

Mini paper plant Technical and Economical Viability of 2 & 3 Tonnes/day Based on Agricultural Residues

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1.00 INTRODUCTION :

Due to the shortage and growing demands of paper, scarcity of raw materials, water, power as well as for high capital investment for large Paper Mills, the Mini Paper Plant is very essential to solve the country's paper crisis. Paper produced from Mini mills will boost the country's Packaging Industries. It is economically and technically feasible from the following points.—

1.01 Finished Products :

There is no problem for selling the paper, since the whole or major portion of the product can be sold to the local consumers. It will avoid the delay in transit, transport expenses, commission for agencies, etc. As a result, both the consumers and the producers are benefited. It will also eliminate the hoarding and accumulation of stock by the unscrupulous dealers and stockists.

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In this paper an elaborate discussion of the techno-economical viability of Mini Paper plants of 2 and 3 tonnes/day capacity has been made. The cellulosic material for pulping is agricultural residues available in plenty in the country. The agricultural residues are, at present, not finding much industrial use in the country.

(a) Section—1.00

In Section 1.00 we have tried to discuss about finished products, raw materials, power, water, land & building, Effluent treatment, break-down & labour trouble, staff & personnel etc., showing the feasibility of the mini Paper Plant.

(b) Section—2.00

In Section 2.00 you will find mainly about design, material of construction etc. for Plant and Equipment suggesting the way of reducing the cost,

(c) Section—3.00 & 4.00

In these Sections we have dealt in detail about Design of 2 & 5 tonnes/day Pulp & Paper Plant which is self-explanatory from the Flow Diagrams & Equipment lists with brief specifications given in the Appendices.

There are various types of plant and Equipment designed and can be set up depending on the availability of raw materials and quality of finished papers for easy marketing. From the Flow Diagrams and lists of equipment in Appendices it may be observed that almost all equipment/items are similar in sizes, capacities etc. in different Plants for reducing the cost of machining and early delivery.

(d) Section—5.00

In conclusion we have suggested some changes in the design and material of construction for a few items for minimising the cost under the changed circumstances.

1.02 Raw materials :

Agricultural residues such as wheat straw, rice straw, jute sticks, Bagasse etc. are suitable raw material for pulping in Mini plants. There may not be much difficulty in procurement and availability, as these units can be set up anywhere in the villages or small towns where the raw materials are the main sources and abundantly available for these industries. It will be collected/procured through the local sources from the direct sellers or smaller agents. The local idle labourers can be engaged for this job which will solve the unemployment problem to some extent. Considerable amount of transportation cost can be saved since the materials are to be procured within the 25 to 30 k.m. radius of the plant. From the above reason it can be observed that cost price for the collection of raw materials will considerably be reduced.

1.03 Power :

Since the country is facing power scarcity it is not evenly distributed over the country. This is a major problem for the big industry. The power requirements for Mini Plant are not much compared to large paper mills and arranging for the power is not difficult. These plants need not be put in big industrial areas avoiding the drop in voltage, breakdown in the main and other electrical difficulties

which lead to stoppage in production.

1.04 Water :

Water is the vital utility for this industry and its requirements are such that it can be obtained from small Rivers, rivulets, deep tube-wells, ponds etc. which are mostly situated everywhere in the country. For the big paper plants it is very essential to select the site nearer to the big Rivers where plenty of water is available throughout the year. For the Mini Paper Plant there is no need of such sites and water can be procured within reasonable limits.

1.05 Land & Building :

Land requirements for these plants are very nominal and either the Government waste land or un-cultivated land can be utilised for this purpose. Since the building area is very less with light structures it can be designed & constructed at very cheap rates by the entrepreneurs themselves without engaging big contractors or architects. To this account a substantial amount of capital investment can be saved.

1.06 Effluent :

Like big paper mills the effluent and Plant waste are not at all problem and can be drained to the nearby fields which will not damage or create any hazard to the local health, rather the waste water will help the surrounding cultivated land for

watering, after providing suitable lagooning for treatment.

1.07 Break-down & Labour Troubles :

In case of big plants, if there is breakdown and labour trouble or similar other difficulties arose, the production suffers a lot, creating the scarcity of paper in the market, affecting the consumer to pay high prices. In case of Mini Paper Plant if this problem arises the production losses are very nominal to the country's requirements of a single plant.

1.08 Staff & Personnel :

Since these plants are not very sophisticated, it is very easy to handle by the less experienced or semi-skilled people who may be available locally. Highly qualified technologists and Engineers are not necessary for these plants & more employment to the local people can be given by raising their standard of living in many ways.

2.00 Plant & Equipment :

Most of the plants, equipment machineries, available or installed in the country are imported and their production capacities are large. As a result the same types of equipment are copied and are being installed in various sizes of the plant for which the cost of the equipment, power, space etc., are increasing as compared to its requirements. Though these equipments are not necessary for

the sizes of the plant but considering the availability in the local and foreign market and having no alternatives, the bigger sizes of the equipment are installed. For this reason the plant cost, power, building and maintenance expenditure etc. are increasing unnecessarily and becoming uneconomical of the Mini Plant. The sizes of the plant and equipment can be redesigned based on the existing design to the required sizes which are to be smaller in capacities. This will reduce all necessary costs of the plant and equipment and making economically feasible of these projects. Besides that, in recent days there are tremendous developments in the engineering industries and materials such as PVG. Fibre glass, Aluminium, Nylon which can be introduced in these plants.

Due to the low capital investment within the reach of small & medium scale entrepreneurs, specifically the technocrats who can set up these units as self employed unit as well as to solve the country's paper shortage.

By the successful implementation of these plants, the machine manufacturer can standardise the plant, equipment, spare parts etc, to have large scale production which will reduce their manufacturing cost etc. considerably, such as pattern making, jigs and fixtures, experience in manufacturing of similar items, technical know-how, engineering

and drawing etc.

All the equipment and machineries etc. provided in these units are based on the available design, easy fabrication and manufacturing facilities at local market and resources. As and when in future if any equipment developed from indigenous sources for better performance of the machine and for better quality of the products, it will be slowly implemented. In this regard the full co-operation from the Technologist, existing paper mills, Machine manufacturers, Technical Associations and Govt. are very essential to implement these plants successfully with sound economical and technological viability. When these plants will operate successfully the manufacturing, design and process deficiency if found or detected, that can be modified for future units. Investigation for future development of these plants and the proper study can be made by IPPTA/Paper Institute/Technologists as regards the process for the different types of raw materials used and advise the manufacturer to develop the machineries accordingly.

Pulp & Paper Plant 2 tonnes/day (24 hrs)

3. Introduction

This plant is designed to produce

Pulp Production per day		Flow diagram No.
Straw Pulp	: 1.00 t A/D	2.5-PP-SRW-I (Fig A) Appendix-A 2.5-PP-SRW-I (Fig B) „ -B
Rag Pulp	: 1.00 t A/D	
Waste Paper Pulp	: 0.50 t A/D	
2.50 t A/D		
OR		
Straw Pulp	: 1.00 t A/D	2.5-PP-SW-II-Appendix-C
Waste Paper Pulp	: 1.50 t A/D	
2.50 t A/D		
OR		
Waste Paper Pulp	: 2.50 t A/D	2.5-PP-W-III-Appendix-D

kraft, poster, wrapping & light weight papers etc. based on raw materials-rag, straw and waste paper. The Pulp Plant is equipped with conventional equipment having 10 m³ rotary tumbling digester. The trimmed width of the paper at reel is about 1500 mm in view of future expansion to 5 TPD. There are 2 types of Machines designed, one is with single Cylinder mould and single mini cast iron M. G. and another is Fourdrinier in place of cylinder mould, keeping all other similar as former. The 2 types of machines are designed such a way that either one can be installed keeping press and M. G. section unaltered. In future while increasing the production to 5 tonnes in this machine, the only change is to be done to M. G. section by installing a 2500 mm. M. G. which either can be imported or developed in the country in near future. In this the M. G. frame, Touch roll etc. will not be disturbed.

3.01 Pulping plant

The Schematic flow diagrams to be read in conjunction with equipment lists given in the appendices for different types of raw materials used. The brief notes for each sections are given below.

3.01/1 Rag/Straw Cutters Section

The rag and straw can be sorted and cut to the required sizes manually or by wheel type small cutters at present. The loading to the Digester will also be done manually but in future when the production increases to 5 tonnes the rag & straw cutter with conveying system to be provided.

3.01/2 Digester Section

The Digester is 10m³ of tumbling rotating type having steam & liquor inlet and distribution arrangements. The content from the Digester can be unloaded to a draining pit constructed with perforated cast iron or wooden plates. The Drainer pit can be at elevated height for easy loading to the Breaker/Potcher manually or can also be discharged to the ground floor level as explained above and can be loaded to the Breaker/Potcher manually or with a small belt conveyor. In case of only waste paper the Hydrapulper to be provided as shown in the flowdiagram.

3.01/3 Breaker & Potcher Washer

Breaker & Potcher with washing drum to be installed at a height of 3 to 3.5 m floor level adjacent to the digester. Rag, straw & waste paper will be processed as shown in the flow diagram in different alternatives. But for waste paper the stock will be processed through refiner. The discharge from these to the dumping chest will be by gravity, avoiding the transfer pumps &

other accessories to save capital & maintenance cost, space, power etc. There will be only one motor with line shaft to drive 2 Breakers or Breaker & Potcher by reducing power & motor cost.

3.01/4 Dumping Chests

Vertical type 10 m³ chests constructed with brick or RCC at the ground floor just below the Breaker/Potcher for Dumping & Storing purpose. These chests are equipped with fabricated or propeller type agitator & mounted vertically and driven by a line shaft with single motor. One transfer Pump for both the chests provided so that it will pump alternatively to save Capital, Maintenance & Power cost. However one stand by pump can be kept for emergency.

3.01/5 Refining and Mixing

The straw pulp will be pumped to a conical refiner (in case of potcher) for making Pulp fibre to the required sizes and sent to the mixing chest through a metering box. The rag and waste paper pulp will directly be pumped to mixing chest through metering box. Thereafter it will be

pumped through a dilution box to a Reffler & vibrating screen to remove stone, sand & floating materials, various unsuitable elements & foreign materials. From the vibration screen it will be transferred to a stock chest by gravity which is equipped with a washing drum to regulate consistency of about 3.5 to 4%. From the chest it will pass to the finishing refiner. Alternatively a Decker can be provided in place of washing chest to thicken the pulp.

3.01/6 Stock Preparation

After the finishing refiner, the stock passes through the dilution box at 0.5% consistency, through Fan pump to centricleaners & the machine chest. From there it passes to machine Level Box & Paper Machine. Alternatively or in future one Selectifier Screen or Horizontal open type rotary Screen to be provided.

The list of equipment for different processes & raw materials are given in Appendix A, B, C & D.

3.02 Paper Machine (Cylinder Mould)

(Schematic Flow Diagram No. 2-PM-IV (Fig. A)-Appendix-E.

Type of Machine	: Cylinder Mould with Mini M.G.
Mould width (effective)	: 1750 mm.
Paper Trimmed width	: 1500 mm. at reel
Substance range	: 28 to 90 GSM.
Operating Speed	: 12 to 40 M/min.
Capacity (Gross)	: 1.5 to 2 tonnes/day (85% efficiency)
Range of Production	: Tissues, wrapping, poster, kraft & other light weight papers.

3.02/1 Cylinder Mould Section

The cylinder mould section is designed with uniflow type vat & distribution roll and constructed with built-in C.I. frame & internal wood. The Cylinder drum is 1020 ϕ x 1800 face spider construction having strip arrangements over the circumference for better dewatering and formation. The Couch roll is 380 ϕ x 1800 face soft rubber covered (Hardness 200-220° P and J on 3mm ball) and provided with mechanical loading. All necessary felt rolls, Vac. boxes with bearings, brackets, frames economically designed.

3.02/2 Press Section

The Paper passes on top of the mould felt and enters in press in between top and bottom felt. Before the Press, one Blow box is provided to separate the paper from the felt. The paper enters the Press having Bottom roll rubber covered, (grooved) hardness 20-25° P and J on 3 mm. ball equipped with mechanical loading to apply Nip Pressure 45 to 50 Kg/LCM. One felt roll is provided before the press for bypassing the top felt from the Press if required.

One Felt Squeeze Press having C.I. rolls and loading by self weight of top roll and counter weight for removal of water from the felt. The necessary felt cleaning equipment provided as shown in the flow diagram.

3.02/3 M.G. Section

There is a 1500 ϕ C. I. Mini M.G. Cylinder which is equipped with a Touch roll having mechanical loading approximately 50-55 Kg/LCM. Nip Pressure. The M.G. frame is suitably designed for 2500 mm. M.G. Cylinder to be installed in future while increasing the production to 5 TPD. The friction reel is itself mounted on the same M.G. frame which rotates along with M.G. In future while installing bigger M.G., the Pope reel can be installed separately or the same friction reel can be kept with some modifications.

3.02/4 Drive

The drive consists of gear box, line shaft, counter shaft, cone pulleys etc. for driving Press, M.G. Cylinder and Squeeze Press. The Main motor is 40 HP variable speed drive D.C. motor with Thirister Control.

3.02/5 Auxiliary Equipment

Vacuum Pump, Back water pump, steam, water pipe line & Finishing house equipment etc. provided.

3.03/1 Head Box (Open Type) :

The Head Boy is designed to ensure, better distribution and flow of stock with dam type slice. It is constructed either from wood or from Aluminium with proper stiffeners. The slice is adjustable type constructed from Stainless Steel Plates.

3.03/2 Wire Part (Fourdrinier) :

Table length 5.5 m and wire length approximately 12 m. This Part consists of 12 Nos. Table Rolls of ebonite/FRP covered, breast Roll ebonite covered, mounted on the shake frame. There are three Nos. Vacuum boxes of wood or Aluminium having polypic or PVC Top. The Couch Roll is ebonite covered mounted on independent frame and connected to the in-drive shaft. All necessary wire guides and return rolls, deckle/device sprays, trim squirt wire tensioning system save-all and white water trays, Breast Board etc. are provided. The Bagally Box and top Couch roll are provided for an alternative arrangements enabling easy pick of different grammage of paper to be produced.

3.03 Paper Machine (Fourdrinier)

(Schematic Flow Diagram No. 2-PM-IV (Fig.B)-Appendix-F.

Type of Machine	: Fourdrinier with Mini M.G.
Wire width	: 1750 mm (effective).
Paper Trimmed width	: 1500 mm at reel.
Substance Range	: 25 to 125 GSM.
Operating Speed	: 10-45 m./min.
Capacity (Gross)	: 1.5 to 2 tonnes/day (85% efficiency)
Range of Production	: Kraft, poster, wrapping, Tissues and various types of papers.

3.03/3 Press Section :

Same as 3.02/2

3.03/4 M. G. Section :

Same as 3.02/3

3.03/5 Drive :

The Drive consists of gear box, line shaft, counter shaft, cone Pulleys etc. for driving Couch Roll, Press, M. G. The main motor with Thirister Control.

3.06/6 Auxiliary Equipment :

Vacuum Pump, Back water couch pit agitator steam, water pipe line, Finishing house equipment etc. provided.

Pulp & Paper Plant 5 TPD (24 hrs.)

4.00 Introduction :

This plant is designed to produce various types of papers such as Kraft, Poster, wrapping and various other types of papers based on raw materials—rag, straw & waste papers. The Pulp Plant is of conventional type having 20 m³ Rotary Tumbling Digester. There are 4 types of machines designed i. e. (1) Fourdrinier machine with Drying Cylinders (MF), (2) Fourdrinier machine with M.G., (3) Cylinder mould with Drying Cylinders and (4) Cylinder mould with M.G. These machines can be expanded in future if required. In the Cylinder Mould machine, 2 cylinder Moulds are provided keeping in view that one Cylinder Mould can work as stand by or both can be utilised for making thicker grammage of the paper.

4.01 Pulp plant :

Schematic Flow Diagram No. 6-PP-SRW-V)-Appendix-G.

Pulp Production per day

Straw Pulp—	3 tonnes A/D.
Rag Pulp—	2 tonnes A/D.
Waste Paper Pulp—	1 tonnes A/D.

Tetal	—	6 tonnes A/D.
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4.01/1 Rag/Straw Cutter Section :

The rag and straw will be sorted out manually and the cutters with necessary dusting equipment to be provided. The loading to the digester to be done by belt conveyor having a feeding chute at top of it with sliding gate for feeding. This will eliminate handling and feeding time by increasing the cooking cycle.

4.01/2 Digester Section :

The digester is 20 m³ of tumbling rotating type for cooking straw and rag. The digester is provided with steam and liquor inlet and distribution arrangements inside. The content from the digester can be unloaded to the draining pit which will either be installed at elevated height or ground floor. The cooked pulp can either be loaded manually or by belt conveyor to the breaker/potcher.

4.01/3 Pulp Preparation Section :

One breaker with washing drum is provided for rag pulping, one potcher washer for straw pulping and one small hydropulper for waste paper pulping. This can be readjusted depending upon the raw materials available or used.

These three items can be installed at the 1st floor approxi-

mately 3.5 m. level which will enable the stock to pass by gravity to the dumping chest. This will eliminate three transfer pumps.

4.01/4 Dumping & Storage Chest:

The chest are vertical type just situated below the equipment mentioned in item 4.01/3.

All the chests are equipped with fabricated/propeller type agitators driven by a line shaft from one Motor. All the chests are provided with independent Pumps for transferring the stock to the Refining and Mixing Section.

4.01/5 Refining & Mixing Section:

The straw pulp will be pumped to the conical Refiner for making pulp fibres to the required sizes and sent to the Mixing chest through a metering box. Rag and waste paper pulp will be pumped directly to the mixing chest through the same metering box. From the mixing chest it will be pumped to the Reffler and Vibrating Screen which are placed at elevated height for asy flow of stock by gravity to the washing chest. The washing chest is provided with a washing drum for regulating the required consistency of 3.5 to 4% as well as to wash the stock finally. The circulation of the stock in the chest will be by pump Alternatively a Decker can be placed in place of washing chest for thickening to the required consistency.

4.01/6 Stock Preparation :

From the washing chest the stock will be transferred to the finishing

refiner for final pulp preparation. And thereafter the stock passes through a dilution box to achieve 0.5% consistency. Thereafter it passes through high Pressure fan Pumps to Centricleaners and machine chest. After the machine chest, it can be directly pumped to a level Box or alternatively to a Pressure Screen and finally to Paper Machine.

4.02 Paper Machine :

Schematic Flow Diagram :

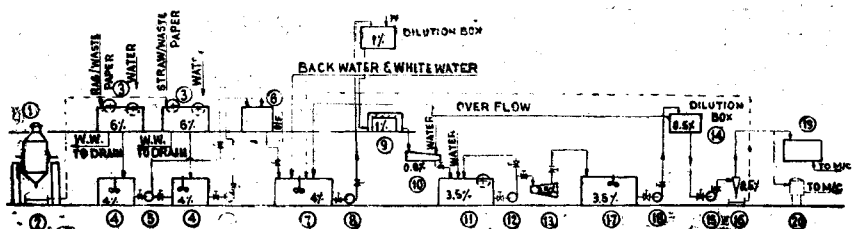
No. 5-PM-VI (Fig. A)—Cylinder mould with Drying Cylinder (Appendix—H).

No. 5-PM-VI (Fig. B)—Cylinder mould with M.G. Cylinder (Appendix—J).

No. 5-PM-VII (Fig. A)—Fourdrinier with Drying Cylinder (Appendix—K).

No. 5-PM-VII (Fig. B)—Fourdrinier with M.G. Cylinder (Appendix—L)
Design and operating datas are given in the respective flow diagram with all necessary informations.

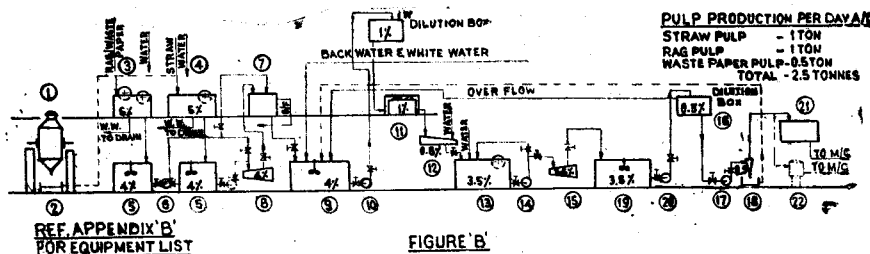
Each section is standardised and can be matched to the different types of machines shown. There could be some more alterations and additions but for the standardisation purpose those are kept same which save time, cost, maintenance etc. for the machine manufacturers and Mills. This machine is similar in design of the 2 tonnes machine explained earlier in Section 3.02 and 3.03 with few additions for the higher capacities.



Ref. Appendix 'A'
For Equipment List

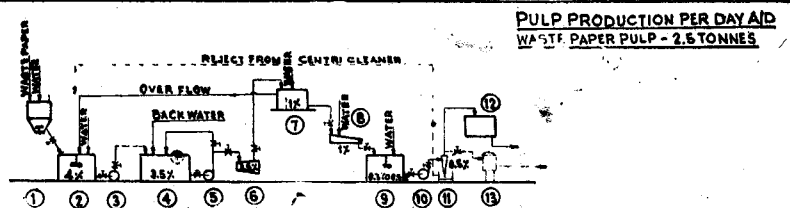
FIGURE 'A'

Plant & Equipment Service
Schematic Flow Diagram For
2.5 TPD
Pulp & Stock Preparation Plant
DRG. No. 1 2.5-PP-SRW-1
4- 029



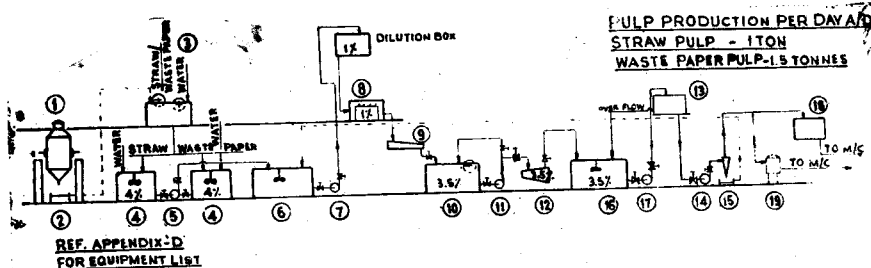
REF. APPENDIX 'B'
FOR EQUIPMENT LIST

FIGURE 'B'



Ref Appendix-'C'
For Equipment List

Plant & Equipment Service
Schematic Flow Diagram
2.5 TPD.
Pulp & Stock Preparation
Plant DRG. No. 2.5-PP-W-
III 4-5030



REF. APPENDIX-'D'
FOR EQUIPMENT LIST

Ref. Appendix-'D'
For Equipment List.

402.A Paper Machine (Cylinder Mould with Drying Cylinders).

(Schematic Flow Diagram No. 5-PM-VI (Fig. A)—Appendix-H.

4.02A/1 Cylinder Mould Section:

There are 2 nos. Cylinder Moulds provided with uniflow vat—Same as item 3.02/1.

One cylinder mould is stand by or it can work when the thicker grammage of paper to be produced.

402A/2 Press Section :

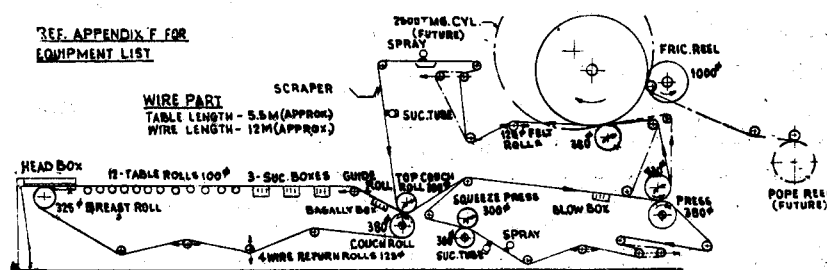
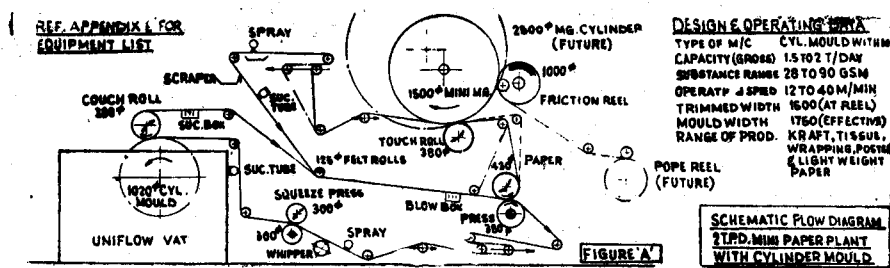
There are 2 nos. Presses i.e. first—Straight Through Press and second—Reverse Press having Top roll 430 ϕ and Bottom Roll 380 ϕ . All other specifications and details are same as item 3.02/2.

4.02A/3 Dryer Section :

The Dryer Section consists of 8 nos. 1200 ϕ x 1650 face and 2 nos. felt dryers of 900 ϕ x 1700 face for Top and Bottom felt with necessary felt Rolls, lead Rolls, stretcher and guide etc. There is one Drive from the line shaft to drive 8 nos. cylinders in one section with necessary gears, pinions etc.

402A/4 Calender Section :

5 nos. Rolls having bottom Roll 400 ϕ , Top roll 350 ϕ & intermediate Rolls 300 ϕ x 1600 face mounted on heavy type fabricated or cast iron open type single framing. The loading will be by hydraulic to apply 80 Kg/LCM load on the calender. rolls Necessary camber bar,



Design & Operating Data

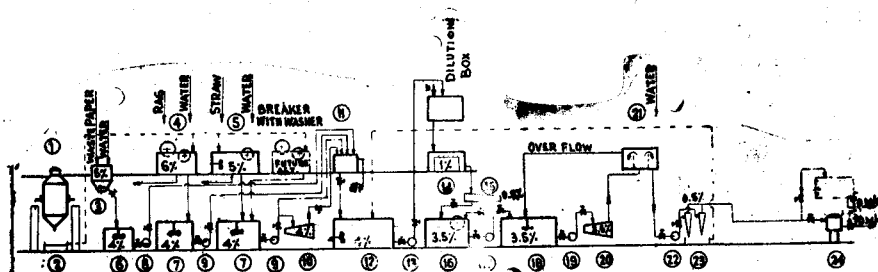
FIGURE 'B'

Type of M/C :—Fourdrinier With M.G.
Capacity :—1.5 To 2 Tonnes/Day
Substance Range :—25 To 125 GSM
Operating Speed :—10 To 45 M/Min
Trimmed width :—1500 (At Reel)
Wire Width :—1750 (Effective)

Wire Length:—12M(Approx.)
Range of Prod:—Kraft, Tissues, Wrapping, Poster & Light Weight Paper

Plant & Equipment service
Schematic Flow Diagram
2T.P.D. Mini Paper Plant
With Fourdrinier
DRG. No.—2-PM-IV
4-5031

Pulp Production Per Day A/D
Straw Pulp —3 Tonnes
Rag Pulp —2 Tonnes
Waste Paper Pulp—1 Ton
Total—6 Tonnes



NOTE
FOR LIST OF EQUIPMENT
REF. APPENDIX-'G'

Plant & Equipment Service
Schematic Flow Diagram 6 TPD.
Pulp Plant
Drg. No. 6-PP-SRW-V
4-5032

doctors, nip guards, lifting and loading device etc. provided.

4.02A/5 Pope Reel :

The friction drum is 900 ϕ fabricated with number of Reel Shells of 162 ϕ with hydraulic arrangements provided.

4.02A/6 Drive :

The drive consists of gear boxes, line shaft, counter shaft, cone pulleys etc. for driving Couch Roll, Press, drying cylinders, calender and pope Reel. The Motor is 75 HP variable speed drive D.C. motor with Thirister Control.

4.02A/7 Auxiliary Equipment :

Vacuum Pump, back water pump, couch pit agitator, steam, water pipe line etc. provided.

4.02B Paper Machine (Cylinder Mould with M.G.).

(Schematic Flow Diagram No. 5-PM-VI) (Fig. B)-Appendix-J.

4.02B/1 Cylinder Mould Section:

2 nos. Cylinder moulds with uniflow vat—same as item 3.02/1 and 4.02A/1.

4.02B/2 Press Section:

(Same as item 3.02/2).

4.02B/3 M.G. Section :

There is a 2500 ϕ M.G. Cylinder with all necessary items similar as item 3.02/3.

4.02B/4 Pope Reel :

Same as item 4.02A/5).

Alternatively a friction reel on M.G. can be provided as shown in the Flow Diagram.

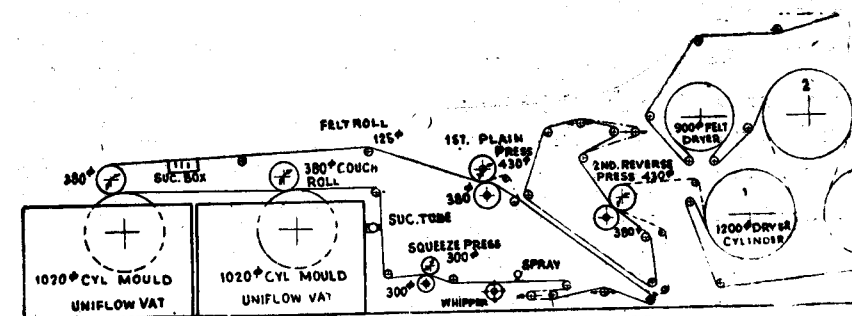
4.02B/5 Drive :

50 HP D.C. motor with

Ref. Appendix 'H' For Equipment list

Same As Flow Diagram

No.5-PM-VII(Fig.A)



Design & Operating Data

Fig: 'A'

Type of Machine	Cylinder Mould(MF)
Capacity(Gross)	4.5 To 5 T/Day
Substance range	40 To 150 GSM
Operating Speed	12 To 70 M/Min
Trimmed Width	1500 At Reel
Mould Width	1750 (Effective)

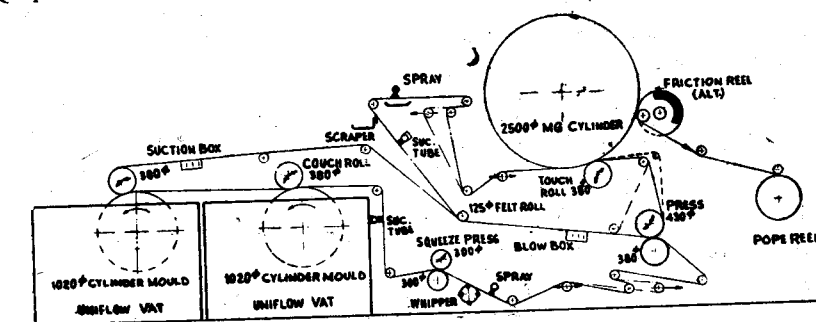
Range of Production

Various Types of Paper & Paper Board

Plant & Equipment Service Schematic Flow Diagram 5Tpd. Mini Paper Plant(Cylindermould & MF).

DRG. No. 5-PM-VI(A) 4-5035

Ref. Appendix 'J' For Equipment List



DESIGN & OPERATING DATA FIG. 'B'

Type of Machine	Cylinder Mould (MG)
Capacity(Gross)	4.5 To 5 T/Day
Substance Range	40 To 150 Gsm
Operating Speed	12 To 70 M/Min
Trimmed Width	1500 At Reel
Mould Width	1750 (Effective)

Range of Production

Various Types of Paper & Paper Board.

Plant & Equipment Service Schematic Flow Diagram 5 TPD. Mini Paper Plant (Cylinder Mould & MG).

DRG. No. 5-PM-VI (B) 4-5033

Thirister Control—Similar as item 3.02/4.

4.02B/6 Auxiliary Equipment :
(Same as item 3.02/5).

4.02C Paper Machine (with Fourdrinier & Drying Cylinder) :
(Schematic Flow Diagram No. 5-PM-VII (Fig. A)—Appendix-K.

4.02C/1 Head Box (Open Type):

The Head Box is designed to ensure proper distribution and flow, constructed from Aluminium or PVC or wood with stiffeners. The projection slice is fabricated from S.S. Plates with micro-adjustment arrangements for the lip. There is a distribution Roll on the Breast Box for better distribution of stocks.

4.02C/2 Wire Part Fourdrinier) :

Table length approximately 7 m. and wire length 15 m. This part consists of 15 nos. Table Rolls, 4 nos. Vacuum Boxes as shown in the Flow Diagram and all other similar to item 3.03/2.

4.02C/3 Press Section:—(Same as item 4.02A/2).

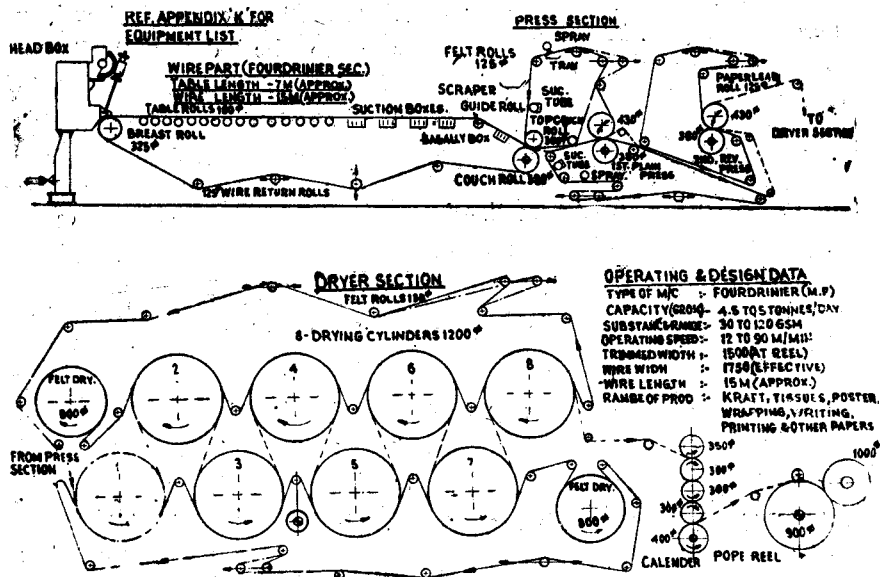
There is a top Press felt with top Couch Roll as arranged in Flow Diagram for easy pick up of the lighter paper.

4.02C/4 Dryer Section:—(Same as item 5.02A/3).

4.02C/5 Calender Section:—
(Same as item 4.02A/4).

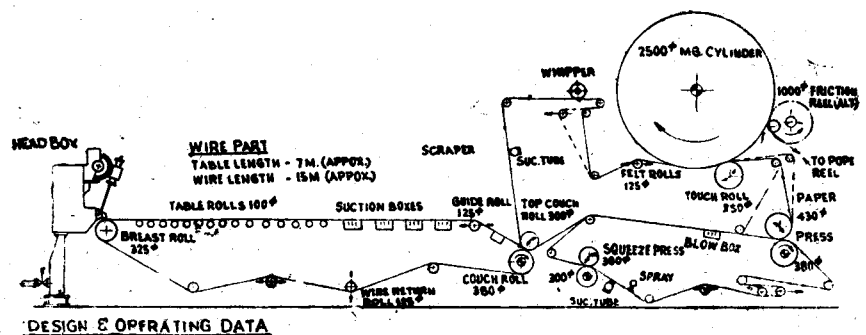
4.02C/6 Pope Reel:—(Same as item 4.02A/5).

4.02C/7 Drive:—(Same as item 4.02A/6)—one extra Drive for Couch Roll.



Plant & Equipment Service
Schematic Flow Diagram For 5 TPD
Mini Paper Plant.
DRG. No. | 5-PM-VII (A)
4-5036

REF. APPENDIX 'L' FOR EQUIPMENT LIST



Design & Operating Data	
Type of Machine	Fourdrinier With MG.
Capacity (Gross)	4.5 To 5 T/Day
Substance Range	30 To 120 GSM
Operating Speed	12 To 90 M/Min
Trimmed Width	1500 At Reel
Wire Width	1750
Wire Length	15 M (Approx.)
Range of Prod	Kraft, Tissue, Poster Wrapping & Other Variety of Papers.

FIGURE 'B'

Plant & Equipment Service
Schematic Flow Diagram 5 TPD.
Mini Paper Plant (Fourdrinier & MG)
DRG. No. — 5-PM-VII (B)
4-5034

4.02C/8 Auxiliary Equipment:—
(Same as item 4.02A/7).

4.02D Paper Machine (Fourdrinier with M.G.).

(Schematic Flow Diagram No. 5-PM-VII (Fig. B)-Appendix-L.

4.02D/1 Head Box-Open Type:—
(Same as item 4.02C/1).

4.02D/2 Wire Part (Fourdrinier):
(Same as item 4.02C/2).

4.02D/3 Press Section :—Same as item 3.02/2 with minor modifications.

4.02D/4 M.G. Section :—(Same as item 4.02B/3).

4.02D/5 Pope Reel:—(Same as item 4.02B/4).

4.02D/6 Drive :—Same as item 5.02A/6 but 1 extra drive for couch roll.

4.02D/7 Auxiliary Equipment:—
(Same as item 4.02A/7).

5.00 Conclusion :

As the Technological Development, changes in design and process of the Plant and machineries, it is very essential to develop economical design to reduce the cost.

Earlier some machine manufacturers and designers have provided factor of safety about 200-300% which is not necessary at this stage for such Plant because of the changing circumstances.

As a matter, some of the items are to be designed lighter, simple and cheap, considering the availability of materials, local manufacturing facilities, easy handling. This will avoid the manufacturers/suppliers and users to pay higher price and delayed delivery to the monopolists who have those facilities/materials.

Considering the various aspects to reduce the cost, early delivery, easy manufacturing Processes, better technology, some changes are suggested to the Mini Machines as follows :

5.01 Head Box (Open Type) :

It can be fabricated either from M.S. with epoxy resin Paint inside or Aluminium with proper stiffener revetted or welded. Slice lip can be made from P.V.C. or Aluminium with M.S. stiffeners. Since there are lot of development in Plastic for industrial use, it is possible to manufacture the head box by FRP moulding.

5.02 Wire Part (Fourdrinier) :

As the machine width is narrow, the Table rolls can be made from FRP/P.V.C./Aluminium Pipes instead of M.S. rubber lined. All Table roll bearings can be nylon, bush with PVC or nylon moulded housings. The suction boxes to be Aluminium casting

or complete FRP moulding.

5.03 Paper Lead Rolls :

It can be made from PVC or Aluminium or FRP.

5.04 Drying Cylinders & Felt Dryers :

Double shell (Jacketed) Drying Cylinders fabricated from M.S. Plates with proper metalisation by spraying method. In case of Paper and for Board no metal-spraying is required.

5.05 Pipe Lines :

Stock pipes from FRP/PVC.

5.06 Cylinder Mould :

Vat can be moulded from FRP. Cylinder mould drum design can be modified to have one or two spiders or without spiders. This will reduce the cost as well as better dewatering. Brass or S.S. Rods and Strips arranged over the circumference of the drum can be changed to PVC/Aluminium/Nylon / High density Polythene.

5.07 Centricleaner :

Complete equipment can be made from FRP moulding.

5.08 Miscellaneous Items :

As there is extra-ordinary high price for steel and non-ferrous materials, more items and components can be made from the Plastic materials specially for the wet Part.

Appendix-A

List of Equipment for 2.5 TPD Pulp Plant

Raw materials : Rag, straw, waste paper Flow Diagram No. 2.5-PP-SRW-I (Fig. A)

Sl. No.	Description	Qty.	Motor	
			HP	Qty.
1.	<i>Tumbling rotary Digester 10m³</i>	1 No.	7.5	1
2.	<i>Drainer Pit</i>	1 No.	—	—
3.	<i>Breaker with washing Drum</i> 250 to 300 Kg/batch one motor provided with line shaft and Mech. clutch to drive 2 Breakers.	2 Nos	75.0	1
4.	<i>Dumping & storage Chest 10m³</i> Vertical type with fabricated or propeller type agitator. One motor provided to drive two agitators.	2 Nos	7.5	1
5.	<i>Stock transfer Pump</i> for item 4—300 litres/minute 75 ϕ x 50 ϕ , 10 m. head.	1 No.	3.0	1
6.	<i>Metering Box of wood</i>	1 No.	—	—
7.	<i>Mixing Chest 20m³</i> Vertical type fabricated or propeller type agitator.	1 No.	7.5	1
8.	<i>Stock transfer pump</i> for item 7, 300 litres/minute 75 ϕ x 50 ϕ , 10 m. head.	1 No.	3.0	1
9.	<i>Reffler of wood or RCC</i>	1 No.	—	—
10.	<i>Vibration Screen</i>	1 No.	3.0	1
11.	<i>Chest with washing drum 20 m³</i> Horizontal type circulation by Pump. (Washing and thickening purpose).	1 No.	3.0	1
12.	<i>Stock Transfer & Circulation Pump</i> for item 11, 600 litres/min. 100 ϕ x 75 ϕ , 20 m. head.	1 No.	5.0	1
13.	<i>Refiner</i> conical type. 8 to 12 tonnes/day.	1 No.	30.0	1
14.	<i>Constant Level Box of wood</i>	1 No.	—	—
15.	<i>High Pressure fan Pump</i> 40 M head, 100 ϕ x 75 ϕ .	1 No.	7.5	1
16.	<i>Centricleaner</i> 400 litres/min.	1 No.	—	—
17.	<i>Machine chest 20 m³</i> Vertical type Fabricated or Propeller type agitator (item 7, Mixing Chest and Machine Chest agitator can be driven by one motor of 10 HP).	1 No.	7.5	1

Sl. No.	Description	Qty.	Motor	
			HP	Qty.
18.	<i>Stock Transfer Pump</i> for item 17, 600 litres/min. 100 ϕ x 75 ϕ , 10m. head.	1 No.	5.0	1
19.	<i>Level Box of wood</i>	1 No.	—	—
20.	<i>Pressure Screen</i> (This item is optional)	1 No.	—	—
		Total	164.5	13

Appendix-B

Raw Materials : Rag, straw, waste paper. Flow Diagram No. 2.5-PP-SRW-I (Fig. B)

Sl. No.	Description	Qty.	Motor	
			HP	Qty.
1.	<i>Tumbling rotary Digester 10m³</i>	1 No.	7.5	1
2.	<i>Drainer Pit</i>	1 No.	—	—
3.	<i>Breaker with washing Drum</i> 250 to 300 Kg/batch for Rag & waste Paper pulp	1 No.	50.0	1
4.	<i>Potcher 20m³</i> with agitator and washing drum for straw Pulp.	1 No.	10.0	1
5.	<i>Dumping & Storage Chest 10 m³</i> Vertical type with fabricated/Propeller type agitator. (one motor for two agitators)	2 Nos	7.5	1
6.	<i>Stock Transfer Pump</i> item 5, 300 litres/min. 75 ϕ x 50 ϕ , 10m head.	1 No.	3.0	1
7.	<i>Metering Box of wood</i>	1 No.	—	—
8.	<i>Refiner</i> conical type, 8 to 12 t/day for straw pulp	1 No.	30.0	1
9.	<i>Mixing Chest 20m³</i> Vertical type fab./propeller type agitator	1 No.	7.5	1
10.	<i>Stock Transfer Pump</i> for item 9, 300 litres/min. 75 ϕ x 50 ϕ , 10 m head.	1 No.	3.0	1
11.	<i>Reffler of wood or RCC</i>	1 No.	—	—
12.	<i>Vibrating Screen</i>	1 No.	3.0	1
13.	<i>Chest with washing drum 20 m³</i> Horizontal type circulation by Pump.	1 No.	3.0	1
14.	<i>Stock transfer and circulation by Pump</i> for item 13, 600 litres/min. 20m head 100 ϕ x 75 ϕ .	1 No.	5.0	1
15.	<i>Refiner</i> conical type, 8-12 t/day.	1 No.	30.0	1
16.	<i>Constant Level Box of wood</i>	1 No.	—	—
17.	<i>High Pressure Fan Pump</i> 40 M head, 75 ϕ x 50 ϕ .	1 No.	7.5	1

Sl. No.	Description	Qty.	Motor	
			HP	Qty.
18.	<i>Centricleaner</i> 400 litres/min.	1 No.	—	—
19.	<i>Machine Chest 20 m³</i> Vertical type. Fab./propeller type agitator (item 9 Mixing Chest & M/C Chest agitator can be driven by one motor of 10 HP)	1 No.	7.5	1
20.	<i>Stock Transfer Pump</i> for item 19, 600 litres/min. 100 ϕ x 75 ϕ , 10 m head.	1 No.	5.0	1
21.	<i>Level box of wood</i>	1 No.	—	—
22.	<i>Pressure Screen</i> (This item is optional)	1 No.	—	—
		Total	179.5	15

Appendix-C

List of Equipment for 2.5 TPD Pulp Plant

Raw Materials : Straw & waste paper. Flow Diagram No. 2.5-PP-SW-II

Sl. No.	Description	Qty.	Motor	
			HP	Qty.
1.	<i>Tumbling rotary digester 10m³</i>	1 No.	7.5	1
2.	<i>Drainer Pit</i>	1 No.	—	—
3.	<i>Breaker with washing Drum 500 kg/batch</i>	1 No.	50.0	1
4.	<i>Dumping & Storage Chest 10 m³</i> Vertical type with fab./propeller type agitator one motor for both chest.	2 Nos	7.5	1
5.	<i>Stock transfer Pump</i> for item 4, 300 litres/min. 75 ϕ x 50 ϕ , 10m head.	1 No.	3.0	1
6.	<i>Mixing Chest 20m³</i> Vertical type fab./propeller type agitator.	1 No.	7.5	1
7.	<i>Stock transfer Pump</i> item 6, 300 litres/min. 75 ϕ x 50 ϕ , 10m head.	1 No.	3.0	1
8.	<i>Reffler of wood or RCC</i>	1 No.	—	—
9.	<i>Vibrating Screen</i>	1 No.	3.0	1
10.	<i>Chest with washing drum 20m³</i> Horizontal type, circulation by Pump.	1 No.	3.0	1
11.	<i>Stock transfer and circulation Pump</i> for item 10, 600 litres/min. 100 ϕ x 75 ϕ , 20m head.	1 No.	5.0	1

Sl. No.	Description	Qty	Motor	
			HP	Qty.
12.	<i>Refiner</i> Conical type.	1 No.	30.0	1
13.	<i>Constant Level Box of wood</i>	1 No.	—	—
14.	<i>High Pressurc Fan pump</i> 40m head, 75 ϕ x 50 ϕ	1 No.	7.5	1
15.	<i>Centricleaner</i> 400 litres/min.	1 No.	—	—
16.	<i>Machine Chest 20m³</i> Vertical type fab./propeller type agitator. Item 6 & M/C Chest agitator can be driven by one motor of 10 HP.	1 No.	7.5	1
17.	<i>Stock transfer pump</i> for item 16. 600 litres/min. 100 ϕ x 75 ϕ - 10m head.	1 No.	5.0	1
18.	<i>Level Box of wood</i>	1 No.	—	—
19.	<i>Pressure Screen</i> (This item is optional)	1 No.	—	—
		Total	139.5	13

Appendix-D

List of Equipment for 2.5 TPD Plant

Raw materials : waste Paper, Flow diagram No. 2-5-PP-W-III

Sl. No.	Description	Qty.	Motor	
			HP	Qty.
1.	<i>Hydrapulper (Batch operation) 5m³ capacity.</i>	1 No.	50.0	1
2.	<i>Dumping Chest 10m³</i> Vertical type fab./propeller type agitator.	1 No.	5.0	1
3.	<i>Stock Transfer pump</i> for item 2, 300 litres/min. 75 ϕ x 50 ϕ , 10m head.	1 No.	3.0]	1
4.	<i>Washing Chest with drum washer 20m³</i> Horizontal type circulation by Pump.	1 No	3.0	1
5.	<i>Stock Transfer pump</i> 600 litres/min. 100 ϕ x 75 ϕ , 20 m head.	1 No.	5.0	1
6.	<i>Refiner</i> Conical type	1 No.	30.0	1
7.	<i>Constant Level Box of wood</i>	1 No.	—	—
8.	<i>Vibrational Sereen</i>	1 No.	3.0	1
9.	<i>Machine Chest 20m³</i> Vertical type fab./propeller type Agitator.	1 No.	7.5	1
10.	<i>High pressure Fan pump</i> 40m head, 75 ϕ x 50 ϕ .	1 No.	7.5	1
11.	<i>Centricleaner</i> 400 litres/min.	1 No.	—	—
12.	<i>Level Box of wood</i>	1 No.	—	—
13.	<i>pressure Screen</i> (Optional)	1 No.	—	—
		Total	114.0	9

APPENDIX—E
List of items for 2 TPD
Cylinder mould machine
Flow Diagram No-2-PM-IV (Fig. A)

Sl.No.	Description	Qty.
1.	<i>Cylinder Mould</i> 1020 ϕ x 1800 face Brass construction with strip arrangements.	1 No.
2.	<i>Vat</i> Uniflow type-wooden	1 No.
3.	<i>Couch Roll</i> 380 ϕ x 1800 face soft rubber covered (200-220 P and J on 3mm ball)	1 No.
4.	<i>Suction & Blow Box</i> Wooden or Aluminium	2 Nos.
5.	<i>Press</i> Top roll 430 ϕ x 1700 face ebonite covered (20-25° P&J on 3mm ball) and Bottom Press Roll 380 ϕ x 1675 face rubber covered, (45-50° P and J on 3mm ball) with mech. loading.	1 Set.
6.	<i>Squeeze Press</i> Top and Bottom roll 300 ϕ x 1750 face CI/MS and Bottom roll grooved. Loading by Counter weight and self waight.	1 Set.
7.	<i>Touch Roll</i> 380 ϕ x 1650 face rubber covered (25-30° P and J on 3mm ball) with mechanical loading.	1 No.
8.	<i>M.G. Cylinder</i> 1500 ϕ x 1650 face C.I. with all necessary fittings.	1 Set.
9.	<i>Felt Rolls</i> 125 ϕ x 1750 face ebonite covered (30 to 35° P&J on 3mm ball).	16 Nos.
10.	<i>Paper Lead Roll</i> 100 ϕ x 1650 face PVC or Aluminium.	1 No.
11.	<i>Reel Shell</i> 162 ϕ x 1650 face.	6 Nos.
12.	<i>Mise. Items</i> All necessary stretchers, guides, scrapers, suction tubes for felts, whipper, spray tubes, doctors, trays, framing, sole plates, pipe line etc. provided.	As Req'd.
13.	<i>Drive</i> Main drive for M.G. Cylinder, Press, Squeeze Press. Auxiliary drive for felt whipper, with all necessary gear boxes, gears, cone pulleys, main V-Pulleys, counter shaft, mechanical clutch coupling etc. to be provided. 40 HP D.C. Motor Thirister Control.	1 Set.
14.	<i>Vacuum Pump</i> 480 m ³ /hr. Capacity at 400 mm. Hg. vas. 75 ϕ x 50 ϕ 20 HP motor.	1 No.
15.	<i>Back Water Pump</i> 100 ϕ x 75 ϕ , 600 litres/min. 10 m. min. head. 5 HP motor.	1 No.

Total HP Req'd.-65

APPENDIX—F
List of items for 2 TPD
Fourdrinier Machine
Flow Diagram No. 2-PM-IV (Fig. B)

Sl. No.	Description	Qty.
1.	<i>Head Box</i> Wooden construction having dam type slice with adjustment arrangements.	1 No.
2.	<i>Breast Roll</i> 325 ϕ x 180 face ebonite covered (25-30° P and J on 3mm ball)	1 No.
3.	<i>Forming Board</i> Wood with PVC or Polypick top.	1 No.
4.	<i>Table Rolls</i> 100 ϕ x 1800 face ebonite/FRP covered (25-30° P and J on 3mm ball)	12 Nos.
5.	<i>Suction Box</i> Wood/Aluminium with Polypick top.	3 Nos.
6.	<i>Wire guide Roll & Return Roll</i> 125 ϕ x 1800 face ebonite covered (25—30° P&J on 3 mm ball).	5 Nos.
7.	<i>Couch Roll</i> 380 ϕ x 1800 face ebonite covered and grooved. (25—30° P and J on 3mm ball)	1No.
8.	<i>Top Couch Roll</i> 300 ϕ x 1800 face soft rubber convered (200—220° P and J on 3mm ball) with loading arrangement.	1 No.
9.	<i>Bagally Box of wooden or Aluminium Construction</i> Having Polypick top.	1 No.
10.	<i>Misc. Items of wire Parts</i> Doctors, wire tensioning system, shower pipe, save all and white water tray, deckle device, Jet cutter and trim squirt, shakihg device, framing etc: provided.	1 Set.
11.	<i>Back Water pump</i> 600 litres per minute, 100 ϕ x 75 ϕ 10 m min. head 5 HP motor.	1 No.
12.	<i>Couch pit Agitator</i> Fabricated horizontal type. Auxiliary drive from paper M/C.	1 No.
13.	<i>Vacuum pump</i> 480 m ³ /hr. capacity at 400 mm. Hg. Vac. 75 ϕ x 50 ϕ	2 Nos.

Note : Refer item 5 to 15 of Appendix E for all other items (Press M.G. Reel).
Total HP Req'd.—65

Appendix—G
List of Equipment for 6 TPD Pulp Plant
Raw materials : Rag, straw, waste Paper Flow diagram No. 6-PP-SRW-V

Sl. No.	Description	Qty.	Motor	
			HP	Qty.
1.	<i>Tumbling Rotary Digester 20m³</i>	1 No.	10.0	1
2.	<i>Drainer pit</i>	1 No.	—	1
3.	<i>Hydrapulper (Batch operation)</i> 2.5 m ³ capacity, for waste Paper pulping	1 No.	25.5	—
4.	<i>Breaker with Washing Drum</i> 500 Kg/batch for Rag Pulping.	1 No.	50.0	1
5.	<i>potcher 20 m³</i> with agitator and washing drum for straw Pulping	1 No.	10.0	1

Sl. No.	Description	Qty.	Motor HP	Motor Qty.
6.	<i>Dumping and storing Chest 10m³</i> (for waste paper pulp)—Same as item 4. App. A.	1 No.	—	—
7.	<i>Dumping and Storing Chest 20m³</i> Same as item 7. App. A (1 motor for three agitators)	2 Nos.	15.0	1
8.	<i>Stock transfer pump</i> For item 6: (Same as item 5, App. A).	1 No.	3.0	1
9.	<i>Stock transfer pump</i> For item 7. (Same as item 5, App. A)	2 Nos.	3.0	2
10.	<i>Refiner</i> conical type. 8 to 12 t/day (for straw pulp)	1 No.	30.0	1
11.	<i>Metering Box of wood</i>	1 No.	—	—
12.	<i>Mixing Chest 30m³</i> Horizontal propeller type agitator.	1 No.	15.0	1
13.	<i>Stock transfer pump for item No. 12</i> (Same as item 12, App. A).	1 No.	5.0	1
14.	<i>Reffler of wood or RCC</i>	1 No.	—	—
15.	<i>Vibrating Screen</i>	1 No.	3.0	1
16.	<i>Chest with washing drum</i> 30 m ³ Horizontal type circulation by Pump.	1 No.	3.0	1
17.	<i>Stock transfer pump</i> For item 16. (Same as item 12, App. A)	1 No.	5.0	1
18.	<i>Machine Chest 30 m³</i> Horizontal propeller type agitator.	1 No.	10.0	1
19.	<i>Stock transfer pump for item 22.</i> Same as item 12, App. A)	1 No.	5.0	1
20.	<i>Refiner</i> Conical type—finishing, 8 to 12 t/day.	1 No.	30.0	1
21.	<i>Constant Level Box of wood</i>	1 No.	—	—
22.	<i>High Pressure Fan Pump</i> 100 ϕ x 75 ϕ 40 m head.	1 No.	7.5	1
23.	<i>Centri cleaner</i> 1000 litres/min	2 Nos.	—	—
24.	<i>Pressure Screen</i>	1 Nos.	10.0	1
Total			242.5	19

Appendix—H
List of Items for 5 TPD Cylinder
Mould machine with Dryers (MF)
Flow Diagram No. 5-PM-VI (Fig. A)

Sl. No.	Description	Qty.
1.	<i>Cylinder Mould</i> —(Same as item 1, App. E)	2 Nos.
2.	<i>Var</i> —(Same as item 2, App. E)	2 Nos.
3.	<i>Couch Roll</i> —(Same as item 3, App. E)	2 Nos.
4.	<i>Press (1st Straight through & 2nd Reverse)</i> 2 Nos. Top Press rolls 430 ϕ x 1700 face ebonite covered (20–25° P and J on 3mm ball) 2 nos. Bottom Press rolls 380 ϕ x 1675 face rubber covered 45 to 50° P and J on 3mm ball with mechanical loading.	1 Set.

Sl. No.	Description	Qty.
5.	<i>Squeeze Press</i> —(Same as item 6, App. E)	1 Set.
6.	<i>Wet felt rolls</i> —(Same as item 9, App. E)	17 Nos.
7.	<i>Paper Lead Roll</i> —(Same as item 10, App. E)	4 Nos.
8.	<i>Drying Cylinder</i> 1200 ϕ x 1650 face C.I. with all necessary fittings.	8 Nos.
9.	<i>Felt Dryers</i> 900 ϕ x 1650 C. I/M.S. fabricated.	2 Nos.
10.	<i>Felt rolls (Dry)</i> 138 ϕ x 1650 face M.S. pipe.	30 Nos.
11.	<i>Paper Lead Spring roll</i> 112 ϕ x 1600 face—PVC.	1 No.
12.	<i>Calender</i> 5 rolls 400, 300, 300, 350 x 1600 face with camber bar and necessary framing, hydraulic arrangements, doctors etc.	1 Set.
13.	<i>Pope Reel</i> 900 ϕ x 1600 face fabricated/C. I drum with 6 nos. 162 ϕ Reel Shells and Hydraulic arrangements.	1 Set.
14.	<i>Drive</i> For Presses, Squeeze Press, Dryers, Calender, Reel with all necessary gear boxes, cone Pulleys, counter shaft, mechanical clutch, couch, coupling etc. to be provided. 75 HP D.C. Motor Thirister Control.	1 Set.
15.	<i>Misc. Items</i> All necessary Felt, Stretcher, guide, doctor, scraper, Suction Box, spray tube, supports, brackets framing sole plates etc.	As Req'd.
16.	<i>Vaccum Pump</i> 760m ³ /hr. at 400 mm Hg. Vac. 100 ϕ x 75 ϕ , 30 HP motor.	1 No.
17.	<i>Back Water Pump</i> 100 ϕ x 75 ϕ , 600 litres/min. 30 m head, 5 HP Motor.	1 No.
Total HP Req'd. 110		

Appendix-J
List of Equipment for 5 TPD Cylinder Mould Machine with M.G.
Flow Diagram No. 5-PM-VI (Fig. B)

Sl. No.	Description	Qty.
1.	<i>Cylinder Mould</i> —(Same as item 1, App. E)	2 Nos.
2.	<i>Vat</i> —(Same as item 2, App. E)	2 Nos.
3.	<i>Couch Roll</i> —(Same as item 3, App. E)	2 Nos.
4.	<i>Blow & Suction Box</i> —(Same as item 4, App. E)	2 Nos.
5.	<i>press</i> —(Same as item 5, App. E)	1 Set.
6.	<i>Squeeze press</i> —(Same as item 6, App. E)	1 Set.
7.	<i>Touch Roll</i> —(Same as item 7, App. E)	1 Set.
8.	<i>M.G. Cylinder</i> 2500 ϕ x 1650 face with all necessary items & hood.	1 Set.
9.	<i>Felt Rolls</i> —(Same as item 9, App. E)	17 Nos.
10.	<i>paper Lead</i> —(Same as item 10, App. E)	1 No.
11.	<i>pope Reel</i> —(Same as item 13, App. H) (Alternatively Friction reel can be provided as shown in the diagram).	1 Set.

Sl.No.	Description	Qty.
12.	<i>Drive</i> For M.G. Cylinder, press, squeeze press, auxiliary drive for felt whipper with all necessary gear boxes, gears, cone Pulleys. Main V-pulleys, counter shaft, Mechanical clutch, coupling etc. to be provided. 50 HP D.C. Motor Thirister Control.	1 Set.
13.	<i>Misc. Items</i> All necessary stretcher, guide, scraper, Suction tubes, whipper, spray tube, doctors, supports, brackets, framing, sole plates etc.	As Reqd.
14.	<i>Vaccum pump</i> (Same as item 16, App. H).	1 No.
15.	<i>Back water pump</i> (Same as item 17, App. H).	1 No.
Total HP Req'd.-85		

Appendix—K
List of Items for 5 TPD Fourdrinier Machine
with Drying Cylinders (MF)
Flow Diagram No. 5-PM-VII (Fig. A)

Sl. No.	Description	Qty
1.	<i>Head Box</i> Wooden/Aluminium, P.V.C. with stiffener & projection slice of S.S. with adjustment arrangements.	1 No.
2.	<i>Breast Roll</i> —(Same as item 2, App. F)	1 No.
3.	<i>Forming Board</i> —(Same as item 3, App. F)	1 No.
4.	<i>Table Rolls</i> —(Same as item 4, App. F)	15 Nos.
5.	<i>Suction Box</i> —(Same as item 5 of App. F)	4 Nos.
6.	<i>Wire Guide Roll & Return Roll</i> (Same as item 6, App. F).	5 Nos.
7.	<i>Couch Roll</i> —(Same as item 7, App. F)	1 No.
8.	<i>Top Couch Roll</i> —(Same as item 8 of App. F)	1 No.
9.	<i>Bagally Box</i> —(Same as item 9 of App. F)	
10.	<i>Misc. Items of Wire Parts</i> (Same as item 10, App. F)	1 Set.
11.	<i>Back water Pump</i> —Same as item 11, App. F)	1 No.
12.	<i>Couch Pit Agitator</i> —(Same as item 12, App. F)	1 No.
13.	<i>Vaucum Pump</i> —(Same as item 16, App. H)	1 No.
14.	<i>Presses (1st Straight through, 2nd Reverse)</i> (Same as item 4, App. H).	1 Set.
15.	<i>Squeeze Press</i> —(Same as item 6, App. E)	1 Set.
16.	<i>Wet felt rolls</i> —(Same as item 9, App. E)	19 Nos.
Note—Refer item 7 to 15 of Appendix—H for all other items as Dryer, Calender and Reel Section, which are identical.		
Total HP required—110		

Appendix—L
List of items for 5 TPD Fourdrinier
Machine with M.G. Cylinders
Flow Diagram No. 5-PM-VII (Fig. B)

Note : For Fourdrinier Part refer item 1 to 13 of Appendix—K which are identical.
For Press and M.G. Section refer item 4 to 13 of Appendix—J which are identical.
Total HP required—110.