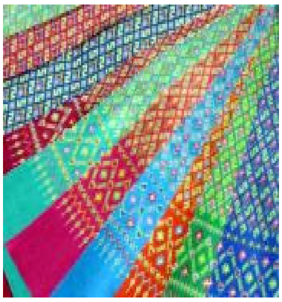
DETAILED PROJECT REPORT
ON
INSTALLATION OF CONDENSATE RECOVERY PUMP IN JET DYEING MACHINE
(PALI TEXTILE CLUSTER)







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CONDENSATE RECOVERY PUMP ON JET DYEING MACHINE

PALI TEXTILE CLUSTER

BEE, 2010

Detailed Project Report on Condensate Recovery Pump in Jet Dyeing Machine

Textile SME Cluster, Pali, Rajasthan (India)

New Delhi: Bureau of Energy Efficiency;

Detail Project Report No.: **PAL/TXT/CSP/03**

For more information

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Acknowledgement

We sincerely appreciate the efforts of industry, energy auditors, equipment manufacturers, technology providers, consultants and other experts in the area of energy conservation for joining hands with Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India for preparing the Detailed Project Report (DPR) under BEE SME Program in SMEs clusters. We appreciate the support of suppliers/vendors for providing the adoptable energy efficient equipments/technical details to the SMEs.

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.

CONTENTS

List of Annexures

List of Figures

List of Tables

List of Abbreviations

- BEE - Bureau of Energy Efficiency
- DPR - Detailed Project Report
- DSCR - Debt Service Coverage Ratio
- FD - Forced Draft
- GHG - Green House Gases
- HP - Horse Power
- 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
- VFD - Variable Frequency Drives
- 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 100gm 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 payback 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, it was observed that there was no arrangement of recovery of condensate from the process machinery using indirect heating. Machineries like Jet Dyeing Machine, Calender Machine, Zero Zero Felt Machine and steam traps is not provided with the system to recover condensate and the hot condensate is not being utilized either. The system was available in only 3 industries. As per the study, 46.61 MT can be saved by installing Condensate Recovery system.

This DPR highlights the details of the study conducted for assessing the potential for installation of Condensate recovery pump on Jet Dyeing Machine, 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 in 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)	3.08
2	Fuel Saving(RPC)	MT/year	46.61
3	Monetary benefit	₹ (in Lakh)	3.50
4	Debit equity ratio	Ratio	3:1
5	Simple payback period	Months	11
6	NPV	₹ (in Lakh)	10.06
7	IRR	% age	92.04
8	ROI	% age	28.64
9	DSCR	ratio	4.68
10	CO_2 saving	MT	98
11	Process down time	Days	2

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 below in fig. 1.

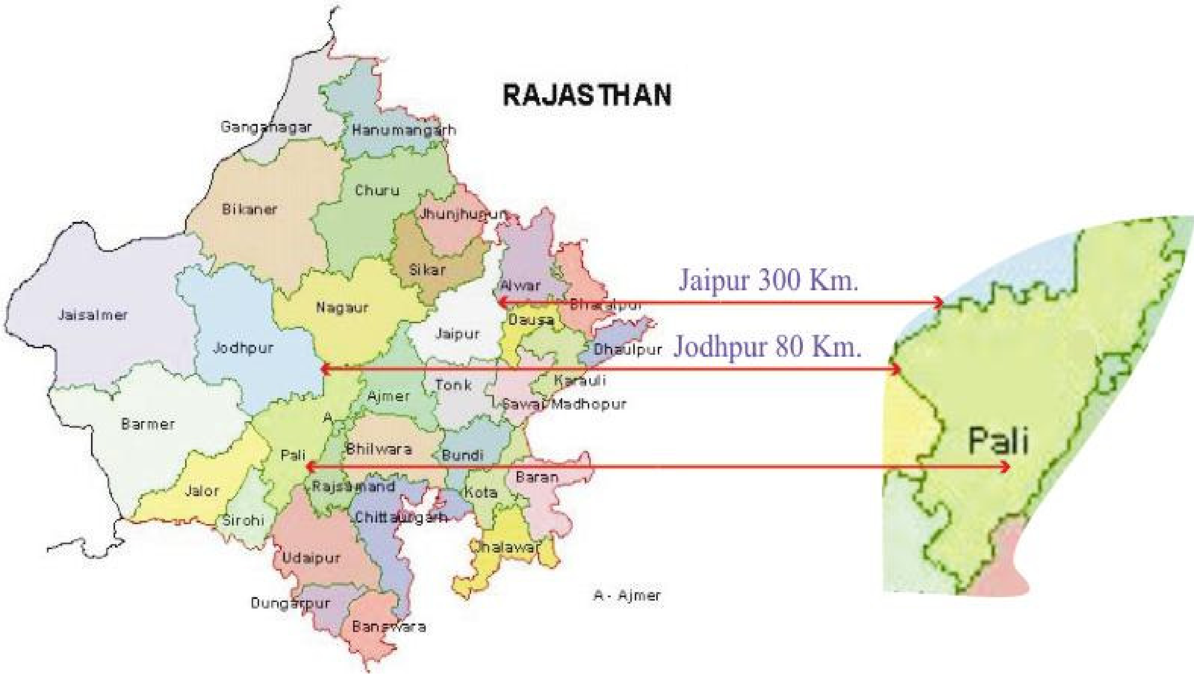

Fig. 1.1 – Pali – Geographical Map

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	27161	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/Yr	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 100000 kWh to 300000 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 Jig 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 color men (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 are drawn below –

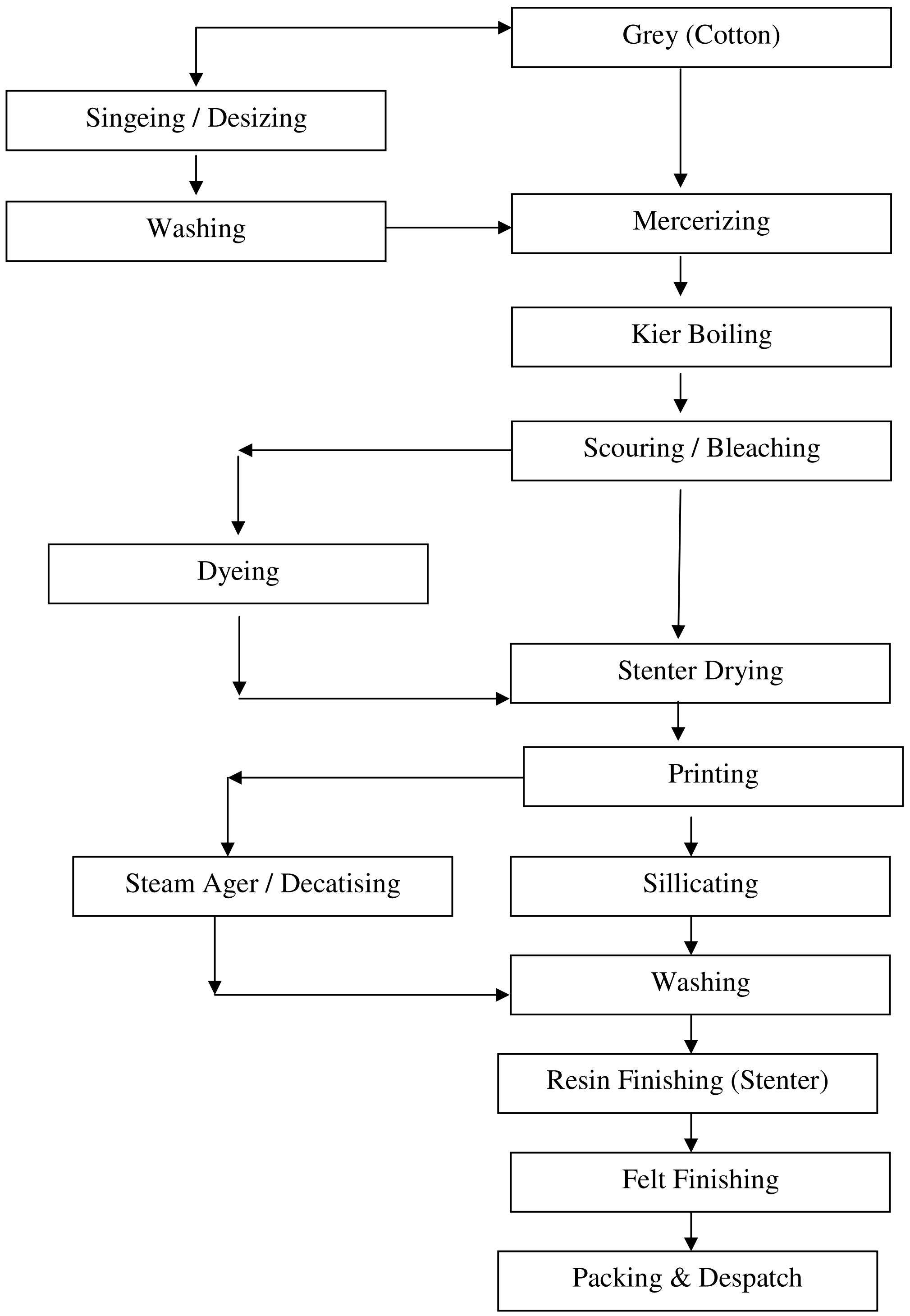

Fig. 1.2 – Process Flow Diagram of Cotton Dyeing and Printing

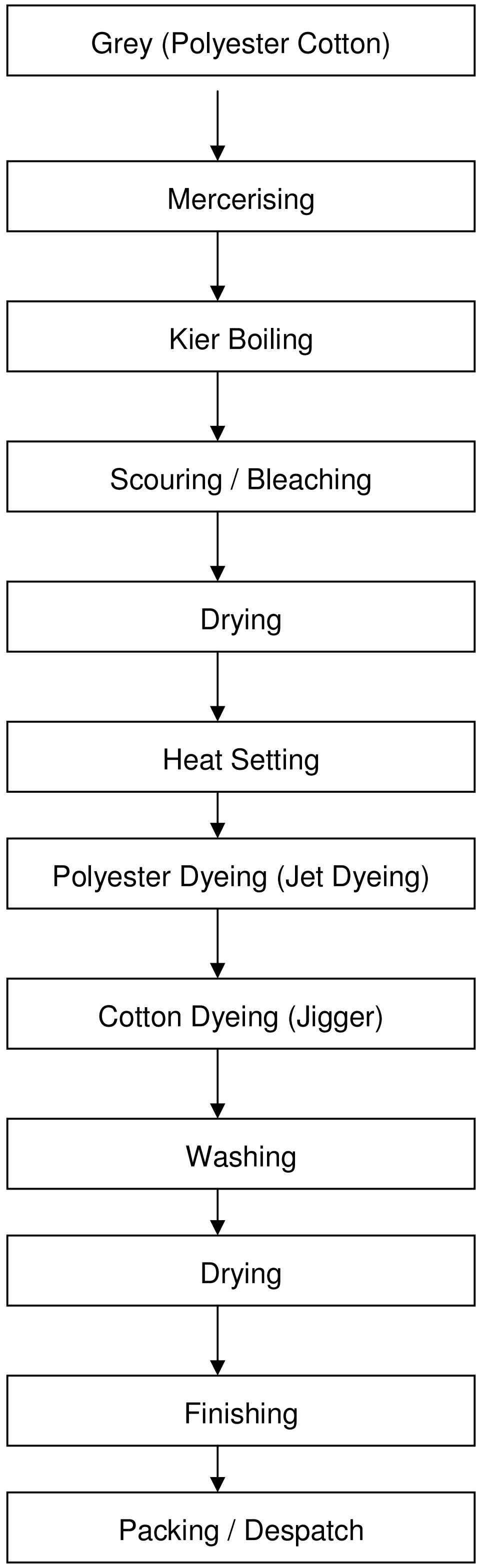

Fig. 1.3 – Process Flow Diagram of Polyester Cotton Dyeing and Finishing

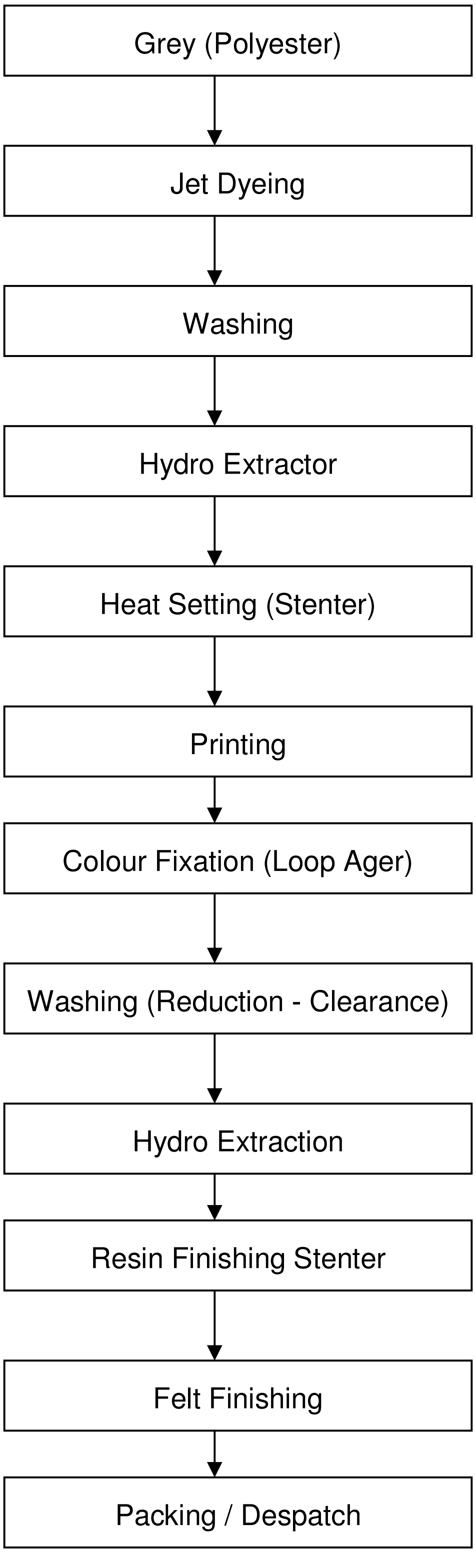

Fig. 1.4 – Process Flow Diagram of Polyester Printing and Finishing

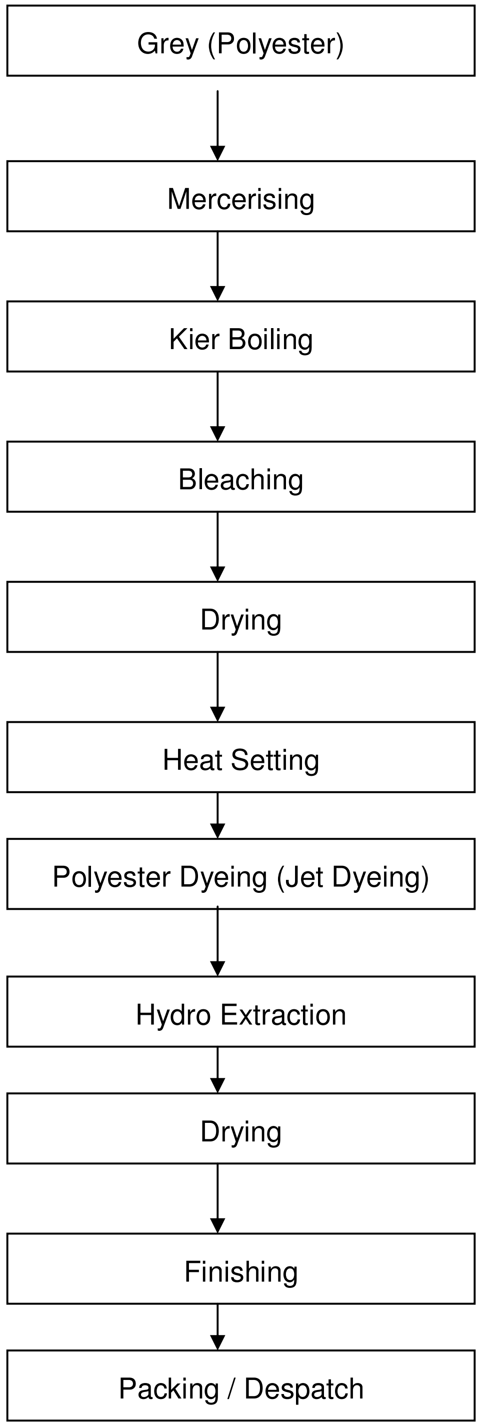

Fig. 1.5 – Process Flow Diagram of Polyester Cotton Dyeing and Finishing

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	**Micro**	**Small**	**Medium**
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	Micro	Small	Medium	Micro	Small	Medium
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	10-16.0
21	Hank	Drying	4.5-6.5

SOURCE – CARBONTRUST UK

SEC in 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

Jet Dyeing Machine revolutionized Polyester dyeing as it works at a very low liquor ratio (1:4), produces very high order of color fastness and also reproducibility with precise control of the process. This triggered its adoption and almost all the units involved in dyeing of polyester or PC blend had to go for this. Presently, Pali Textile cluster has a population of over 150 Jet Dyeing Machines and all of these uses disperse dyes. Only one no. of closed jigger could be found which was used for Polyester Dyeing in the entire cluster.

It is a dyeing machine which dyes the cloth by forcibly contacting the jet flow of dyestuff solution. It executes efficient dyeing in such a manner that the tension on the cloth is decreased as much as possible, and that the cloth dyes evenly with a relatively small amount of dyestuff.

The sketch of a Jet Dyeing Machine is placed below. The various components of the machine are Stainless Steel Vessel, Pump, dye tank, piling motor, reel motor and Heat Exchanger. The pump motor in a typical 250 kg per batch size is of 10 HP and is the largest

electrical load in the machine.

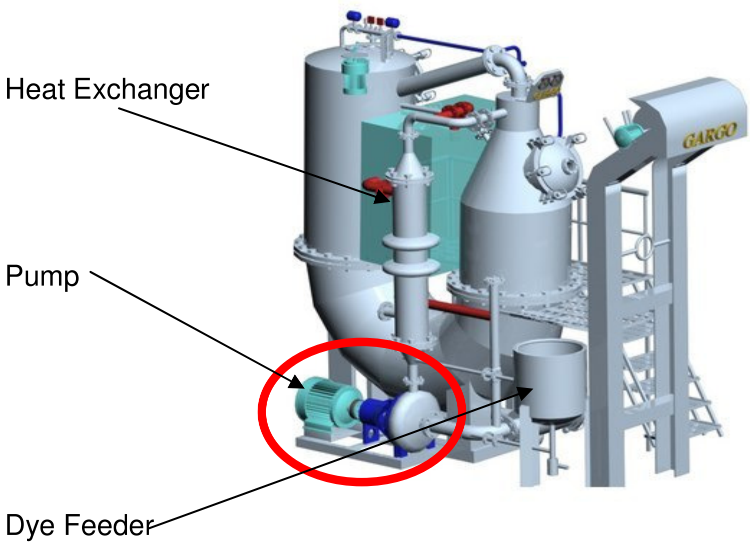

Fig. 1.6 – Sketch of Jet Dyeing Machine with location of pump

The pump is not only the largest electrical load but is also having the highest operating hour out of all the other motors available. In fact the pump remains operative as long as the machine operates except during loading and unloading. Typically, one dyeing cycle is of 3 hours duration with 10 minutes for loading and 10 minutes required for unloading. A typical dyeing cycle is appended below –

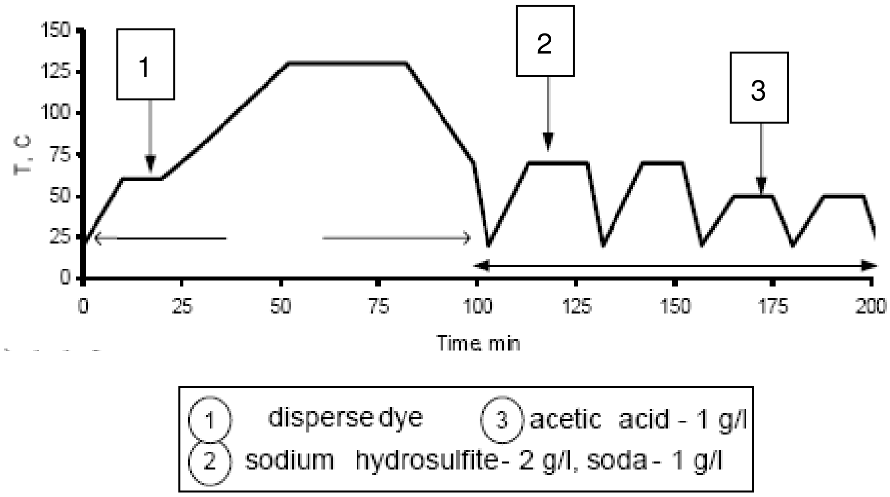

Fig 1.7 – Duty cycle of Jet Dyeing machine

Elaboration of the process is as below:-

- Set the dye bath with the above materials. Raise the temperature to 50℃ and run for 10 minutes.
- Dissolve the dyestuff with soft water at 50℃ and filter it.
- Add the dyestuff slowly in to the bath. Check the pH value to 5.5. to 6.
- Raise the temperature to 115℃ at 2℃ per minute and run 10 minutes.
- Raise the temperature further from 115℃ to 135℃ at 0.5℃ per minute.
- Hold for 45 to 60 minutes according to the depth of the shade.
- Lower the temperature to 80℃ and drain the bath.
- Do hot wash (70℃) for 10 minutes followed by cold wash.

Specification of Jet dyeing machine of different capacity is shown in Table 1.6 below:

Table 1.6 Specification of Jet dyeing machine of different capacity

Details	***Unit***	***Value***				
Fabric Loading Capacity	kg	60	100	150	250	350
Pressure Vessel Diameter	mm	600	700	870	935	1040
Liquor Ratio (1 :3) upto	litre	180	300	450	750	1050
Connected Power						
Main Pump Motor	HP	7.5	7.5	10	10	12.5
Piling Motor	HP	1	1	1	1	1
Take Off Reel Motor	HP	1	1	1	1	1
Max. Working Temp.	°C	140	140	140	140	140
Max. Working Pressure	kg/cm^2	4	4	4	4	
Heating Time (Average)30°C-130°C	Min	30	30	30	30	30
Cooling Time Average 130°C-85°C	Min	15	15	15	15	15
Steam Pressure Required	kg/cm^2	7	7	7	7	7
Water Pressure Required	kg/cm^2	2	2	2	2	2
Fabric Speed Upto	Mtr/Min	300	300	300	300	300
Floor Space Required						
Vessel length (A)	mm	1800	2300	2470	2535	2720
Total Length (B)	mm	3660	4260	4430	4495	4680
Vessel Width (C)	mm	600	700	870	935	1040
Total Width (D)	mm	2065	2165	2335	2400	2505
Height (E)	mm	2600	3100	3425	3425	3925

1.3.2 Role in process

Jet dyeing Machine is a versatile machine wherein polyester and blended fabric is dyed. All the processes required for dyeing is completed in the jet dyeing machine and the dyed fabric is then put to hydro extractor for water removal and then to stenter for heat setting and finishing.

Benchmarking for existing specific energy consumption

Energy consumption in Jet Dyeing machine would depend on following mentioned things

- Duration of each process and cycle
- Sizing of Pump
- Duty point of pump

1.3.3 Energy audit methodology

The following methodology was adopted to evaluate the performance of Jet dyeing machine which is shown in Fig. 1.8 below:

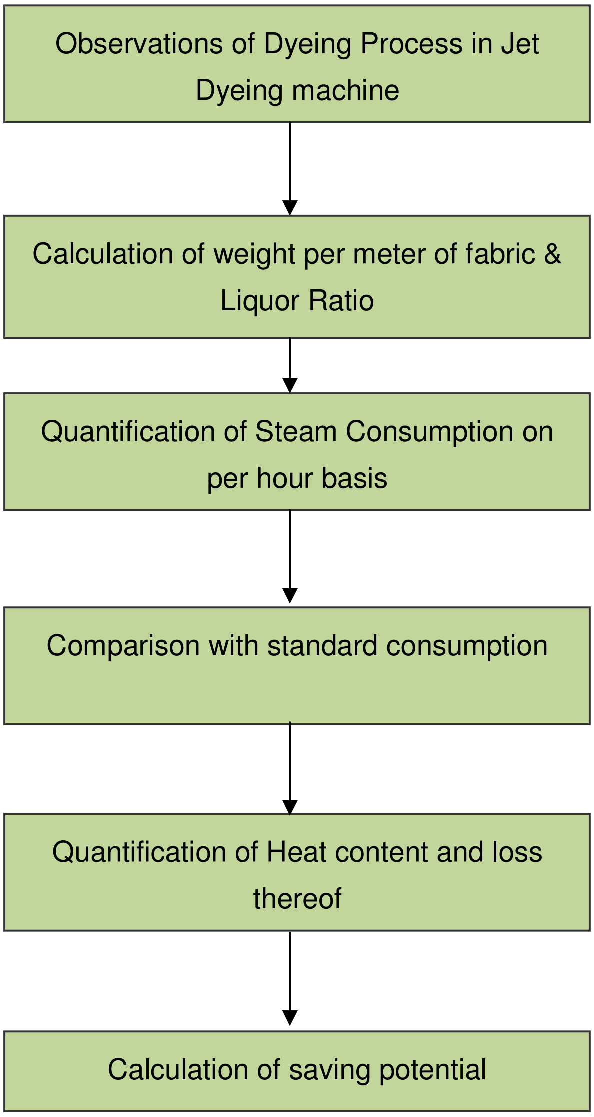

Fig. 1.8 Energy Audit methodologies

1.3.4 Design and operating parameters specification

The requirements of the disperse dyeing is that the fabric should be dyed at a temperature between 115 °C to 135 °C for sufficient period so that uniform dyeing occurs and also colour fastness is achieved. This heating is done by way of supplying heat to Dye Water through steam in a heat exchanger.

1.3.5 Operating efficiency analysis

Rated steam consumption of a 250 kg fabric capacity Jet dyeing Machine is 250 kg per hour. Presently, only 3 units are recovering condensate. By not recovering the condensate, heat contained in the condensate is simply wasted.

Added advantage of the system is that all the condensate removal steam circuit elements like steam traps and other loads can be attached to it for recovery of additional condensate.

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:-

1. Kick Off Seminar to create awareness
2. Energy Audit (Detailed and Preliminary) in over 78 units
3. Capability building and involvement of institutional financers, local service providers and also domestic equipment manufacturers.
4. Design and distribution of dissemination material containing most of the measures.
5. Design and distribution of Cluster Manual containing technology gap assessment and cost benefit analysis of proposed Energy Conservation measures.
6. 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 steam utilization audit was earlier conducted in most of the big units by a service provider and a few of them subsequently purchased the system. The barrier seems to be other than knowledge of its saving potential and feasibility.

- Condensate Recovery Pump is a part of the steam distribution and utilization system and comes as an optional unit with steam system. The reason for non adoption seems to be non propagation as a module with guaranteed cost benefit potential to the entrepreneurs. The entrepreneurs are in Micro, Small and medium sector and they do not have trained or educated manpower. Cost of spares also seems to be a reason for non adoption.
- 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. ₹ 3.0 lakh investment for one location (Consisting of 4 to 6 Jet Dyeing Machine) and cannot be managed from internal resources.
- 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.
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- 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 to 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

The condensate Recovery Pump proposed to be installed is a diaphragm pump drawing the motive power from steam and has a steam consumption of 5 kg per tonne of condensate removed. The condensate collects in the receiver of the pump. When the receiver gets filled with condensate up to a prefixed level, flow of steam is triggered, which in turn pumps condensate through positive displacement. The condensate thus recovered is pumped into Feed Water Tank.

Description of equipment

The typical consumption of a 250 kg capacity Jet Dyeing Machine is 150 kg Steam per hour and most of the units do not have systems to recover either of flash steam or condensate. Typically, 97% condensate is recoverable in a non direct injection type system and heat content in the condensate and also in Flash Steam is typically 10% each. Condensate recovery from Steam Traps near these machines can also be considered by using the same system. A typical system is shown in Fig. 2.1& Fig. 2.2 below:

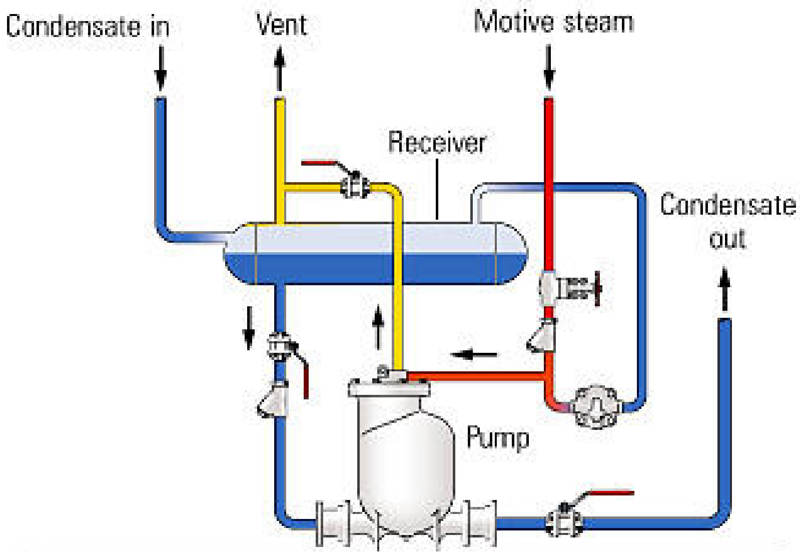


Fig. 2.1 – Sketch of Typical Condensate Recovery Pump

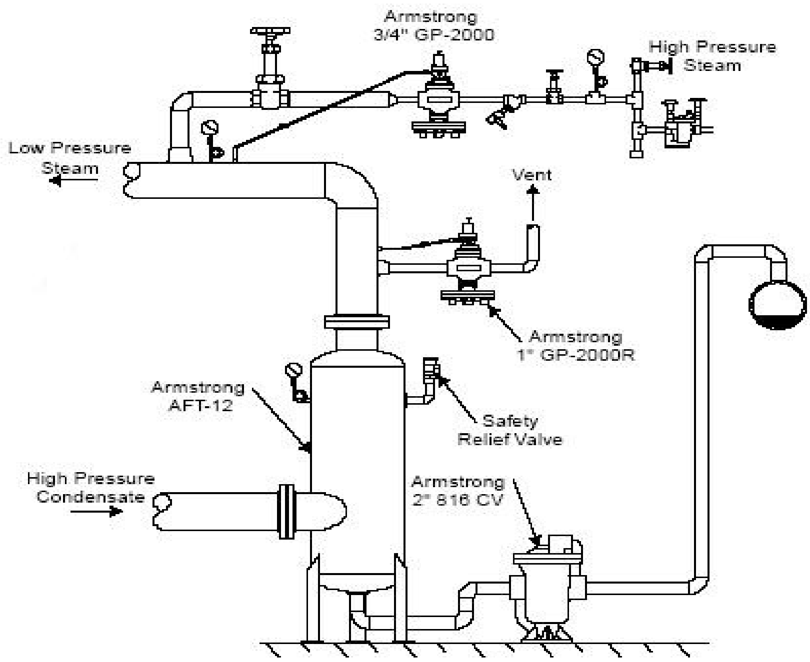


Fig. 2.2 – Typical Arrangement for Flash Steam recovery

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 hooked on to existing Jet Dyeing Machine without any modification to existing Machinery.

2.1.3 Superiority over existing equipment

Since the system works on indirect heat transfer from steam to dyeing fluid i.e. water, any intervention on condensate and flash steam side for its recovery will not have any bearing on functional output of the Jet Dyeing Machine.

2.1.4 Availability of equipment

The system can be delivered within 3 to 4 weeks of placement of order from M/s Forbes Marshall as per attached quotation.

2.1.5 Source of equipment

This technology has recently been implemented in one of the famous textile process house at Bhilwara 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 given in Annexure 1 and Annexure 2.

2.1.7 Terms and conditions in sales of equipment

Term and conditions in sale of the equipment are given in Annexure 2.

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 diaphragm pump, flash steam vessel with control equipments and insulated pipelines. The unit has been observed to have a life cycle of over 10 years.

2.3 Suitable Unit for Implementation of Proposed Technology

The proposed system can be implemented in over 20 clusters of 3 Jet Dyeing Machines each. Total potential for energy saving would be 932 MT RPC 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

Installation of condensate recovery pump would save about 46.60 MT RPC per year. Detail of fuel saving calculation is given in Annexure 5.

3.1.2 Electricity saving

No electricity saving is possible.

3.1.3 Improvement in product quality

The proposition will have no impact on the product quality.

3.1.4 Increase in production

Installation of proposed machinery will not have any impact on the production of the units.

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

The implementation of the proposed project would result in saving of makeup water in the boiler.

3.2 Monetary benefits

The monetary saving arising out of implementation of proposed technology for three Jet dyeing machine would be ₹ 3.49 lakh per year. Detail of fuel saving calculation is given in Annexure 5.

3.3 Social benefits

3.3.1 Improvement in working environment in the plant

Proposed equipment reduces the GHG emission by reducing electricity consumption.

3.3.2 Improvement in workers skill

Not contributing to any improvement in skill sets of workers. However, lot of problems in working condition and also safety preparedness at the workplace would improve due to elimination of release of flash steam and hot condensate.

3.4 Environmental benefits

3.4.1 Reduction in effluent generation

The indirect benefit of implementation of the proposed system would accrue by way of lesser quantum of flue gas released in the atmosphere.

3.4.2 Reduction in GHG emission

The equivalent saving in GHG emission for a cluster of 3 Jet dyeing pump would be 98 MT CO_2 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 equipment (CPPU Model) is about ₹ 2.28 lakh (1.98 Lakh+10.3% ED + 2% CST + 2.5% Freight = 2.28 Lakh) as per the quotation from M/s Forbes Marshall attached as Annexure 2.

4.1.2 Erection, commissioning and other misc. cost

Erection & commissioning cost and other miscellaneous cost are about ₹ 0.72 lakh. A detail of project installation cost is given in Table 4.1 below:

Table 4.1 Details of proposed equipment installation cost

S.No	Particular	Unit	Value
1	Equipment cost	₹ (in Lakh)	2.28
2	Erection & Commissioning cost	₹ (in Lakh)	0.72
3	Interest during implementation	₹ (in Lakh)	0.08
4	Other misc. cost	₹ (in Lakh)	Nil
5	**Total cost**	₹ (in Lakh)	3.08

4.2 Arrangements of funds

4.2.1 Entrepreneur's contribution

Entrepreneur will contribute 25% of the total project cost which is ₹ 0.77 lakh.

4.2.2 Loan amount.

Remaining 75% cost of the proposed project will be taken from the bank which is ₹ 2.31 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 ₹ 3.50 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 3.08 lakh and monetary savings due to reduction in Electricity & Fuel consumption is 3.50 lakh hence, the simple payback period works out to be 11 months.

4.3.3 Net Present Value (NPV)

The Net present value of the investment at 10% works out to be ₹ 10.06 Lakh.

4.3.4 Internal rate of return (IRR)

The after tax Internal Rate of Return of the project works out to be 92.04%. 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 28.64%.

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	11
2	NPV	₹ (in lakh)	10.06
3	IRR	% age	92.04
4	ROI	% age	28.64
5	DSCR	ratio	4.68

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	86.77	9.36	28.55	4.44
Realistic	92.04	10.06	28.64	4.68
Optimistic	97.32	10.73	28.72	4.91

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

Annexure -1: Information Brochure of equipment

TÜV CERT
ISO 9001 : 2000
Certificate: 04100 1994 0422
RWTÜV

\ Forbes Marshall

Compact Condensate Pump

Pressure Powered

Description:
Compact Condensate Pump is a positive displacement pump unit operated by steam, compressed air or pressurised gas. The compact pump has in built receiver. This eliminates need of separate storage tank. The size enables this pump to be used with individual equipments also. The pump is specifically designed to pump hot condensate and liquids of specific gravity 1.0 down to 0.9.

Sizes & Pipe Connections:
20 & 25 NB Compact Condensate Pump

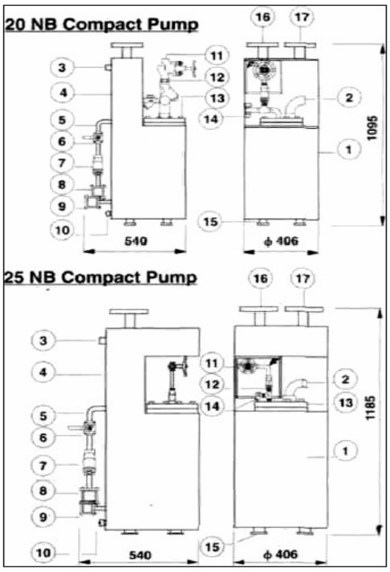
Pump Size (NB)	Inlet Connection (NB) Flange BS – 10 Tab FE	Outlet Connection (NB) Flange BS 10 Tab 'H'
20	20	20 Tab H
25	25	25 Tab E

Limiting Conditions:
Body design: 8.7 kg/cm^2 g at 220° C.
Operating inlet motive pressure:
Steam, compressed air or pressurised gas 3 to 8.7 kg/cm^2
Steam consumption: 3 kg of steam per 1000 kg liquid pumped.
Air consumption: 220SCF per 1000 kg liquid pumped.

How to Specify:
Example: 20 NB SPIRAX MARSHALL Compact Condensate Pump
Accessory: Condensate Flow Meter (CFM 1) Insulation Jacket

Available Spares:
- Set of Internals
- Gasket Kit (pkt. of 5)
- Valve Kit
- Exhaust Valve Kit
- Float Assembly
- Spring Assembly (pkt. of 2)

How to order Spares:
Always order spares giving description & PC. No. given in 'User Manual' under the heading 'Available Spares'.



S. No.	Description	Material
1	Compact Condensate Pump Shell	MS ERW Pipe
2	Exhaust Elbow	MS
3	Overflow Socket	MS
4	Receiver Shell	MS ERW Pipe
5	Condensate Inlet Line	MS
6	Ball Valve for Condensate Inlet	Carbon Steel
7	20NB/25 NBFIG 12 Strainer	C.I.
8	25/40 NB DCV2 for Condensate Inlet	SS
9	25 NB DCV2 for Condensate Outlet	S.S
10	15 NB Drain	MS
11	15 NB Piston Valve for Steam Inlet Connection	FCS
12	20NB/25 NB FIG 12 Strainer Steam Inlet	C.I.
13	Cover Plate Assembly	See Overleaf
14	15NBTD21 Trap	SS
15	LEG Support	MS
16	Condensate Inlet Conn. 20 NB/25NB Flanged to BS 10 TAB 'F'	MS
17	Vent Connection 50 NB/80NB Flanged to BS 10 Tab 'F' 'E'	MS

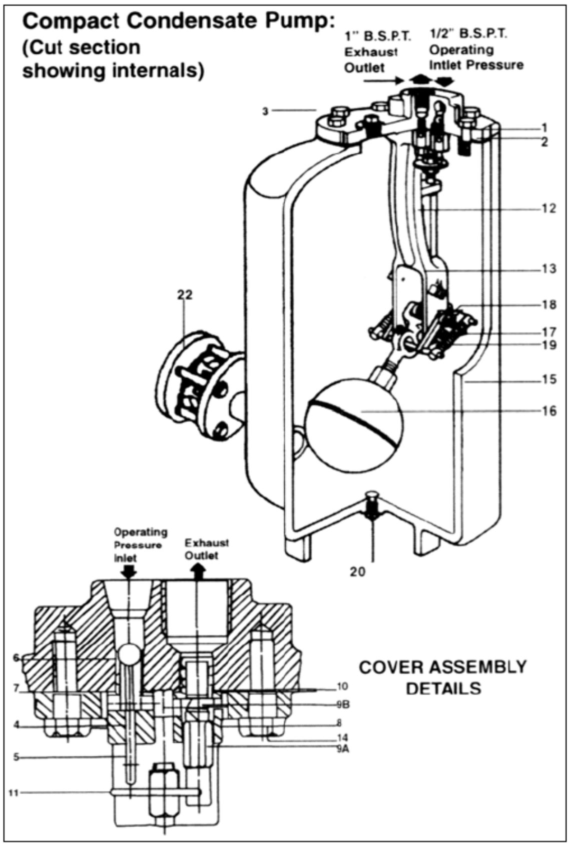
ENERGY IS LIFE
BEE
CONSERVE IT

How to select and size:
From the inlet pressure (motive pressure) and back pressure conditions given below, select the pump size, which meets the capacity requirement of the application. Select optional extras as required. Back pressure is the lift height (H) in mtr x 0.1 plus bar(g) in return line plus downstream piping friction pressure drop in bar(g) at the lesser of six times the actual flow rate or 340 litre / minute.

Capacity kg/hr
For liquid specific gravity (0.9 to 1).

No	INLET Pr. (M.P.) (bar)	TOTAL Lift Or Back Pr (bar)	Condensate Flow Rate (Kg/hr)	
			20 NB Compact Pump kg/hr	25NB Compact Pump kg/hr
1	8.7	1	600	1020
2	8.7	2	514	900
3	8.7	3	482	800
4	8.7	4	470	780
5	7	1	590	900
6	7	2	550	900
7	7	3	475	800
8	7	4	390	780
9	6	1	580	900
10	6	2	520	900
11	6	3	425	800
12	6	4	300	690
13	5	1	550	900
14	5	2	430	840
15	5	3	320	720
16	4	1	440	840
17	4	2	340	720
18	3	1	325	660

Compact Condensate Pump:
(Cut section showing internals)



COVER ASSEMBLY DETAILS

Example:
Condensate Load____________________450 kg/hr
Steam/Air Pressure available for
Operating Pump_____________________7 bar (g)
Vertical Lift from Pump to the
Return piping_______________________9 m
Pressure in return piping (piping fiction
negligible)__________________________1.72 bar

Solution:
1. Calculate "H", the total lift or back pressure against which the condensate must be pumped
= (9mx0.1) + 1.72
= 2.62 bar
2. From capacity table: 7 bar operating inlet pressure and 3 bar backpressure Pump has a capacity of 475 kg/hr

Note from capacity factor charts:
Pump capacity using compressed air (% BP/ MP = 3/7) = 42% =1.1 x 475 = 522 kg/hr.

Capacity multiplying Factors for motive gas supplies (other than steam)

% BACK PRESS VS. MOTIVE PRESSURE (BP/MP)

10%	20%	30%	40%	50%	60%	70%	80%	90%
1.04	1.06	1.08	1.10	1.12	1.15	1.18	1.23	1.28

Material

Sr.	Description	Material	Standard
1	COVER	C I	IS210 FG220
2	COVER GASKET	Asbestos free synthetic fibre	IS 2712
3	STUD&NUTM-12	MS	IS 1367
4	INLET VALVE SEAT	S.S. TYPE 304	ASTM A 276
5	INLET VALVE STEM	S.S. TYPE 304	ASTM A 276
6	INLET VALVE HEAD	S.S.	
7	INLET SEAT GASKET	COPPER	
8	EXHAUST SEAT	SS TYPE 304	ASTM A-276
9A	EXHAUST VALVE	S.S.TYPE410	ASTM A-276
9B	EXHAUST VALVE HEAD	S.S.	
10	EXHAUST SEAT GASKET	S.S.TYPE 304	ASTM A-240
11	VALVE ACTUATOR DISC	SS TYPE 304	ASTM A-276
12	PUSH ROD	SS TYPE 304	ASTMA-276
13	MECHANISM YOKE	C.I	IS210 FG260
14	MECHANISM SCREWS. M-12	SS TYPE 304	ASTM A 193
15	BODY	MS	IS 2062
16	FLOAT	SS TYPE 304	ASTM A-240
17	LINKAGE MECHANISM	SS TYPE 304	ASTMA-351 FC8
18	PUSH ROD ACTUATOR	SS TYPE 304	ASTM A-351 CF8
19	SPRING	SS TYPE 316	
20	PLUG 1/2-BSPT	MS	ASTM A 105
21	HANDLE (not shown)	MS	IS 2062
22	DISC CHECK VALVE	SS316	

CLICK FOR ADDRESS

Annexure -2: Quotation from M/s Forbes Marshall

Forbes Marshall

SPIRAX MARSHALL P. LTD.
10-11/AHD-RS/SPX-PCRA/121

16th NOV 2010

Petroleum Conservation Research Association
Jaipur

Kind Attn: Mr. Suman Kumar (Jt. Director)

SUB: Proposal for Condensate Recovery System.

Dear Sir,

With reference to your discussion with Mr. Maulik Sheth regarding budgetary offer for Spirax Make condensate recovery system, Please find below offer for the same.

Here we have given two options for condensate recovery

1. Condensate Load : 800-850 kg/hr
2. Condensate Load : 1500-1700 kg/hr

We at the Forbes Marshall Group are committed to the cause of Energy conservation and the association of Spirax Marshall with the various engineering industries is more than 60 years old. Spirax Marshall has technical and financial partnership with Spirax Sarco Limited, U.K. and is the Flagship Company of the Forbes Marshall group.

If at any moment of time you have any doubt, please feel free to ask.

Thanking you,

Spirax Marshall PVT.Ltd.

Rajan Shah
(09825010723)
Steam Engineering Group
rshah@forbesmarshall.com

Forbes Marshall

SPIRAX MARSHALL P. LTD.
10-11/AHD-RS/SPX-PCRA/121 **16th NOV 2010**

QUOTATION

Option 1: SPIRAX Make Condensate Recovery System – 25 NB & 150 NB Flash Vessel

Compact Pressure Powered Pump (CPPPU)

Max. Condensate Flow	:	800-850 Kg/Hr.
Back Pressure	:	1 Bar g
Motive Pressure	:	4 Bar g Steam Pressure
PPPPU Pump size	:	25 NB
Flash Vessel	:	150 NB
Price Per Unit	**:**	**Rs.1,20,750/- (PPPPU)**
Price per Unit	**:**	**Rs. 77,250/- (Flash Vessel)**

PPPPU Consisting

- Pump with Receiver
- Inlet Isolation Valve , Strainer , Disc Check valve for Pump Inlet Line
- Outlet Disc Check Valve for Outlet Line

6" Flash Vessel Consisting

- Flash Vessel
- Ball Float Steam Trap
- Sight Glass
- Strainer
- Pressure Gauge & Safety valve.

Forbes Marshall

SPIRAX MARSHALL P. LTD.
10-11/AHD-RS/SPX-PCRA/121 **16th NOV 2010**

Option 2: SPIRAX Make Condensate Recovery System – 40 NB & 150 NB Flash Vessel

Compact Pressure Powered Pump (PPPPU)

Max. Condensate Flow	:	1500-1700 Kg/Hr.
Back Pressure	:	1 Bar g
Motive Pressure	:	4 Bar g Steam Pressure
PPPPU Pump size	:	40 NB
Flash Vessel	:	150 NB
Price Per Unit	**:**	**Rs.1,71,500/- (PPPPU)**
Price per Unit	**:**	**Rs. 77,250/- (Flash Vessel)**

PPPPU Consisting

- Pump with Receiver
- Inlet Isolation Valve , Strainer , Disc Check valve for Pump Inlet Line
- Outlet Disc Check Valve for Outlet Line

6" Flash Vessel Consisting

- Flash Vessel
- Ball Float Steam Trap
- Sight Glass
- Strainer
- Pressure Gauge & Safety valve.

Forbes Marshall

SPIRAX MARSHALL P. LTD.
10-11/AHD-RS/SPX-PCRA/121 **16th NOV 2010**

TERMS & CONDITIONS

PRICES	:	EX-WORKS, Pune exclusive of all taxes, duties, levies etc. as applicable.
P&F CHARGES	:	@ 2.5%
DUTIES/TAXES	:	Central Excise Duty will be charged extra as applicable at the time of despatch. Present rate of C.E. duty is @10.3%. CST @2% against Form `C' otherwise 13%will be charged. Please specify CST, ST & Excise Regn. No. while placing the order.
PAYMENT	:	30% non-refundable advance along with order and balance against Proforma Invoice.
DELIVERY	:	4 weeks from the date of receipt of advance along with technically & commercially clear order.
VALIDITY	:	30 Days from the date of offer
INSURANCE	:	To be arranged by you, alternatively we can arrange on your behalf at your cost @0.75% and the charges will be added in the final invoice.
Freight & Octroi	:	Extra at actuals.
ORDERING INFORMATION	:	Your purchase order should be prepared in the name of our Mfg. Co. M/s. SPIRAX MARSHALL P. LTD., PUNE and mail it our Ahmedabad Office address for further processing.

Yours faithfully,
For Spirax Marshall P. Ltd.

Rajan Shah
Steam Engg. Group
Mobile: 98250 10723

Annexure 3 Detailed financial calculation

Assumption

Name of the Technology	Condensate Recovery Pump in Jet Dyeing Machine		
Details	**Unit**	**Value**	**Basis**
Installed Capacity	Kg/hr	850	Feasibility Study
No of working hours	Hours	7200	Feasibility Study
No of Shifts per day	Shifts		
Capacity Utilization Factor	%age		
Proposed Investment			
Equipment cost	₹ in lakh	2.28	
Civil works, erection and commissioning	₹ in lakh	0.72	
Investment without IDC	₹ in lakh	3.00	
EPC cost	₹ in lakh	0.08	
Total investment	₹ in lakh	3.08	
Financing pattern			
Own Funds (Equity)	₹ in lakh	0.77	
Loan Funds (Term Loan)	₹ in lakh	2.31	
Loan Tenure	yr	5	Assumed
Moratorium Period	Months	6	Assumed
Repayment Period	Months	66	Assumed
Interest Rate	%/yr	10	SIDBI Lending rate
Estimation of Costs			
O & M Costs	% on Plant & Equip	4	Feasibility Study
Annual Escalation	% age	5	Feasibility Study
Estimation of Revenue			
Fuel saving (RPC)	Tonne	46.61	
Cost of fuel	₹/tonne	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	2.31	0.12	2.19	0.27
2	2.19	0.24	1.95	0.21
3	1.95	0.44	1.51	0.18
4	1.51	0.55	0.96	0.13
5	0.96	0.66	0.30	0.07
6	0.30	0.30	0.00	0.01
		2.31		

WDV Depreciation

₹ (in lakh)

Particulars / years	1	2
Plant and Machinery		
Cost	3.08	0.62
Depreciation	2.46	0.49
WDV	0.62	0.12

Projected Profitability

₹ (in lakh)

Particulars / Years	1	2	3	4	5	6	7	8
Fuel savings	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
Total Revenue (A)	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
Expenses								
O & M Expenses	0.12	0.13	0.14	0.14	0.15	0.16	0.16	0.17
Total Expenses (B)	0.12	0.13	0.14	0.14	0.15	0.16	0.16	0.17
PBDIT (A)-(B)	3.37	3.37	3.36	3.35	3.35	3.34	3.33	3.32
Interest	0.27	0.21	0.18	0.13	0.07	0.01	-	-
PBDT	3.11	3.16	3.18	3.22	3.28	3.33	3.33	3.32
Depreciation	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
PBT	2.94	3.00	3.02	3.06	3.12	3.17	3.17	3.16
Income tax	-	0.91	1.08	1.10	1.11	1.13	1.13	1.13
Profit after tax (PAT)	2.94	2.09	1.94	1.97	2.00	2.04	2.04	2.03

Computation of Tax

₹ (in lakh)

Particulars / Years	1	2	3	4	5	6	7	8
Profit before tax	2.94	3.00	3.02	3.06	3.12	3.17	3.17	3.16
Add: Book depreciation	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Less: WDV depreciation	2.46	0.49	-	-	-	-	-	-
Taxable profit	0.65	2.67	3.18	3.22	3.28	3.33	3.33	3.32
Income Tax	-	0.91	1.08	1.10	1.11	1.13	1.13	1.13

Projected Balance Sheet

₹ (in lakh)

Particulars / Years	1	2	3	4	5	6	7	8
Liabilities								
Share Capital (D)	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77
Reserves & Surplus (E)	2.94	5.03	6.97	8.94	10.94	12.98	15.01	17.04
Term Loans (F)	2.19	1.95	1.51	0.96	0.30	0.00	0.00	0.00
Total Liabilities (D)+(E)+(F)	5.90	7.75	9.25	10.66	12.01	13.74	15.78	17.81

Assets	1	2	3	4	5	6	7	8
Gross Fixed Assets	3.08	3.08	3.08	3.08	3.08	3.08	3.08	3.08
Less Accm. depreciation	0.16	0.32	0.49	0.65	0.81	0.97	1.14	1.30
Net Fixed Assets	2.91	2.75	2.59	2.43	2.26	2.10	1.94	1.78
Cash & Bank Balance	2.99	5.00	6.66	8.24	9.74	11.64	13.84	16.03
TOTAL ASSETS	5.90	7.75	9.25	10.66	12.01	13.74	15.78	17.81
Net Worth	3.71	5.80	7.74	9.71	11.71	13.74	15.78	17.81
Debt Equity Ratio	2.84	2.53	1.96	1.24	0.39	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	0.77	-	-	-	-	-	-	-	-
Term Loan	2.31								
Profit After tax		2.94	2.09	1.94	1.97	2.00	2.04	2.04	2.03
Depreciation		0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Total Sources	3.08	3.11	2.25	2.10	2.13	2.16	2.20	2.20	2.19
Application									
Capital Expenditure	3.08								
Repayment Of Loan	-	0.12	0.24	0.44	0.55	0.66	0.30	-	-
Total Application	3.08	0.12	0.24	0.44	0.55	0.66	0.30	-	-
Net Surplus	-	2.99	2.01	1.66	1.58	1.50	1.90	2.20	2.19
Add: Opening Balance	-	-	2.99	5.00	6.66	8.24	9.74	11.64	13.84
Closing Balance	-	2.99	5.00	6.66	8.24	9.74	11.64	13.84	16.03

IRR

₹ (in lakh)

Particulars / months	0	1	2	3	4	5	6	7	8
Profit after Tax		2.94	2.09	1.94	1.97	2.00	2.04	2.04	2.03
Depreciation		0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Interest on Term Loan		0.27	0.21	0.18	0.13	0.07	0.01	-	-
Cash outflow	(3.08)	-	-	-	-	-	-	-	-
Net Cash flow	(3.08)	3.37	2.46	2.28	2.26	2.23	2.21	2.20	2.19
IRR	92.04%								

NPV	10.06

Break Even Point

₹ (in lakh)

Particulars / Years	1	2	3	4	5	6	7	8
Variable Expenses								
Oper. & Maintenance Exp (75%)	0.09	0.10	0.10	0.11	0.11	0.12	0.12	0.13
Sub Total*(G)*	0.09	0.10	0.10	0.11	0.11	0.12	0.12	0.13
Fixed Expenses								
Oper. & Maintenance Exp (25%)	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04
Interest on Term Loan	0.27	0.21	0.18	0.13	0.07	0.01	0.00	0.00
Depreciation *(H)*	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Sub Total (I)	0.46	0.40	0.37	0.33	0.27	0.21	0.20	0.21
Sales (J)	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
Contribution (K)	3.40	3.40	3.39	3.39	3.38	3.38	3.37	3.37
Break Even Point (L= G/I)	13.53%	11.84%	10.98%	9.64%	7.92%	6.23%	6.04%	6.11%
Cash Break Even {(I)-(H)}	8.76%	7.06%	6.19%	4.85%	3.12%	1.42%	1.22%	1.29%
Break Even Sales (J)*(L)	0.47	0.41	0.38	0.34	0.28	0.22	0.21	0.21

Return on Investment

₹ (in lakh)

Particulars / Years	1	2	3	4	5	6	7	8	Total
Net Profit Before Taxes	2.94	3.00	3.02	3.06	3.12	3.17	3.17	3.16	24.64
Net Worth	3.71	5.80	7.74	9.71	11.71	13.74	15.78	17.81	86.01
									28.64%

Debt Service Coverage Ratio

₹ (in lakh)

Particulars / Years	1	2	3	4	5	6	7	8	Total
Cash Inflow									
Profit after Tax	2.94	2.09	1.94	1.97	2.00	2.04	2.04	2.03	12.98
Depreciation	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.97
Interest on Term Loan	0.27	0.21	0.18	0.13	0.07	0.01	0.00	0.00	0.86
Total (M)	3.37	2.46	2.28	2.26	2.23	2.21	2.20	2.19	14.81

DEBT

Interest on Term Loan	0.27	0.21	0.18	0.13	0.07	0.01	0.00	0.00	0.86
Repayment of Term Loan	0.12	0.24	0.44	0.55	0.66	0.30	0.00	0.00	2.31
Total (N)	0.39	0.45	0.62	0.68	0.73	0.31	0.00	0.00	3.17
	8.71	5.50	3.70	3.33	3.07	7.15	-	-	4.68
Average DSCR (M/N)	4.68								

Annexure -4: Details of procurement and implementation schedules

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 from installation of condensate recovery pump in jet dyeing machine

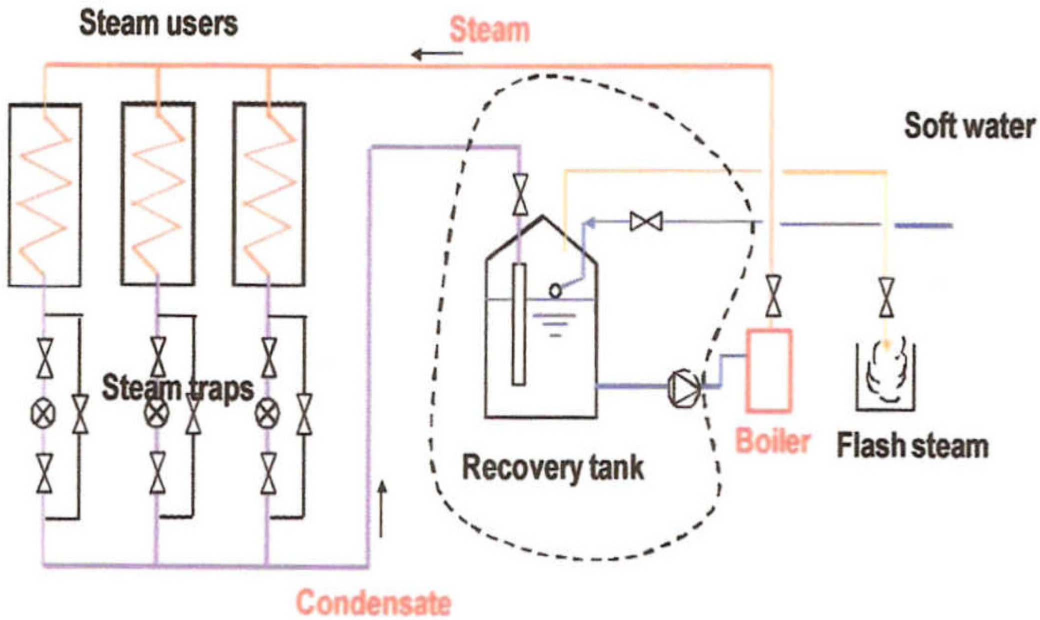
Flash Steam Recovery Potential			
1	No. of Jet Dyeing Machine	No.	3
2	Steam Consumption of Jet Dyeing M/c per hr	kg/hr	150
3	Total operating hours	hr/year	7200
4	GCV of fuel	kCal/kg	8200
5	Flash Steam Recovery Potential (10%)	kCal/hr	28800
6	Equivalent Fuel Saving Per year	MT	25.28

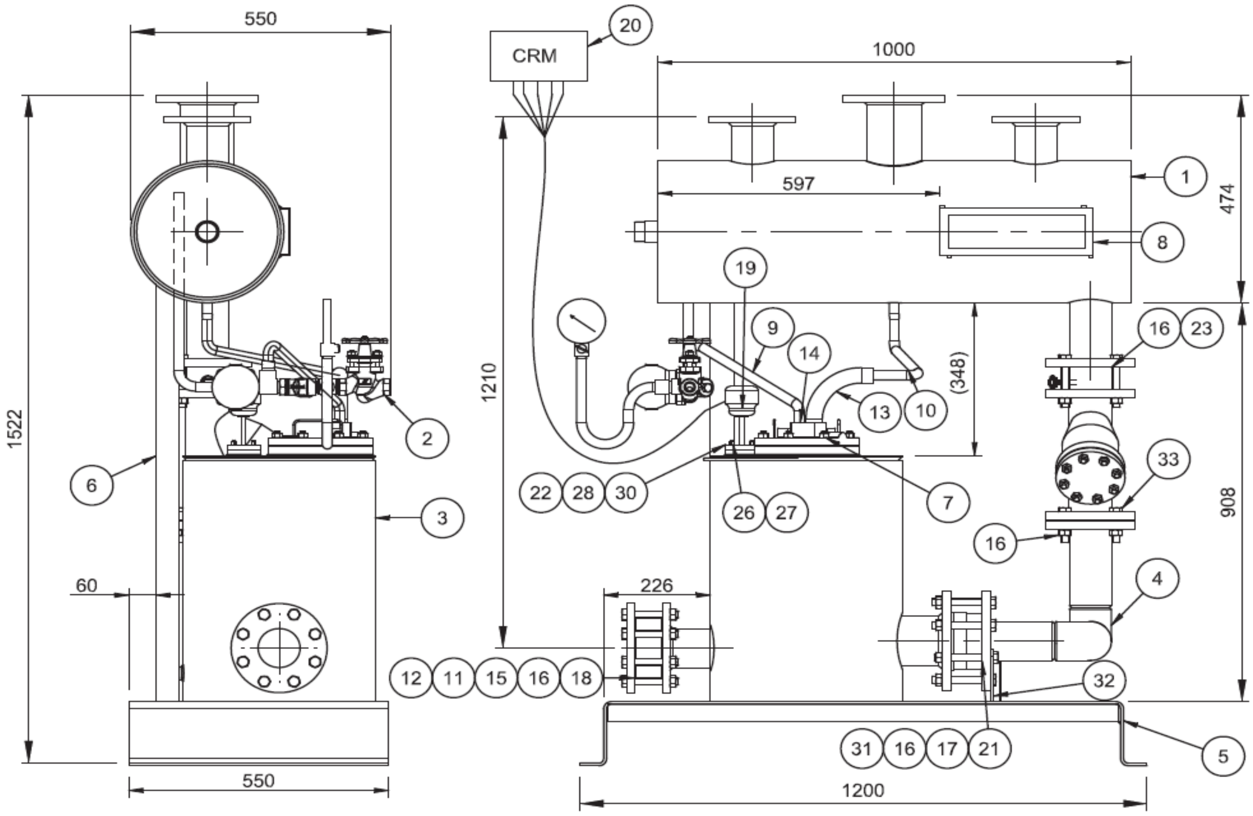
Condensate Recovery potential			
1	No. of Jet Dyeing Machine	No.	3
2	Steam Consumption of Jet Dyeing M/c per hr	kg/hr	150
3	Temperature of steam	^{o}C	100
4	Temperature of water after condensate	^{o}C	40
5	Condensate Recovery Potential (90%)	kg/hr	405
6	Heat available in condensate	kCal/hr	24300
7	Total operating hour	hr/year	7200
8	GCV of fuel	kCal/kg	8200
9	Equivalent Fuel Saving Per year	MT	21.33
10	Total fuel saving potential (25.28+21.33)	MT/year	46.61
11	Cost of fuel	₹/MT	7500
12	Monetary Equivalent	₹ (Lakh)	3.49
13	Cost of implementation	₹ (Lakh)	3.0
14	Simple Pay Back Period	Months	9

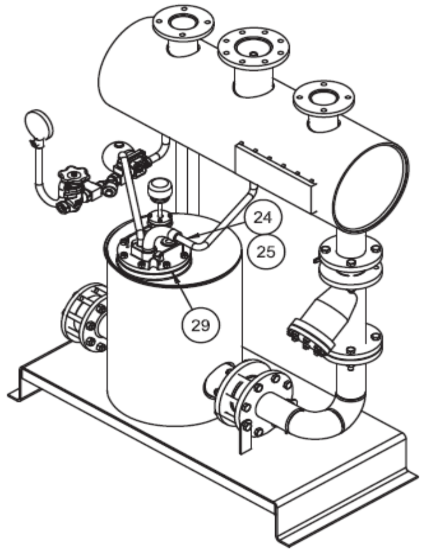
Annexure -6: Details of equipment service providers

S.No.	Technology	Name of Service Provider	Address	Contact Person and No.
1.	Installation of Condensate Recovery pump and Flash Vessel	M/s Forbes Marshall	Ahmedabad Office	Mr. Parthav Shah
2	Pejawar Electronics	M/s Thermax		
3	Automated Control System For Dyeing Machine	M/s Indian Boilers Ltd.		

Annexure –7 Typical arrangement drawings for proposed system

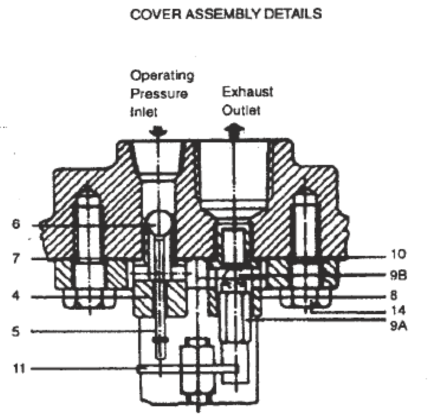


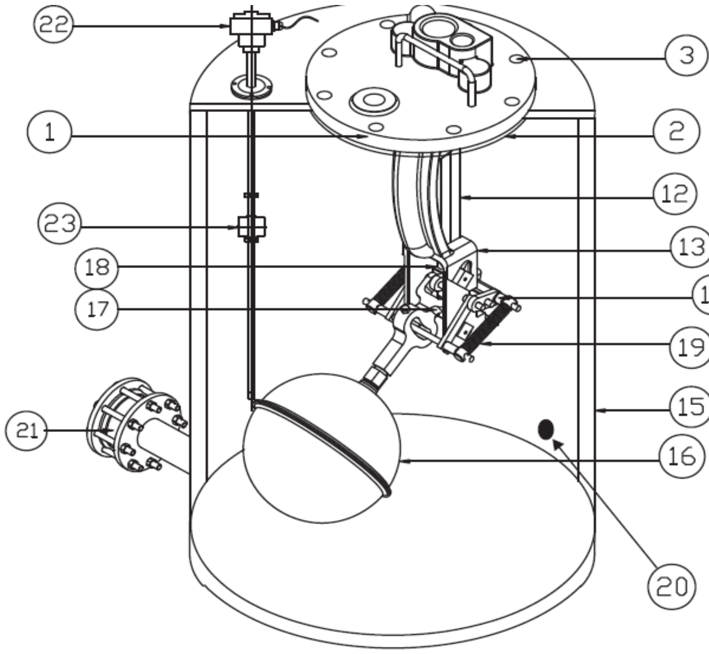




Sr. No.	DESCRIPTION	Sr. No.	DESCRIPTION
1	RECEIVER ASSLY.	18	80NB DISC CHECK VALVE GASKET
2	STEAM INLET CONNECTION ASSLY.	19	REED SENSOR ASSLY
3	SHELL ASSLY.	20	CRM UNIT
4	CONDENSATE INLET ASSLY.	21	100NB DISC CHECK VALVE
5	FRAME ASSLY.	22	REED SENSOR FLANGE
6	SUPPORT ASSLY.	23	M16 X 110L HEX HEAD BOLTS
7	ACTUATOR MECHANISM ASSLY	24	STUD M12 X50L
8	NAME PLATE	25	NUT M12
9	1/2" STEAM INLET HOSE 500 LONG	26	STUD M6 X 35L
10	1" EXHAUST HOSE 500 LONG	27	NUT M6
11	80NB DCV3	28	SENSOR MOUNTING FLANGE
12	80NB TABLE F FLANGE	29	MECHANISM GASKET
13	1" BSPT (M) 90º BEND	30	REED GASKET
14	1/2" BSPT PIPE NIPPLE 100mm L	31	M16 X 130L HEX HEAD BOLTS
15	M16 X 120L HEX HEAD BOLTS	32	CONDENSATE LINE SUPPORT
16	M16 NUT	33	M16 X 70L HEX HEAD BOLTS
17	100NB DISC CHECK VALVE GASKET		

Pressure Powered Pump





Material :

SR. NO.	DESCRIPTION	MATERIAL	STANDARD	SR. NO.	DESCRIPTION	MATERIAL	STANDARD
1	COVER	CAST IRON	IS 210 Gr FG260	12	PUSH ROD	STAINLESS STEEL	ASTM A 276 TYPE 304
2	COVER GASKET	SYNTHETIC FIBRE	--	13	MECHANISM YOKE	C. I.	IS 210 FG 260
3	STUD & NUT M-12	C.S.	-- --	14	MECHANISM Studs M12	STAINLESS STEEL	IS 1364
4	INLET VALVE SEAT	STAINLESS STEEL	ASTM A 276 TYPE 304	15	BODY	C. S.	IS 2062
5	INLET VALVE STEM	STAINLESS STEEL	ASTM A 276 TYPE 304	16	FLOAT	STAINLESS STEEL	ASTM A 240 TYPE304
6	INLET VALVE HEAD	.STAINLESS STEEL	--	17	LINKAGE MECHANISM	STAINLESS STEEL	ASTM A 351 CF8
7	INLET SEAT GASKET	COPPER	--	18	PUSH ROD ACTUATOR	STAINLESS STEEL	ASTM A 351 CF8
8	EXHAUST SEAT	STAINLESS STEEL	ASTM A 276 TYPE 304	19	SPRING	INCONEL	--
9(A)	EXHAUST VALVE	STAINLESS STEEL	ASTM A 276 TYPE 304	20	PLUG 1/2" BSPT	FORGED CARBON STEEL	ASTM A 105
9(B)	EXHAUST VALVE HEAD	STAINLESS STEEL	ASTM A 276 TYPE 304	21	DISC CHECK VALVE	STAINLESS STEEL	--
10	EXHAUST SEAT GASKET	COPPER	--	22	FLOW-TEMP. SENSOR	STAINLESS STEEL	
11	VALVE ACTUATOR DISC	STAINLESS STEEL	ASTM A 276 TYPE 304	23	SENSOR FLOAT	STAINLESS STEEL	ASTM A 240 TYPE 304

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