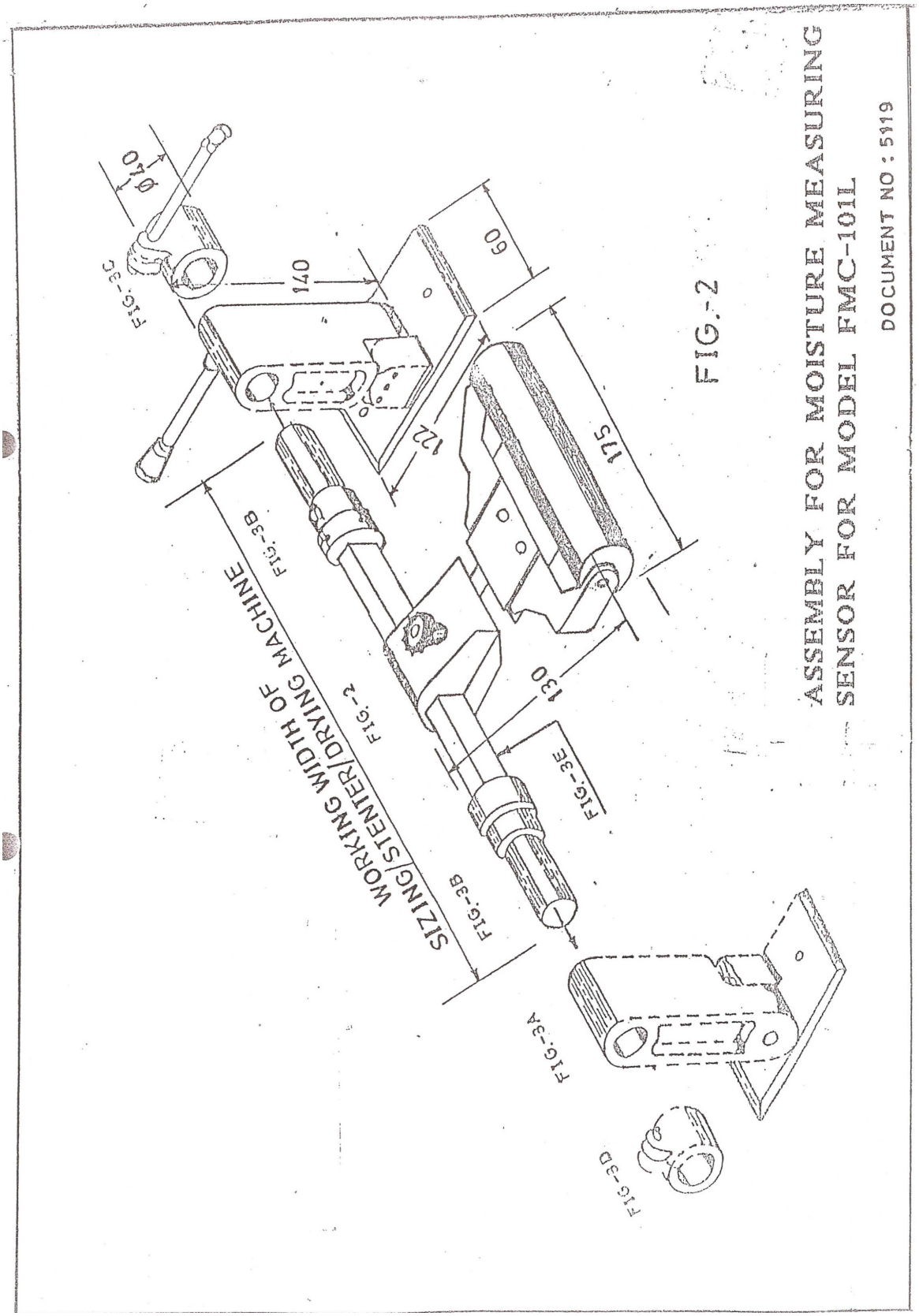
Energy Saving Calculation by Installation of Fabric Moisture Control		
Assume weight of fabric(Normal grade used at Pali)	kg/m^2	0.07
Content of moisture at stenter entry	% age	70
Present moisture content at stenter exist	% age	5
Standard Moisture Regain Value	% age	7
Fabric Width	mtr	1.2
Speed of fabric in stenter	mtr/min	60
Moisture removal per hour for drying from 70% to 5%	kg moisture/hour	= 0.07x1.2x1x60x60x(70-5)/100 = 196.56
Energy required per hour for drying from 70% to 7%	kg moisture/hour	= 0.07x1.2x1x60x60(70-7)/100 = 190.51
i.e.3% less moisture removal or 3% less Heat is required if over drying by 2°C is avoided. Considering, evaporation efficiency in stenter to be 39.7% (as per standard energy balance), the saving works out to 3x100/ (39.7) = 7.5%.		
Rating of stenter	kCal/hr	3,00,000
Energy Saving by 7.5% at 75% capacity utilization	kCal/hr	22,500
Efficiency of the Thermopac	% age	70
GCV of fuel	kCal/kg	8200
Net saving of fuel per hour	Kg	3.9
Yearly saving Potential	MT/Year	28.08
Cost of fuel	₹/MT	7500
Monetary saving	₹ in lakh	2.11
Investment	₹ in lakh	1.0
General Pay Back Period	months	5.6

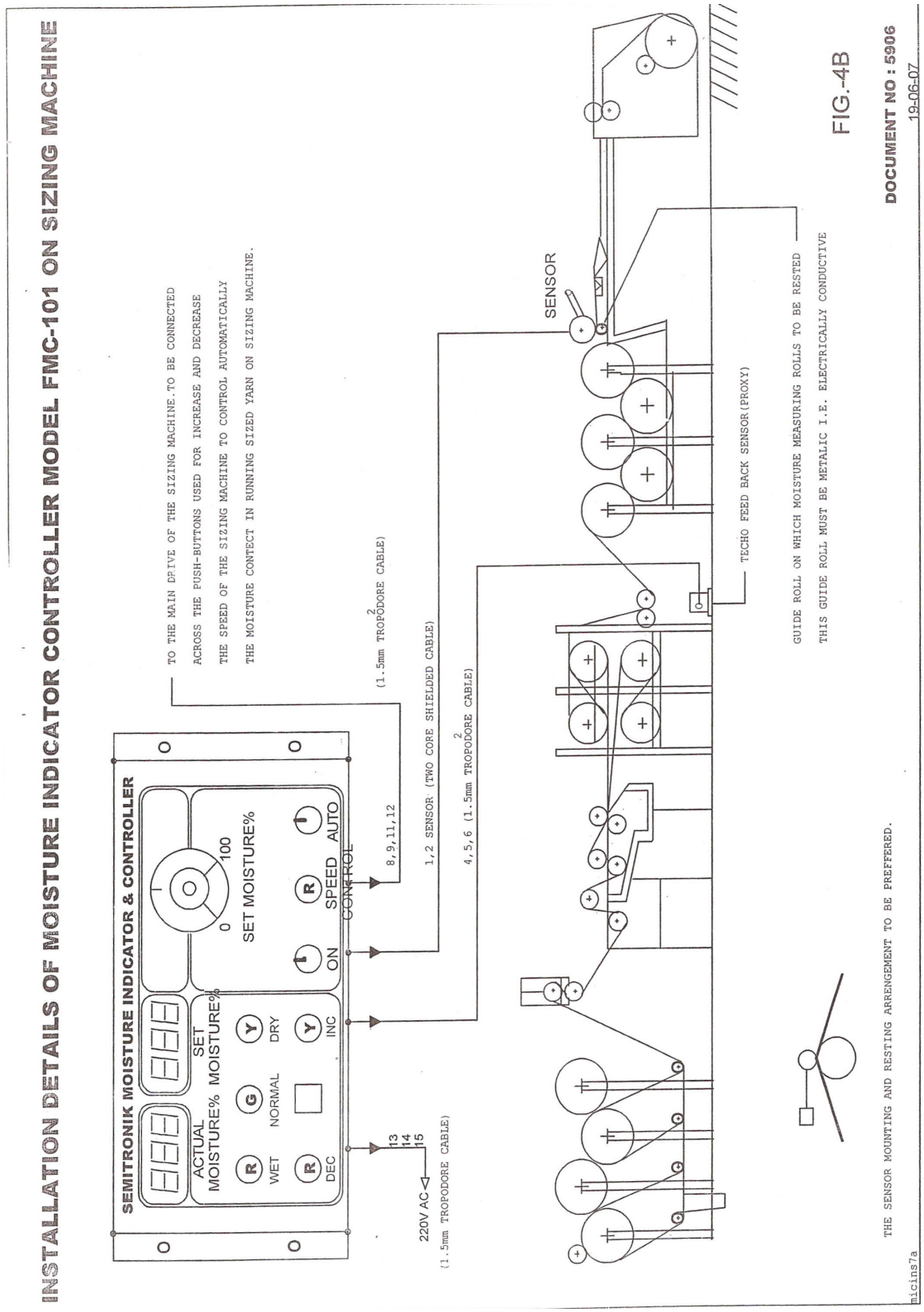
Annexure -6: Details of equipment service providers

S.No.	*Technology*	*Name of Service Provider*	*Address*	*Contact Person and No.*
1.	Installation of Residual Moisture Control System	M/s SEMITRONICS	17 CD, Archana Industrial Estate, Rakhial Road, Ahmedabad 079-22741011	Mr. Parthav Shah
2	Installation of Residual Moisture Control System	M/s Montforts Germany through agent M/s ATE India Ltd.	Delhi Office	
3	Installation of Residual Moisture Control System	M/s PLEVA	PLEVA GmbH Rudolf-Diesel-Strasse 2 D-72186 Empfingen-Germany Tel.: (+49) (0) 74 85 10 04 Fax: (+49) (0) 74 85 10 09 E-mail: info@pleva-controls.de www.pleva-controls.de	

Annexure – 7 Typical arrangement drawings for proposed system




ASSEMBLY FOR MOISTURE MEASURING
SENSOR FOR MODEL FMC-101L
DOCUMENT NO : 5119
FIG.-2
SIZING/STENTER/DRYING MACHINE
WORKING WIDTH OF
140
60
175
130
12
FIG.-3C
FIG.-3B
FIG.-2
FIG.-3E
FIG.-3A
FIG.-3D


INSTALLATION DETAILS OF MOISTURE INDICATOR CONTROLLER MODEL FMC-101 ON SIZING MACHINE
SEMITRONIK MOISTURE INDICATOR & CONTROLLER
ACTUAL MOISTURE%
SET MOISTURE%
WET
NORMAL
DRY
DEC
INC
ON
SPEED CONTROL
AUTO
SET MOISTURE%
0
100
TO THE MAIN DRIVE OF THE SIZING MACHINE.TO BE CONNECTED
ACROSS THE PUSH-BUTTONS USED FOR INCREASE AND DECREASE
THE SPEED OF THE SIZING MACHINE TO CONTROL AUTOMATICALLY
THE MOISTURE CONTECT IN RUNNING SIZED YARN ON SIZING MACHINE.
2 (1.5mm TROPODORE CABLE)
8,9,11,12
1,2 SENSOR (TWO CORE SHIELDED CABLE)
2 4,5,6 (1.5mm TROPODORE CABLE)
220V AC
13
14
15
(1.5mm TROPODORE CABLE)
SENSOR
TECHO FEED BACK SENSOR(PROXY)
GUIDE ROLL ON WHICH MOISTURE MEASURING ROLLS TO BE RESTED
THIS GUIDE ROLL MUST BE METALIC I.E. ELECTRICALLY CONDUCTIVE
FIG.-4B
DOCUMENT NO : 5906
19-06-07
THE SENSOR MOUNTING AND RESTING ARRENGEMENT TO BE PREFFERED.
micins7a

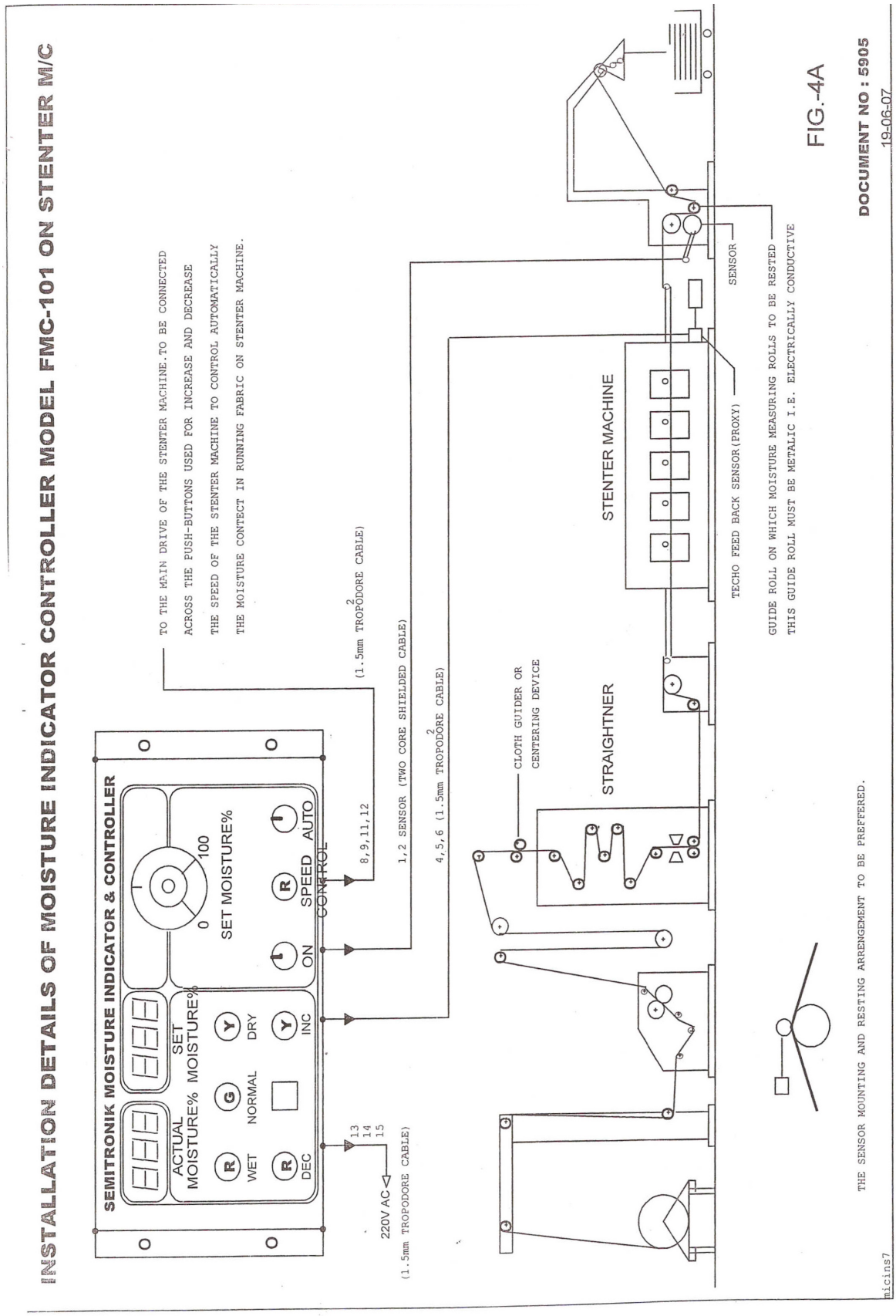

INSTALLATION DETAILS OF MOISTURE INDICATOR CONTROLLER MODEL FMC-101 ON STENTER M/C
SEMITRONIK MOISTURE INDICATOR & CONTROLLER
ACTUAL MOISTURE%
SET MOISTURE%
WET
NORMAL
DRY
DEC
INC
ON
SPEED
AUTO
CONTROL
0
100
SET MOISTURE%
TO THE MAIN DRIVE OF THE STENTER MACHINE.TO BE CONNECTED
ACROSS THE PUSH-BUTTONS USED FOR INCREASE AND DECREASE
THE SPEED OF THE STENTER MACHINE TO CONTROL AUTOMATICALLY
THE MOISTURE CONTECT IN RUNNING FABRIC ON STENTER MACHINE.
(1.5mm TROPODORE CABLE)
8,9,11,12
1,2 SENSOR (TWO CORE SHIELDED CABLE)
4,5,6 (1.5mm TROPODORE CABLE)
220V AC
13
14
15
(1.5mm TROPODORE CABLE)
CLOTH GUIDER OR
CENTERING DEVICE
STRAIGHTNER
STENTER MACHINE
TECHO FEED BACK SENSOR(PROXY)
SENSOR
GUIDE ROLL ON WHICH MOISTURE MEASURING ROLLS TO BE RESTED
THIS GUIDE ROLL MUST BE METALIC I.E. ELECTRICALLY CONDUCTIVE
THE SENSOR MOUNTING AND RESTING ARRENGEMENT TO BE PREFFERED.
DOCUMENT NO : 5905
19-06-07
micins7

FIG.-4A

for treatment of:	dimension stabil woven fabrics
nominal width:	200 cm
working width:	60 - 180 cm
speed range:	2,5 - 50 m/min
range control:	conventional
heating:	circulating oil
stenter chains:	pin chain

Monforts Textil · Postfach 10 17 01 · 41017 Mönchengladbach

Reference Purpose

INDIEN

Date 22.03.2010
Your message
Agents ATE

Quotation 45-06-1385-3

STENTER FRAME RANGE

- **Infeed combination**
- **Finishing padder MATEX 6000 Finish**
- **Straightening machine**
- **Stenter Frame MONTEX 6500 - 5F TwinAir with horizontally reversed stenter chains**
- **Outlet combination**

for treatment of:	dimension stabil woven fabrics
nominal width:	200 cm
working width:	60 - 180 cm
speed range:	2,5 - 50 m/min
range control:	conventional
heating:	circulating oil
stenter chains:	pin chain
in principle according to drawing:	45-061385-3

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Infeed combination

1. **High cloth inlet**
   - cloth guidance system Erhardt & Leimer BFA 3700 with KF 2020 pneumatic cloth guides and manual width adjustment (for a minimum fabric width of 65 cm) — 3.400,-- EUR*
   - Monforts supply — 10.640,-- EUR

2. **Cloth guiding frame**
   - with floating rotary compensator for padder speed control
   - guiding roller for operating without padder — 6.490,-- EUR

Finishing padder MATEX 6000 Finish

3. **Two-Bowl pad mangle with horizontal pad bowl arrangement**
   - machine frame with traverses and claddings, discharge sheets made of stainless steel, large dimensioned pneumatic cylinders for achievement of high contact pressures
   - manual adjustment of the contact pressure
   - squeeze rollers: one driven roller, hard rubber and one even-pressure roller, soft rubber for a maximum contact pressure of 12t
   - 3 kW drive for counter-pressure roller — 92.460,-- EUR

4. **Liquor trough made of stainless steel**
   - pneumatically lifted and lowered
   - level control system with pressure sensor
   - two-fold cloth passage — 5.690,-- EUR

5. **Expander unit for woven goods**
   - curved expander roller before the nip — 3.530,-- EUR

Straightening machine

6. Straightening unit
Mahlo ORTHOMAT RFMC-12

• execution 124 with 4 scanners	60.010,-- EUR*
• servohydraulic drive of skew and bow roller	
• 3 skew rollers	
• 2 bow rollers	
• detection by transmitted and reflected light	
• preset bias	
• PC with 15" TFT colour touch-screen	
• light regulation separately for each scanner	
• automatic scanner positioning	
• automatic scanner cut off	
• back-up control panel	
• safety gates	
• remote diagnostic package	
• speech output	
• standard colour RAL 7038 agate-grey	
• pedestal	530,-- EUR*
• cooling system for electrical side panel	2.900,-- EUR*
• cooling system for touch-screen	2.130,-- EUR*
• Monforts supply	110,-- EUR

Stenter Frame MONTEX 6500 - 5F TwinAir with horizontally reversed stenter chains

7. Stenter inlet with overfeed device

• fabric inlet frame with operating platform	
• upper traction roller	
• bottom traction roller	
• individual drives for the traction rollers 2.2 kW, 50 Hz each	
• overfeed device for pre-needling up to +60% as compared with the stenter chain speed	
• 2 guide rollers	37.060,-- EUR

8. Control box at the stenter inlet

• turnable into line of sight, with the necessary adjustment, operation and indication aggregates for the set-up and control of the stenter frame range	
• air conditioning	9.160,-- EUR

9. Fabric infeed device

- 2 needling-in devices, selvedge tensioning device, right and left separately adjustable, 2 x 0.8 kW drive, pneumatically lifted and lowered
- selvedge uncurlers with 2 driven uncurling spindles (LA 8201) made of stainless steel, 2 x 0.3 kW drive

26.760,-- EUR

10. Fabric feed device with high-tech stenter chains "Hercules"

- infeed track control with frequency controlled drive and selvedge feeler
- inlet field 3100 mm long
- 2 after-pin wheels for the inlet field tracks
- pneumatic chain tensioner
- chain tracks in the treatment chamber
- outlet field 3200 mm long
- 2 after-pin wheels for the outlet field tracks
- 2 frequency controlled stenter chain drives, 3 kW, 50 Hz each
- horizontally reversed pin chains with long-life lubrication
- fabric outlet frame
- depinning rollers

193.740,-- EUR

11. Electrical width adjustment with individual drive for each spindle

- 6 spindles for the treatment chamber, 0.55 kW drive each
- 1 spindle for the outlet field, 0.55 kW drive
- digital width indication at the inlet and outlet of the stenter frame

32.490,-- EUR

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12. Treatment chamber TwinAir plus

- 5 treatment fields, 3000 mm long each
- 150 mm thick insulation cladding for especially high thermal insulation
- Lift-O-Matic
  space saving pneumatic lifting doors, opening and closing at the push of a button
- air circulation filters Secuclean, insert filter system with traction filters for cleaning during production, bottom additional protective filters for the suction chamber
- CADstream nozzle system HLD with "down-stream" flow conduct
- TwinAir plus
  equipment for the constant flow-off of the circulating air from the fabric by division of the flowing air into a right and left partial flow
- **Integrated heat recovery**
  with air/air heat exchanger for cooling of the exhaust air and heating of fresh air. Integrated into the roof of the stenter as standard component of the internal exhaust air/fresh air ducts.
- 1 suction fan with frequency controlled drive motor, nominal efficiency 7.5 kW
- 1 connection tube for direct connection of the suction fan,
  1 supporting frame for the installation of the suction fan on the chamber roof
- 1 fresh air fan with frequency controlled drive motor, nominal efficiency 7,5 kW
- fresh air supply to the fronts of the chamber

option:

- *1 service frame for the cleaning of the heat exchangers* — *3.660,-- EUR*
- **potential for energy saving**
  by means of heat recovery up to:
  15% on drying processes (130-150 °C)
  30% on heatsetting processes (180-200 °C)
  20% on combined processes

163.130,-- EUR

13. Compact front walls of the chamber

- cold air barriers at the fabric inlet and outlet openings — 22.690,-- EUR

14. Floor insulation

- special insulation panels made of mineral fibre, 100 mm thick, for machine installation directly on the ground floor of the factory hall — 1.740,-- EUR

15. Air circulation TwinAir with seperate upper/lower air guiding and electrical regulation of the air quantity

- for 5 treatment fields with 2 air circulation fans each
- frequency controlled high efficiency motors in the highest energy efficient Class EFF1, directly flanged, nominal efficiency 7.5 kW/1450 rpm speed range 580 up to 1450 rpm
- 2 frequency converters 7,5 kW each
- 4 frequency converter/s 15 kW each — 74.010,-- EUR

16. Bypass flaps to avoid markings on the fabric

- automatically closed at fabric standstill
- pneumatically controlled — 15.320,-- EUR

17. Circulating oil heating

- 5 air heaters for the treatment chamber
- 5 automatic temperature control system/s with motor regulating valves, max. temperature of circulating air 230° C
- shut-off valves to be provided by customer — 47.840,-- EUR

18. Exhaust air moisture measurement and control system

- 1 sensor Mahlo ZS 96 — 9.030,-- EUR

19. Cooling zone with CADstream nozzle system

- 1600 mm treatment length, drive motor directly flanged, nominal efficiency 11 KW, nominal speed 1500 rpm — 11.120,-- EUR

S20. Monforts Qualitex 540
central operating system Easy Touch

- all fabric transport drives with frequency-controlled AC-drives
- controlled deceleration of speed to final standstill for normal shutdown and emergency stop
- control and monitoring instruments in the inlet and outlet area
- switch cabinet
  - wired ready for connection - designed for ambient temperature of max. 40°C and a relative air humidity of 90%
- function control of electrical equipment by test runs and technical acceptance test before shipment of the range
- conventional range control
- TFT colour screen 12" (touchscreen) command input by touching the input fields
- additional conventional control elements
- input and display of the machine speed
- input and display of the stentering width
- input of temperature setpoints and indication of actual values
- input and indication of the fan speeds for circulating air and exhaust air (for frequency controlled drives)
- input and indication of the set values for the fabric transport drives
- integration of the Monformatic Professional (only with the corresponding equipment)
- set-up data administration
  database for 100 set-up records
- Qualitex is prepared for teleservice
- telediagnosis and service support (telephone line and telephone connection to the machine to be provided by customer)
- language change
- voltage stabilizer — 50.690,-- EUR

21. Power lines

- power cables for the fabric transport drives
- power cables for the small drives
- power cables for the drives of the air circulation fans — 7.650,-- EUR

22.	**Control lines** • control cables, ready for installation	7.200,-- EUR
23.	**Switch cabinets, prepared for assembling of air condition** • air condition of standard practice with the accessory distribution and waste ducts to be provided by the customer • necessary for ambient temperature of more than 40° C and a relative air humidity of more than 90% • all individual switch cabinets are connected as a unit and are equipped with ducts for conditioned air flow; the air condition provided by the client can be assembled into specially prepared switch cabinets	5.550,-- EUR

Outlet combination

24.	**Delivery support with driven traction roller** • 3 kW drive, 50 Hz	22.710,-- EUR
25.	**Piece length measuring unit** • electrical metre or yard counter with pulse transmitter, digital display with 6 digits at control desk	790,-- EUR
26.	**Plaiter** • cloth tension controllable • lap length 1000 mm	14.620,-- EUR
27.	**High-performance ionization unit Mahlo ANTISTAT AMW-2** • 1 ionization rod for the plaiter	1.070,-- EUR*

Price for Monforts supply	**872.220,-- EUR**
Net price for devices of other make	**70.040,-- EUR***
Total price of the range (excluding options)	**942.260,-- EUR**

Prices marked with a star are machine components which will be manufactured by sub-suppliers. These components are offered at a net price. The price includes the necessary connection parts and the corresponding design costs.

Terms of delivery and payment

The index figures mentioned are not binding. They might be increased or decreased according to the nature of the articles to be treated and to the prevailing operational conditions.

The prices are to be understood for a delivery FOB European port, as per INCOTERMS 2000, including container packing, excluding installation.

Paint finish:
Treatment chamber panels and housing parts are painted with structured paint agate-grey (RAL 7038). Certain functional parts have a uniform corrosion-protection by a silver grey varnish or zinc coating. Switch cabinets in grey according to DIN standards.

The prices quoted are valid for a period of 90 days.

Conditions of payment:
100 % out of an irrevocable and by a German bank confirmed letter of credit to be opened in our favour within 2 weeks after order placing with Deutsche Bank AG, Dresdner Bank AG or Commerzbank AG and to be payable at sight in Germany upon presentation of shipping documents. All banking charges outside Germany and confirmation charges of the German bank are on buyer's account.

Delivery time:
abt. 5 months after full clarification of all technical details and fulfilment of the terms stipulated. The time of delivery indicated is valid at the moment of the estimate. We reserve the right to fix exactly the time of delivery on placing of order corresponding to the conditions valid at that time.

Subject to technical alterations.

Country of Origin:
Federal Republic of Germany

For the rest our supply is subject to our 'General Terms and Conditions for the Supply of Machinery and Machine Parts' in conformity with the general terms of supply for the export of machinery and machine parts, as recommended by the VDMA (German Machinery and Plant Manufacturers' Association), Issue June 2002, as per enclosure.

A. MONFORTS Textilmaschinen GmbH & Co. KG

Enclosures

A. Monforts Textilmaschinen GmbH & Co. KG
Schwalmstrasse 301
41238 Mönchengladbach · Germany
Telefon: +49 (0) 2161 401 - 409 /-408
Internet: www.monforts.de
Ust-Id-Nr.: DE 811506224

Member of VDMA (Verband Deutscher Maschinen- und Anlagenbau / German Engineering Federation)
HRA 3133 Mönchengladbach · Geschäftsführer: Dipl.-Ing. Roland Hampel, Dipl.-Kfm. Dipl.-Ing. Wolfgang Kaphahn
Persönlich haftende Gesellschafterin: A. Monforts Textilmaschinen-Verwaltungs-GmbH, Mönchengladbach HRB 4634
Commerzbank AG (BLZ 310 400 15) Kto. 1 920 180 00 IBAN: DE49 3104 0015 0192 0180 00 (COBADEFF310)
Deutsche Bank AG (BLZ 310 700 01) Kto. 5 988 100 00 IBAN: DE30 3107 0001 0598 8100 00 (DEUTDEDD310)
Dresdner Bank AG (BLZ 310 800 15) Kto. 9 408 836 00 IBAN: DE70 3108 0015 0940 8836 00 (DRESDEFF310)

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