

**Project Planning for Small and
Medium Scale Industries No.18**

Sanitary Napkin

Manufacturing Plant

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This technical brochure was compiled to help in the drafting of a suitable plan for the construction of a Sanitary Napkin Manufacturing Plant.

The production scale and manufacturing process have been described in this brochure on the basis of a typical instance.

The profitability was estimated by fixing certain required conditions, which may differ from country to country.

We hope that the data contained in the brochure will help you to draw up the most suitable plan for the industrialization of your project.

In case a government or public organization requests the Japan Consulting Institute to conduct a feasibility study of the above industry for the purpose of establishing the most suitable plan, it is possible for us to carry this out free of charge.

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1. Introduction

Sanitary napkin, which is produced mainly from woodpulp and paper, is the commodity used by women during the period of menstruation.

This brochure sets an example of the model plant to manufacture sanitary napkin and explains the manufacturing process, capital investment required, cost of production estimated, etc.

Half of the world population is women. Menstruation always goes with women. For many years in the past, cotton cloth folded lengthwise had been used in the name of sanitary belt. Absorbent cotton or tissue paper folded were also used. The introduction of sanitary napkin made mainly from woodpulp and paper into the market some 30 years ago was an epoch making event to brighten the life of women.

The body construction, the quantity of menstrual flows and the life style of women vary with the regions or countries. Consequently, it is the trend that some specific types of sanitary napkin are required to meet the needs of women in the respective regions or countries.

The manufacturing technology employed for sanitary napkin has achieved a remarkable development lately owing to the improvements of the manufacturing method, modifications of the processing machines and the development of raw materials of better quality. To speak of the technical level of Japan to manufacture sanitary napkin, Japan is leading the world followed by no superior in the technology.

There are many plants in Japan, who are engaged in the manufacture of sanitary napkin of various types. The inexpensive amount of the initial investment is the reason for the establishment of quite a number of plants.

In view of more activities of women at the job site and in the area of various sports as the worldwide trend, the domestic production of sanitary napkin in the developing countries to meet the specific needs of women in the respective countries should be a reasonable project for the levelling up of hygienic standards and improvement of social welfare in that area. Such

a project will surely be welcomed by women living there.

We shall be pleased if this brochure would be of some reference to the planners of the project to establish a sanitary napkin plant, which is believed to be a promising undertaking in any country.

2. Demand and Supply of Sanitary Napkin in Japan

The requirement of sanitary napkin in Japan made a rapid growth during the past 10 years from 1961 to 1971. In the year of 1966, the consumption of sanitary napkin surpassed the usage of absorbent cotton or cutted piece of cotton, which had been the old fashioned material used for the sanitary purposes. At the current stage of 1986, the supply of sanitary napkin represents more than 95% of the overall requirements of the material for sanitary usages.

The background for the remarkable growth of demand for sanitary napkin in Japan is thought to be attributable to the following factors:

- ① Economic development as a whole.
- ② Japan holds the second place in paper production in the world. Not only the paper making technology, but also the paper processing technology are well developed.
- ③ The sales prices of sanitary napkin are reasonably cheap as against the personal income level.



Photo 1. Sanitary Napkin

From the technical viewpoint, the development of dry-laid nonwoven has greatly contributed to the production growth of sanitary napkin.

Generally speaking, it is said that about 60% of the female population are the users of sanitary material. In the case of Japanese women, menstruation usually starts at the age of about 12, or it is said that it starts when the girls grow to the height of 140 cm.

The Japanese population now stands at 120 million, of which about 35 million are estimated to be the users of sanitary napkin.

The frequency of menstruation per year is calculated to be 13 (365 days divided by 28 days), assuming the cycle at an average of 28 days. One's monthly days last for 4 to 6 days. The number of pieces of sanitary napkin used during one period is said to be about 20 pieces. This leads to the per capita consumption figure of 250 pieces per year. One piece of sanitary napkin of regular type weighs 6 grams. The total consumption per year in terms of the weight is calculated as follows:

$$35,000,000 \text{ persons} \times 250 \text{ pcs.} \times 6 \text{ gr.} \\ = 52,500 \text{ tons}$$

On the other hand, sanitary napkin production in Japan in 1986 is estimated at about 55,000 tons. This means that the demand and supply are practically balanced. The number of brands amount to as many as 100.

3. Quality Requirement for Sanitary Napkin

It is needed that sanitary napkin meets the following quality requirements:

- ① Production should be made under perfect hygienical conditions.
- ② The menstrual blood should be absorbed adequately.
- ③ The menstrual blood should be held long without any leakage.
- ④ The feel to skin should be comfortable without any stick to skin.
- ⑤ Flexibility is required to allow free body motion.
- ⑥ No breakage while it is used.
- ⑦ It should be light weighted and convenient for changes and carrying.
- ⑧ The price should be reasonably cheap.
- ⑨ It should be disposable in an easy way.

4. Types of Sanitary Napkin

Many kinds of sanitary napkin are manufactured with varied composition of raw materials. The rough classification by types and sizes is shown in Table 1.

Table 1. Types of Sanitary Napkin

	Thin type (super-mini)	Regular type	Night use (long type)	High grade type
Inner dimensions (mm)	68 × 185	68 × 185	68 × 210	
Outer dimensions (mm)	70 × 195	70 × 195	70 × 230	
Wt. per pc. (gr.)	av. 3.5	av. 6.0	av. 12.0	
Remarks	Handy to carry in 3 or 4 folds. Popular for young women.		Size is large. Mainly for night use.	An addition of super-absorbent polymer and/or active carbon is designed to increase the absorptive capacity or to remove the odor.

5. Composition of Raw Materials for Sanitary Napkin

Various raw materials are used for fabrication of sanitary napkin as explained hereunder.

- ① As the facing material, dry-laid type carded nonwoven or rayon paper is used. Either material will give a comfortable feel to the skin. Dry-laid nonwoven has better strength and durability. In this paper, dry-laid nonwoven will be taken up for the planning of a model plant.
- ② Waterproof laminate paper
- ③ Absorbent paper to wrap fluffed softwood bleached sulfite pulp mounted on it.
- ④ Fluffed softwood bleached sulfite pulp – hereinafter called NBSP
- ⑤ Absorbent paper
- ⑥ Both sides adhesive tape or hot melt adhesive.
To be placed in the middle layer of NBSP for absorbing and holding the liquid discharged.
- ⑦ Wrapper of individual pieces
Tissue paper is used as the wrapper of individual pieces. Film is used for some products as the wrapper.
To be stuck to the panty to avoid slippage of the sanitary napkin. Both sides adhesive tape will be taken up in this manual for the planning of a model plant.
- ⑧ For high grade products, super absorbent polymer and/or active carbon are used as an addition to increase the absorptive capacity or to remove the odor.

The composition of raw materials for the regular type is shown in Figure 1.

Name of raw materials	Specifications			
	Width (mm)	Length (mm)	Sub./m ² (gr.)	Wt. (gr.)
① Dry-laid nonwoven	175	195	18	0.6
② Waterproof laminate paper	105	195	26	0.5
③ Pulp wrapping paper	180	160	15	0.4
④ Pulp-NBSP				3.6
⑤ Absorbent paper	55	160	30	0.8
⑥ Both sides adhesive tape	45	15 & 10		0.1
Total				6.0/pc.
⑦ Napkin wrapper	120	200	16	0.4

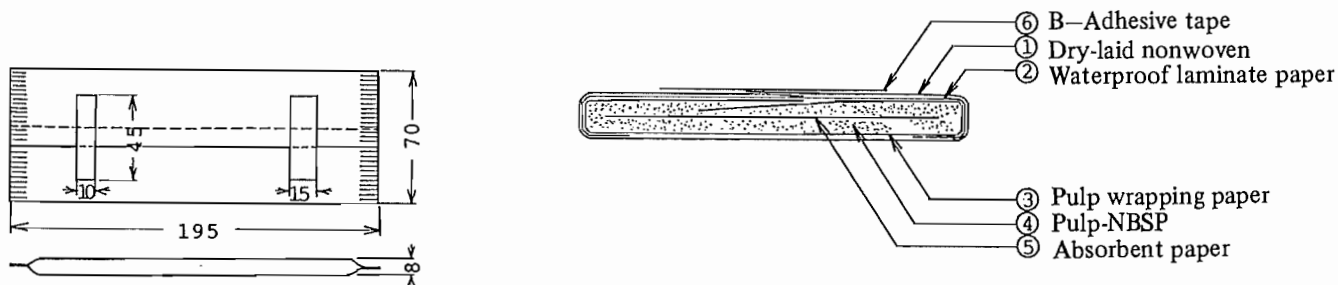


Fig. 1 The Composition of Raw Materials for Regular Type



Photo 2. Sanitary Napkin

6. Model Plant for the Manufacture of Sanitary Napkin

In this paper, a city with a population of 500,000 is supposed to be the market. Assuming that a model plant is to be established in this city, the project planning is made as follows.

6.1 Estimate of Demand

The number of pieces of sanitary napkin consumed in Japan per person per year is about 250 pieces in terms of regular type, as explained earlier.

In the developing country, people are accustomed to take good care of any commodities. Disposable goods are rather new to them. Taking such factors into consideration, we will use a conservative figure of 150 pieces as an annual per capita consumption of sanitary napkin. Assuming that 30% of the total population would be the potential users of sanitary napkin, the annual demand for the napkin is calculated as follows:

$$500,000 \text{ persons} \times 30\% \times 150 \text{ pcs./year} \\ = 22,500,000 \text{ pcs./year}$$

6.2 Production Scale

In case of planning a sanitary napkin manufacturing plant, there are two ways of thinking as stated below.

- (a) With a view to hold the self supply position for raw materials as much as possible, an integrated operation from tissue paper to napkin is to be planned, installing both a tissue paper making machine (hereinafter called tissue machine) and a sanitary napkin making machine (hereinafter called napkin machine).
- (b) The installation of a napkin machine only is to be planned. In this case, all the raw materials required for the making of napkin have to be purchased from outside sources.

This brochure selects Course (b). The installation of a napkin machine only is to be taken up at the initial stage. When the napkin business goes on smoothly, then an integrated system, namely, Course (a) should be pursued as the second phase of the project. When the production scale is set to match the annual demand of 22,500,000 pieces per year as estimated earlier, the following calculation is made in this connection.

Operating hour:

8 hours with one shift/day

Operating ratio: 80%

Working days:

22 days/month (264 days/year)

On the above basis, the output per minute is calculated as follows:

$$22,500,000 \text{ pcs./yr} \div (8 \text{ hr.} \times 60 \text{ min} \\ \times 0.8 \times 22 \text{ days} \times 12 \text{ month.}) = 222 \text{ pcs./min.}$$

This means that a napkin machine having a productive capacity of no less than 222 pieces per minute should be installed. In Japan, various types of napkin machine are available. In this paper, we will adopt a napkin machine having a productive capacity of 250 pieces per minute. When this napkin machine is operated under the abovementioned operating conditions, the daily output should become as follows:

250 pcs./min. × 8 hr. × operating ratio 80%* = 96,000 pcs./day

Remarks * the rest of 20% or 100 minutes represents the downtime, the rest time for lunch and the time required for cleaning of the machine.

The annual output should become as follows:
96,000 pcs./day × 264 days
= 25,344,000 pcs.

When the demand comes up, an increased production can be achieved by means of increasing the operating hours from the initial 8 hours to 16 hours and then to 24 hours or an additional line should be installed. Sanitary napkin manufacturing plant consists of one line of pulp fluffing/feeding machine and one line of napkin machine. There two lines are used in combination. Generally speaking, a pulp fluffing/feeding machine has a larger capacity than a napkin machine. Even if an additional line of napkin machine is installed, the original one line of pulp fluffing/feeding machine should be enough to take care of two lines of napkin machine.

6.3 Manufacturing Process

Manufacturing process at a sanitary napkin manufacturing plant will be explained hereunder.

As to the case of installation of both a tissue machine and a napkin machine with the intention of an integrated operation as explained under Paragraph 6.2 (a), the flow sheet, explanation on the process, cost of installation, etc. are stated in the Appendix attached as a reference.

(1) Flow sheet

The flow sheet of a sanitary napkin manufacturing plant is shown in Figure 2.

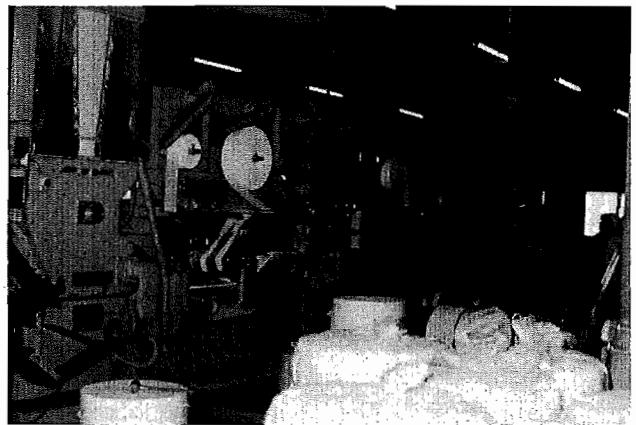


Photo 3. Sanitary Napkin Machine

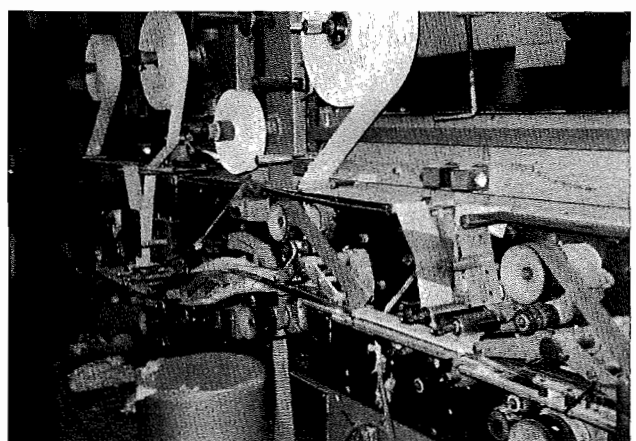


Photo 4. Sanitary Napkin Machine

(2) Manufacturing process of sanitary napkin

The manufacturing process starting from the feeding of NBSP and crushing of it down to the final stage of packing the individual pieces of sanitary napkin and the machinery arrangement of the manufacturing line are shown in Figure 3.

(3) Explanation on the manufacturing process

The main points of the manufacturing process shown in Figure 3 are explained as below.

① Sheet pulp of NBSP (softwood sulfite pulp) marked (A) in Figure 3 is mounted on the conveyor, sheet by sheet, and sent to the pulp rough crusher. Then, the crushed pieces of pulp is sent pneumatically by the suction fan to the pulp fluffing machine.

② Pulp pieces are further refined into a fluffed form by the pulp fluffing machine. Then, the fluffed pulp is sent pneumatically to the pulp storage bin.

③ Fluffed pulp is stored in the storage bin to maintain a constant level. Fluffed pulp is defiberated by the agitator located at the bottom of the storage bin, and sent pneumatically by the fan to the pulp fluff former on the napkin machine. The exhaust air is led to the bag filter marked (9) in Figure 3.

④ At the pulp fluff former, fluffed pulp is dropped down from the duct marked (10) and spreaded by the Garnet Roll onto the pulp wrapping paper marked (B). The accumulation of pulp is made uniformly to keep a fixed weight.

The spreading and accumulating of fluffed pulp occasionally fails to keep uniformity, because fluffed pulp is sensitive to the temperature and humidity. The skill and experience are needed for the proper control of operation at this critical part.

⑤ The manufacturing process of the napkin machine is explained in serial order.

* At the 3-fold part, absorbent paper marked (C) is placed in the middle of fluffed pulp. The whole absorbent body is made in the form of three folds.

* At the fluffed pulp cutting section, the absorbent body is cut in a fixed size.

* Waterproof laminate paper marked (D) is supplied from the upper part to wrap up the absorbent body.

* Dry-laid nonwoven sheet marked (E) is supplied from the lower part to wrap up the whole absorbent body to function as the facing material.

* Both sides adhesive tape marked (F) is cut into the fixed size and sticked to the fixed position of sanitary napkin.

* Both ends of sanitary napkin are heat sealed and cut to turn out individual pieces.

* Individual pieces are packed, piece by piece.

⑥ The stacker discharges the products sideways. The operator counts the number and pack the products into bags.

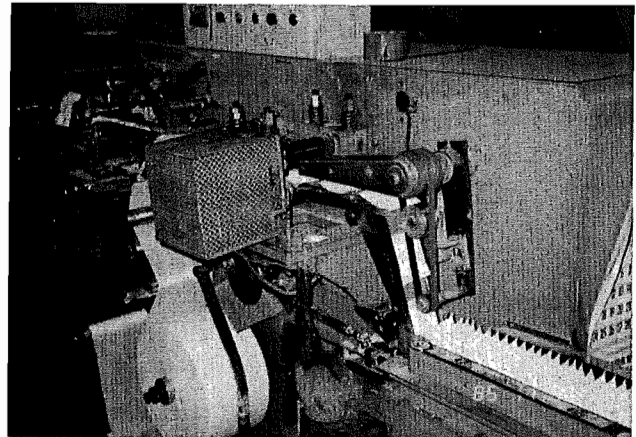


Photo 5. Napkin Pieces on the Conveyor

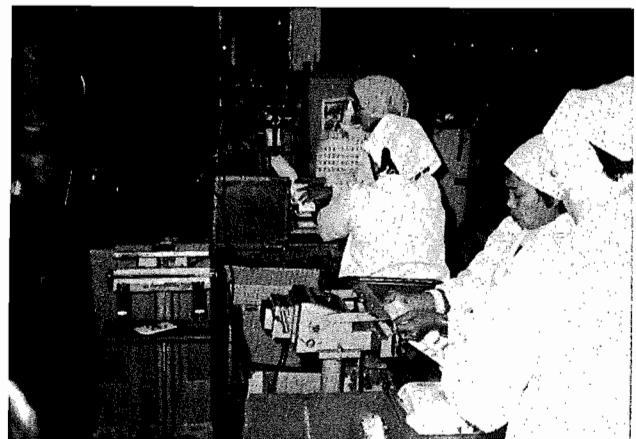


Photo 6. Napkin Pieces Packing Part

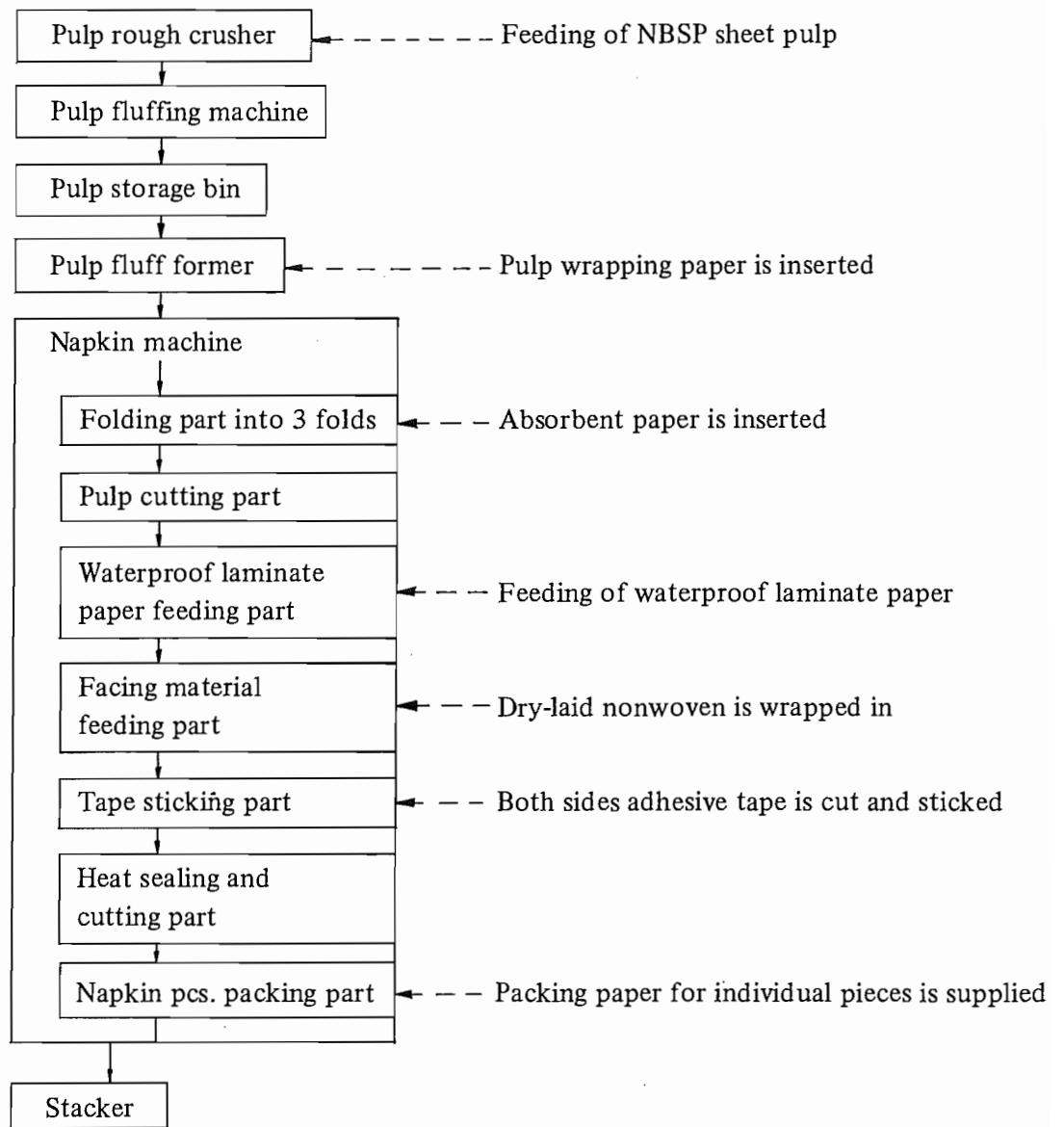
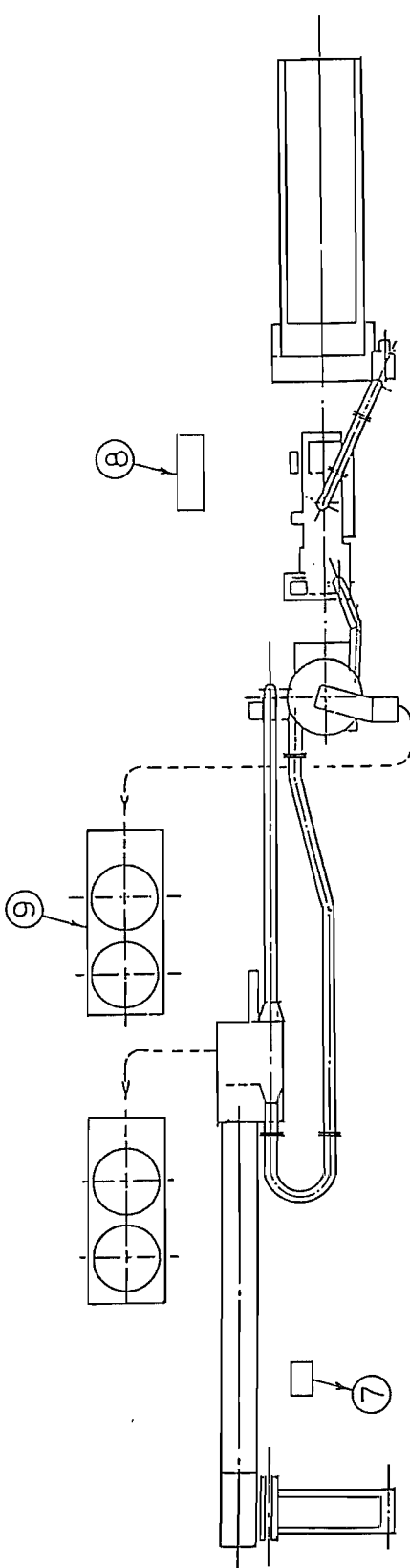
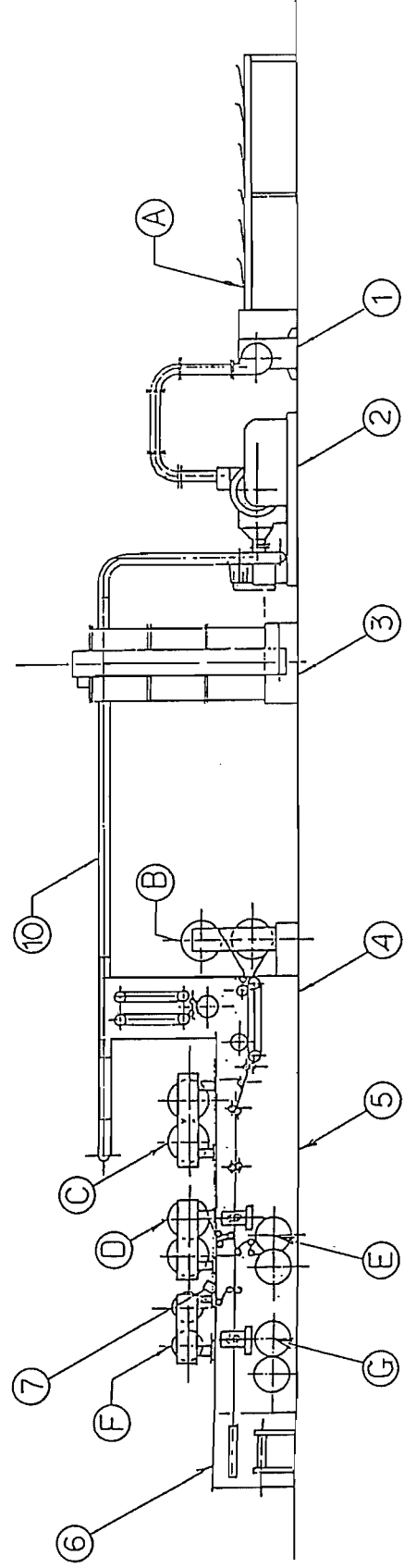


Fig. 2 Flow Sheet of Sanitary Napkin Manufacturing Plant



Napkin Machine
 Pulp Fluffing Capacity : 300 kg/hr.
 Production Capacity of Napkin: 250 pcs./min.



- Ⓐ Pulp-NBSP
- Ⓑ Pulp wrapping paper
- Ⓒ Absorbent paper
- Ⓓ Laminate paper
- Ⓔ Dry-laid nonwoven
- Ⓕ B-adhesive tape
- Ⓖ Napkin packing paper

- ① Pulp rough crusher
- ② Pulp fluffing machine
- ③ Pulp storage bin
- ④ Pulp fluff former
- ⑤ Napkin machine
- ⑥ Stacker
- ⑦ Sticker applicator
- ⑧ Control panel
- ⑨ Bag filter
- ⑩ Duct

Fig. 3 Manufacturing Process of Sanitary Napkin and Machinery Arrangement

6.4 Raw Materials Required

Assuming that 96,000 pieces of sanitary napkin of regular type are produced per day, the requirements of raw materials are shown in Table 2.

6.5 Utilities

(1) Electric power 110 kWh/hr

Electric power required for driving a napkin machine plus power required for air conditioning.

(2) Water required 20 m³/day

Water will be required for cooling of the pulp crusher, moisture control of sheet pulp of NBSP, and also for use at the test room, kitchen, toilet, etc.

(3) Fuel oil 50 l/day

Fuel will be used at the test room and kitchen. Boiler will not be needed except for the region where the room heating is required.

6.6 Machinery and Equipment Required

The names of machinery and equipment required and brief specifications are shown in Table 3.

Table 2. Raw Materials Required

Name of raw material	Wt./pc. (gr.)	Wt./day (kg)	Loss (%)	Daily req. (kg)	Monthly req. (kg)
1. Dry-laid nonwoven	0.6	57.600	5	60.630	1,334
2. Waterproof laminate paper	0.5	48.000	5	50.260	1,106
3. Pulp wrapping paper	0.4	38.400	5	40.420	889
4. Pulp-NBSP	3.6	345.600	10	384.000	8,448
5. Absorbent paper	0.8	76.800	5	80.840	1,778
6. Both sides adhesive tape	0.1	2,400m	5	2,530m	55,660m
Total	6.0				
7. Packing paper for individual pcs.	0.4	38.400	5	40.420	889
8. Other packaging materials					

Table 3. Machinery and Equipment Required

Names of machinery and equipment	Brief specifications
1. Pulp fluffing-feeding machine	One line having NBSP treating capacity of 300 kg/hr
2. Napkin machine	One line having productive capacity of 250 pcs./min.
3. Power receiving and distribution equipment	Transformer 300 kVA/unit, a set of distribution equipment
4. Water supply equipment	1 set
5. Compressed air supply equipment	Compressor 3.75 kW 1 unit; A set of air piping
6. Air conditioning equipment	1 set
7. Testing apparatus	1 set
8. Spare parts	1 set
9. Vehicles	One forklift and one truck

6.7 Cost of Machinery and Equipment

Cost of Machinery and Equipment (FOB Japan port); US\$556,000.

The above cost contains the cost of one line of napkin machine having a productive capacity of 96,000 pieces of regular type and a set of auxiliary equipment.

The above quotation covers the process from mounting NBSP sheet on the conveyor to finishing the individually packed pieces of napkin. The breakdown of machinery and equipment covered by the quotation is shown in Table 3.

6.8 Plant Layout and Buildings

Area of the plant site: $100\text{ m} \times 200\text{ m} = 20,000\text{ m}^2$
 Floor space of buildings: $24\text{ m} \times 50\text{ m} + (12\text{ m} \times 20\text{ m}) \times 2 = 1,680\text{ m}^2$
 height of buildings . . . 5.5 m

In case of installing a tissue machine as explained in the Appendix, an additional building having the following floor space will be required.
 $(12\text{ m} \times 50\text{ m}) + (9\text{ m} \times 10\text{ m}) = 690\text{ m}^2$
 The plant layout and buildings is shown in Figure 4.

6.9 Workers and Placement

Assuming that the plant is operated with one shift for 8 hours and the working days a month are 22 days, workers required and their positions is shown in Table 4.

7. Production Cost and Annual Sales

In making calculation of estimated cost of production, actual circumstances of respective countries have to be taken into account. Since it is difficult to adopt such factors as the basis of calculation, the following basic conditions are assumed in this paper for the cost calculation.

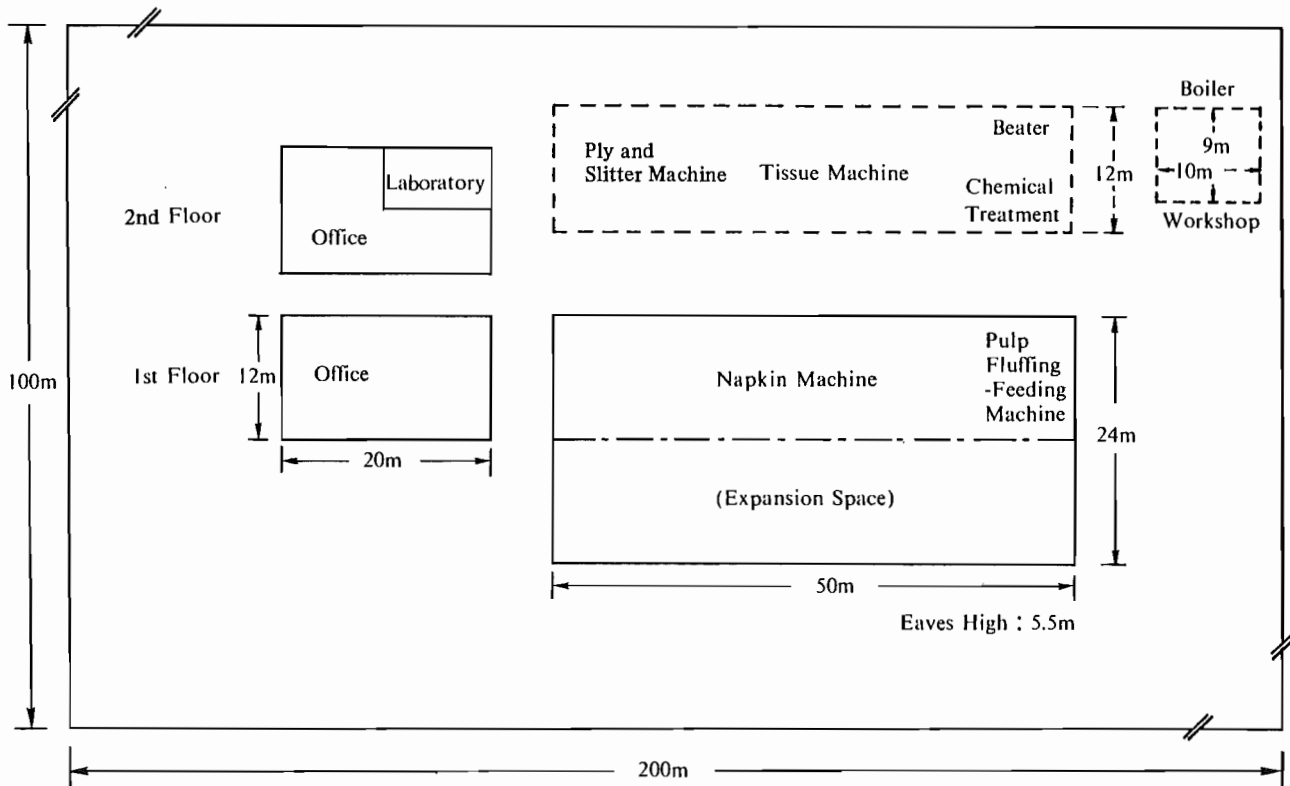


Fig. 4 Plant Layout and Buildings

Remarks: The part shown in dotted lines is the space for a tissue machine to be installed additionally, which is explained in the Appendix.

Table 4. Workers and Placement

	Male	Female	Classification
Administration Dept.			
Plant Manager	1		Plant Manager
Secretary		1	Clerk
Management staff	3		Management staff
Clerk	3	7	Clerk
Guardman	4		Clerk
Driver	2		Worker
Universal maid		6	Odd-jobber
Production Dept.			
Dept. Chief	1		Management staff
In charge of:			
Laboratory		2	Technical Worker
Pulp Crusher	1		Technical Worker
Napkin Machine	2		Technical Worker
Machine Maintenance	1		Technical Worker
Electricity	1		Technical Worker
Products Counting		4	Skilled Worker
Heat Sealing		4	Skilled Worker
Packing of Products		2	Worker
Forklift	2		Worker
Total	21	26	
Grand total		47	

7.1 Basic Conditions for the Calculation of Fixed Capital, Working Capital and Production Cost

(1) Fixed capital

- (a) Construction cost of plant buildings
To be set at US\$400/m²
- (b) Cost of machinery and equipment
The FOB price, Japan port quoted in 1986 is to be used.
- (c) Spare parts
To be set at 10% of cost of machinery and equipment.
- (d) Ocean freight and insurance
To be set at 10% of cost of machinery and equipment.
- (e) Foundation works for installation of machinery and equipment (including auxiliary

works)

To be set at 10% of cost of machinery and equipment.

- (f) Cost of installation works
To be set at 6% of cost of machinery and equipment.
- (g) Supervision cost
To be set at 6% of cost of machinery and equipment.
- (h) Commissioning cost
To be set at 2% of cost of machinery and equipment.
- (i) Expenses for training
To be set at 10% of cost of machinery and equipment.
- (j) Contingency
To be set at 10% of cost of machinery and equipment.

(2) Working capital

- (a) Cost of raw materials
Calculation is made on the basis of holding 2-month supply.
- (b) Inventory of products
Calculation is made on the basis of holding one month supply as inventory.

(3) Production cost

- (a) Cost of raw materials (containing packing materials)
As to the cost of raw materials, the market prices prevailing in Japan are taken as reference. The FOB prices, Japan port and purchase prices payable per month are shown in Table 5.
- (b) Unit cost of utilities

Electric power	US\$0.06/kWh
Water	US\$0.40/m ³
Fuel oil	US\$0.20/l

Table 5. Unit Prices of Raw Materials and Purchase Prices per Month

Name of raw material	Requirement/month (kg)	Unit price (FOB yen/kg)	Monthly purchase (yen)
1. Dry-laid nonwoven	1,334	950	1,267,300
2. Waterproof laminate paper	1,106	480	530,880
3. Pulp wrapping paper	889	330	293,370
4. Pulp—NBSP	8,448	100	844,800
5. Absorbent paper	1,778	300	533,400
6. Both sides adhesive tape	55,660m	¥16/m	890,560
7. Packing paper for individual pcs.	889	350	311,150
8. Other packaging materials			910,800
Total			¥5,582,260

= US\$ 31,013

Conversion rate: US\$1 = ¥180

(4) Labor cost

Direct cost of labor per person per year is set as follows:

Plant manager	US\$12,000
Management staff	US\$10,000
Clerk	US\$ 4,000
Technical Worker	US\$ 5,000
Skilled worker	US\$ 4,000
Worker	US\$ 3,000
Odd-jobber	US\$ 1,000

(5) Maintenance cost

To be set at 3% of cost of machinery and equipment.

(6) Depreciation

Depreciation on the basis of fixed installment is used. Depreciation on machinery and equipment (fixed capital minus cost of buildings) should be 7% per annum. Depreciation on buildings should be 3% per annum.

(7) Insurance

To be set at 0.5% of fixed capital.

(8) Interest

One half of the fixed capital is to be covered by a long term loan. The interest of such loan is set at 10% per annum.

(9) Selling and administration expenses

To be set at 10% of the sales.

Remarks: The conversion rate: US\$1 = ¥180

7.2 Capital Required

(1) Fixed capital

	US\$
Plant site	not included
Construction cost of bldgs. 1680 m ²	420,000
Machinery & equipment FOB Japan	556,000
Spare parts	55,600
Ocean freight & insurance	55,600
Foundation works	55,600
Installation works	33,360
Guidance and supervision	33,360
Commissioning	11,120
Training	55,600
Contingency	55,600
Sub-total	US\$1,331,840

(2) Working capital

(a) Cost of raw materials
An amount equivalent to two-month supply of imported raw materials is counted as a part of the working capital.
 $US\$31,013 \times 2 = US\$62,026$

(b) Inventory of products
An amount equivalent to a month's production is thought to be the inventory, which should be counted as a part of the working capital.
 $[US\$ 861,583^{*1} - (US\$ 76,429^{*2} + US\$ 101,376^{*3})] \times 1/12$
 $= US\$56,982$
Remarks: *¹ Production cost
 *² Depreciation cost
 *³ Selling and administration expenses

Working capital:
(a) + (b) = US\$119,008

Capital required:
(1) + (2) = US\$1,450,848

7.3 Production Cost

(1) Cost of raw materials
Taken from Table 4 US\$372,156/year

(2) Utilities
Electricity
 $US\$0.06 \times 110 \text{ kWh} \times 8 \text{ hr} \times 22 \text{ days} \times 12 \text{ months} = US\$13,939/\text{year}$
Water
 $US\$0.40 \times 20 \text{ m}^3 \times 22 \text{ days} \times 12 \text{ months} = US\$2,112/\text{year}$
• Fuel oil
 $US\$0.20 \times 50^e \times 22 \text{ days} \times 12 \text{ months} = US\$2,640/\text{year}$

Sub-total US\$18,691/year

(3) Labor cost

		US\$/year
Plant manager	1	12,000
Management staff	4	40,000

Clerk	15	60,000
Technical worker	7	35,000
Skilled worker	8	32,000
Worker	6	18,000
Odd-jobber	6	6,000

Sub-total US\$203,000/year

(4) Maintenance cost
 $US\$556,000 \times 3\% = US\$16,680/\text{year}$

(5) Depreciation
Machinery and equipment:
 $(US\$1,331,840 - US\$420,000) \times 7\%$
 $= US\$63,829/\text{year}$
Buildings:
 $US\$420,000 \times 3\% = US\$12,600/\text{year}$

Sub-total US\$76,429/year

(6) Insurance
 $US\$1,331,840 \times 0.5\% = US\$6,659/\text{year}$

(7) Interest
 $US\$1,331,840 \times 1/2 \times 10\%$
 $= US\$66,592/\text{year}$

(8) Selling and administration expenses
 $US\$1,013,760 \times 10\% = US\$101,376/\text{year}$

Production cost US\$861,583/year

7.4 Annual Sales

The sales price of sanitary napkin of regular type per piece is set at US\$0.04, taking into account the prevailing market price in Japan.

Annual sales
 $US\$0.04 \times 25,344,000 \text{ pcs.}$
 $= US\$1,013,760$

8. Profitability

Based on the abovementioned factors and

conditions, the profitability of the model plant is calculated as follows:

Annual sales of products	US\$1,013,760
Production cost	US\$ 861,513

Profit	US\$ 152,247
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Profit ratio against sales

$$\text{US\$152,247} \div \text{US\$1,013,760} = 15\%$$

Profit ratio against capital investment

$$\text{US\$152,247} \div \text{US\$1,450,848} = 10.5\%$$

Profit ratio against sales of 15% as well as profit ratio of 10.5% against capital investment show that this plant has a high profitability.

9. Others

When construction and operations of a sanitary napkin manufacturing plant are planned, it is recommended that technical assistance be received from a corporation who is well experienced and actually engaged in the manufacture of napkin.

For instance,

- (a) Two trainees are to be dispatched to an experienced sanitary napkin plant to receive training there for a period of two months.
- (b) During the construction, the dispatch of two supervisors from a corporation engaged in the napkin production should be arranged to receive their assistance for a period of two months.
- (c) At the stage of test runs, the dispatch of two supervisors from a corporation engaged in the napkin production should be arranged to receive their assistance for a period of two months.

The above three methods are just some idea for recommendation.

Appendix

Method to make an Integrated Operation by means of Installing a Tissue Machine and a Napkin Machine.

One case would be that a tissue machine is already owned by the plant. The other case would be to install a new tissue machine for making facial tissue paper, pocket tissue paper, table napkin paper, toilet tissue paper, etc. plus tissue paper for use of sanitary napkin. This Appendix will explain the method of how to supply tissue paper to the line of napkin machine, showing a flow sheet and brief explanation on the manufacturing process. Raw materials, which are not manufactured at the own plant, are, of course, to be purchased from outside sources.

(1) Flow sheet

Figure 5 shows a flow sheet in case sanitary napkin is manufactured on an integrated basis from tissue paper self-made to napkin paper.

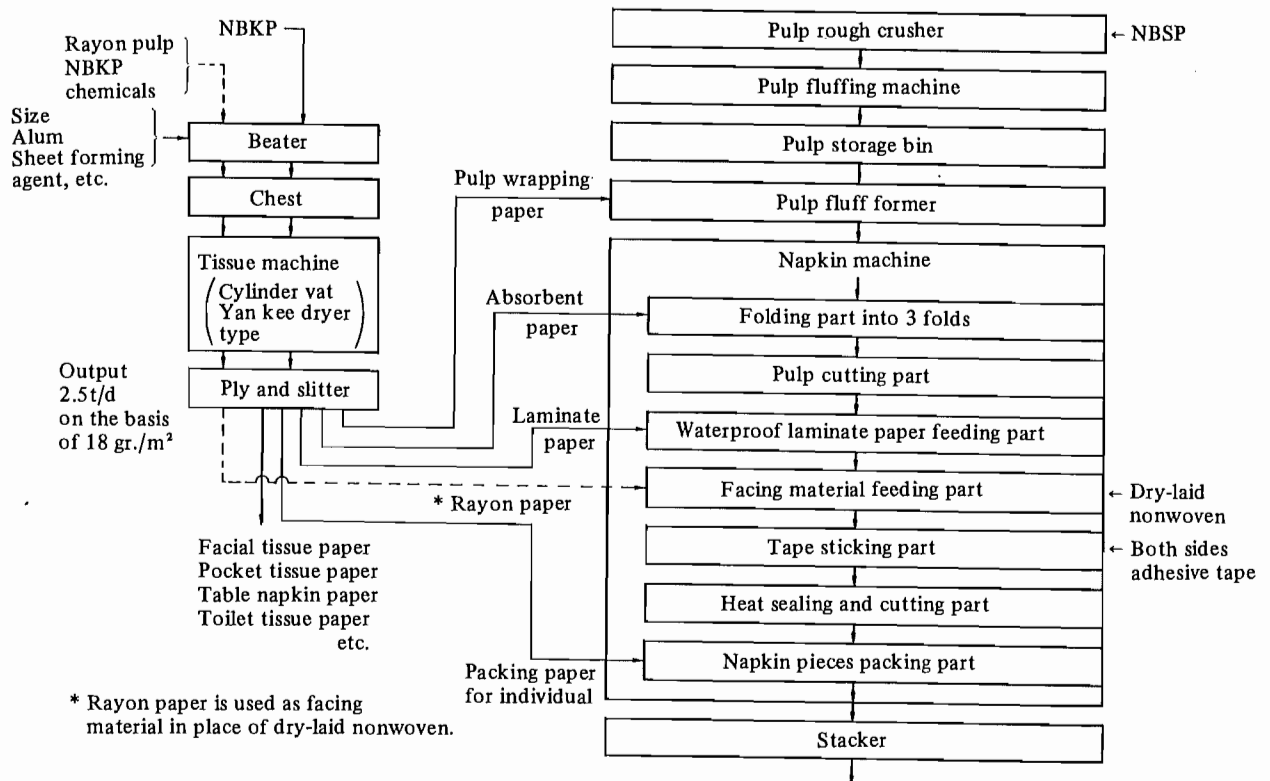


Fig. 5 Flow Sheet of an Integrated Operation from Tissue Machine to Napkin Machine

(2) Rough sketch of a tissue machine

Figure 6 shows the rough sketch of a tissue machine and a ply and slitter machine.

(3) Machinery and equipment required

One line of tissue machine will need the following equipment besides the equipment required for a line of napkin machine, which is already covered under Paragraph 6-3, (1) to (3).

- ① Three units of Hollander Beater having a capacity of 300 pounds each.
- ② Chemicals preparation equipment . . . one set
- ③ Tissue machine one unit
- ④ Ply and slitter machine one unit
- ⑤ Package boiler having a capacity of
1.5 tons/hr one unit
- ⑥ Auxiliary equipment

When a tissue machine is installed, a higher capital investment will, of course, be needed. The initial cost will become inevitably high. However, when this project is evaluated on

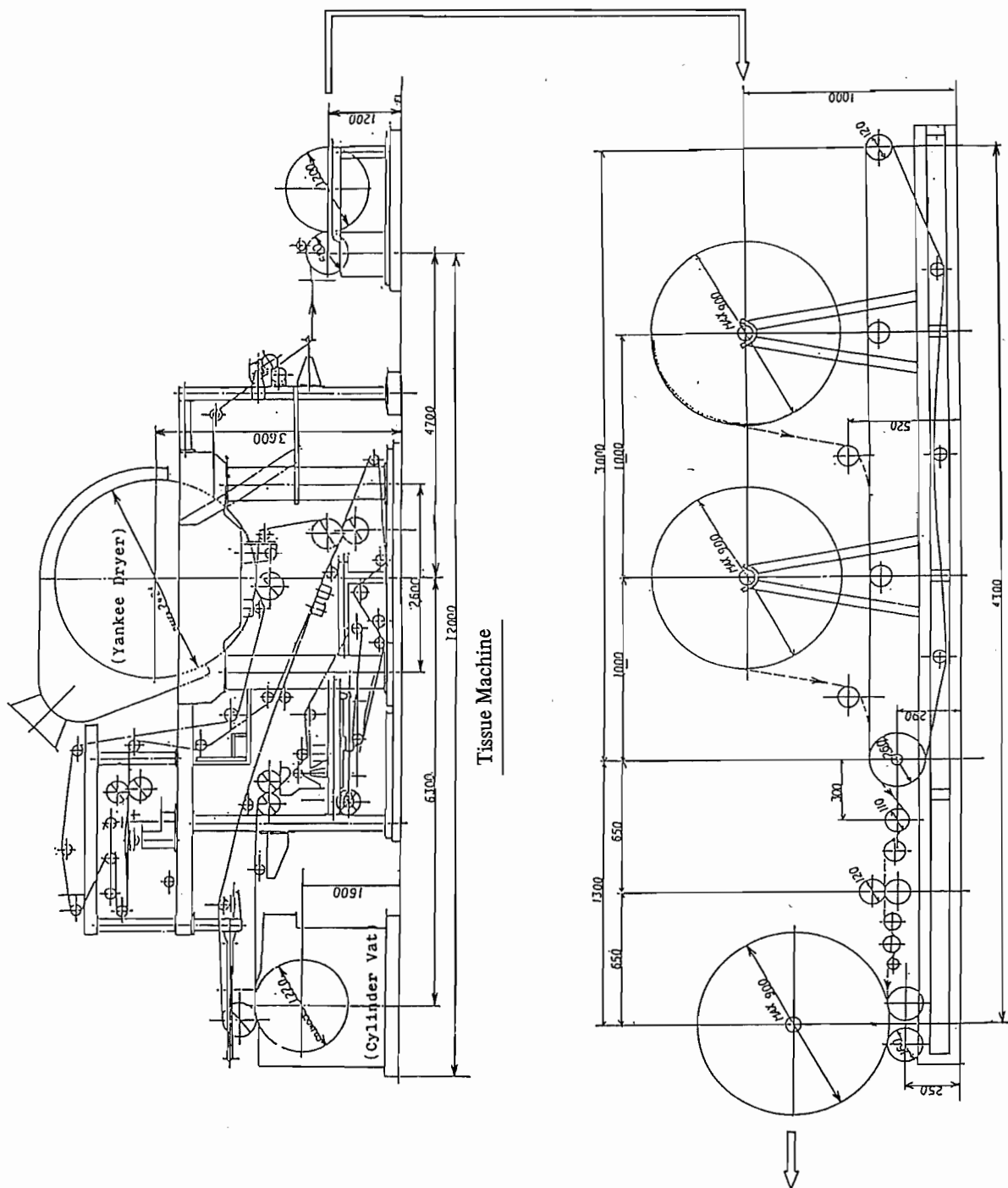


Fig. 6 Rough Sketch of a Tissue Machine and a Ply and Slitter Machine

a long term basis, the installation of a tissue machine together with a napkin machine will enable the supply of raw materials at a lower cost than the purchased raw materials eventually. Moreover, the products to be made on the tissue machine will become more versatile.

The line of tissue machine will have to manufacture varieties of products in small lots. The machine to be selected should be the type capable of producing small lots effectively. At the stock preparation department, the adoption of the beater system is advisable, to speak in particular.

(4) Explanation on the process

① Based on the production schedule by types of tissue paper to be produced, the requirements of NBKP are calculated. The quantity of pulp thus determined is fed in the beater. The required amount of chemicals is also fed in the beater, fluorescent dyestuff should not be used.

The beating of pulp is made until the aimed degree of freeness is obtained.

② Tissue paper of different qualities ranging from hardsized tissue paper to soft and fluffy tissue paper must be made on a single tissue machine with clear distinction of qualities from grade to grade. Skill and experience of the workers are required in this part of operation in particular.

③ Tissue paper made on the tissue machine is then sent to the ply and slitter machine for

cutting of the web into specified width. The products are temporarily stocked at the warehouse with remarks of the grades sticked thereto.

④ When the workers become well trained in operations, production of rayon tissue paper having a smooth face texture should be attempted by means of beating the mixed stock of purchased rayon pulp with NBKP in the beater. This rayon tissue paper is usable as the facing material as a replacement for the dry-laid nonwoven.

In this case, there may be a problem of the web sticking to the dryer. Caution is required to overcome this problem.

(5) Cost of machinery and equipment

One set of tissue machine (FOB Japan Port);
US\$1,111,000

Capacity: 2.5 ton/day of tissue paper on the basis of the substance of 18gr./m²

The production equipment consists of the stock preparation part including three units of beater, the chemical treatment equipment, tissue machine, ply and slitter machine, etc.

The production equipment should also include one steam boiler having a capacity of 1.5 tons/day.

(6) Utilities

(a) Electricity	1,100 kWh/ton of paper
(b) Process water	220 m ³ /ton of paper
(c) Fuel oil	360 ɛ/ton of paper

Project Planning for Small and Medium Scale Industries

- No. 1 Rice Milling Plant and Rice Bran Oil Manufacturing Plant
- No. 2 Plastic Woven Bag Manufacturing Plant
- No. 3 Container Board Manufacturing Plant
- No. 4 Plastic Blow Bottle Manufacturing Plant
- No. 5 Concrete Block Manufacturing Plant
- No. 6 Glassware Manufacturing Plant
- No. 7 Galvanized Iron Sheet Manufacturing Plant
- No. 8 Fishing Net Manufacturing Plant
- No. 9 Ice Making, Refrigeration and Cold Storage Plant
- No.10 Starch and Syrup Manufacturing Plant
- No.11 Instant Noodle Manufacturing Plant
- No.12 Surimi and Surimi-Based Food Manufacturing Plant
- No.13 Polyethylene Shopping Bag Manufacturing Plant
- No.14 Retreading Tire Manufacturing Plant
- No.15 Husk Fired Thermal Power Plant
- No.16 Fishmeal Manufacturing Plant
- No.17 Assorted Animal Feed Manufacturing Plant
- No.18 Sanitary Napkin Manufacturing Plant

Project Planning for Small and Medium Scale Industries No.18

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