5) Production Yield

The indication of the net reeling yield and finishing yield are in the Table 5-6-1. PPM intends to raise the overall yield of Unit 1 up to 90%.

(1) Fig. 5-6-1 shows the mass balance concerning BANDEROL of PM 1.

The figure represents values derived from the production plan of March. The figures of those virgin pulp, circulation pulp and finishing amount may change with the system of Air-Dry (AD) or Bone-Dry (BD) bases.

It does not matter when the moisture content is thought to be 10% for both the pulp and paper.

In such consideration, the Bone-Dry System will be an easy way in calculation. Therefore, PPM seems to calculate by means of this system. The method to think will be necessary to be changed concerning little paper moisture content. (Here, the consideration is made as a Bone-Dry Basis.)

In the Table 5-6-1, the net reeling yield of BANDEROL is 84 and finishing yield is 87. Consequently, the raw material is 1,368.2 kg, gross reeling production is 1,149 kg and finishing is 1,000 kg for the loss of 219.2 kg, the following formula can be obtained:

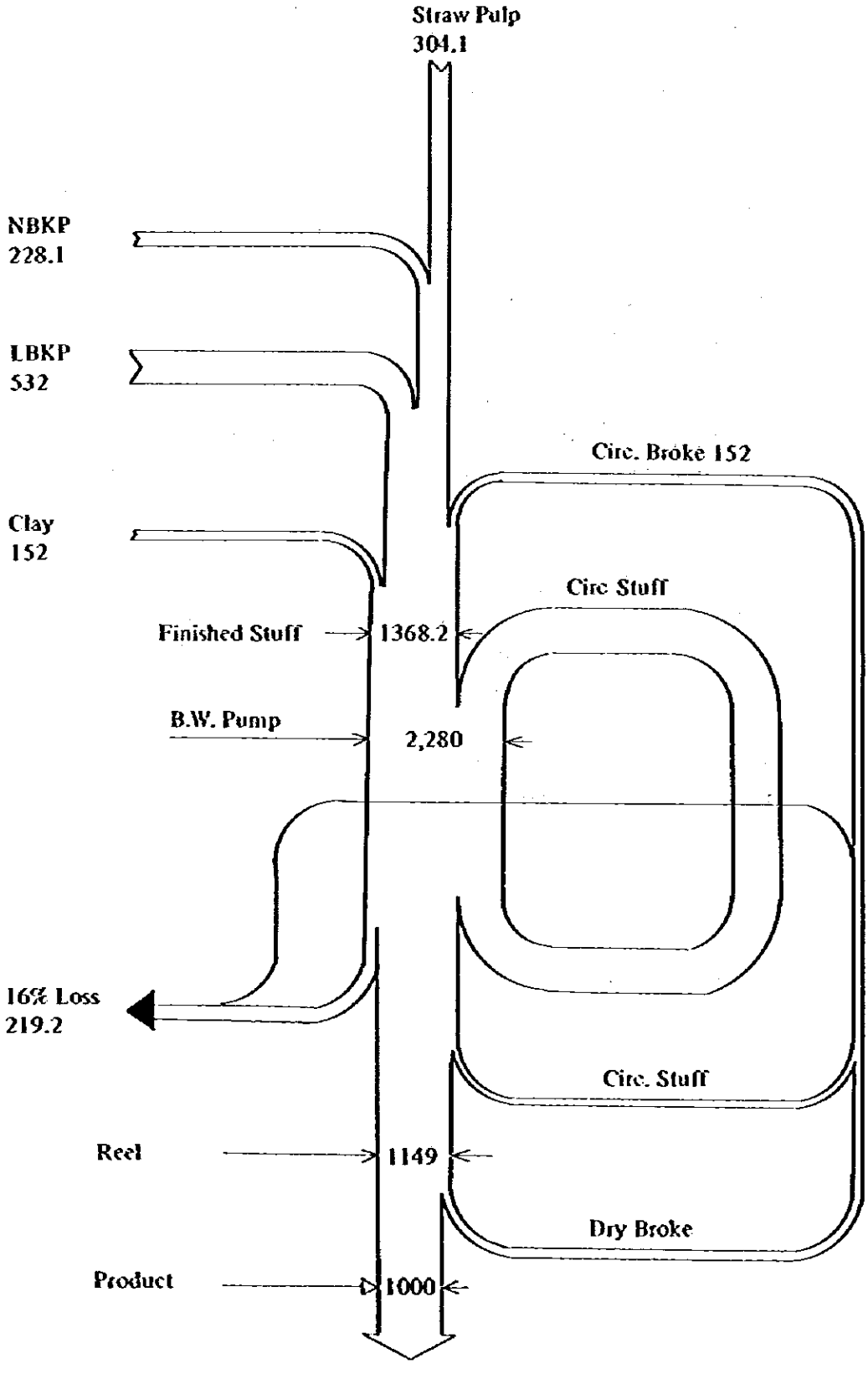
Net reeling yield : $1 - (219.2/1,368.2) = 0.84$
Finishing yield : $(1,000/1,149)$

The circulation broke of 152 kg which is to be omitted in the calculation is included into the raw material of 1,368.2 kg.

(2) Generally speaking, the total yield is to be shown by the ratio of the finished production per the new furnished pulp stock.

Fig. 5-6-1 Production Plan by PPM Production Plan in Mar, 1984

PM 1 -- Mass Balance (For Banderol only)



Namely, now, the following formula can be obtained:

$$\frac{1{,}000}{1{,}368.2 - 152} \times 100 = 82.2\%$$

Note) Refer to the item of the total yield in the Table 5-6-2.

Namely, this means that since the fibre loss into effluent of 219.2 kg can be observed for the new furnished stock; 1,368.2 – 152 = 1,216.2 kg, hence 219.2/1,216.2 = 18% is to be of the yield loss. Consequently, 100 – 18 = 82% is the total yield and this idea is easy to be used for the production plan.

(3) Total yield as BD basis of 82% is equivalent to about 77% when converted into Air Dry basis. In this project, PPM values were converted by this system and improved values were set under comparison with the same brand in Japan.

(4) When the indication by AD basis is applied, generally, it is calculated as follows:

Weight loss	: 1%
Moisture loss (Pulp 10% and Paper 5%)	: 5%
Fibre loss into effluent	: 2%
Loss total	: 8%
Total yield (AD basis)	: 92%
Total yield (BD basis)	: 97%

6) Gross reeling Amount, Net reeling Amount and Finishing Yield

(1) Gross reeling amount is an actual weight production by means of the reel and is a total-weight production at the paper-making process indicated by the value employing the gross reeling width before the trim edge is cut down at the finishing plant.

(2) Net reeling amount is a weight production at the paper-making process indicated by the net width shown by the finishing dimensions and is a value for which the trim edge width is subtracted from the gross reeling amount.

(3) PPM value shows a gross reeling amount in the calculation. Then, the finishing yield is indicated by the rate of the finished product per the gross reeling amount including the trim edge. Therefore, it is natural that the finishing yield is lower than the general value.

(4) Compared from this idea, the present PPM finishing yield is 3 to 7% better than the value in the Table 5-6-1.

Based upon this calculation method, the figure calculated in the Japanese way is shown in the Table 5-6-2. The revised finishing yield is equivalent to this way of culculation.

7) Production Efficiency

(1) In PPM budget statement, the declaration of intention can be nowhere found out. Provided that the finishing yield is clarified by the annual report of the manufacturing department in fiscal 1983 and revised values can be used by the product net as finishing width.

(2) The operation efficiency is indicated in the budget statement of fiscal 1984 and is equivalent to about 90% when it is evaluated in the Japanese way.

(3) In addition, since the gross reeling amount and finish amount as actual results of fiscal 1983 are described in the annual report of the manufacturing department, these are comprehensively applied. Various kinds of efficiency were trial-calculated as follows:

(4) Net reeling Efficiency and Total Efficiency

Net reeling efficiency = Net reeling amount/theoretical net reeling amount x operation efficiency

Total efficiency = finishing amount/theoretical net reeling amount

= Net reeling amount x finished yield/theoretical net reeling amount

(5) The above-mentioned calculation results are shown in the Table 5-6-2 List of Analysis on the Pre-improvement Paper Production Efficiency

Based upon these kinds of efficiency, the improvement plan of this project was executed. In future, the application to the production control would be recommended.

Table 5-6-2 List of Analysis on the Pre-improvement Paper Production Efficiency

Derived and revised from the budget table of March 1984

No.	Brand		Basis weight (GSM)	Finishing dimensions (mm)			Net trimming ratio (%)	Revised finishing yield (%)	Paper-making speed (MPM)	Net reeling amount (ADt/d)		Finishing amount (ADt/d)	Calculated efficiency (%)				Total yield (%)
				Product net width	Gross reeling widgh	Trim edge width				Theoretical Theoretical	Actual net reeling amount	Actual finishing amount	Finish	Opreation	Net reeling	Total efficiency	
-1	HVS Warna	I	80	650 x 1,000	2,060	110	94.66	84.51	46	10.34	8.59	7.26	84.52	90	92.30	70.21	76.9
-2	HV Offset	I	60	620 x 880	1,900	40	97.89	83.76	62	9.96	8.33	6.98	83.79	92	90.91	70.08	74.8
-3	HVS Putih	I	50	550 x 750	2,100	50	97.62	81.95	65	9.59	8.31	6.81	81.95	92	94.19	71.01	72.4
-4	Kertas Water Mark Pt	III	70	650 x 1,000	2,100	150	92.86	87.23	46	9.01	7.90	6.89	87.22	92	93.99	76.22	71.0
-5	Warter Mark Warna	III	70	650 x 1,000	2,100	150	92.86	87.23	46	9.04	7.90	6.89	87.22	92	93.99	76.22	68.4
-6	Cyclo Style Ef	II	69	213 x 330	2,100	120	94.29	98.63	65	12.79	9.35	9.22	98.61	92	79.46	72.09	78.2
-7	Zour Froef	III	70	1,010 Roll	2,070	50	97.58	88.13	46	9.37	6.92	6.10	88.15	90	82.06	65.10	72.2
-8	Mail Zegel	III	80	610 x 860	2,140	60	97.20	82.30	30	7.19	6.07	4.99	82.21	89	94.85	69.40	82.3
-9	Bandrol	III	60	750 x 1,020	2,100	60	97.14	89.56	62	10.93	7.71	6.91	89.62	88	80.16	63.22	82.2
-10	Banorol	III	50	730 x 1,020	2,100	60	97.14	89.56	65	9.55	7.71	6.91	89.62	90	89.71	72.36	82.2
-11	Reform	III	120	1,570 Roll	2,060	50	97.57	86.09	32	11.11	8.85	7.62	86.10	88	90.53	68.59	82.2
-12	SPR Water Mark Ied	III	80	670 x 1,000	2,100	90	95.71	83.59	30	6.95	5.97	4.99	83.58	92	93.38	71.80	76.8
-13	SPR Biasa	III	80	670 x 1,000	2,100	90	95.71	85.68	40	9.26	6.79	5.82	85.71	88	83.33	62.85	71.7
-14	Cheque Putih	III	100	650 x 1,000	2,060	110	94.66	88.74	30	8.42	5.91	5.24	88.66	86	81.62	62.23	79.2
-15	Ijazah (STTB)	III	130	715 x 927	1,940	86	95.57	52.32	24	8.33	5.42	2.84	52.40	80	81.32	34.09	52.3
-16	Post Wesel	IV	175	650 x 970	2,000	60	97.00	90.72	22	10.76	8.25	7.49	90.19	90	85.19	69.61	83.1
-17	Kartu Post	IV	175	600 x 850	2,100	50	97.62	90.15	22	11.37	8.31	7.49	90.13	90	81.20	65.88	83.1
-18	London Warna	IV	190	610 x 860	2,140	60	97.20	86.42	20	11.38	9.37	8.10	86.45	90	91.49	71.18	79.8
-19	Door Stag Putih	V	28	440 x 690	1,900	140	92.63	86.37	68	4.83	3.68	3.18	86.41	94	81.06	65.84	85.5
-20	Door Stag Warna	V	28	440 x 690	1,900	140	92.63	86.37	68	4.83	3.68	3.18	86.41	94	81.06	65.84	85.5
-21	Bank Post Putih	V	44	650 x 1,000	2,000	50	97.50	84.10	70	8.65	5.53	4.65	84.09	88	72.65	53.76	75.2
-22	Corona	V	37	460 x 960	1,900	60	96.84	84.68	70	6.86	4.94	4.18	84.62	90	80.00	60.93	68.4
-23	Buku Telephone	V	37	620 x 880	1,900	40	97.89	81.72	70	6.94	5.28	4.31	81.63	92	82.69	62.10	72.2
-24	Sigaret Putih	VI	26	460 x 890	2,000	60	97.00	82.47	64	4.65	3.85	3.18	82.60	96	86.25	68.39	81.1
-25	Sigare Nankin	VI	26	460 x 890	2,000	60	97.00	82.47	64	4.65	3.85	3.18	82.60	96	86.25	68.39	81.1
-26	Coverture Warna	VII	60	650 x 1,000	2,060	110	94.66	92.96	65	10,95	8.06	7.49	92.93	93	79.14	68.40	75.7
-27	HV Omslag	VIII	80	650 x 1,000	2,060	110	94.66	97.19	41	9.88	8.06	7.83	97.15	93	87.71	79.25	77.3
-28	HV Omslag	VIII	200	730 x 1,000	2,100	100	95.24	96.60	20	11.52	9.18	8.87	96.62	93	85.69	77.00	77.3
-29	HV Omslag Biru Tua	VIII	70	650 x 1,000	2,150	110	94.88	96.96	46	9.51	8.49	8.23	96.94	95	93.77	86.54	77.3
-30	Kraft Colat	VIII	45	900 x 1,200	1,900	100	94.74	97.11	70	8.16	7.00	6.80	97.14	95	90.30	83.33	77.3
-31	Water Mark	III	100	650 x 1,000	2,060	110	94.66	84.51	30	8.42	5.91	4.99	84.43	86	81.61	59.26	76.8
	Averale				2,039	85	95.83	87.61	48.45	8.88	6.94	6.68	87.61			68.54	76.9

5-6-2 Control and/or Management to be strengthened after Renovation Work

1) Preparedness for Production Increase and Assurance of Raw Materials

(1) Production Increase for Unit I

Enhancement of overall efficiency by renovation of facilities and increased production by speed-up of the machine have been planned. It is necessary to arrange for working materials to meet such production increase.

In this project, the renovation for the improvement of the total yield is to be carried out in addition to the above, and the following is the increased portion of the raw materials after the renovation realized by combined effects of increased production and improved yield.

(Unit: BDt/Year)

No.	Item	Present situation	After improvement	Increase or decrease
1	Production	3,767	5,180	+1,413
2	Bleached straw pulp	824.61	1,754.02	+929.41
3	Unbleached straw pulp	0	1,099.66	+1,099.66
4	Straws	3,298.44	7,905.33	+4,606.90
5	NBKP	633.63	721.39	+87.76
6	LBKP	1,583.6	789.24	−794.36
7	Clay	432.11	(432.11)	±0
8	$CaCO_3$	25.43	147.18	+121.75
9	TiO_2	1.19	1.16	±0

(Note) In Item 7, the increase or decrease of clay is set at nil., which is a temporary value provided that the filler yield shows no change even after the renovation.

(2) Portion of Grade Changes in Unit II

For PM 3 line, a newly installed bobbin slitter in the finishing room consititute the main investment, and for the rest some small improvements are made for the reduction of fiber loss due to the overweight of products and a minor improvement of the stock preparation equipment.

With the improved gains by the increased production of EAGLE after the improvement, the 478 ton portion of SILVER BIRD will be transferred to PM 2. By reducing the said weight loss to 4%, the following shows the increase or decrease of the raw materials required:

(Unit: BDt/Year)

No.	Item	Present situation	After improvement	Increase or decrease
1	Production	2,939	2,904.5	34.5
2	NBKP	1,101.08	1,058.73+109.60	+67.25
3	LBKP	852.53	676.52	−176.01
3	Flax	43.07	28.07	−15.0
4	$CaCO_3$	772.94	754.40	−18.44
5	TiO_2	21.66	34.26	+12.60

(Note 1) This amount of NBKP, instead of Flax being mixed into EAGLE, is to be increased after improvement.

(Note 2) The amount of Flax is only remained for GOLDENBIRD with the mixing ratio of 2.5% as present standard.

(Note 3) The $CaCO_3$ to be furnished with EAGLE should be considered to apply the France quality.

2) Steam supply Control for Increased Production

(1) One boiler is renewed, by which the supply of 14 T/H x 14 kg/cm²G is established.

(2) For the estimated steam consumption after the improvement work is completed, the unit consumption is set as follows, which is the control target value.

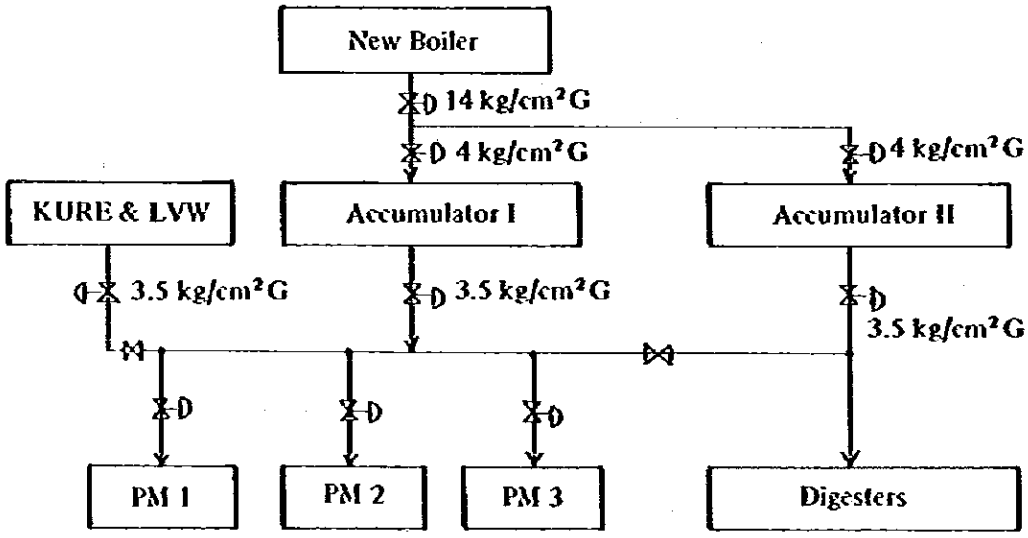
Pulp plant	(T/Y)		(T/T)	(T/Y)
Bleached pulp	1,754	x	4.5	= 7,893
Unbleached pulp	1,100	x	4.5	= 4,950
PM 1	2,980	x	4.0	= 11,920
PM 2	2,200	x	4.3	= 9,460
PM 3	2,904.5	x	4.5	= 13,095
In-house miscellaneous use	1.0 T/H x 24 H/D x 310 D/Y			8,184
Decrease by leakage	0.1 T/H x 24 x 310			
Total (Normal load average)				55,500 T/Y
				(7.5 T/H)
Allowance for the peak load				
Pulp plant	3.0 x (7,893 + 4,950) = 38,529			
PM 1, 2 & 3	1.5 x 34,475			= 51,713
Others	1.1 x 8,184			= 9,008
				99,250 T/Y
Peak response evaporation amount				(310 days/Year)
				(13.34 T/H)

(3) Operation Control of New Boiler

With a capacity corresponding to the peak load, the new boiler can meet all the steam requirement with the use of it alone, so that other four boilers existing are kept as spare boilers on standby in case of the shutdown of the new boiler for periodical inspection.

As for both LANCASHIRE boilers existing, however, the peak load is large in the cooking department (peak at rising temperature is 10 t/h) or above, and therefore, it is recommended that the said 2 boilers be applied for the steam accumulators.

Consequently, the following shows the pressure for respective parts;



After the renovation work is completed, the amount of consumed steam may increase by an additionally increased production of manufacture facilities, in which case the new boiler will operate in parallel with the existing KURE, and it is recommended that the pressure reducing valve be re-set and the combustion control be carried forward for economic operation of the boiler. (Heat efficiency will drop except the economic points.)

3) Increased Production and Power Supply

(1) The increased portion of power requirement after the renovation work is estimated at about 250 kW by offsetting the decreased portion of the requirement for the parts to be discontinued.

(2) Most of the increased portion is the renovated portion of Unit I, PM 1 and 2.

(3) For Unit I, the existing installation capacity is about 2,300 kW, however, the maximum power consumption is about 850 kW by the performance data in the 6 kV Receiving Distribution Center as of Dec., 1983.

Therefore the present Demand Factor is about 37%.

(4) As for the total installation power increased at Unit I, after renovation work, is estimated at about 220 kW and its demand factor will be at about 67%.

(5) Therefore, assuming that the maximum power consumption after the renovation is increased about 150 kW and totally about 1,000 kW.

(6) The capacity of the Unit I substation is, as opposed the above, 500 x 3 + 630 = 2,130 kVA and the Transformer load factor is about 60%, thereby the Transformers being equipped with capacity can meet the power supply enough to cover, after renovation.

(7) The increased portion of 220 kW is concentrated on PM 1 and 2, so the power distribution of 630 kVA alone is indequate, therefore consequently power distribution from 500 kVA should also be taken into consideration.

5-6-3 Situation of Mill Operation

1) To grasp the movement of the entire mill, it is recommendable that control charts, as given in and after the next page, should be prepared, and posted in the president's room and the mill conference room, which as a result, leads to up-lifting the awareness of all the company employees toward the betterment of the company's performance, and furthermore such charts should be used as explanatory data at the regular cost review meeting.

2) List of Charts Attached

(1) Fig. 5-6-2

Record of total sales amount vs. production in 8 years

(2) Fig. 5-6-3

Monthly production record of Unit I: pulp & paper in 1983 to 1984

(3) Fig. 5-6-4 (1) to (3)

Daily record of straw pulp & paper production of Unit I in 1983

(4) Fig. 5-6-5

Amount and unit price record of straws purchased in 5 years

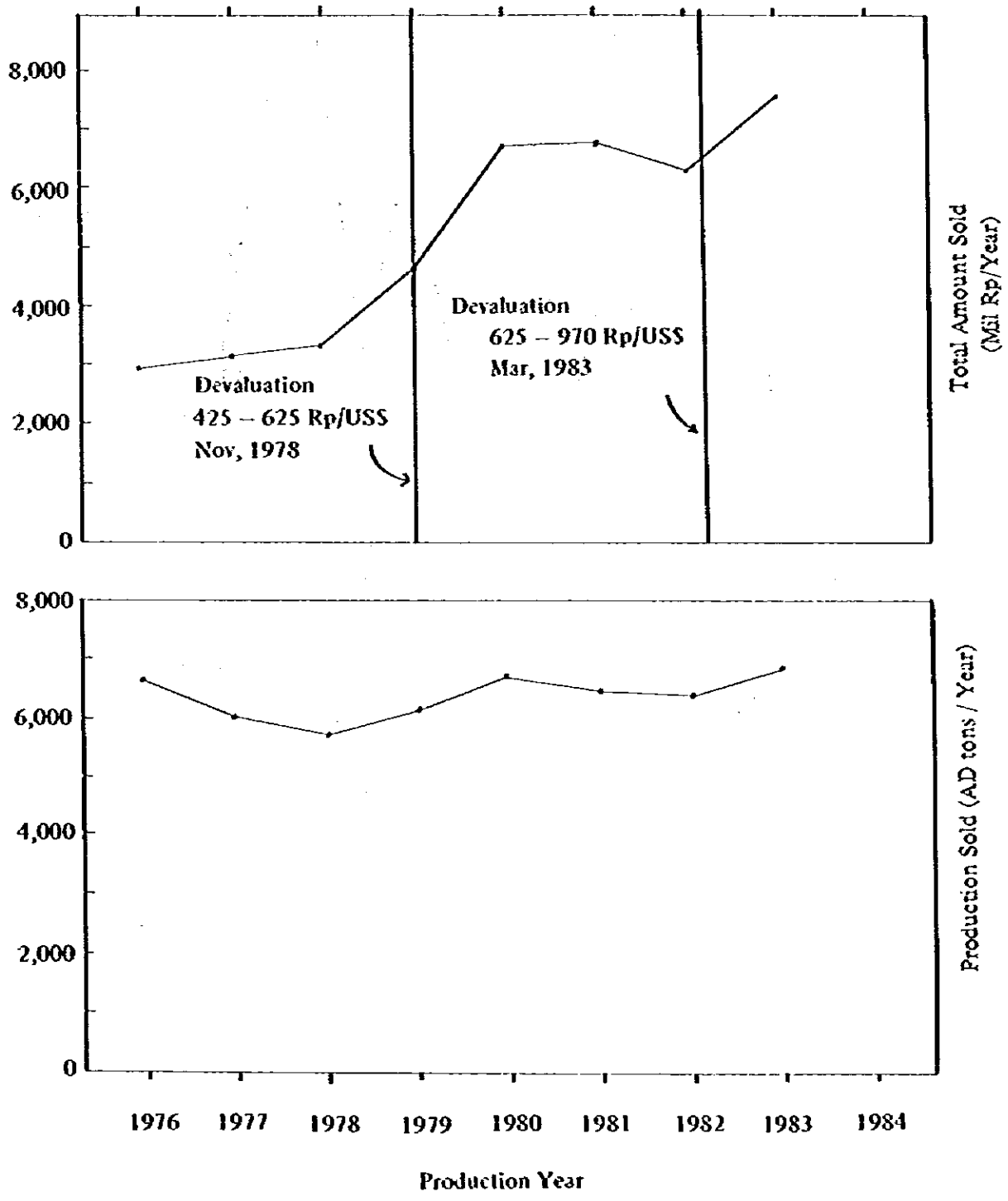


Fig. 5-6-2 Record of Total Sales Amount vs. Production in 8 years

Fig. 5-6-3 Monthly Production Record of Unit 1 : Pulp & Paper in 1983 -- '84

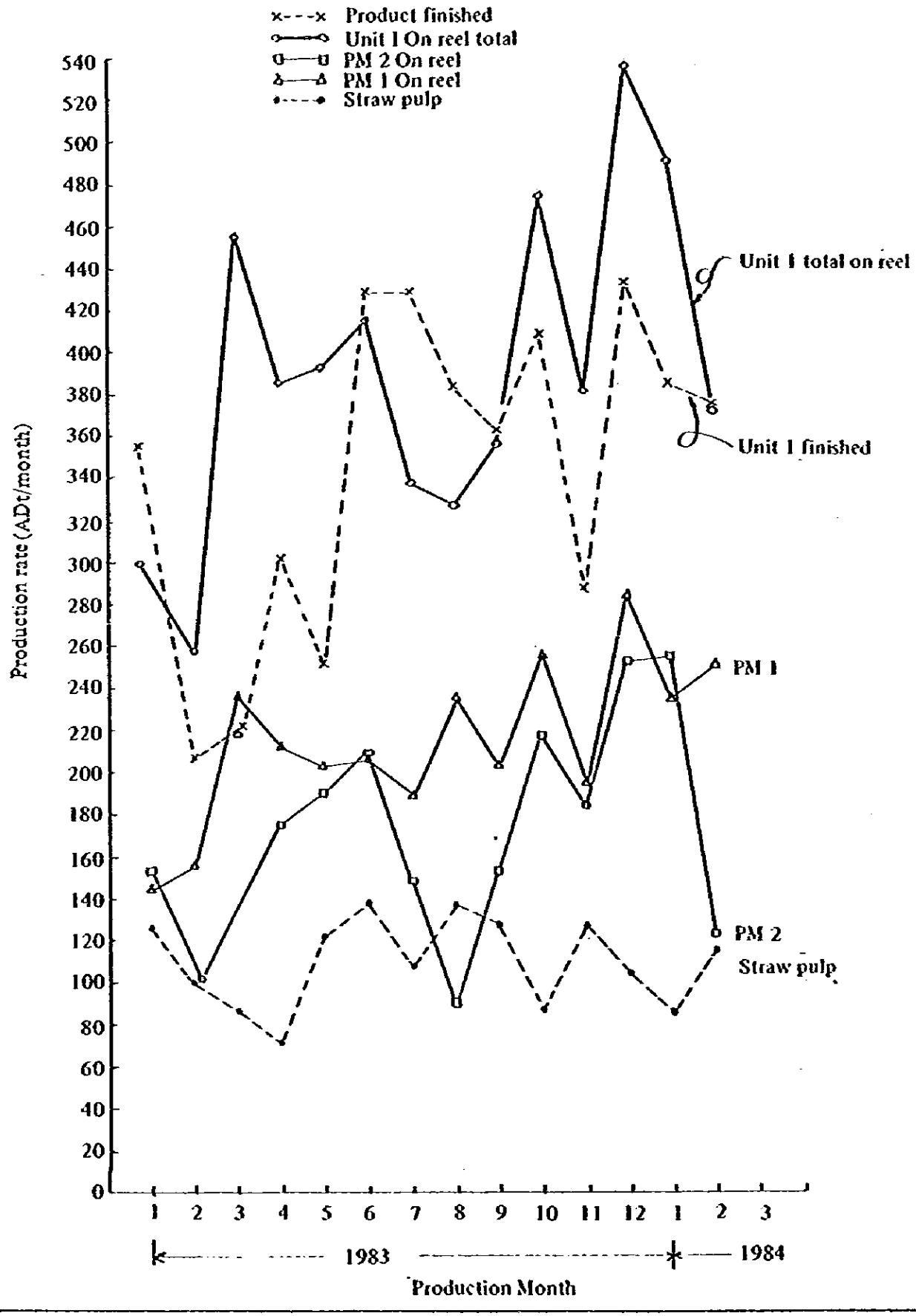


Fig. 5-6-4 (1) Daily Record of Straw Pulp & Paper Production of Unit I (I) ('83: Jan – Apr.)

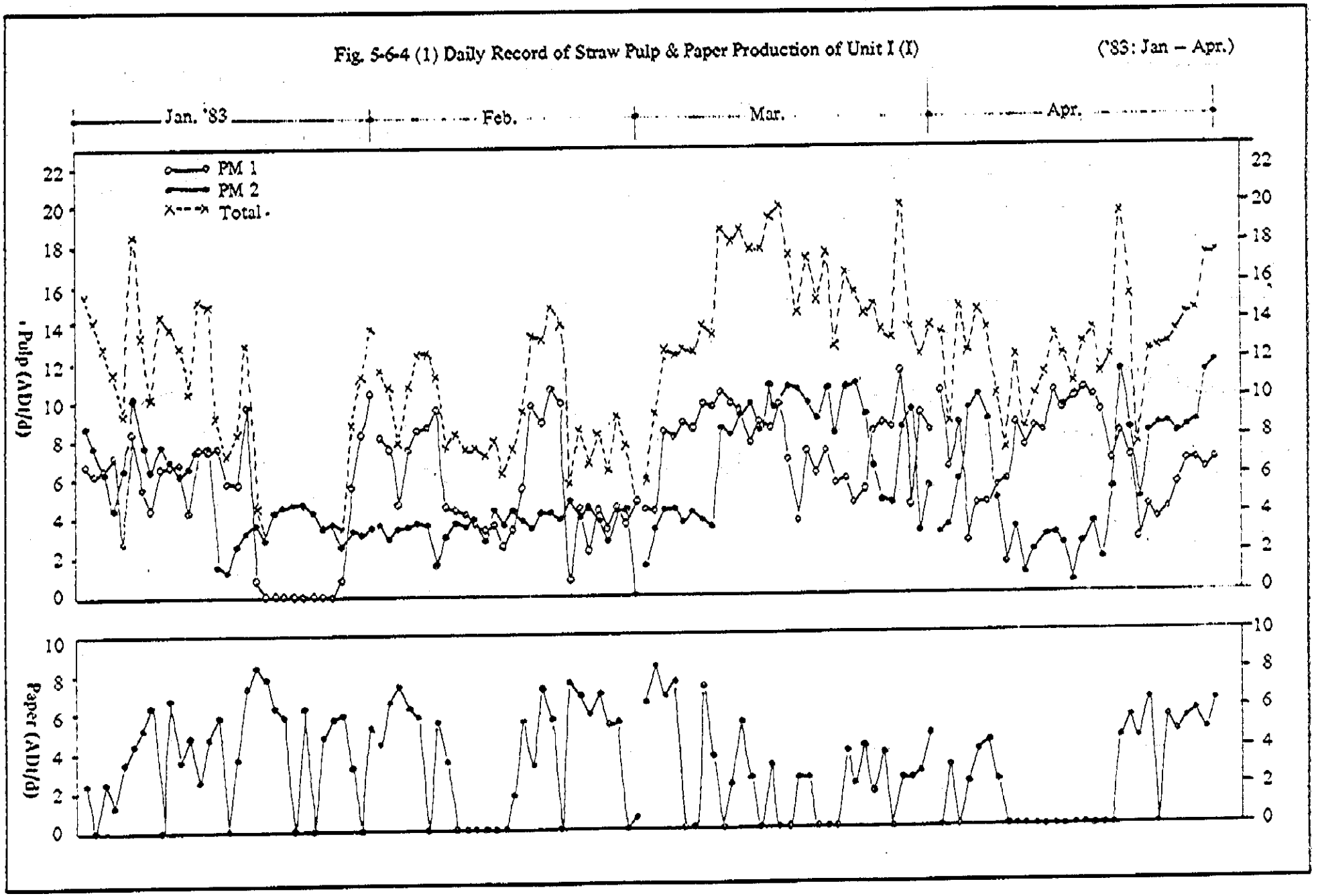


Fig. 5-6-4 (2) Daily Record of Straw Pulp & Paper Production of Unit 1 (II) ('83 : May – Aug)

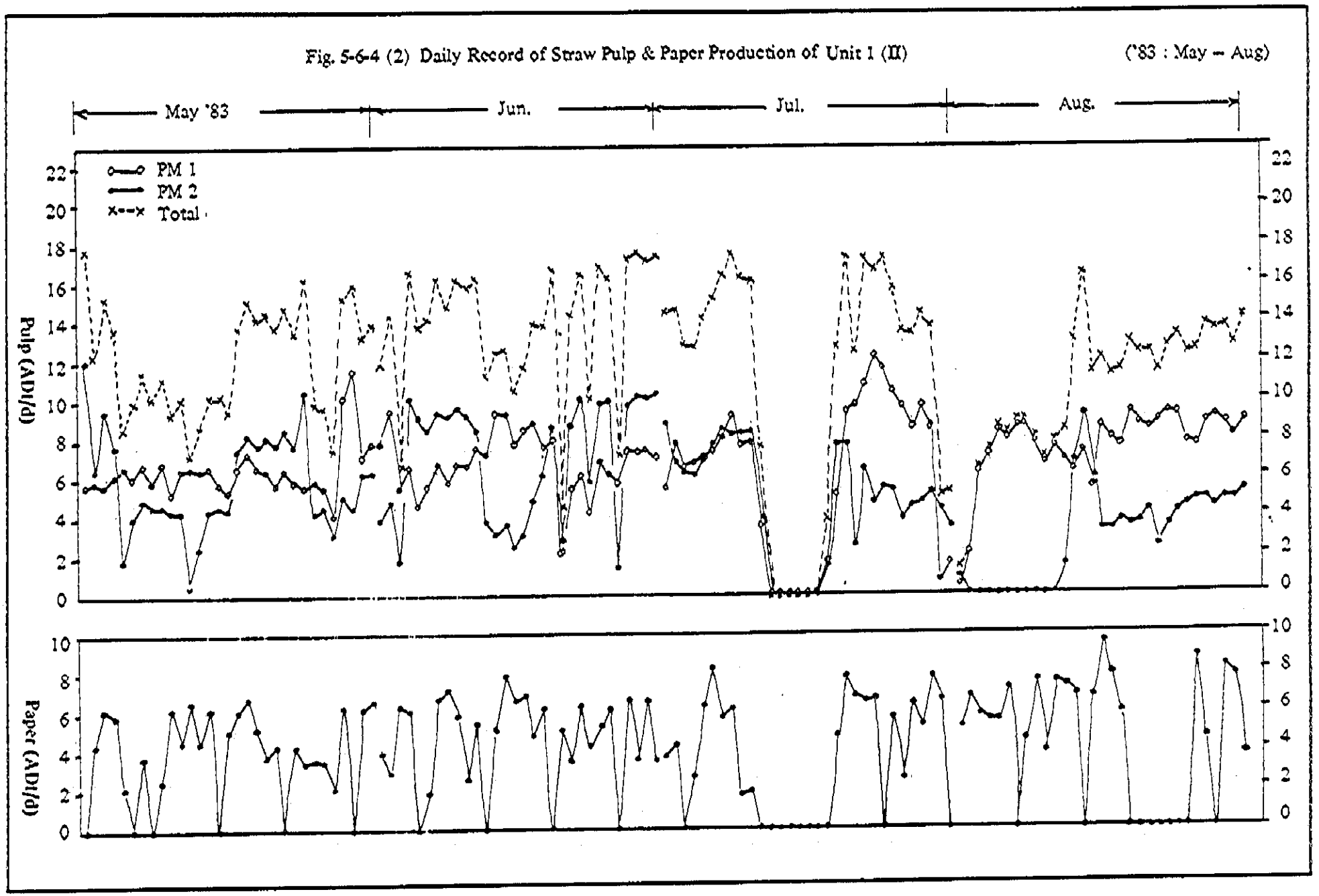


Fig. 5-6-4 (3) Daily Record of Straw Pulp & Paper Production of Unit 1 (III)

('83 : Sep – Dec.)

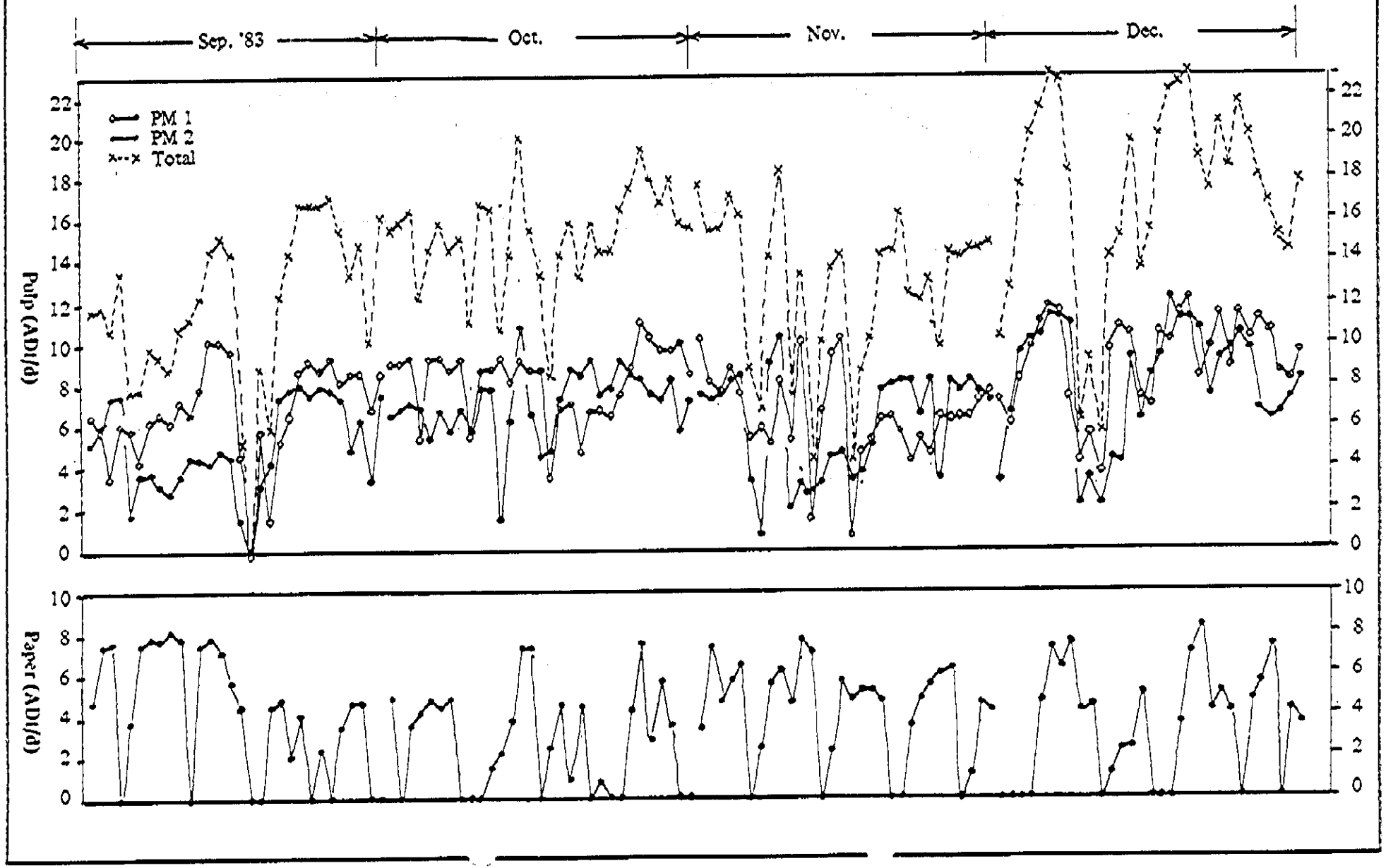
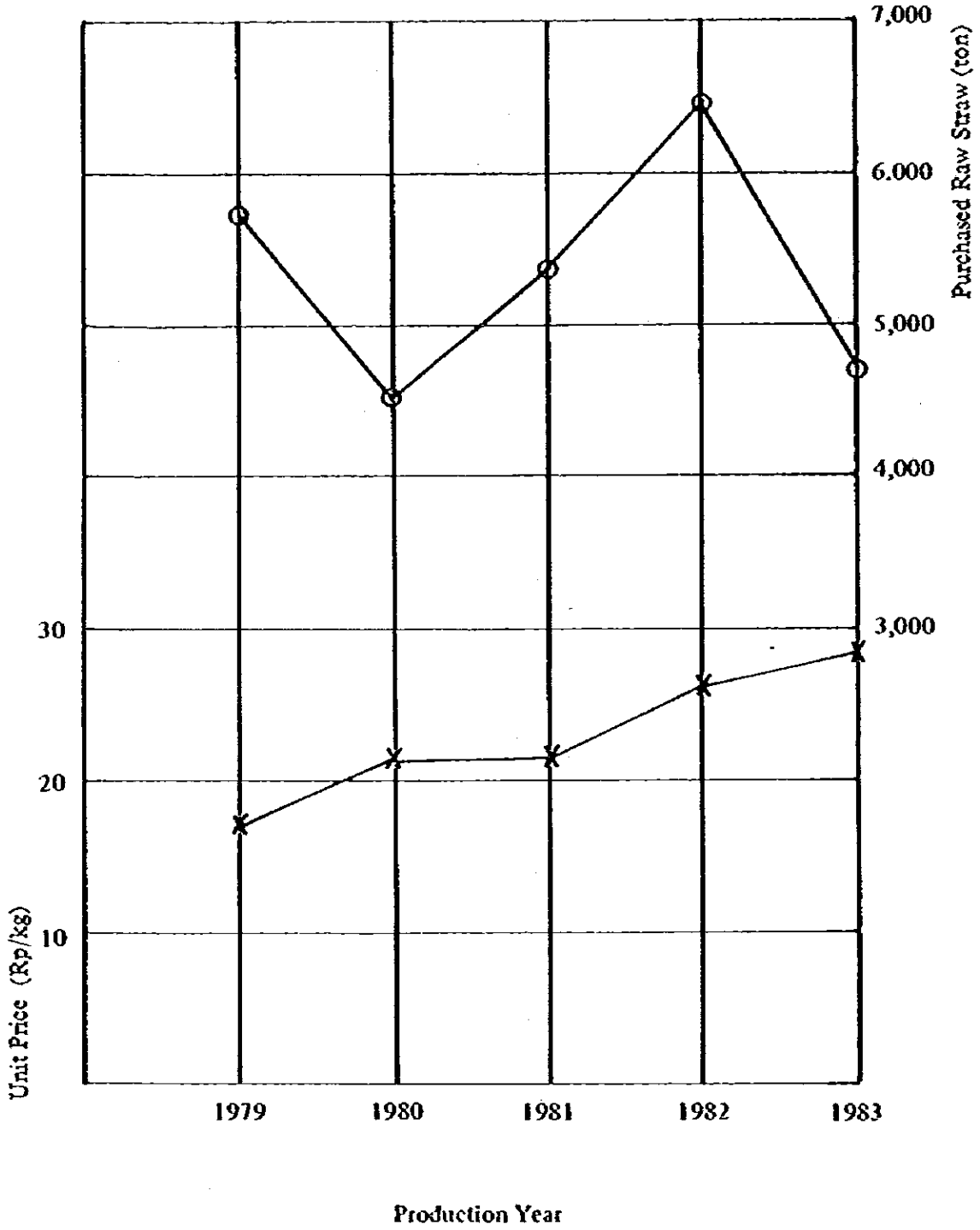


Fig. 5-6-5 Raw Straw Purchased & Unit Price in 5 years



Chapter 6.

PRESENT TECHNICAL PROBLEMS AND COUNTERMEASURES

Chapter 6.
PRESENT TECHNICAL PROBLEMS AND COUNTERMEASURES

This chapter describes the present technical problems and countermeasures by departments or sections.

This covers the results of the investigation on the defective points and points to be improved in operation, control and equipment which was made on basis of the materials obtained and observation conducted during the factory survey. Since the contents are very detailed and there are many suggestions which can be implemented immediately, it is recommended that they are gradually to be implemented to contribute to the quality stabilization and higher earnings.

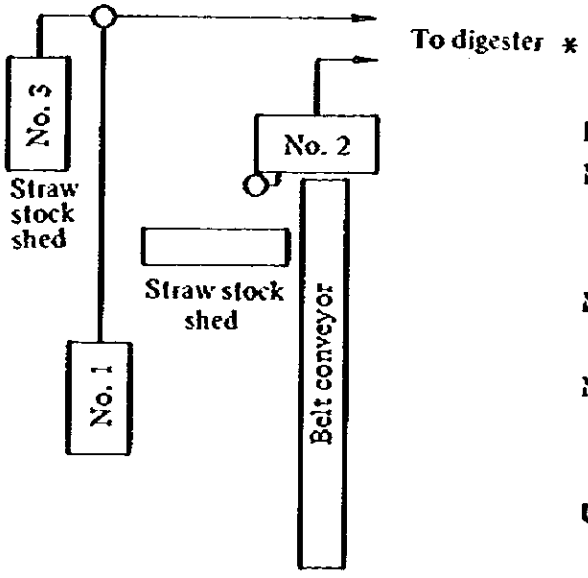
6-1 Own Straw Pulp Plant

3 straw cutters and 6 digesters are owned to make straw pulp for own use. Actually, however, it is getting difficult to obtain straw material and the recent production volume of this section is reduced to a level of 4 – 5t/BD per day for bleached pulp, with operating ratio of about 50% against the capacity. Also most of these equipments have been used from the inauguration of the plant in 1924 and therefore do not function satisfactorily although some improving measures were taken for them from time to time; especially, 2 of 3 straw cutters are damaged and only the remaining one, which is out-dated, is used, but its functions are far from satisfaction.

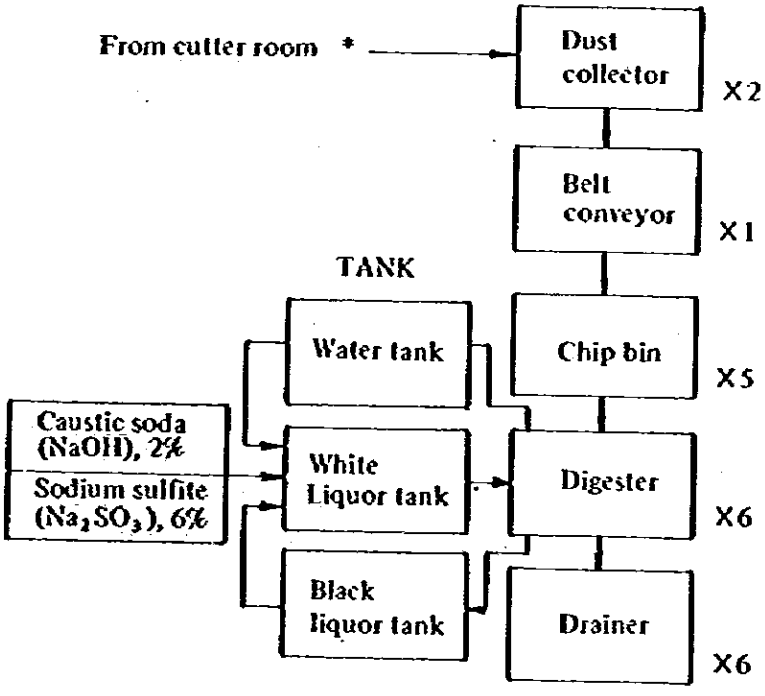
Regarding the quality of straw material, less ears of rice can be obtained because of breeding of rice plants and the major part of the material the plant receives consist of culms of rice. In addition, collecting and storage procedures have not been established; many straws are collected and stored in bad conditions, thus having 40% of moisture content on the average and sometimes very degraded straws are mixed.

The yield of straw pulp production has lowered under these circumstances, being at level of 25% more or less in these several years.

6-1-1 Machines and Equipment; Process Flow



Pneumatic conveyor
No. 1 cutter: Motor 30 kW
Diameter : 780mm
Width of cutting edge : 770mm
No. 2 cutter: Damaged
Air blower for straw stock
No. 3 cutter: Motor 45 kW
Diameter : 650mm
Width of cutting edge : 440mm
Unserviceable because of damaged rotor



Vertical type X 5: capacity 35m³;
pressure resistance 4 kg/cm²
Cylinder type X 1: capacity 24m³;
pressure resistance 12 kg/cm²

White liquor tank X 1: capacity 12.5m³

Black liquor tank X 1: capacity 20m³

Water tank X 1: capacity 30m³

6-1-2 Personnel

For straw cutters 6 operators x 3 shifts
For cooking 4 operators x 3 shifts

6-1-3 Operating Conditions

1) Operation Standard

Straws with mean moisture content of 20% acceptable

Feeding to digester	: 4,000kg as BD
Caustic soda (NaOH)	: 2%, 7%
Sodium sulfite (Na_2SO_3)	: 6 % 0
Cooking temperature	: 120°C
Cooking time	: 4h
Liquor ratio	: 1 : 4

2) Current situation

(1) All kinds of straws (with ears of rice bundled, with long ears of rice,or culms of rice) are received in a mixed condition loaded on a 4-ton cargo truck; they are measured with a truck scale for determination of wieght and moisture content, then stored and directly carried to the cutter room.

When straws once stored in the stock shed are used, they are received by measuring them with a truck scale again for determination of acceptable weight.

(2) The plant has 2 stock sheds for storage of received straws: one located on south side of the plant site, the other on west side. Currently only the south stock shed, which is nearer to the cutter room, is used because the quantity now received is little.

(3) Moisture content of straws received

Straws from the storage place are accepted after measuring, or sometimes purchased straws are directly accepted.

The weight of straws accepted from the stock sheds is calculated on the basis of 20% moisture content. Upon acceptance, moisture content of straws is reinspected and bone dry weight is calculated.

Moisture Content of Straws by Month, 1983

Item / Month	Mean misture content (%) of straws from stock sheds	No. of acceptance	Moisture content (%)		
			Average	Max.	Min.
Jan.	45	95	42	68	18
Feb.	44	85	40	65	20
Mar.	48	27	45	72	22
April	40	38	38	55	20
May	35	55	45	65	18
June	42	70	39	70	20
July	35	59	35	70	22
Aug.	38	68	35	55	18
Sept.	40	69	37	62	20
Oct.	42	64	40	65	20
Nov.	35	93	32	72	20
Dec.	40	89	38	65	28

(4) Mixing ratio of straws delivered

Jelami (Segon), culms of rice in bulk cargo	: 82%
Merang Panjang (Segon), Ears of rice with chaffs	: 8%
Merang Kepala (PB-8), Ears of rice without chaffs	: 10%

(5) Because of insufficient capacity of cutters as mentioned above, only straws bundled with bamboo strips (Merang Panjan) are cut and others are fed directly to the digesters through No. 2 cutter pneumatic pipe. However, even those bundled are cut unsatisfactorily and most of them remain uncut before passing through the pneumatic pipe. Moreover, they have much moisture content. These conditions sometimes cause the pneumatic pipe to be plugged.

Air blowing time for 1 batch of straws (4t/BD) (See attached sheets No.1-1 and No. 1-2.)

Mean time: : 4.08h
Max. time: : 7.0h
Min. time: : 3.0h

(6) Feeding and cooking

Straws received from the cutter room through the pneumatic pipe are directly fed to the digesters. When straws are fed nearly to the full, white liquor is injected and circulated along with further feeding of the stock. When straws have been fed in full, the weight fed to the digester is calculated based on the volume sent from the cutter room, and the amount of white liquor to be applied is determined on the basis of the bone dry weight of straws filled up.

The cooking operation.

Cooking Conditions during the Study (Mar. 1 – Mar. 20)

Process /condition \ Values observed	Average	Max.	Min.
Straw feeding	4.08 h	7.0 h	3.0 h
Temperature raising	3.14 h	5.5 h	2.75 h
Cooking	4.96 h	7.5 h	4.0 h
Black liquor blowing	2.53 h	4.0 h	1.5 h
Straw moisture content	32.01 %	51.0 %	27.0 %
Caustic soda (NaOH)	1.97 %		
Sodium sulfite (Na_2SO_3)	6.01 %		

6-1-4 Problems on equipment/operation and proposed countermeasures

1) To prevent degradation of straws stocked and sand mixing into them the floor level raising with concrete pavement in the stock shed is recommended.

2) To prevent degradation of straws having much moisture content, it is necessary to build up an effective stock control system, whereby the stocked straws should be moved for pulping in the order of the time of delivery.

3) Insufficient capacity and function of cutters

Because of having been used for a long time since inauguration of the plant in 1922, No. 1 cutter is extremely aged and does not serve with proper cutting function required, while No. 2 and No. 3 newer cutters stand unserviceable due to damages.

Countermeasures

Straw cutters should be renewed.

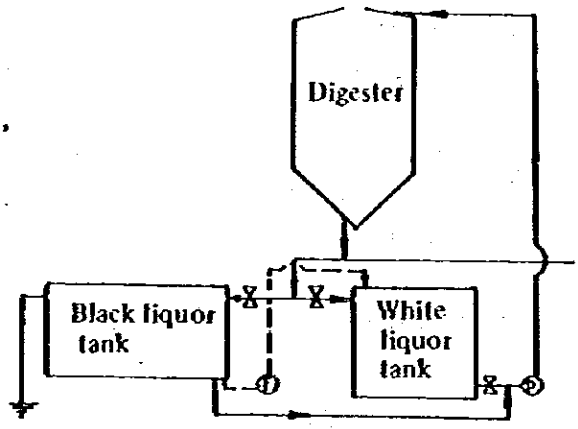
4) In addition to imperfect packing glands used for the digester, pulp is used in place of packings; this caused steam leakage and consequently, it is difficult to raise the pressure above 2kg/cm^2, resulting in the delay in cooking time and its variation.

Countermeasures

Packing glands should be repaired and new packings be used.

5) Because of complicated transfer route from black liquor tank to white liquor tank, it is difficult to measure the volume of black liquor used.

Transfer route of black liquor
(Solid line indicates actual route, while dotted line indicates proposed route.)



Countermeasures

Currently white liquor is fed to the digester using a liquor injection pump, and then it is returned to the white liquor tank through black liquor recovery route. It is recommended to connect the black liquor tank directly with the white liquor tank and install a pump between them to feed white liquor to its tank as shown by dotted line in the diagram.

6) Feeding time

Feeding time required is 4.08h on the average. Moisture content of straws is excessively high. Besides, straws having a length of over 17cm are fed to the digester at the ratio of 82% of the total amount fed, causing frequent plugging of the blow pipe. When this trouble occurs, the feeding amount has to be reduced. Much time has to be used for the removal of straws plugged up in the pipe.

Countermeasures

The straw cutter must be replaced with a new one, capable of cutting the straws into the length of about 5cm.
A belt conveyor should be newly installed.

7) Amount to be fed

Currently when the digester becomes full with the straws, the fed weight is taken from the feeding volume from the cutter room and then the weight is converted into bone dry weight on the assumption that the moisture content of the straws is 40% on the average. This method does not provide a correct weight of the straws filled in the digester.

Countermeasures

It is proposed to adopt a belt conveyor system for feeding of straws and install an integrating meter so that the fed weight of straws can be correctly measured.

8) Cooking cycle

Cooking is greatly affected by the variation in temperature raising and cooking time. Therefore, it is recommended to build up an effective control system of them.

Temperature raising time	: 3.14h average, 5.5h Max., 2.75h Min.
Cooking time	: 4.96h average, 7.5h Max., 4.0h Min.

Countermeasures

Digester packing glands should be repaired and correct packings be used. More close contact with the boilerman is suggested to obtain confirmation on correct steam volume supplied.

9) Cooking degree (P.N) (See Table 6-1-3 attached.)

Cooking data of September 1983 show a large variation with an average value of 7.66h, max. value of 13.4h and min. of 5.8h. It seems that the cooking degree is not measured at present. It is recommended to measure such values at least once a day for control of the cooking process.

Countermeasures

Fed weight of straws should be measured (installation of a meter).

Moisture content of straws should be measured (For a lot with instable moisture content measured values should be confirmed before preparation of white liquor).

10) Merang Panjang

Many Merang Panjan straws are tied in bundles too tightly and cannot be cut satisfactorily with a cutter. Uncut straws may cause undercooking. Also some polypropylene strips are used to make bundles of straws; these polypropylene strips put in the digester may cause some troubles in paper machine process.

Countermeasures

These undesirable materials should be removed completely before cutting.

Inspection Report on No. 1 Straw Cutter Capability (Mar. 8, 1984)

Throughput	:	5 ADt
Moisture content	:	37.9% average, 60.3% max., 20% min.
Required cutting time	:	228 min.
Capability	:	1.3t/ADt/h

(Distribution of Cutting Length)

Item / Length	Before cutting %	After cutting %
16cm or shorter		17.44
17cm – 27cm	14.65	68.20
28cm – 40cm	85.35	14.36

Straws with length of approx., 5cm after cutting is desired to meet better cooking but 82.56% corresponds to those with length of 17cm or longer. Therefore, this cutter does hardly function as a cutter.

A. With cutting capability of 1.3 ADt/h, the cutter provides 31.2 ADt of straws per day, that is, only for 4.5 batches of the digester approximately.

B. Because of imperfect feeding device of the cutter, the major part of straws come parallel to its cutting edge and are discharged uncut.

C. Even when straws come in right angle position to the cutting edge, they remain uncut frequently and discharged tied in a bundle.

D. Many culms also remain uncut.

Table 6-1-1 Past Record of Actual Operation Data Straw Pulping

			1975 Globe Digester					1975	1977 Vertical Digester		1983 Vertical Digester						Remarks
	Test Number		1	2	3	4	5	Existing x	633	634	June 14	Aug. 13	Aug. 13	Aug. 14	Sept. 8	Sept. 9	Sept.13	
1	Filling of Straw	ADkg	3,880	3,880	3,880	3,880	3,880	4,000~5,000	4,550	4,550	6,490	5,470	3,450	5,550	6,570	4,737	3,365	
2	Moisture Content	%	28.7	28.7	28.7	28.7	28.7	28.7	28.6	28.6	64.5	27.0	25.0	25.0	49.1	20.0	20.0	
3	Filling of Straw	ODkg	2,766	2,766	2,766	2,766	2,766		3,213	3,213	3,303	4,190	2,588	4,163	3,344	3,790	2,693	
4	Charging of Chemical																	
	NaOH	%	6.5	5.0	10.0	6.5	6.5	6 ~ 7	8.6	8.6	2.0	1.92	2.0	1.5	6.38	6.09	6.0	
	Na_2SO_3	%									5.86	5.97	5.8	6.0				
5	Rising Time of Temp.	H	1.0	1.0	1.0	1.0	1.0	2.0	2.6	2.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	
6	Cooking Time of Temp.	H	2.5	2.5	2.5	2.5	1.5	2.5	2.5	2.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
7	Cooking Temp.	°C	120	120	120	140	135	120	120	120	135	135	135	135	135	135	135	
8	Cooking Degree	PN	5.9	8.7	5.7	4.2	8.7	7.7	7.1	7.6	8.87	6.09	5.81	6.64	6.2	13.4	6.66	
9	Cooking Yield	%	59	72.9	49.6	49.5	64.6	65.7	61.0	61.0	63.77				52.38	52.27	47.67	
8	Charging of Effective Cl_2	%	3.5	3.5	3.5	3.5	3.5	3.5	2.0	2.1								
9	Bleaching Consistency	%	4.0	4.0	4.0	4.0	4.0	4.0	3.5	3.5								
10	Total Yield Pulping	%	45.1	37.3	47.9	39.8	45.1				53.26	31.74	51.08	30.92	37.02	32.0	44.95	
11	Brightness	%	77.6	70.6	76.0	80	75.9	75.9	72.0	76.0								

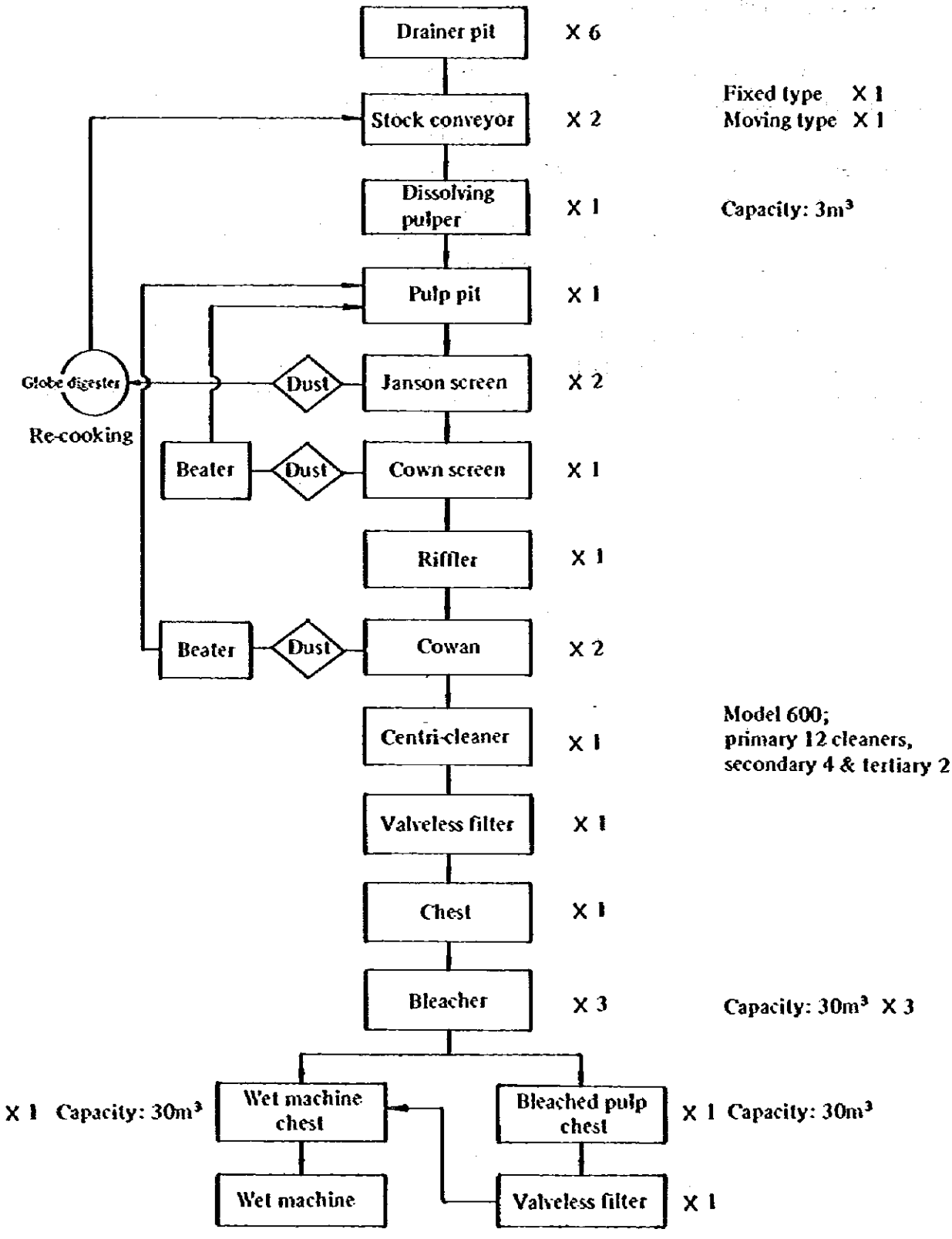
6-2 Washing and Bleaching Plant

One dissolving pulper, 3 Cowan screens, 1 set of centri-cleaner, 3 bleachers and 2 beaters are installed in the plant for washing and bleaching of pulp for own use. Most of installed equipment and machines have been used since the plant's inauguration in 1922 and many of them provide decreased functioning due to lack of correct maintenance.

Much undercooked and/or undissolved pulp is produced. Such a pulp is re-cooked with a globe digester, causing a considerable loss of steam and cooking chemicals.

The dissolving pulper provides continuous dissolution. As the plant has no pulp consistency control device, the pulp consistency at dust removal and bleaching stages is not stable, thereby causing reduction in dust removing efficiency and increase in spillover of the stock.

6-2-1 Machines and Equipment; Process Flow



6-2-2 Personnel

For dissolution, washing and bleaching, 5 operators X 3 shifts
For wet machine, 4 operators X 2 shifts

6-2-3 Operating Conditions

1) Operation Standard

Addition ratio of Calsium Hypoclorite (as available Cl_2) for bleaching: 3%
Bleaching time : 2 hours

2) Current situation

(1) Dissolution of straw pulp is made in continuous dissolving process with a pulper. Dissolved pulp is overflowed from the pulper top into the pulp pit, passes through dust removers, is bleached per each batch and then is taken up on reels of the wet machine.

[Consistency at Each Operation Stage]

Stage \ Consistency %	Average	Max.	Min.
Dissolving pulper	2.6	3.2	1.8
Janson screen	1.7	2.0	1.3
Riffler	1.9	2.5	1.5
Centri cleaner	1.7	1.9	1.5
Valveless filter	3.4	4.2	2.8
Bleacher	3.44	3.9	3.0

(2) Tail screened by Jansson screen is re-cooked with a globe digester and returned to the pulper.

(3) Dust screened by Cowan screen is rebeaten with a beater and returned to the pulper pit.

(4) Additives and their quality (See Table 6-2-1 (1) and (2) attached.)

Addition of bleaching chemicals: 3.5% average as available Cl_2

Pulp brightness : 52.3% average, 62% Max., 44% Min.

Pulp freeness : 410cc average, 500cc Max., 380cc Min.

Moisture content at wet machine reels : 70% average

(5) Required time for bleaching of one batch (hour)

Process \ Time required	Average	Max.	Min.
Stock feeding	3.45	5.5	1.5
Washing	1.02	3.5	0.5
Bleaching	2.0		
Washing	5.82	9.5	3.0
Total time required	12.29		

6-2-4 Problems on equipment/operation and proposed countermeasures

1) Pulp consistency at dust removal stage (See p. 6-17.):

Pulp consistency at dust removal stage is too high in addition to its variation in a wide range, thus the consistency remains very instable and ineffective. This may be attributable to manual operation of pulp feeding from the drainer pit.

Countermeasures

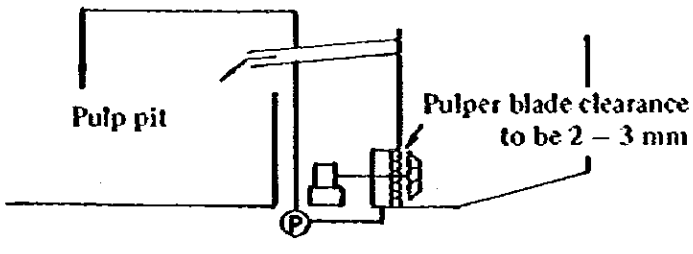
The level of the existing pulp pit should be raised and an agitator should be installed together with a C.R.C. to ensure an even consistency of the pulp.

2) Dissolution by pulper

A considerably large amount of dust (about 100kg) is rejected by Jansson screen per batch. This indicates that a considerably large amount of undissolved pulp is included in addition to undercooked pulp. The pulper should be inspected for repair and maintenance.

Countermeasures

The blade clearance of the existing dissolving pulper is too wide (12mm). To prevent that un-dissolved long pulp fibers remain to be overflowed from the pulper top, the blade clearance should be adjusted to 2 – 3 mm and also pump discharging of pulp after screening should be adopted.

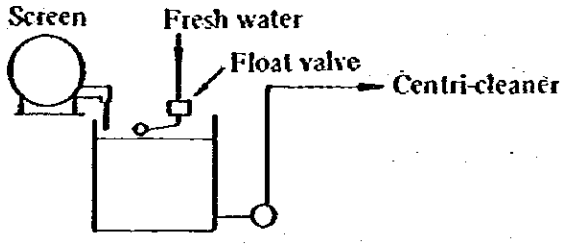


3) Pulp consistency in centri-cleaner process

Operating consistency in centri-cleaners is too high (1.7% average) in addition to its variation in a wide range, thus the consistency remains very instable.

Countermeasures

A water regulation valve should be installed in the level tank at the inlet of the set of the centri-cleaners, to ensure a stable level.



4) Cowan screen

Unexpectedly much dust remains of Cowan screen after Jansson screen (2F) and riffler (1F); this may be attributable to the variation of washing water pressure and/or the plugging of screen.

Countermeasures

Recommendations are: cleaning of screen plates; implementation of water flushing by use of a high-pressure water at every weekly shutdown; removal of residues and foreign matters using a hand drill, if screen plates are significantly plugged up, etc. Sotck of some spare plates is also recommended for replacement and correct maintenance of screens.

5) Valveless filter

Pulp consistency concentrated by valveless filter is very low (3.4% average) in addition to its variation in a wide range; this condition may affect feeding amount and consistency into the bleacher and also make difficult to measure a correct amount of additives (Cl_2), thereby causing the variation in brightness of bleached pulp.

Countermeasures

Operation control for the valveless filter should be set up for checking the pulp consistency in the chests.

6) Washing time in bleacher

Washing time in bleacher is in variation (5.82h average, 9.5h max. and 3.0h min.); this may be attributable to insufficient water amount and plugging of washing drum wires. This condition reduces operating efficiency of the bleacher and also causes energy losses.

Countermeasures

It will be necessary to establish an effective control system for equipment maintenance and operation as well.

7) Valveless filter

The valveless filter for bleached pulp chest is stopped at present. It is unknown whether the filter is stopped because of a failure or because it is thought unnecessary. Anyway this filter should be used in an effective way for both reduction of operation time of the bleacher and power saving.

6-2-5 Yield of Straw Pulp Production

1) Production history

Average production yield of straw pulp during past 5 years (actual data):

Yield agst. stock feeding	: 26.13%
Yield agst. stock accepted	: 28.04%
Yield in July 1983	: 25.0% (Information from the annual report)
Yield in February 1983	: 25.0% (– ditto –)
Yield in test operation, 1975	: 43.04% (Expansion)
Yield in test operation, 1983	: 40.14% (Plant laboratory)

2) Pulp production yield during the study, Mar. 1 – Mar. 20, 1984 (See Table 62-1.):

Yield agst. stock accepted : 22.98% (Jansson screen dust cooked pulp excluded)

As described above, the plant's production yield is below 30% except those obtained test operations in 1975 and 1983, and lower production yield has been observed (22.98%) during our study.

3) Problems and Proposed Countermeasures

(1) Degradation of quality of purchased straws:

Purchase contracts specify that straws with water content of 40% or higher are not accepted. However, actually a considerable amount of straws which appear degradated with moisture content of 50% or higher are mixed in truck deliveries and it is difficult to sort them out. Especially, Merang Panjang and Merang Kepala straws have much deteriorated straws included. The plant has few stock currently, therefore, it cannot be deemed that they have deteriorated during storage in the plant site, and this degradation may be attributable to collecting and storage procedures on the part of straw seller. Straws with moisture content of 50% or more are susceptible to a significant degradation, and when those are cooked, fibers are decomposed, causing a reduction in cooking yield.

Countermeasures

Quality of purchased straws should be checked upon receiving:

A. Purchase contracts must be revised to include prohibition of delivery of straws having a moisture content of 40% or higher, stating that they shall be rejected if and when delivered (Purchase price must also be reviewed).

B. Sorting at straw collecting point should be requested in order to ensure the implementation of more strict moisture content inspection upon purchase and receiving.

C. Received/accepted straws should also be subject to sorting during in-plant storage; they should be used in the order of receiving.

D. Dispatching of an instructor to the collecting point may also be taken into consideration so as to give necessary guidance to the collectors of straws and inspect the quality of collected straws.

(2) Undercooked/Undissolved pulp

Previously Jansson-screen dust mainly consisted of chaffs or bamboo strips used to tie Merang Panjan straws. Currently one batch of digester turns out about 100 BDkg but which is recooked. This brings about losses in steam and chemical additives. This status may apparently be attributable to malfunction of cutters allowing uncut straws to be fed to the digester, resulting in insufficient penetration of cooking chemicals.

Undissolved pulp may be attributable to the lowered capability of the pulper due to lack of proper maintenance of it.

Countermeasures

A. Straw cutters must be replaced with new ones so that straws can be cut in a length of 5cm or less (to obtain a higher penetration of cooking chemicals).

B. Repair and maintenance of the dissolving pulper (adjustment of blade clearance).

C. Repair and maintenance of the digester (repair of packing glands and use of new and correct packings).

D. Checking of cooking conditions

(3) Cowan-screen tail (dust)

Unexpectedly much dust is accumulated at Cowan screen, which may be attributable to washing water pressure variation or screen plugging.

The washing water reaches to the pulp pit after circulation through the beater drainer. Outflow of the water on the way of circulation might be a possible case.

Countermeasures

A. Repair and maintenance of the screen basket (the basket should be flushed using a high-pressure washer.);

Removal of residues and foreign matters with a hand drill from time to time.

B. Use high pressure water for flushing.

6-2-6 Production Cost of Straw Pulp (See Table 6-2-2 attached.)

1) Bleached pulp yield has been reduced about 10% in these several years, down to the level of 25%. The plant also maintains a high unit ratio of steam consumption of 6 t/t and has a high steam unit cost of 21,670 Rp./t due to the lowered efficiency of the boiler.

2) It is necessary to carry out a careful inspection of the quality of straws to be purchased for improvement of production yield and also to implement correct repair of the drainer pit for prevention of fiber losses.

3) Targets for improvement:

		(Current)	(To be improved to:)
(1)	Bleached pulp yield	25%	35%
(2)	Steam unit consumption	6 t/t	4.5 t/t
(3)	Steam unit cost	21,670 Rp.	16,000 Rp.

4) Measure for improvement:

(1) Upgrading of the quality of straws

- Replacement of straw cutters
- Installation of a belt conveyor

- Repair of digester's airtightness
- Modification of drainer pit
- Installation of an unbleached pulp dump chest and a C.R.C.
- Renewal of Cowan screen basket

(2) Steam cost reduction:

- Improvement of digester's airtightness
- Improvement of steam unit price by replacing the boiler
- Effect of improved yield

6-2-7 Quality Characteristics of Straw Pulp

Generally unrefined straw pulp has low freeness and therefore, can be more easily refined than wood pulp, though it depends on the type of raw straw to be used and cooking conditions. The straw pulp has lower freeness sometimes because of partial overcooking, but basically because the fiber is less long than the wood pulp and therefore has a greater diameter-length ratio. A higher freeness can be obtained by washing to remove fines, however, it is not easy to sort them out.

Usually, coarse pulp cooked with soda is relatively viscous while that cooked with sodium sulfite mixed has more freeness with strong binding. In case of selecting refiners for installation, composition of the cooking liquor and cooking conditions must be taken into consideration. The straw pulp cooked with soda has a lower tearing strength compared with the softwood SP, but there is no significant difference between these two pulps in other strength properties. (See Table 6-2-3)

Normally, a pulp manufactured in chlorine process has higher strength while that manufactured with sodium sulfite is soft and bulky.

The straw pulp is characterized by its good formation, smoothness, high consistency and also high hemicellulose content. Higher hydration rate obtainable by refining and less power required for such a process (refining) also feature the straw pulp. When bleached straw pulp is used alone in the paper machine process, it is susceptible to picking in the press roll; therefore, chemical wool pulp is mixed so that finished papers can be used as bond paper for documents and certificates, printing, writing, etc.

It is said that the power required for refining can be saved by 30% when the stock has a 50% straw pulp mixed.

A mix of straw pulp with wood pulp offers a smooth glossy paper with good formation and good fiber entanglement, however, the tear strengh will not come up to it's expectation. The following properties are affected by mixing of bleached straw pulp:

- Burst factor : The more bleached straw pulp is mixed, the higher it is.
- Tear factor : No significant difference
- Opacity : is higher as straw pulp addition increases.
- Sizing degree : increases as straw pulp addition increases.

Table 6-2-1 (1) Actual Operating Data of Bleaching (1984)

Table 6-2-1 (1)

No.	Date	Cooking Number	Filling Straw (Digester) BDkg	Filling Time (H)	Deckering Time (H)	Consistency (%)	Filling of Unbleached Pulp (BDkg)	Charging CL_2 (kg)	Washing Time (H)	Brightness (%)	Freeness (cc)	Production of Pulp (BDkg)	Yield (%)	Remarks
1	Mar. 5	140	3,750	5.5	0.5	3.9	1,169	40.92	6.0	46		1,086	28.96	
2		141	3,650	4.5	3.0	3.8	1,133	39.64	5.5	44		964	26.41	
3		142	3,500	3.5	1.5	3.9	1,165	40.81	5.0	48		1,023	26.06	
4	Mar. 6	143	3,950	3.5	1.0	3.8	1,134	39.73	5.0	47		956	22.96	
5		144	3,850	3.0	1.5	3.8	1,185	39.73	5.0	46		833	22.94	
6		145	3,750	1.5	0.5	3.3	978	34.23	5.0	48		878	23.41	
7		146	3,750	2.0	0.5	3.3	978	34.25	5.0	50		935	24.93	
8	Mar. 7	147	3,850	2.45	0.5	3.9	1,165	40.78	5.5	52		976	25.32	
9		148	3,780	4.5	1.5					48		848	22.43	
10		149	3,750	3.5	1.0	3.4	1.013	35.46	4.0	53		845	22.53	
11		150	3,900	2.5	0.5	3.0	941	32.93	4.0	48		825	21.15	
12		151	3,800	2.5	1.0	3.2	989	35.46		52		690	18.15	
13		152	3,750	5.0	0.5	3.3	986	34.50		55		658	17.55	
14	Mar. 8	153	4,200	3.0	1.0	3.7	1,125	39.43	5.5	56		736	17.52	
15		154	5,500	4.5	0.5	3.6	1,100	38.47	3.0	53		799	19.49	
16		156	4,100	3.0	1.0	3.6	1,100	38.47	5.0	58		879	21.44	
17		157	3,950	5.0	0.5	3.3	986	34.50	3.0	62	430	990	25.06	
18		158	4,000	3.5	1.5	3.7	1,107	38.76	4.5	55	450	841	21.10	
19		159	4,150	4.0	1.5	3.6	1.099	38.28	4.0	48	400	808	19.47	
20	Mar. 9	160	3,900	3.5	1.0	3.7	1.697	38.39	4.0	52	450	928	23.79	
21		161	3,850	3.5	2.0	3.7	1,114	39.0	9.0	50	450	984	25.56	
22		162	3,950	5.5	3.0	3.8	1,146	40.11	7.0	50	450	1,131	28.63	
23		163	3,840	2.5	0.5	3.4	1,028	35.98	7.5	58	420	721	18.78	
24	Mar. 10	164	3,800	2.5	0.5	3.4	1.028	35.98	7.5	48	450	737	19.39	
25		165	3,950	3.0	1.5	3.4	1,036	36.25	5.5	58	400	879	22.25	
26		166	3,750	2.5	1.0	3.0	1.033	36.14	7.0	55	400	731	19.49	
27	Mar. 12	167	3,900	2.5	0.5	3.8	1,146	40.11	4.5	48	420	759	19.46	
28		168	3,950	3.0	1.0	3.5	1,079	37.78	8.5	58	420	724	18.32	
29		169	4,000	3.0	1.0	3.7	1,136	39.75	9.6	55	450	759	18.98	
30	Mar. 13	170	3,650	4.0	0.5	3.5	1,079	37.78	4.0	60	400	875	23.97	
31		171	3,750	3.5	0.5	3.6	1,108	38.79	8.0	50	450	821	21.89	
32		172	3,800	2.5	1.0	3.4	1,036	36.25	4.0	62	350	837	22.03	

Table 6-2-1 (2) Actual Operating Data of Bleaching (1984)

No.	Date	Cooking Number	Filling Straw (Digester) BDkg	Filling Time (H)	Deckering Time (H)	Consistency (%)	Filling of Un-bleached Pulp (BDkg)	Charging CL_2 (kg)	Washing Time (H)	Brightness (%)	Freeness (cc)	Production of Pulp (BDkg)	Yield (%)	Remarks
33		173	3,850	3.5	0.5	3.6	1,108	38.79	8.0	55	450	970	25.19	
34		174	3,706	4.5	0.5	3.4	1,145	36.57	8.5	52	420	737	19.92	
35	Mar. 14	175	4,340	4.9	3.5	3.2	1,114	39.0	6.0	52	500	697	16.06	
36		176	3,750	3.5	0.5	3.4	1,045	36.57	9.5	52	420	856	22.83	
37		177	3,850	4.0	1.0	3.7	1,138	39.75	6.5	52	380	843	21.90	
38		178	3,800											
39	Mar. 15	179	3,900	1.0	0.5	3.3	990	39.84	7.0	58	400	897	23.0	
40		180	3,800	3.0	0.5	3.1	930	37.2	6.0	58	400	745	20.13	
41		181	3,850	3.5	0.5	3.9	1,170	46.8	4.0	58	400	1,063	27.61	
42	Mar. 16	182	3,850	2.5	0.5	3.5	1,049	36.73	6.0	52	430	1,006	25.79	
43		183	3,900	2.75	1.5	3.8	1,152	49.34	6.0	47	450			
44	Mar. 17	184	3,850											
45		185	3,750											
46	Mar. 19	186	3,650											
47		187	3,700											
			x 3.886	x 3.45	x 1.02	x 3.44	x 1,079	x 38.65	x 5.82	x 52.6	x 410	x 860	x 22.31	

Table 6-2-2 Record of Total Yield of Bleaching Straw Pulp

Year	Delivery Volume at Store House	Receiving volume at Cutter Room	Production of Pulp	Bleached Pulp Yield
	BDkg	BDkg	BDkg	%
1979	4959.133		1485.319	32.3
		4920.549		30.19
1980	3982.954		982.322	24.66
		3798.548		25.86
1981	4298.295		1099.907	25.59
		3998.694		27.51
1982	5218.631		1127.291	21.60
		4065.489		27.73
1983	3792.927		1007.255	26.56
		3482.429		28.92

- Picking stength : is improved as straw pulp addition increases.
- Stiffness : has higher stiffness as straw pulp addition increases.

Table 6-2-3 Comparison of Strength Properties between Straw Pulp and Other Pulps

		SBKP	LBNSC	LBKP	NBKP
Refining degree	(cc)	470	350	–	–
Brightness	(%)	79.8		87.6	86.1
Breaking length	(km)	8.64	7.18	5.0	7.1
Burst factor		6.71	5.52	5.6	6.1
Folding endurance		1,300	250	675	2,200
Tear factor		98.3	68	68	107

(Note)

SBKP : Straw Bleached Kraft Pulp
LBNSC : Hard Wood Bleached Neutral Sulfite Semi Chemical Pulp
LBKP : Hard Wood Bleached Kraft Pulp
NBKP : Soft Wood Bleached Kraft Pulp

6-3 Stock Preparation Section - Unit I

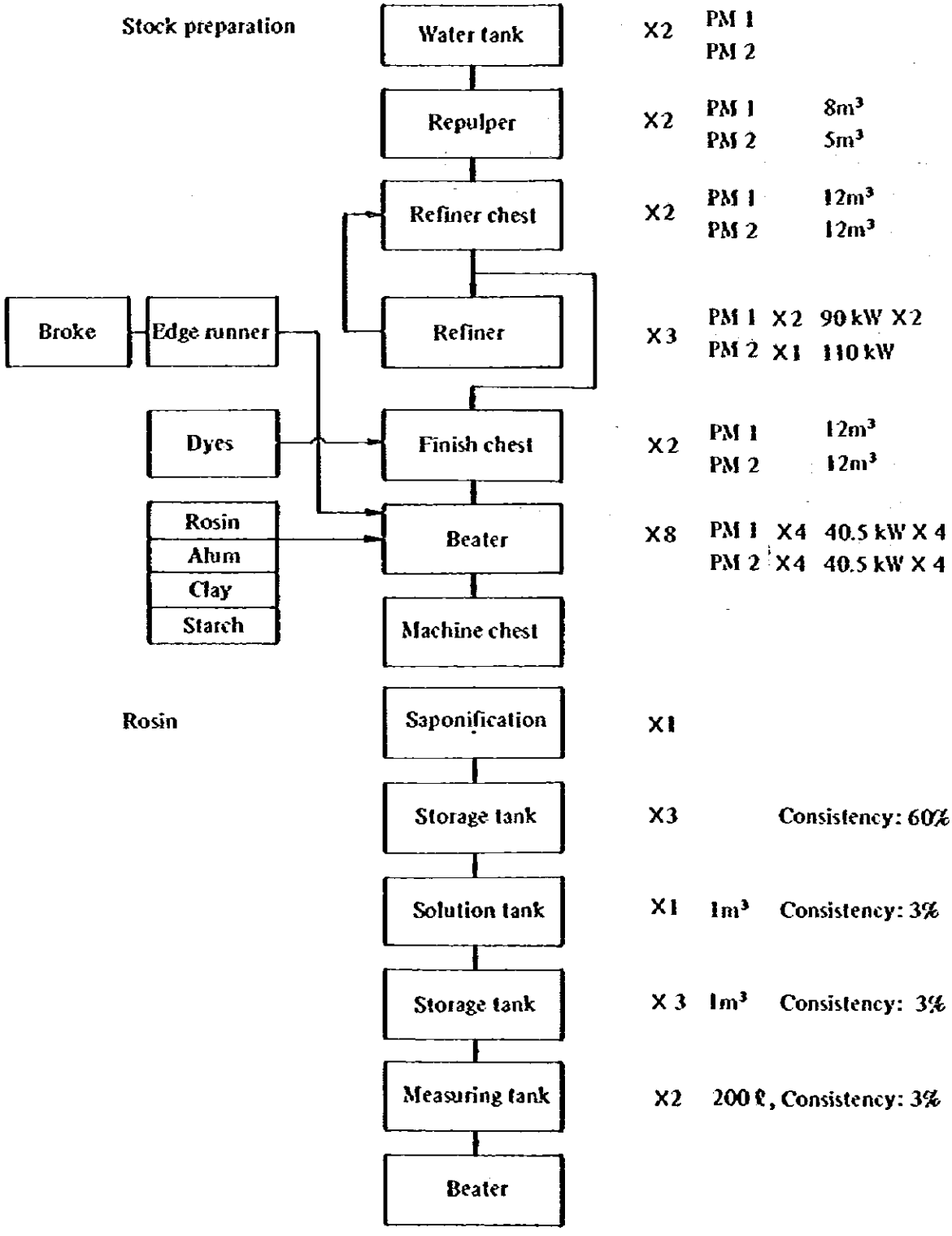
The plant has 2 hydra-pulpers, 3 refiners and 8 beaters for stock preparation for PM1 and PM2 of this Unit I.

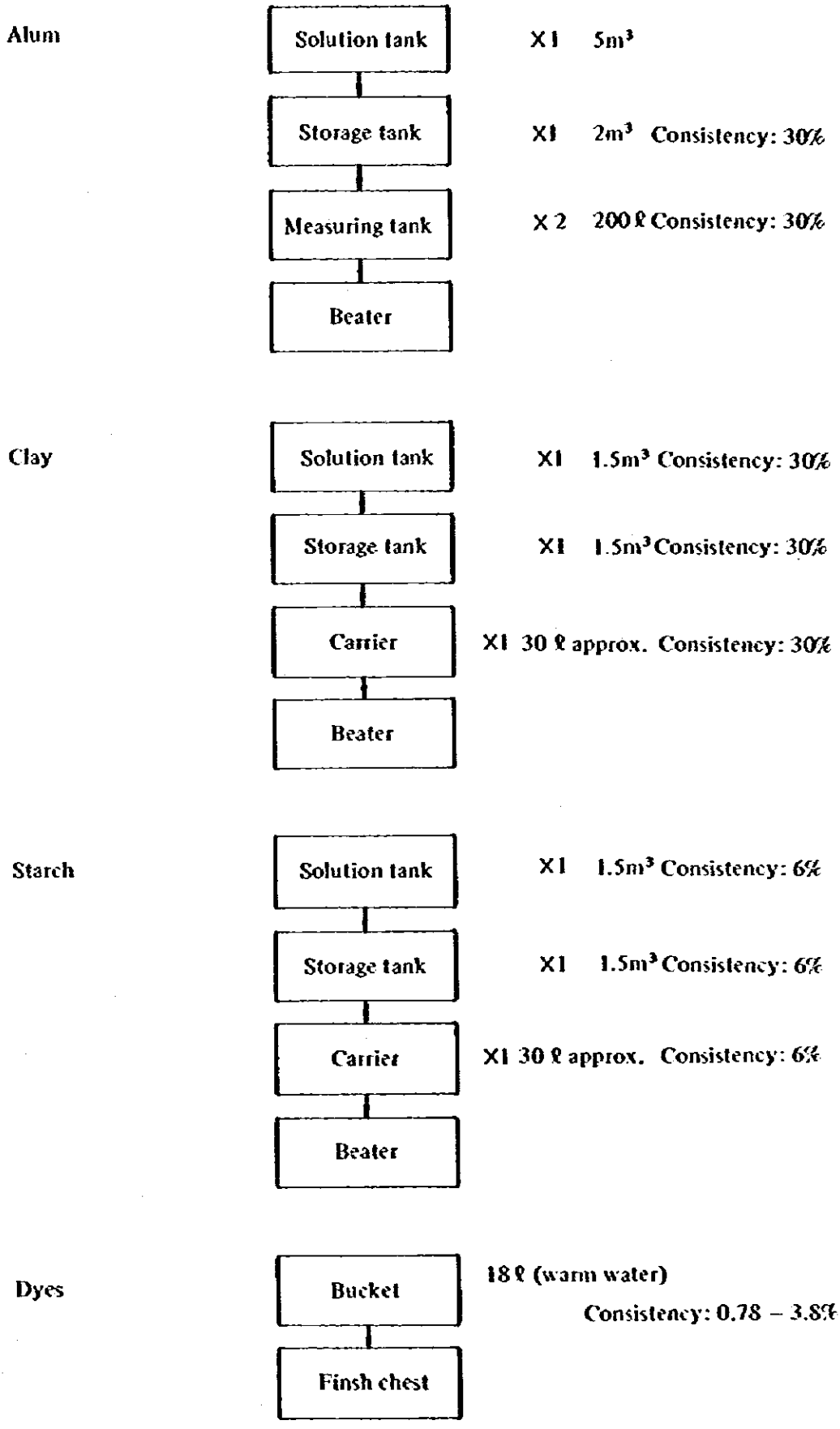
The hydra-pulpers and refiners have been introduced recently, but the beaters are those used mainly for straw pulp since 1924 and rather applicable to repulping and mixing of straw pulp than to beating of wood pulp. Currently they are used mainly for mixing and broke repulping, however, they are significantly in a bad shape with poor workability, allowing much dust to come into them.

Also the use of the beaters for the final stage of stock preparation is not proper, and this results in promotion of uneven mixing of additives to the stock as well as instable stock consistency.

LBKP is the main stock and the amount of straw pulp mixed is adjusted according to its production volume. Straw pulp, however, is not used subject to its characteristics (beating speed, opacity and formation).

6-3-1 Machines and Equipment; Process Flow




Alum
Solution tank
X1 5m³
Storage tank
X1 2m³ Consistency: 30%
Measuring tank
X 2 200 ℓ Consistency: 30%
Beater
Clay
Solution tank
X1 1.5m³ Consistency: 30%
Storage tank
X1 1.5m³ Consistency: 30%
Carrier
X1 30 ℓ approx. Consistency: 30%
Beater
Starch
Solution tank
X1 1.5m³ Consistency: 6%
Storage tank
X1 1.5m³ Consistency: 6%
Carrier
X1 30 ℓ approx. Consistency: 6%
Beater
Dyes
Bucket
18 ℓ (warm water)
Consistency: 0.78 – 3.8%
Finsh chest

6-3-2 Personnel

For repulping	:	2 operators X 3 shifts in 4 groups
For refining	:	2 operators X 3 shifts in 4 groups
For beating	:	4 operators X 3 shifts in 4 groups
For chemical prepatation	:	3 operators X 3 shifts in 4 groups

6-3-3 Operating Conditions

1) Operation Standard (See Table 6-3-1 attached) Pulp mixing; Additive chemicals mixing; Freeness

2) Current situation (See Tables 6-3-2 and -3 attached)

(1) Pulp mixing

15% – 25% of NBKP is mixed with a difference within a range of 10% by paper grades. Of 85% – 75% of LBKP, straw pulp accounts for 35% on the average though this value changes subject to its production volume.

(2) Repulping and refining

NBKP, LBKP, straw pulp and broke are mixed up and repulped in each batch of 480kg with a consistency of 3 – 4%. Broke is sometimes repulped individually using a beater. The broke of PM 1 is squashed with an edge runner and mixed with new stock in a beater.

(3) Chemicals used as additives

Rosin and alum are flowed to the measuring tank where they are measured, and then added to the beater. Starch and clay are measured using the carrier and then added to the beater.

(4) Inspection of freeness

A given amount of the stock is sampled with a cup and measured with a Canadian freeness tester.

(5) Beaters

Stock preparation for PM 1 is done with 2 conical refiners, 90KW and for PM 2 with one double-disk refiner, 110KW. Lack in capability of refining for PM 2 is compensated with the said conical refiner.

(6) Feeding to paper machine chest

After observing the capacity of paper machine chest, its bottom connection pipe is closed. The stock is flowed from the beater together with white water. After conditioning of consitency of the flow the connection pipe is opened. When the stock is balanced, a beater's operator takes samples at the paper machine end to measure basis weight.

6-3-4 Problems on Equipment/Operation and Proposed Countermeasures

1) Beaters:

Beaters are very old ones being used since the inauguration of the plant, wherefore very deteriorated and imperfectly serviced. Since they have been designed for dissolving and mixing of straw pulp, they have fly bars and bed plates made of bronze and lightweight drums, therefore, are not appropriate for beating purposes. Fly bars are found worn, groovings are not deep, circulation is slow; therefore, they do not work satisfactorily as mixing apparatus too.

Countermeasures

They should be replaced with more efficient mixing chest system to ensure prevention of dust entering and energy saving.

2) Variation in consistency of repulped stock (See Table 6-3-4 attached):

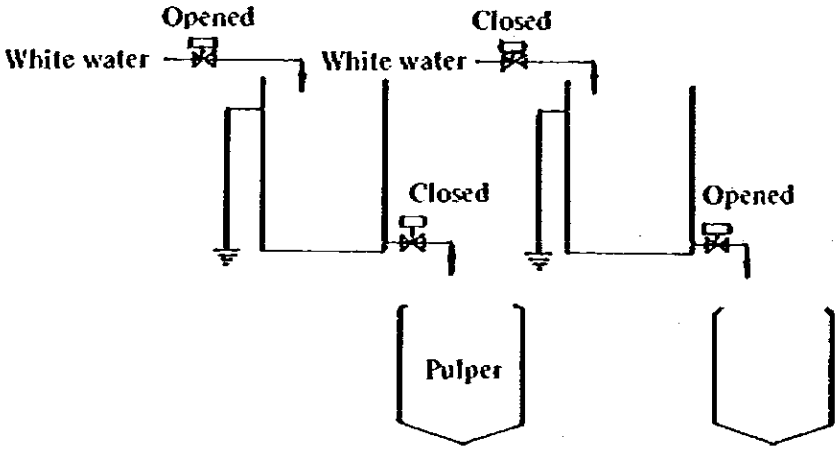
White water feed is regulated by receiving overflow in a water tank. However, a correct and stable water feed is unavailable since white water is fed to the pulper with the inflow valve opened and consequently feed time and amount vary depending on the individual who conducts feeding. In addition, the water is fed while the stock is dissolving.

Countermeasures

It is recommended to use magnetic solenoid valves instead of both existing inflow valve of the water tank and feed valve of the pulper.

Feed valve opened	--	white water valve closed
Feed valve closed	--	white water valve opened

The valves should be arranged in interlocking posistions as mentioned ablove, and repulping should be processed in the following procedures: completion of white water feed → operation of pulper → feeding of the stock → completion of repulping → completion of discharging from pulper in operation → stop of pulper



3) Variation in consistency of the stock sent to paper machine chest (See Table 6-3-4 attached):

When the completed stock is supplied to the machine chest, white water is fed from the beater to control the stock consitency by observing the scale inside the machine chest after flowing of one beater portion of the stock.

variation in repulping consistency in the pulper.
variation in mixing amount in the beater, and/or
variation in white water flow rate.

And these variations, when two or more are provoked together at one same time, cause the stock consistency in the machine chest to fluctuate, thereby causing fluctucation of the basis weight.

Countermeasures

It is recommended to install C.R.Cs before refining and machine chest to ensure the stability of the stock consistency.

4) Double-disk refiner for PM2 (See Table 6-3-5 attached):

It is observed that the refining of Banderol stock with the double disk refiner requres and increased electric power by 30% compared with the conical refiner at the same fiber compositions. This increased power requirement may be attributable to the following cases:

Excessive throughput	(15t/day – 30t/day) is to be kept as a proper rate.
Refining blades worn	(Groove depth of both blades to be not less than 4mm)
Flexible pipe plugged	(bend, if any, to be straightened)
Imperfect balancing of rotors	

Countermeasures

It is necessary to carefully recheck the above-mentioned points. Also it is suggested to familiarize the operators more with the hydraulic double-disk refiner so that it may be operated with more skill. In addition, it will be required, if the case may be, to take into account the introduction of a constantgap disk refiner.

5) Prevention of contamination of purchased pulp:

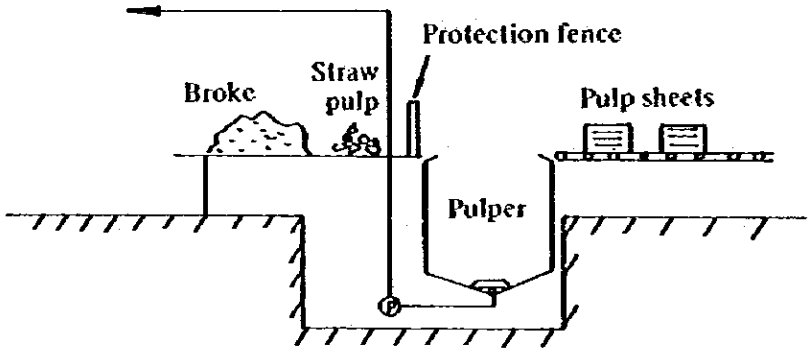
Purchased pulp is stored in one of the stock sheds (located on the west side of the plant site) as if it were scraps. Unlike the straw material, the pulp forms part of the product. Therefore, it should be stored more carefully. The shed floor should be paved with concrete to raise the floor level and to prevent entering of rainwater. Furthermore, the use of a forklift is suggested to stack it in 3 or 4 piles, which can save the required space.

Countermeasures

It is advisable to pave the shed floor with concrete as mentioned above and also to establish an effective control system for the storage of pulp.

6) Prevention of mixing of impurities (Feeding to the pulper):

Sometimes soil has not been removed completely from portions of the pulp before such a pulp is on the belt conveyor. This soil adherence is especially oversved in the feeding part of straw & broke pulp and many impurities get mixed here.



With a protection fence provided, however, it is removed when the straw and/or broke pulp are fed; this causes many times entering of impurities on the floor since pulper top comes parallel to the floor level.

Countermeasures

Pavement of pulp conveyor room
The pulper top to be placed at a height of 1m from the floor level.
Effective training program and control system to be established with respect to carrying and handling of the broke.

7) Measuring of freeness:

Currently quantitative system with a cup is applied for taking samples for freeness measurement. Since the consistency in the chest varies much sample weight (3g as BD base) may vary with this sampling method and correctness may not be expected.

Countermeasures

It is recommended to use a centrifugal dehydrator.

8) Mixing and beating of broke and new stock:

In PM 2 the broke is mixed with a new stock and beated. However, while the broke causes a rapid freeness drop as a whole since it is refined once again, fibers of the new stock are not yet cut sufficiently. Therefore, this mixing and beating should not be applied at least for those products requiring good formation.

Countermeasures

At the present circumstances, it is desirable to beat the broke with a beater individually, but fundamentally a broke pulper should be mounted for repulping it.

9) It is observed that the plant uses a very aged hoist gear requiring a lot of labor work for lifting of chemical materials used for stock preparation.

Countermeasures

We recommend the plant to install an electric hoist and I-beams.

10) The alum measuring tank is damaged. A 100-lit. plastic tank is placed on the side of a beater, and a bucket is used for measuring and adding the alum. This way does not ensure a correct measuring.

The operation results of the plant in 1983 show that the average amount of addition of alum was higher than the standard and moreover such an addition was carried out in a very rough way and that the beater's pH value was very low (pH 3). This indicates that important parts of machines are exposed to potential corrosion and deteriotaion.

Countermeasures

The measuring tank must be repaired immediately. Also to keep the beater's pH value always adjusted within a range of pH 3.5 – pH 4.0, instructions and education should be given to the operators so that they will frequently check the said pH value and correctly measure chemical additives.

11) The clay is carried to the beater on a carrier, therfore, its consistency is set at a high value of 30%. Because of a high solution consistency the clay cannot be stirred well by the storage tank's agitator, thus causing sedimentation and filter mesh blinding which in turn cause an imperfect filtration and a variation in the amount of addition.

Countermeasures

The solution consistency should be set to values between 15% and 20%; our recommendation is to install a storage tank having a capacity of about $10m^3$ with a transferring pump to ensure a correct measuring and addition of clay.

12) Starch:

Because of the boiling kettle's jacket damaged, steam is directly blown to boil starch. There is no thermometer to measure the temperature of starch being boiled. Starch cannot be completely gelatinized with a temperature lower than 80°C, the situation of which may cause staining of the printing blanket when the paper is placed for printing. Starch preparation work should be controlled in an effective way.

Countermeasures

A thermometer should be placed to the boiling kettle and an agitator to the storage tank, and a pump should be used for flowing the solution to ensure a correct measuring and addition of starch.

13) Dyes:

A considerable dispersion is observed in the dye solution temperature. If a dye is subjected to a low temperature, a perfect coloring cannot be expected causing color tone discrepancy. A high addition consistency may cause an uneven coloring.

Countermeasures

Solution temperature should be maintained at 70°C or higher, and addition consistency at a value of 1% or less.

(14) Addition of chemicals (See Table 6-3-6 attached):

The data of the plant operation in 1983 show that the main paper grades manufactured had varied additions of clay and alum. Especially, the clay significantly affects the paper quality including ash content and opacity. It is recommended to establish an effective control system.

(15) Paper-making quality observed during the study (See Fig(s). 6-3-2 and 6-3-3 attached.):

As regards PM 1 OMSLAG Paper in basis weight of 70g±2g, 14 out of 34 measurements were out of control limit, resulting in 41%. As to PM 2 DOOR-SLAG Paper in basis weight of 27g±8%, only 2 out of 41 measurements were out of control limit. This is not a bad figure. As against the standard ash content of 4.5%±0.3% for PM2 DOORSLAG, the following values have been observed: 9.10% average, 13% max. and 6.6% min., therefore, ash content is excessive and has a wide variation.

Countermeasures

An effective guidance and control system should be established as basis weight and ash content are very important points to be supervised.

(16) Comparison of data on the same grade made on PM 1 & 2 (BANDEROL 60g) (See Fig. 6-3-4 attached.)

		No. of measure-ment	Mean value	Max.	Min.	σ
Basis wt.	PM 1	44	59.36g	62.2g	57.0g	1.37
60g±3g/m²	PM 2	25	58.75g	63.1g	49.1g	3.32
Thickness	PM 1	44	82.5u	91.0u	73.0u	4.00
70u ±10μ	PM 2	25	81.16u	90.0u	72.0u	4.68
Tearing	PM 1	40	56.2	68.0	34.0	0.64
45 ± 15g	PM 2	21	41.1	50.0	32.0	0.61

The PM 1 is more stable than the PM 2 from the viewpoint of basis weight. As to thickness and tearing strength no remarkable difference is observed between the two paper machines. It seems that the PM 1 is more familiarized with the making of BANDEROL paper, and thus is more stable.

6-3-5 Proposals for Improvement in Stock Preparation Section

1) In consideration of the problems or troubles described in Section 6.3.4 above,we would propose removal of existing beaters, and adoption of new stock preparation equipment in order to achieve the following objectives:

1. Obtainment of stablized pulp stock quality
2. Prevention and removal of entering of impurities
3. Stabilization of pulp consistency
4. Implementation of stabilized freeness
5. Implementation of stabilized addition of chemical additives

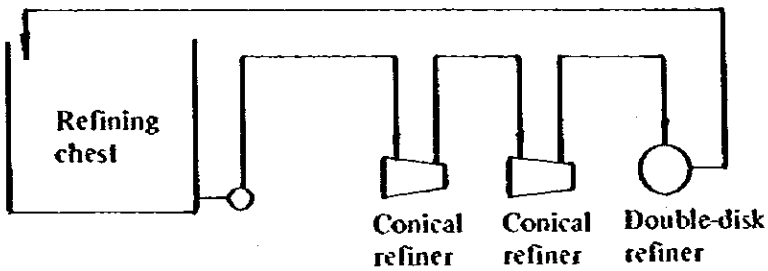
2) Equipment required for the proposed improvement

(1) Stock preparation

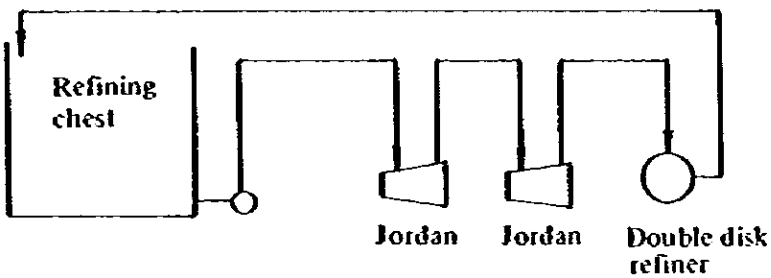
Classification / Item	Specification	Renovation	Prepared by PPM
1. Chest	20 m^3		4
2. Agitator		4	
3. Double-disk refiner	110 kW	1	
4. Hydra-pulper	10 m^3	1	
5. Magnet bar		10	
6. Stock pump		5	
7. C R C		4	
8. Three-way valve		7	
9. Measuring tank		2	
10. Jansson screen		2	
11. Broke thickner		2	
12. White water chest	12 m^3		1
13. Fork lift	2.5 t		1

(2) Layout of refining equipments

1. PM 1 : Double-disk refiner X1
Conical refiner X2



2. PM 2 : Double-disk refiner X1
Jordan engine X2



3) Operators required

For pulper : 4 operators X 3 shifts (4 groups)
For refining : 2 operators X 3 shifts (4 groups)
For mixing : 2 operators X 3 shifts (4 groups)

4) New Refining Equipment and Capacity

Items \ Machine			PM 1		PM 2	
Items			BANDEROL		DOORSLAG	
Basis weight			60		28	
Mixing ratio	NBKP	%	27.5		23	
	LBKP	%	72.5		77	
	Straw pulp	%				
	Broke	%				
Freeness	Start		633		630	
	Finish		180		215	
	Drop		453		415	
Refining equipment capacity						
Double-disk refiner			110 kW X 1		110 kW X 1	
Conical refiner			90 kW X 2			
Jordan engine					45 kW X 2	
kWH / TΔ freeness			Double-disk 110 kW	Conical 180 kW	Double-disk 110 kW	Conical 90 kW
			339.8	498.3	311.25	456.5
t / h	available		0.324	0.361	0.353	0.197
t / day	available		7.776	8.664	8.472	4.728
			16.440		13.200	
Operating ratio		80%	13.152		10.560	
Required pulp throughput		(t/day)	12,550		6,350	
Allowance		(t/day)	2.142		4.210	

Table 6-3-1 Operating Condition of Stock Prep.

Kind of Paper	Basis Weight (g/m²)	Mixing Ratio Pulp (%)				Freeness		Chemical (%)					Machine speed (m/min)	Production Rate (t/d)	Remarks
		NBKP	LBKP	Straw	Broke	SR	CSF (cc)	Clay	Rosin	Alum	Starch	Dyes			
PM 1															*MECHANICAL PULP
1 HVS	80	25	60		15	48 b2	230	20	1.75	2.5	3	0.015	46	9.6	
2 H.V.S. Offset	60	12.5	72.5		15	48 b2	230	20	1.75	2.5	3	0.015	62	9.0	
3 HS	50	12.5	72.5		15	48 b2	230	20	1.75	2.5	3	0.015	65	9.0	
4 Water Mark	70	25	70		5	50 b2	215	13.5	2.5	5.5	6	0.015	46	9.0	
5 Water Mark (W)	70	25	70		5	50 b2	215	13.5	2.5	5.5	6	0.015	46	9.0	
6 Mail Zegel	80	27.5	62.5		10	50 b2	215	–	3.0	6.0	9.5	0.015	30	6.6	
7 Baderol	60	25	65		10	55 b2	180	13.0	1.3	2.5	3	0.015	62	8.4	
8 Banderol	50	25	65		10	55 b2	180	13.0	1.3	2.5	3	0.015	65	8.4	
9 S.P.R.	80	35	60		5	55 b2	180	–	3.5	6.0	7	0.015	40	7.5	
10 S.P.R. Water Mark	80	30	60		5	55 b2	180	–	3.5	6.0	7	0.015	30	6.6	
11 Cheque	100	25	65		10	55 b2	180	15.0	1.0	3.5	6	0.015	30	9.6	
12 Perform	120	25	65		10	48	230	12.5	2.5	5.0	6	0.016	32	9.6	
13 S.T.T.B.	130	30	65		5	48 b2	230	–	3.25	6.0	10	0.015	24	6.0	
14 Post Wesel	175	20	65		15	48	230	13.0	1.0	2.5	3	0.16	22	9.0	
15 Kartu Post	175	20	65		15	48	230	13.0	1.0	2.5	3	0.16	22	9.0	
16 London	190	20	65		15	48	230	8.5	2.0	4.0	6.5	0.16	20	10.2	
17 H.V. OM Slag	80				100	40	310	12.5	–	1.5	–	0.16	44	9.0	
18 H.V. OM Slag	200				100	40	310	12.5	–	1.5	–	0.16	20	10.2	
19 Om Slag Biru Tua	70				100	40	310	12.5	–	1.5	–	1.0	46	9.6	
20 Kraft Coklat	65				100	40	310		1.0	2.0	–	1.0	46	9.0	
21 Kraft Coklat	85				100	40	310		1.0	2.0	–	1.0	40	9.6	
22 Cyclo Style	69	10	70		20	48	230	13.0	0.6	2.5	2.5	0.015	65	10.5	
23 Water Mark	100	25	75		5	50 b2	215	13.0	2.5	5.5	6.5	0.16	30	6.6	
24 Couver ture	55				100	40	310	15.0	1.5	2.5	2.5	0.16	65	9.0	
PM 2															
1 Cigaret Putih	26	28	68		4	52 b2	200	$CaCo_3$ 18.5	–	–	–	0.015	64	4.2	
2 Cigaret Narkin	26	28	68		4	52 b2	200	$CaCo_3$ 18.5	–	–	–	0.16	64	4.2	
3 Doorslag Putih	28	20	65		15	50 b2	215	10.0	2.5	4.5	3.5	0.015	68	4.8	
4 Doorslag (W)	28	20	65		15	50 b2	215	10.0	2.5	4.5	3.5	0.16	68	4.8	
5 H.V.S. Putih	50	12.5	72.5		15	40 b2	230	20.0	2.5	4.5	3.5	0.015	72	7.5	
6 Bank Post	40	20	70		10	40 b2	230	10.0	1.5	4.0	6.5	0.015	70	6.0	
7 Corona	37	25	70		5	52 b2	200	19.0	2.8	5.0	12.0	0.015	70	4.4	
8 Buku Tele pone	36	30	15		*55	48	230	11.0	5.5	3.25	–	0.015	70	4.7	

Table 6-3-2 Actual Record of Operation Data of PM 1

Date	Kind of Paper	Basis Weight	Mixing Ratio of Pulp				Refining Rate	Consistency	Freeness	Refining Time	Load	Refining Capacity		Remarks
			NBKP	LBKP	STRAW	BROKE						kg / H	kg / D	
		G/m²	%	%	%	%	BDkg/Batch	%	CC	Min.	AMP	BDkg	BDkg	
Mar. 1	Post Wesel	175	25	42	33		480	4.0	x 255 Max. 275 Min. 240	x 70 Max. 90 Min. 60	150 x 2	411	9,864	
2	Refom	120	25	25	50		480	4.1	x 243 Max. 210 Min. 220	x 53 Max. 60 Max. 45	150 x 2	543	13,032	
3	Refom	120	25	25	50		480	4.1	x 224 Max. 250 Min. 210	60	150 x 2	480	5,760	
4	M.V. Offset	60	18.75	25	31.25	25	480	4.1	x 236 Max. 280 Min. 210	x 45 Max. 90 Min. 30	150 x 2	640	15,360	
21	Banderol	60	25	50	25		480	3.75	x 252 Max. 260 Min. 250	x 58 Max. 75 Min. 45	140 x 2	496	11,917	

Table 6-3-3 Actual Record of Operation Data of PM2

Date	Kind of Paper	Basis Weight	Mixing Ratio of Pulp				Refining Rate	Consistency	Freeness	Refining Time	Load	Refining Capacity		Remarks
			NBKP	LBKP	STRAW	BROKE						kg / H	kg / D	
		G/m²	%	%	%	%	BDkg/Batch	%	CC	Min.	AMP	BDkg	BDkg	
Mar. 1	Doorslag	26	18.75		68.75	12.5	480	4.0	x 145 Max. 160 Min. 140	x 100 Max. 110 Min. 90	120	288	6,912	
2	Doorslag	26	18.75		68.75	12.5	480	4.1	x 167 Max. 190 Min. 130	x 100 Max. 120 Min. 90	120	288	6,912	
3	Doorslag	26	18.75		81.25		480	4.1	x 160 Max. 190 Min. 130	x 140 Max. 165 Min. 120	150	205	4,937	
	Doorslag	26	18.75		68.75	12.5	480	4.2	x 186 Max. 200 Min. 160	x 90 Max. 105 Min. 70	120	320	7,600	
4	Doorslag	26	18.75		68.75	12.5	480	4.2	x 162 Max. 200 Min. 140	x 84 Max. 106 Min. 75	160	342	8,228	
9	Doorslag	26	37.50	62.5			480	x 4.15 Max. 4.45 Min. 4.0	x 203 Max. 220 Min. 190	x 290 Max. 330 Min. 270	120	98	2,367	
20	Banderol	60	25.0	50.0	25.0		480	x 3.95 Max. 4.1 Min. 3.8	x 242 Max. 270 Min. 215	x 198 Max. 210 Min. 180	120–130	145	3,490	
20	Banderol	60	25.0	50.0	25.0		480	4.0	180	80	130 x 2	360	8,640	

Table 6-3-4 Unit I PM 2 Actual Operation Data in (1984)

Date	Hour	Consistency		
		Refining Chest (%)	Machine Chest (%)	Head Box (%)
Mar. 13	14.00	3.4	1.7	0.23
	17.30	3.6	1.6	0.19
	22.30	2.4	2.2	0.21
	1.00	2.8	2.1	0.20
14	6.00	4.3	2.4	0.30
	10.00	4.1	2.4	0.35
	15.00	3.3	2.1	0.37
	18.00	3.5	2.3	0.37
15	6.35	3.36	2.4	0.40
	11.15	4.0	2.27	0.37
	14.30	4.25	2.28	0.45
	17.30	3.96	2.27	0.40
16	6.35	3.36	2.40	0.35
	11.00	3.30	2.40	0.37
x		3.55	2.20	0.325
Max.		4.25	2.40	0.450
Min.		2.40	1.60	0.190

Table 6-3-5 Refining Capacity of Stock Preparation

Item		PM 1			PM 2					
Mixing Ratio (%)		NBKP	LBKP	STRAW	NBKP	LBKP	STRAW	NBKP	LBKP	STRAW
		25	50	25	25	50	25	18.75	–	81.25
Refining Ratio	BDkg/Butch	480			480			480		
Consistency	(%)	3.75			3.95			4.1		
Freeness	Start	573			573			435		
	End (cc)	252			240			160		
Freeness Drop	(cc)	321			333			275		
Ampare	(A)	140 X 2			120			120		
	(kW)	147.4			63.2			63.2		
Refining Hour	(h)	0.97			3.3			2.33		
Hourly Refining Rate	(BDkg/h)	495			14.5			206		
Daily Refining Rate	(BDkg/d)	11,800			3,480			4,944		
Normal Refining RAte	(BDkg/20h)	9,504			2,740			3,955		
Unit Consumption Rate of Elect. Power	(kWh/t)	297.8			435.8			306.8		
Refining Power	(kWh/t100cc)	98.9			130.9			111.7		

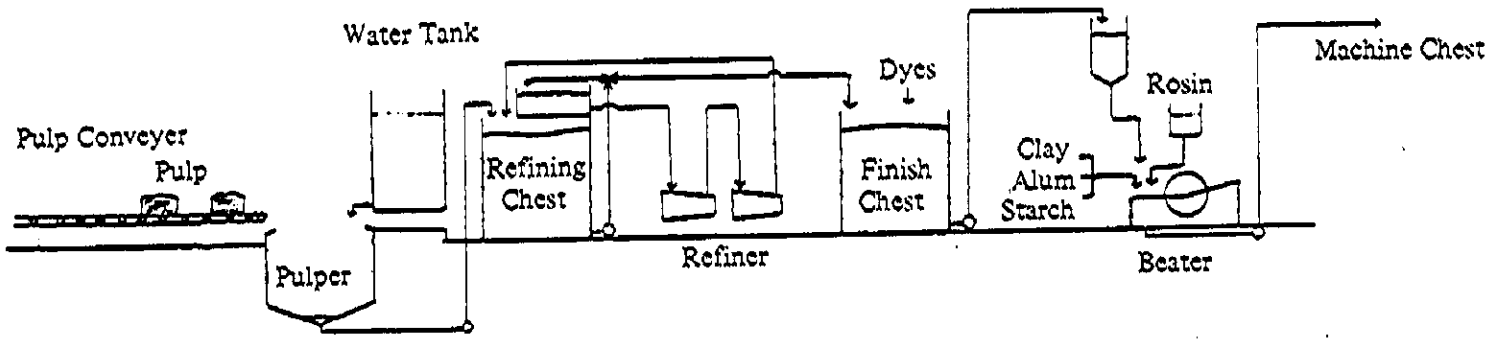
PM 1 Conical Refiner

PM 2 Double Disk Refiner

Table 6-3-6 Actual Mixing Ratio of Chemical Agent At Stock Prep. (1983)

Kind of Paper	Basis Weight (g/m²)	Standard Point of Chemical	Standard (%)	Jan. (%)	Feb. (%)	Mar. (%)	Apr. (%)	May (%)	June (%)	July (%)	Aug. (%)	Sep. (%)	Oct. (%)	Nov. (%)	Dec. (%)	x (%)	Max. (%)	Min. (%)
1 Banderol	60	Clay	13	9.7				12.7	12.6	12.5	14.1	12.4	14.0	12.48	16.9	13.04	16.9	9.7
		Rosin	1.3	1.8				1.3	1.22	0.94	1.4	1.22	1.4	1.2	1.7	1.35	1.8	0.94
		Alum	2.5	3.5				2.6	2.5	1.92	2.9	2.53	2.8	2.5	3.4	2.74	3.5	1.92
2 Cyclostile	69	Clay	13	10.2	11.8	8.0	13.1	12.5	12.3	11.8	11.5		11.0	12.9	12.3	11.46	13.1	8.0
		Rosin	0.6	0.9	0.68	0.57	0.64	6.61	0.61	0.58	0.64		0.6	0.57	0.55	0.64	0.9	0.57
		Alum	2.5	3.5	2.6	2.4	2.6	2.5	2.5	2.4	2.6		2.5	2.5	2.5	2.66	3.5	2.4
															–	–		–
3 Mailzogi Segal	80	Clay	–													2.8	2.9	2.7
		Rosin	3.0				2.9		2.7							5.25	5.5	5.0
		Alum	6.0				5.5		5.0									
																–	–	–
4 STTB	130	Clay	–													3.3	3.6	2.8
		Rosin	3.25		3.6	3.25								2.8		6.9	8.5	5.2
		Alum	6.0		8.5	7.1								5.2				
																13.3	15.3	12.1
5 Post Wesel	175	Clay	13.0			15.3		12.1	12.5							2.5	5.5	1.0
		Rosin	1.0			5.5		1.0	1.0							3.4	5.2	2.5
		Alum	2.5			5.2		2.5	2.5									
																12.47	13.6	11.3
6 Peform	120	Clay	12.5			13.6	11.3			12.5						1.4	2.2	0
		Rosin	2.5			2.0	2.2									2.57	3.1	0
		Alum	5.0			3.1	4.6											
															7.3	7.33	8.3	5.8
7 Doorslag	26	Clay	10.0	5.8	8.3	6.5	16.6	7.8	8.2		7.4	7.3	7.4		1.9	2.22	3.0	1.98
		Rosin	2.5	2.5	2.6	3.0		2.0	2.0		2.0	1.98	2.0		3.5	4.06	5.6	3.5
		Alum	4.5	4.4	4.2	5.6		3.8	3.7		3.7	3.7	3.9					
																18.34	22.79	16.3
8 Sigaret	28	$CaCo_3$	20.0	17.7	22.77		16.6				16.3							
																–	–	–
																3.5	4.2	2.8
9 S.P.R.	80	CLAY	–													7.2	8.4	5.9
		Rosin	3.5	4.2				2.8										
		Alum	6.0	8.4				5.9										

PM 1 Stock Preparation



PM 2 Stock Preparation

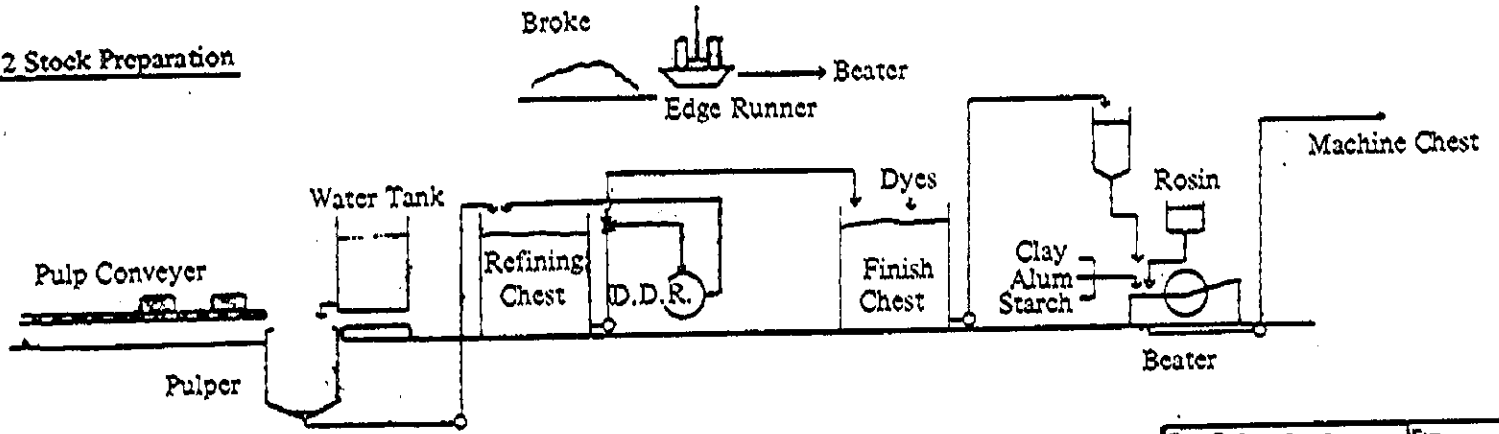


Fig. 6-3-1

Fm. PADALARANG	Exp.
UNIT : STOCK PREP.	Traced
PRESENT FLOW DIAGRAM AT STOCK PREPARATION	Drawn
	Checked
Scale / Date / Dwg. No.	Appr.

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6-3-2 Unit I PM 1 Test Result of Omslag

Mar. 8 – 11 1984 By Performance Analysis

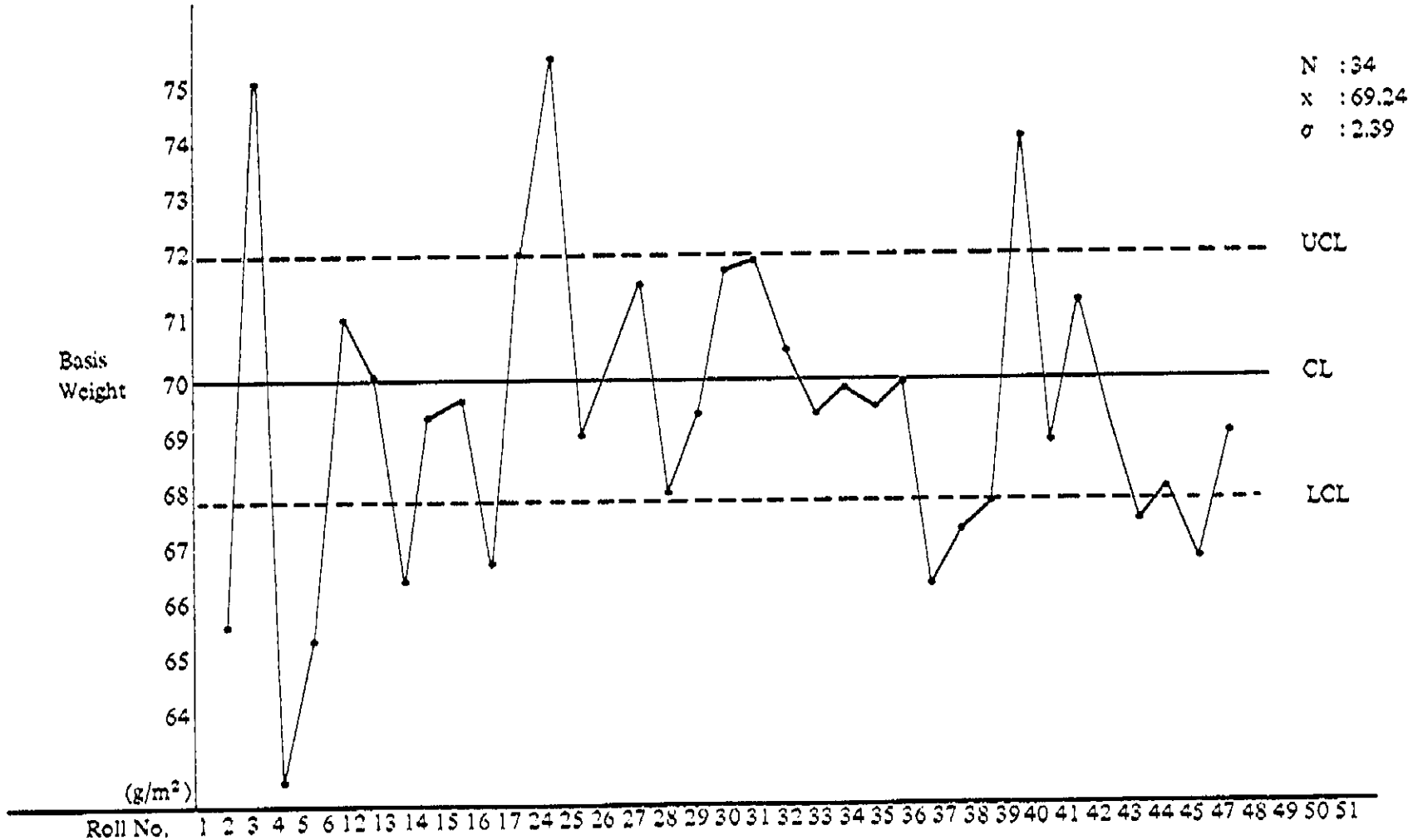


Fig. 6-3-3 Unit I PM 2 Test Result of Doorslag

Mar. 2 – 8 1984 By Performance Analysis

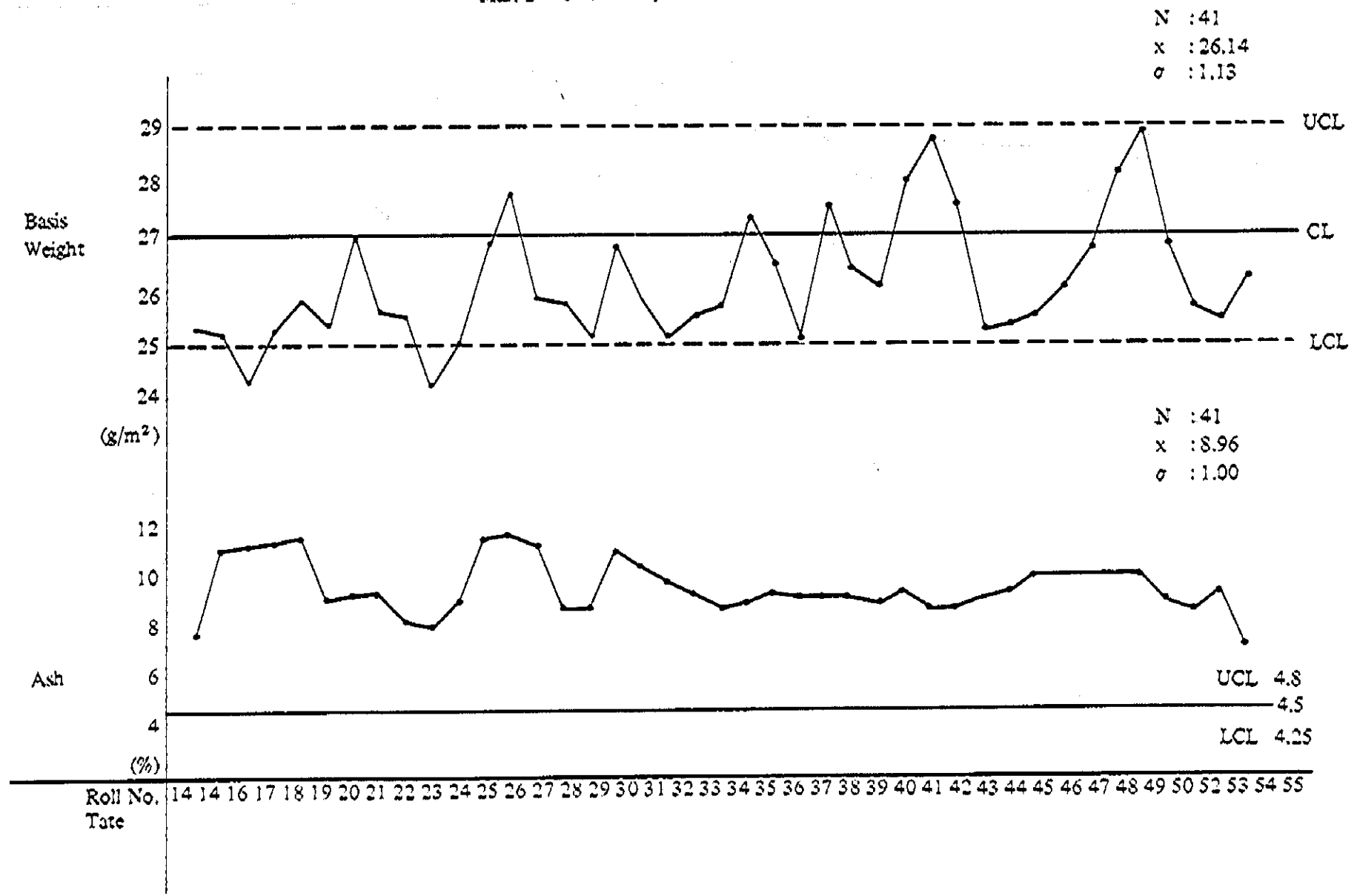
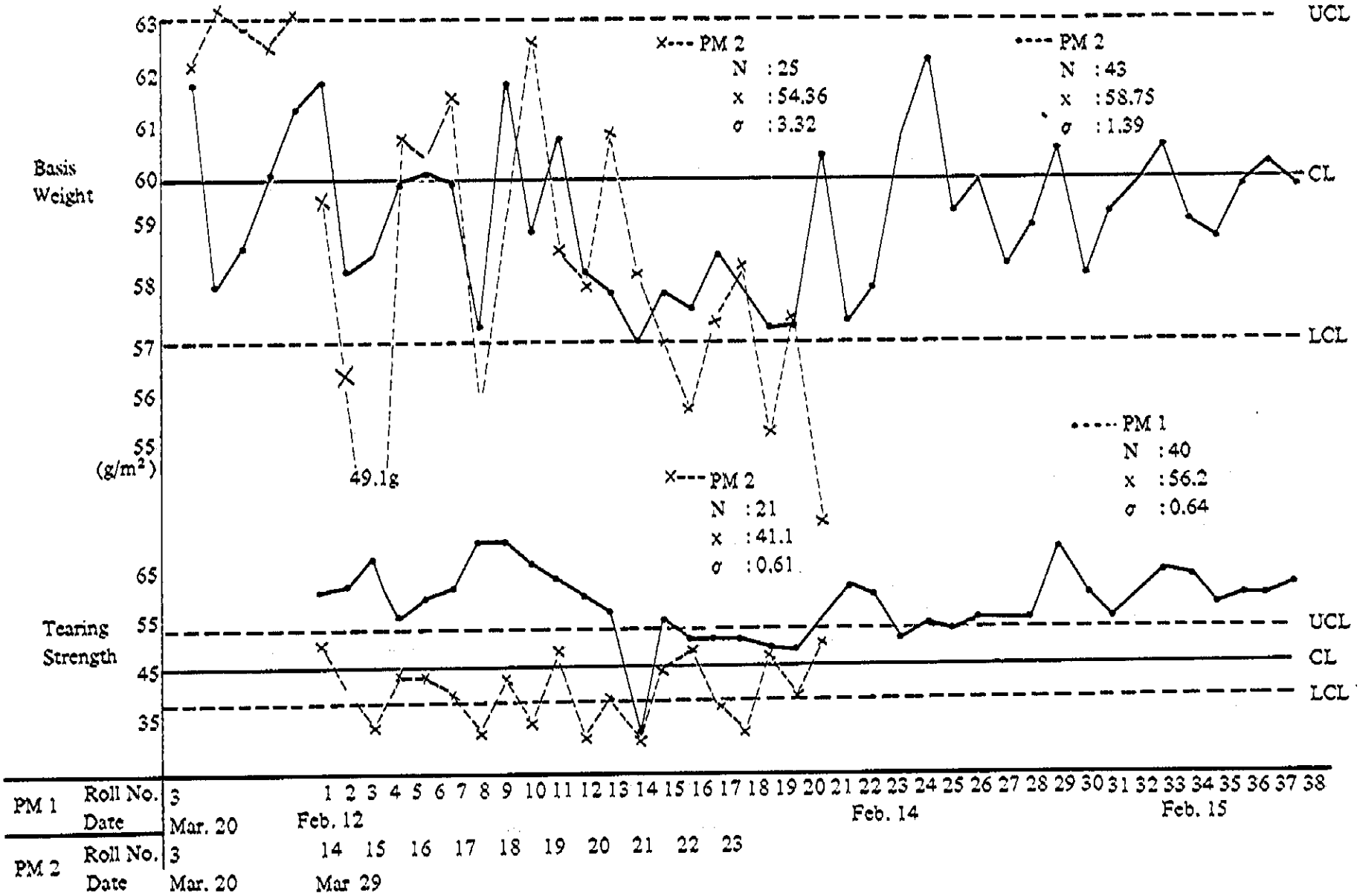


Fig. 6-3-4 Actual Quality Comparison of Banderol Produced by Both PM 1,2 (in 1984)

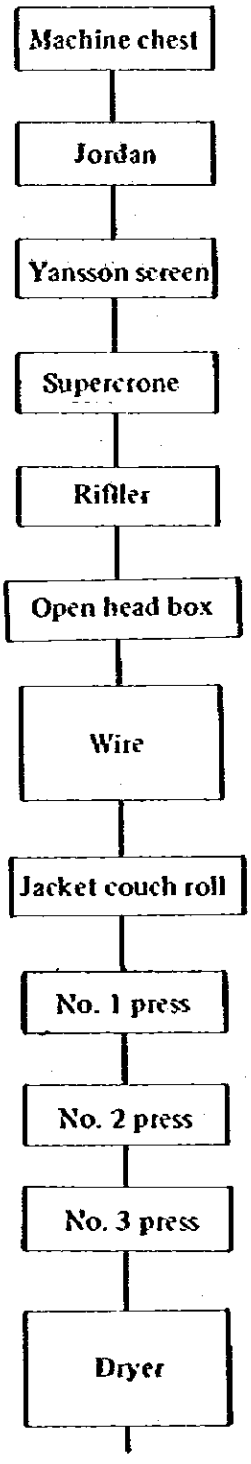


6-4 Unit I, Section PM I

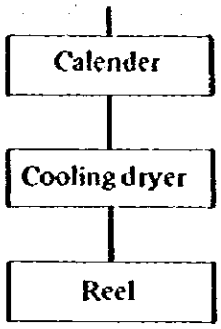
PM I is a paper machine which has continued operations ever since the inception of operation in the manufacture of the products (BANDEROL, STTB) mainly for use of the government and public offices under the favorable circumstances in terms of price and quality. The main unit still remains in its original form only with some modification made on the machine approach and reel part after 1972. The machine speed is 20 – 60 m/min, wire width 2,150 mm with sheet production basis weight of 50 – 200 g/m². The daily production of 14.5 t/d and machine speed are at a low level. This is a machine making varieties in basis weight which is approximately 50 – 120 g/m² mainly. There are also some main grades combining the use of broke, and the operation that will adversely affect the operation control system (pulp preparation, freeness, mixing and dust removal) is being executed. The sheet production yield in the past three years is 86.23%, which is low. And the sheet production efficiency is 84.82% on the average during the investigation period that shows an unfavorable figure. The major cause is the break induced by the stains of the matter (sand, grit and rust), sludges and dust mingling with the paper stock. As the result of the inspection of HV. OFFSFT 60 g/m² (which was rolled up on the reel) during the period of the investigation, 31 pinholes were found per 25m². The impurities 1 mm or above in size found in 25 m² are quite many, thereby reducing remarkably the product quality value.

The dust removal equipment such as Janson Screen and Superclone are poor in capability. As a specialty paper production machine a large quantity of impurities are detected in the stock received. The mill as a whole should work on the improvement in quality as the main target and at the same time implement the control intensification. Unless the control policy is established with the improvement in quality as a subject matter among restpective departments and the operating control is completely carried out, the competitiveness in both quality and price would drop, leading to the fall of earnings. To avoid and cope with it, the information on the market and its trend must be accurately grasped, on the basis of which the improvement in quality must be performed. Now is high time to put the workers' heart and soul into the improvement of the quality of the products to always meet the requirements from the customers, and the operational and control standards must be restudied and the positive attitude of tackling difficult problems is required to be held in mind consciously. The absence of the consistency control equipment of the paper stock and unstable consistency of the paper stok to be received are the major factors to cause the basis weight fluctuation. The velocity of the driving unit is adjusted by the huge cone pulley, and draw adjustment is the belt-driven type adjusted by the small-sized pulley at each section. Thus a lot of repairs in the production equipment caused by slip trobles have to be made, resulting in difficulties in such aspects as operation and maintenance.

6-4-1 Equipment and Flow



Machine chest	2 units	20 m³
Jordan	1 unit	45 kw
Yansson screen	1 unit	1 x 2 m
Supercrone	1 unit	
Riffler		wooden-made
Open head box		Width 1,300 mm
Wire		75 mesh, 2,400 x 15,500 mm
Jacket couch roll		360ϕ
No. 1 press		360ϕ
No. 2 press		360ϕ
No. 3 press		360ϕ (top roll steel)
Dryer	6 units	1,250ϕ
	1 unit	1,000ϕ
	1 unit	1,800ϕ



1 unit

3 stages

2 units

Baby cylinder

Surface single reel

6-4-2 Personnel

4 persons X 3 shifts (4 groups)

6-4-3 Operating Conditions

1) Operating standards

1. Paper width	2,150 mm
2. Speed	21 – 60 m/min
3. Basis weight	50 – 200 g/m²
4. Daily production	14.5 t/d as theoretical figure
5. Sheet making yield	80 – 90%

2) Actual Circumstances at Present

Refer to Table 6-4-3 in an attached document.

1. Paper width	1,900 – 2,150 mm
2. Speed	21 – 60 m
3. Basis weight	60 – 120 g/m²
4. Sheet making efficiency	84.82% on average

This is rather low efficiency, which is attributed to frequent occurrences of the sheet break by the pinholes produced at the dandy roll by the mingling of the foreign matter and the dirts on the jacket couch. A lot of pinholes and impurities are seen in the paper, causing to deteriorate the quality.

6-4-4 Problems of Equipment and Operation and Appropriate Countermeasures

1) Sheet Break and Deterioration of Quality from Contamination by Foreign Matter

Result of HV Offset 60 g/m² : Inspected Area 25 m²

Item	Total number	Number per m²
Pinhole 5 mm or above	17	0.68
Pinhole 4 mm or below	14	0.56
Flow sludge	2	0.08
Impurity 1 mm² or above	18	0.72

The inspection conducted only for 25 m² shows the result as the above and the fact of 0.52 pinholes existing per m² means a remarkable deterioration in quality even without the sheet break.
An improvement in quality including facilities is required, while the complete implementation of the operation control is most important.

Countermeasures

(1) To strengthen the control of pulp preparation work and broke treatment work of edge runner.

(2) To stabilize the consistency of the paper stock.

(3) To stabilize the freeness of the paper stock.

(4) To bring uniformity of chemical additives and additive ratio.

2) Machine Approach

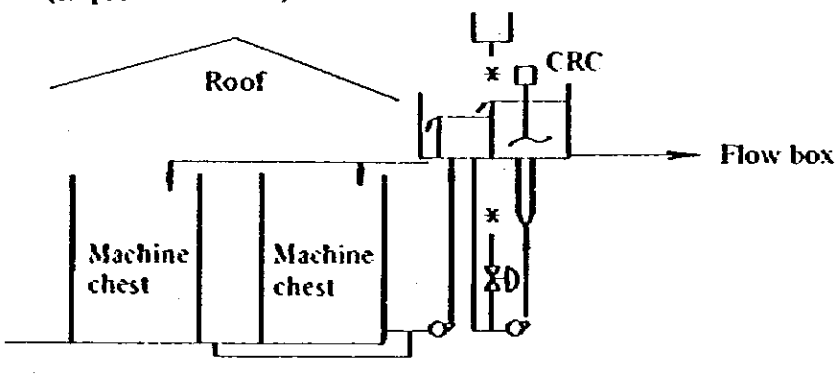
Two machine chest units of 20 m^3 permit the stock holding of 1,200 kg (Cons., of 3%). The circulating system is taken from stuff pump to jordan to stuff box. For the sheet production of daily 10 t/d, the circulation of partial paper stock for a period of approximately two hours promotes the freeness of the paper stock by jordan, which fluctuates the freeness, and the fluctuation of dry line on the wire suction boxes causes fluctuation of quality.
The fluctuation of the stuff box stock level brought about by the delivery pressure of jordan makes basis weight unstable.

Countenneasure

(1) The paper stock should be completed at the stock preparation section jordan after the machine chest should be stopped to be employed and the dry line fluctuation on the wire should be avoided. A consistency regulator is desired to be installed for stabilizing the basis weight.

(2) A roof should be installed over the chest to prevent contamination by dust and foreign matter.

(Improvement Plan)



(3) At the time of colored sheet production, the sampling stock shall be picked at beaters at each batch and the colors shall be matched with squeezed stock samples.

3) Dust Removal

Supercrone is used for the basis weight less than 100 g/cm² and for 100 g/m² and up, Yansson screen (hole type 5 mm in width) is used, but it is not always used so far for some main grades. Riffler is used only for the basis weight over 100 g/m². The dust removal equipment to the flow box entrance is imperfect, which is causing a lot of troubles during sheet making, resulting in the low sheet making efficiency and deterioration of quality. The figure 0.72 mm/m² is too large as the impurities on HV. OFFSET 60 g/m² for 1 mm² or above, thereby deteriorating the quality in appearance and consequently reducing the product value markedly.

Countermeasure

The pressure screen shall be installed and the dust removal efficiency shall be increased through screening the entire main grades.

4) Head Box

(1) The inclination made by the trough at the entrance of the head box causes the paper stock to flow rapidly and therefore the paper stock runs against the streaming plate No. 1 and scatters. The sludge adheres to the streaming plate in stream and the lack of spray shower for defoaming produces a lot of foram, generating floating sludge, especially much is seen sticking to the wall of the head box.

(2) The paper inspection of HV. OFFSET 60 g/m² shows a floating dirt of 0.08 articles/m². Large sludge becomes a cause of the sheet break in the couch roll, deteriorating the sheet making efficiency. The contamination by foram adhering to the streaming plate or the outside of the trough causes the occurrence of slime and the slime increases gradually and falls off, mixing with the paper stock, which becomes causes of the sheet break and floating dirt.

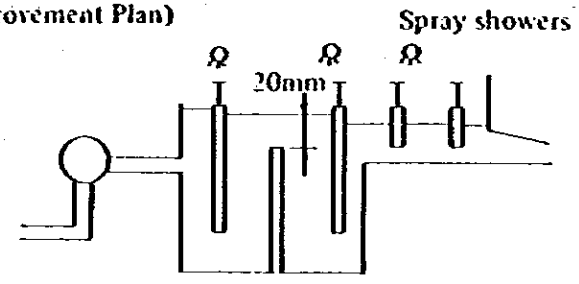
(3) The slime is produced by the heavey contamination of the inside of the head box, a lot of scale adhesion and sludge accumlation.

Countermeasure

(1) The buffle plate shall be installed at the entrance of the trough for adjusting rapid flow to prevent the turbulent flow of the paper stock.

(2) Strengthening of Prevention of Sludge Adhesion to Streaming Plate and Spray for Defoaming.

(Improvement Plan)



(3) Water washing shall be executed periodically to prevent the sludge adhesion at the time of the sheet break and /or change of reel.

(4) The streaming plate No. 2 shall be controlled to place 20 mm below the fluid level.

(5) The inside of the head box shall be carefully washed when the paper machine is stopped.

5) Slice

(1) The slice is the most important part in the paper machince and therefore daily control and maintenance shall be performed with care. The throat incorporated on the upper part of the slice, through which the paper stock smoothly flows out on to the wire, should always be kept clean. This smooth flow of the paper stock ensures good quality and flat paper. A lot of scale adhesion to the slice throat is a questionable problem on PM 1.

(2) The rubber sheet which is used in the lower lip produces corrugation in the cross direction caused by the deterioration, showing thick and thin parts in paper. The corrugation in the rubber sheet causes air to enter between the wire and the rubber sheet and generates air bubbles. The disappearance of air bubbles on the wire makes such a part of the paper alone thin, resulting in the deterioration of the paper appearance.

Countermeasures

(1) It shall be made the operational standard to clean polish the slice, throat and the upper part of the lip when the paper machine stopped.

(2) The rubber sheet of the lower part of the lip must be replaced when the corrugation occurs.

(3) The edge point of the upper part of the lip shall be polished without fail when the wire is replaced.

6) Table Roll

Due to the gap between the holder brackets and metals, the table rolls vibrate with the shaking of the wire, and the metal of the table roll vibrates right and left, which is undesirable from the viewpoint of the sheet formation. The dry line is not uniform in the cross direction due to the unlevelling roll.

Countermeasure

(1) The brackets should be replaced or modified.

(2) The table roll should be always adjusted correctly.

7) The dandy roll is employed for the purposes of eliminating the difference between the face and back on the paper surface to obtain better formation and of marking on the paper surface by the dandy roll with the mark. If the dandy roll is misused, the formation is deteriorated and for the dandy mark, the mark will not appear clearly.

(2) The dandy roll metal is the open type and touches the wire by its self weight, and so it is important to keep the wire tension constant.

(3) Since the dandy roll is small in diameter (150ϕmm), its revolution is fast, thereby generating a lot of foam.

(4) The dandy effect is not seen since the suction box for the dandy roll is un-functional.

Countermeasure

(1) The diameter of the dandy roll shall be made bigger to 250ϕmm or above.

(2) An antifriction bearing shall be exploited for the dandy roll journal.

(3) The dandy roll stand shall be operated by the one-touch operation by the handle on the operation side.

(4) The suction box for the dandy roll shall be used.

(5) The steam damping used for defoarming shall be standardized when the dandy roll is utilized.

8) Suction Box

(1) The suction box is corroded in parts and has reached the limit of use though some repairs were made.

(2) The suction plate constitutes two slits and its sucking is powerful, causing the bend of the wire. The sucking shall be controlled by the valve, but often produces the sheet break induced by the inadequate operation.

(3) The air causes the sheet break due to the water pressure fluctuation in the side seal water in the suction box.

Countermeasure

(1) The suction plate shall be changed from a three-plate to five-plate type and the bend of the wire shall be prevented to reduce the abrasion of the wire.

(2) The sucking adjustment of the suction box shall be conducted by the adjustment of the prime valve and in addition, individual adjustment shall be performed.

(3) The seal water in the suction box shall be cut off, which consequently saves water. A five-plate system should be adopted with approximately 20 to 30 mm. At both ends having round holes. The width of slit shall be almost the same as that of the slice and the spreaded part of the paper stock shall be sucked in by the round hole.

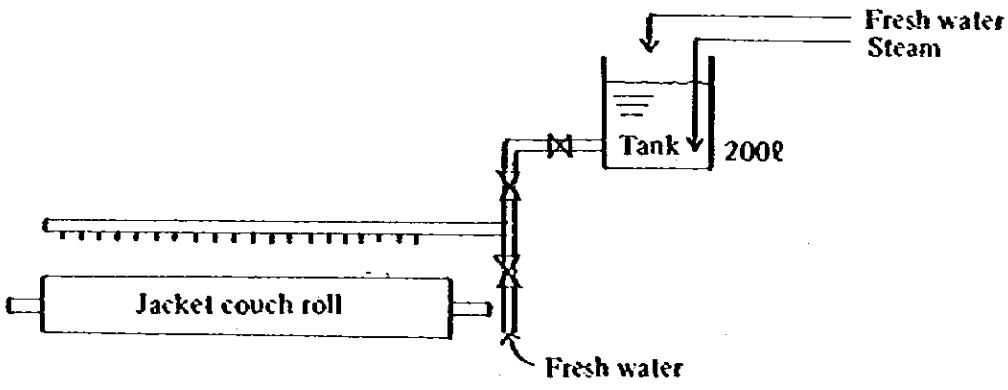
9) Couch Roll

(1) The major problems in connection with the jacket couch roll are the sheet break and the staining by the collapsed holes which is the chief factor that puts the process of the paper machine in disorder including the nonuniformity of dewatering in the cross direction. Such being the case, the control during the operation should be fully executed.

(2) The jacket couch roll, which requires most complete washing in the paper production line, is not equipped with a continuous washing device, thereby reducing the production of paper because prompt washing is impossible at the time of the stain occurrence.

Countermeasures

(1) The tank with a capacity of 200 litter shall be placed higher than the jacket couch roll and steam pipes shall be installed so that jacket will be washed by hot water containing approximately 0.3% of caustic soda (NaOH).



(2) The metal, roll and other parts in the couch roll have been repaired by welding including a spare roll and have reached the limit of usefulness, and as a result, 90% of the sheet break are generated in the couch. This is a main factor of reducing the sheet making efficiency and therefore the couch should be replaced with a suction couch roll. Expected advantages if the above is carried out are:

A. Reduction of the sheet break
B. Reduction of damages of wire caused by the mixing of foreign matter (sand and metal; etc)
C. The reduction of moisture content; reduction of 2 to 3% of moisture content at couch roll correspond 12 to 15% of the dry efficiency in the dry part.
D. The moisture in the cross direction will be made uniform if the staining of the jacket and partial abrasion are eliminated.

10) Wire Guide Roll

(1) The wire guide is operated manually and negligence of supervision of the wire would allow the wire to move too far, come off the width of the edge, producing the leakage of the paper stock and making the edge of paper thin, eventually leading to the sheet break.

(2) An excessive movement of the wire will be liable to damage the edge of the wire and shorten the wire life.

Countermeasure

(1) The adjustment of the wire guide shall be done by appointing a specific person to do the job (ex. wire serviceman) and intensify the supervision.

(2) When the movement of the wire leans to one side, the degree of parallelization between breast roll and couch roll shall be measured.

(3) Attention shall be always paid to the wire stretch and stretch the wire a little tighter than usual.

(4) An automatic guide equipment is desirable if possible.

11) Wire

The wire, if used normally, will stretch little by little and damages will usually occur at the edges. For the wire repair, the threading alone is executed without repairing of holes opened.

Countermeasure

(1) Damages on the wire edge will be eliminated by annealing both edges of the wire about 20 mm. Annealing the edges of the wire shall be performed by the wire manufacturer.

(2) A needle for repairing shall be prepared when the wire is abraded and have holes.

(3) Tools for repairing patches for the wire would be purchased from the wire maker.

12) White Water generated at Wire part.

The white water is discharged outside and back water is used. The lack of white water requires the supply of fresh water.

Countermeasures

The dewatered white water in the suction box shall be recovered into the back water pit.

13) Press Part

(1) A single felt suction box is installed in the press No. 1 and 3, but the sucking power is weak and therefore seems to be not effective.

(2) The nip adjustments in No. 1, 2 and 3 are done separately on the operation and driving sides respectively, producing a lot of trouble in operation.

Countermeasure

(1) Overhanling of the Nash pump and the cleaning of the suction box shall be implemented.

(2) As for the nip adjustment some modification should be made to adjust nip press of both handles at tender and driving sides connected by a torque shaft. Or a passage to the drive side should be mounted to make an easy access to the drive side.

14) Dry Part

(1) A number of paper dust and pieces of broke paper are seen in the vicinity of the dryer doctor and such pieces often drop on to drying web. As a result, this paper dust adhesion and piece of paper deteriorates the appearance of paper quality. Attention should be paid to the prevention of paper dust drops onto paper at the time of sheet production of printing grade.

(2) The difference of tension in the canvas sheet reduces the drying efficiency. The weakness of the stretch generates the difference of nonuniform moisture in the cross direction and machine direction.

Countenneasure

(1) The paper dust on the dryer will be reduced by the temperature adjustment of the dryer, however, will not be eliminated entirely, and accordingly, the dust shall be cleaned during downtime for changeover of grades, and at the time of sheet break.

(2) It is important to adjust the tension of the canvas sheet to keep it constant. The weight of the automatic stretch should be controlled so as not to touch the floor.

15) Drive

The speed change of the drive of PM 1 is to be performed by a huge cone pulley and draw shall be adjusted by a small-sized cone pulley at each section.

The further speed up will not be expected by the belt driven type and its control will be difficult. The clutch has become worn out and is causing trouble. The Lecion belt is mainly used for belt, constituting leather partially. The lack of a spare belt makes it impossible to cope with the situation in emergency.

Countermeasure

(1) The spare belt must be prepared since the Lecicon belt requires a lot of time for coupling.

(2) The belt must be remodeled into the sectional driven type and the improvement in efficiency must be aimed at.

16) Reel Part

The quality shall be decided at the time of reeling on the spool at the reel part. The control of the basis weight alone shall not be enough to control the quality and the improvement of measurement items in the reel is necessary to maintain the constant quality in the cross direction and machine direction.

Countermeasure

(1) As measuring Items

Basis weight measurement:	Cross direction 6 places
Thickness measurement:	Cross direction 12 places
Moisture measurement:	Cross direction 6 places

Unless the above items are measured and controlled at the jobsite, the quality may not be controlled or maintained.

17) Intensification of Quality Control

The control job shall be conducted to observe the state of paper during its production on the machine, inspect and strive to detect abnormalities promptely. Since the control and inspection largely affect the efficiency in the sheet production, it is important to intensify the supervision.

(1) Paper Inspection

The paper shall be inspected at the time for changeover of reels. The sheet formation of an area of about 5 to 7 m^2 and existence of impurities shall be inspected and the number of the impurities of 0.5 mm^2 or above shall be examined and then the impurities shall be analized for taking countermeasures.

(2) Inspection

When holes are found in the paper, examine exactly the abnormalities of clothing materials or holes by the staining and take a proper measure promptly.

(3) Inspection of Sheet Formation

The condition of the stream of paper shall be regularly grasped from under the paper before the reel and three times of inspection during one reel shall be made, which must be standardized.

(4) Contact in Emergency

Refer to the Delivery Slip for reel Table 6-4-4.

To transmit correctly the status of the paper of each reel (hole, impurities and number of times of the sheet break) to the subsequent process, the Delivery Slip (temporary) shall be prepared and contact shall be made closely to facilitate the following process such as selection of defective paper as well as to reduce the sorting labor.

The contact in emergency has not been yet made in connection with the reel presently and therefore the status of the paper manufactured is not made clear in the cross direction and machine direction.

(5) Control of Standard Sample

Standard samples shall be prepared for the production of colored paper and tone of colour shall be matched. In addition, the fluorescent lamp for identifying colors shall be installed in the sheet production room. The standard samples shall be kept in a dark room and replaced periodically.

Table 6-4-1 Daily Production Reeling & Finishing Yield by Major Paper Brands

No.	Brand	Basis weight g/m²	Operation speed m/min	Production on reel kg	Yield %	
					Paper machine	Finishing
1	Kertas W. Mark	70	46	9.0	80	81
1	HVS P. Copy	80	46	9.6	81	80
1	Reform	120	32	9.6	87	84
1	Post wesel	175	22	9.0	84	88
1	Kartu post	175	22	9.0	84	88
1	SPR	80	40	7.5	82	82
1	Mail zegel	80	30	6.6	90	80
1	STTB	130	20	6.0	86	50
1	Omslag	110	–	–	–	–
1	Banderol	60	62	8.4	84	87
1	Cyclostyle	69	65	10.5	84	93
2	Banderol	60	–	–	–	–
2	Cyclostyle	69	–	–	–	–
2	Doorslag	28	68	4.8	82	80
2	Corona	37	70	4.4	82	82
3	Eagle	24	120	–	–	–
3	Golden bird	25	140	–	–	–
3	Silver bird	25	140	–	–	–

Table 6-4-2 Quality Standards of the Padalarang Products

Item / Brand		Basis Weight	Thickness	Ash Content	Moist. Content	Tensile Strength		Elongation		Opacity	Brightness	Air Permeability	Smoothness		Sizing Degree	Tearing Strength	
						MD	CD	MD	CD				MD	CD		MD	CD
		g/m²	1/1000mm	%	%	kg	kg	%	%	%	%	Sec/100cc	Sec/100cc	Sec/100cc	Sec	g	g
1	Kertas W. Mark	70	70±3	90±10	8±0.5	Min. 7	Min. 4.5	Min. 2.2			Min. 90	91±1		Min 17	Min 13	Min. 9	Min. 40	Min. 48
1	HVS Copy	80	80±3	105±10	6 – 7	Min 7					Min 90	88±0.5		Min. 9	Min 8	Min. 10	Min. 48	Min. 67
1	Reform	120	120±5	182 b5	Min 5	Min 6.2	Min. 5.3				Min. 96	86±1.0	Min. 26	Min. 3	Min. 2	200 Up	Min. 95	Min. 120
1	Post Wesel	175	175	230±9			Min. 11.0		Min. 2.4		100 Up		Min. 66	Min. 12	Min. 9	200 Up	Min. 153	Min. 178
1	Kartu Post	175	175	249±6			Min. 9.6		Min. 1.7		100 Up		Min. 62			200 Up	Min. 176	Min. 221
1	SPR	80	80±4	90±10		10	Min. 8.5±5%	5.0±15%			Min. 85	82.5		20 b2			Min. 100	125
1	STTB	130	130±4	150±10		10	Min 12±15%	7.0±15%			Min. 90	81.0±2		19 b1			Min. 100	125
1	Omslag	110	110±5	149±5			Min. 3.9		Min. 1.3		Min. 97		Min. 19	Min. 11	Min. 8.5			
1	Banderol	60	60±3	70±10		10	Min. 4±15%	25±15%			Min. 85	70 – 72				Min. 163	Min. 92	Min. 107
1	Cyclostyle	69	69±3	113±2	Min. 6.3	Min. 6.4	Min. 3.4		Min. 2.0		Min. 91	79±0.5	Min. 23	Min. 6.5	Min. 4.7		45±15%	52±15%
2	Doorslag	28	27±8%	47±2	4.5±0.3	Min. 7	Min. 1.5		Min. 1.7		Min. 64	86±1	Min. 26	Min. 18	Min. 11	Min. 29	Min. 48	Min. 59
2	Corona	37	37±1	55±5	6.0±1		Min. 2.2		Min. 2.0		Min. 78	88±1	Min. 30	Min. 20	Min. 14	Min. 0.6		
3	Eagle	24	24–25.5	38±2	17±1	5 – 6	0.9 – 1.0	0.4 – 0.5	1.8 – 2.3	4.0 – 5.5	Min. 80.5	93±1	100–120			Min. 4		
3	Golden Bird	25	25–25.5	37±3	15±1	5 – 6	0.85–1.2		1.3 – 2.6		79±3	89±1	Min. 60					
3	Silver bird	25	25–25.5	37±3	12 – 15	5 – 6	0.9 – 1.2		1.7 – 2.6		77±3	89±1	Min. 50					

Table 6-4-3 Performance Analysis Data of PM1 Actual Operation

Date	Brand	Basis weight	Operation speed	Paper width on reel	Production on reel	Theoretical production on reel	Operation hour			Sheet making efficiency	Remarks
							Sheet making	Sheet breaks	operation stop		
		g/m²	m/min	mm	kg	kg	min	min	min	%	
3/2	Reform	120	30	2,060	10,540	16,660	1,440	16		98.9	
3	Reform	120	30	2,060	9,650	16,660	1,440	136		90.6	
4	HV Offset	60	60	1,900	7,890	9,850	1,440	288		80.0	
5	HV Offset	60	60	1,900	6,720	9,620	1,415	427	25	69.8	
6	HV Offset	60	60	1,900	9,090	2,520	1,440	147		89.9	Cleaned wire part
7	Kraft coklat	65	51	2,150	9,570	10,120	1,375	26	65	98.1	Cleaned wire part
8	Cyclo style	70	60	2,100	10,140	12,670	1,440	288		80.0	
9	Cyclo style		60	2,100	10,020	12,320	1,440	261	40	81.2	
10	Cyclo style		60	2,100	6,620	8,090	1,065	193	375	81.9	Mechanical breakdown
11	Cyclo style		60	2,100	9,010	10,940	1,440	254		82.4	
12	Cyclo style		60	2,100	2,050	3,090	435	146	1,005	66.4	Wire cloth breakage and change
13											Wire cloth, down and change
14											Wire cloth, down and change
15											Wire cloth, down and change
16											Wire cloth, down and change
17											Wire cloth, down and change
18											Wire cloth, down and change
19											Wire cloth, down and change
20	Banderol	60	55	2,060	5,430	6,528	960	161	480	83.2	Agitator damaged at machine chest
21	Banderol	60	55	2,060	5,730	6,444	1,260	135	180	83.2	Cleaned press part
22	Mail zegel	80	30	2,100	6,900	7,200	1,440	60		95.8	
							Total	2,538		84.82	

Table 6-4-4 Reel Delivery Slip

Example of filling up

Person in charge of machine	Brand					g/m²	Reel No.		
	Date	Time	Basic Weight g/m²	Moisture Content %	Trim Width mm		Q'ty of gross production		
	Remarks						Impurities	Size m	Q'ty
								0.3	
								0.5	
	Basic weight g/m²	1	2	3	4	5	6	x	R
	Thickness μ	1/2	3/4	5/6	7/8	9/10	11/12	x	R
	Moisture contents %	1	2	3	4	5	6	x	R
Person in charge of cutter	Remarks								

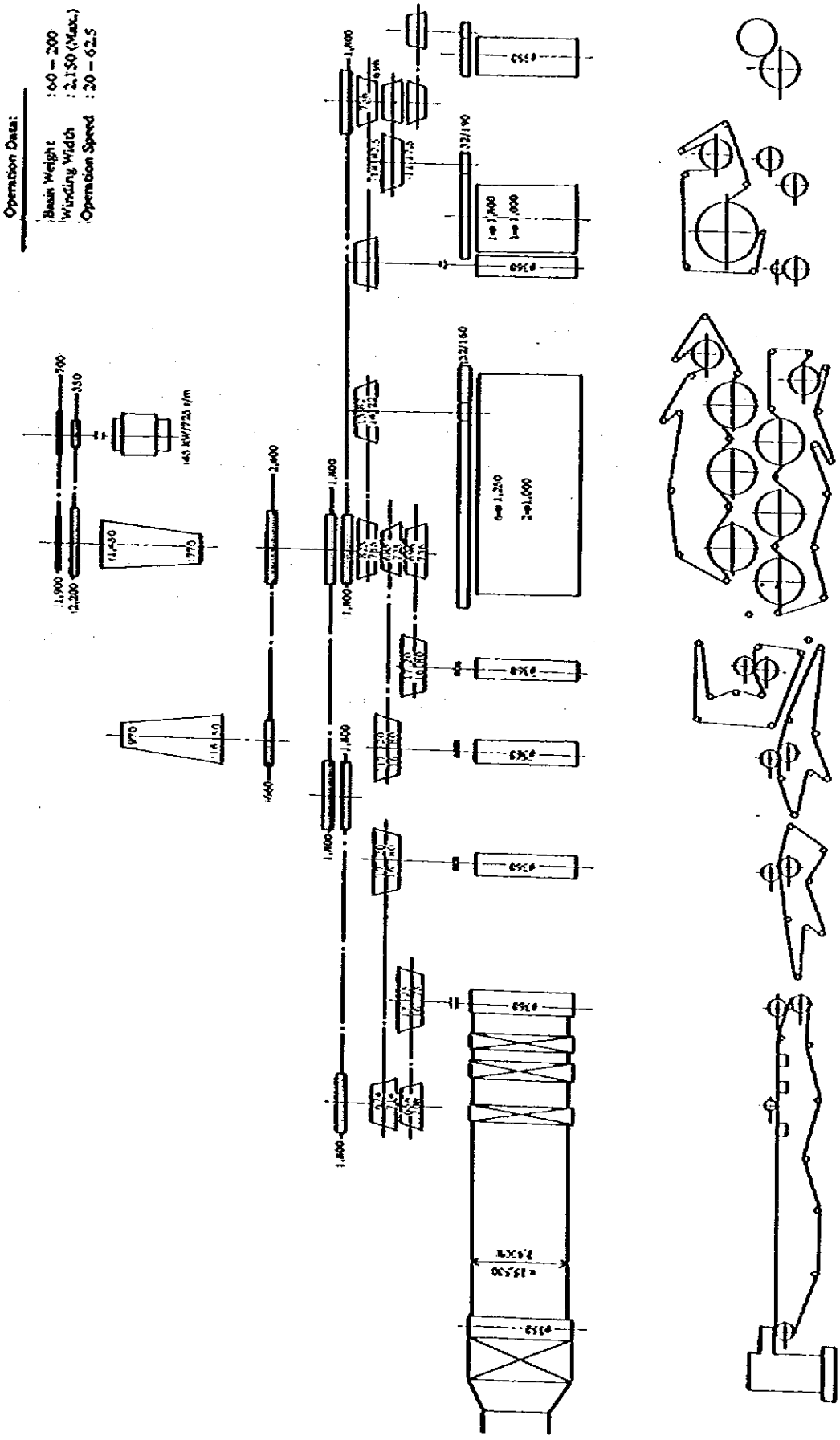


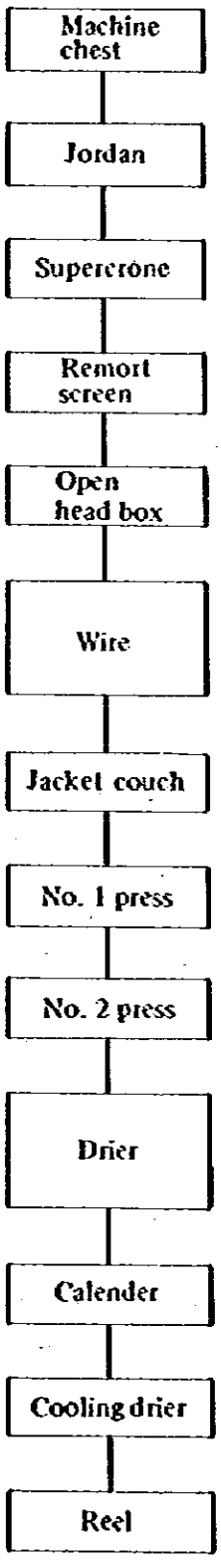
Fig. 6-4-1 PM 1 Outline of Existing Driving System

6-5 Unit I, Section PM 2

Ever since first being put into operation in 1938, the No. 2 paper machine (PM 2) has kept operations, with partial modifications made on it. However, the equipment has become slightly obsolete; hence, operating efficiency and the quality of the products have dropped. Since the main grades of paper manufactured are thin papers, the sheet breaks occur frequently, thus reducing the efficiency of production. The major cause of the sheet breaks is frequent contamination of the stock with foreign matter (sand, grit, etc.) and consequent stains of the dandy roll and jacket couch roll. Even when sheet breaks do not occur, the sheet manufactured contains many pin holes and dirts caused by foreign matter; hence, the finished paper is not regarded as a high quality product, and thus possesses a poor commodity value.

A paper machine should be capable of producing paper of good quality, provided that no mechanical malfunctions or defectiveness of supplies exist. Thus, it is no exaggeration to assert that the productivity of a paper machine depends upon the paper stock used. Paper production can be stabilized and quality and efficiency can be increased by striving for increased awareness of the role of stock to be received and by seeking improvement in the quality of the stock through accurate feedback between the departments concerned; such efforts are required for securing a stable supply of the stock in good quality.

6-5-1 Equipment, machinery and its flow diagram



Machine chest	2 units	20 m³ X 2
Jordan	1 unit	45 kW
Supercrone	1 unit	2000K
Remort screen	1 unit	Model PS400
Open head box		Width 2,150 mm
Wire		75 mesh, 2,250 mm x 16,000 mm
Jacket couch		360 ϕ
No. 1 press		360 ϕ
No. 2 press		360 ϕ
Drier	8 units 1unit 5 units	1,250 ϕ 1,800 ϕ 1,000 ϕ
Calender		3 stages
Cooling drier	2 units	
Reel		Single surface reel

6-5-2 Personnel

4 operators x 3 shifts 4 groups

6-5-3 Operating Conditions

1) Operating standards (standards for manifold paper)

Refer to Table No. 6-4-1 and -2 in appended document.

Trim width on reel	1,900 mm
Speed	68 m/min
Basis weight	28 g/m²
Daily production	4.8 ADt/d
Reeling yield	82%

2) Actual circumstances at present

Paper grade	Manifold paper
Basis weight	28 g/m²
Speed	44 – 70 m/min (average 66.86 m/min)
Daily production	1,080 – 4,630 kg/D (average 3,599 kg/D)
Sheet making efficiency	60.84 – 94.02% (average 75.12%)
Downtime	1.0 – 9.38 h (average 5.45 h)
Operating efficiency	92.9% (March 2 – 22, 1984)

Results of paper surface examination: Number of pin holes 6.6 holes/m², containing numberless foreign matter and dirts

As mentioned above, both the operating efficiency and the sheet making efficiency are low, and the sheet breaks due to contamination of the stock by foreign matter constitutes the primary cause of decreased sheet making efficiency. According to the results of paper surface examination, pin holes are very numerous, i.e., 6.6 holes/m², moreover, numberless foreign matter and dirts are seen, resulting in marked deterioration of visual quality value.

6-5-4 Problems of Equipment and Operation and Appropriate Countermeasures

The sheet breaks accounted for most of the downtime (an average of 5.45 h/d) pulp stock by foreign matter and the staining of the dandy roll and jacket couch due to the mixing of oil leaking from the metal parts into the pulp stock by way of the circulating white water, since frequent lubrication of the rotating parts is required due to the obsolescence of the equipment. The dust collector is also inadequate and its manner of employment is inappropriate. Therefore, the equipment should be improved accordingly, and measures for preventing contamination by foreign matter should be drawn up and implemented at each stage of the production process, starting from the stock preparation section.

1) Machine approach

(1) The machine chest capacity of the 2 units is 40 m^3, equivalent to BD 1,400 kg in quantity of paper stock. With respect to paper production, this quantity is equivalent to a retention of about six hours. Since the paper stock circulates in the cycle consisting of the machine chest, Jordan, stuff box and machine chest, in that order, and a part of the stock passes through the Jordan again, the freeness of the paper stock in the chest fluctuated, resulting in dewatering fluctuation on the wire.

(2) Since a consistency regulator is not incorporated, variations in consistency of the pulp stock supplied from the beater constitute a direct cause of fluctuations in basis weight.

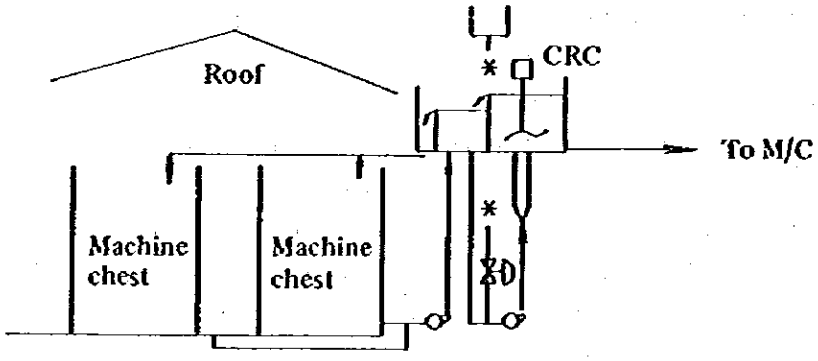
Countermeasures

(1) Pulp stock received at the machine chest, which has been completely and thoroughly prepared at the stock preparation room, should be used as it is and the Jordan should not be used.

(2) A consistency regulator should be installed in the regulating box in order to prevent fluctuations in basis weight.

(3) A roof should be installed over the machine chest, which is of the open type, to prevent contamination by dust and foreign matter.

(Improvement Plan)



2) Dust removal

Dust is removed by means of a Supercrone and Ramort screen; however, since rejects are not discharged, foreign matter remains in the Ramort screen and is also caught in the scraping foil, thus abrading the backet.

Countermeasures

(1) Same as countermeasures for PM 1 approach flow, aimed at the improvement of dust removing efficiency.

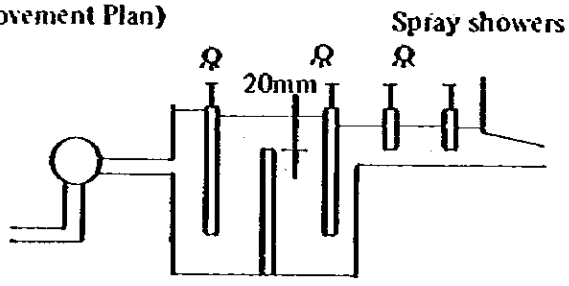
3) Head box

Scale adheres to the inside of the head box, and sludges adhere to the upper surface, resulting in a flow of sludges. Defoaming spray showers are few in number, and adhesion of floating sludges to the flow regulating vane is observed.

Countermeasures

(1) Spray showers should be installed additionally for defoaming and preventing the adhesion of floating sludges.

(Improvement Plan)



(2) The inside of the head box should be carefully cleaned during the period when the machine is stopped.

(3) Adhesions of scale should be washed away by applying a 1.5 to 2% sodium hydroxide solution.

4) Wire part

Due to the gap between the table rolls and brackets, the table rolls vibrates in conjunction with the shaking of the wire. Consequently, the paper stock on the wire jumps, thus destroying the sheet formation.

Countermeasures

(1) The clearance between the bracket and metal of the table rolls should be removed. Rolls in which a gap occurs should be repaired together with the bracket, when the wire is replaced.

5) Dandy roll

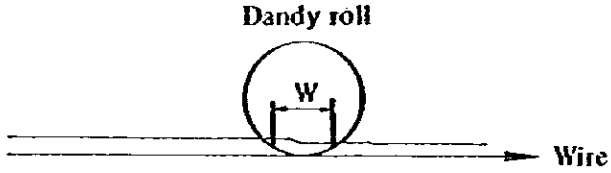
(1) A suction box is not installed below the dandy roll, and the dry line ends before reaching the dandy roll. Under the present arrangement, the use of the dandy roll has no effect.

(2) If the paper stock is of inferior quality, the use of the dandy roll frequently causes lowering of efficiency, and its use is of little advantage; in particular, it tends to create excessive operational troubles during the production of manifold paper in 28 g/m^2.

Countermeasures

(1) The standards for use of the dandy roll should be determined according to the grades of paper to be made. Moreover, the quality of the paper stock must be carefully examined before the dandy roll is used.

(2) An appropriate width of water inside the dandy roll consitutes a prerequisite condition for its effective use. The dry line should be adjusted so as to satisfy this condition.



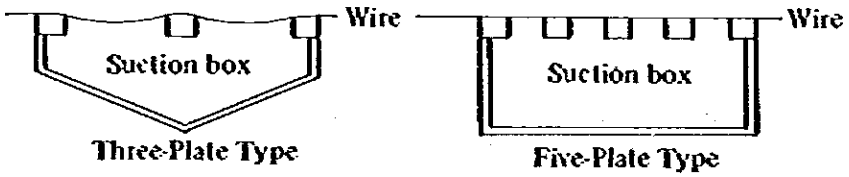
6) Suction box

(1) The suction box is extremely obsolete and corroded, and has reached the limit of its usefulness. The wire has a bend and, thus, abrasion is rapid, since suction is performed by three suction plates.

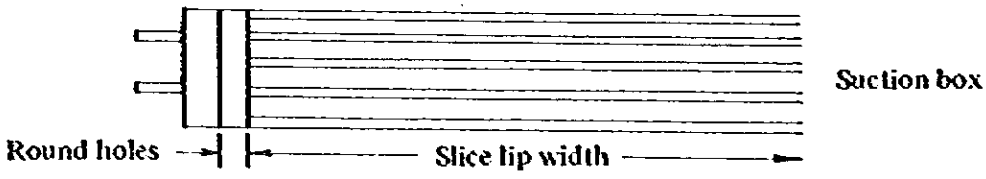
(2) The sides of the suction box are sealed by seal water; however, air is sucked in due to fluctuations in the quantity of water.

Countermeasures

(1) The suction box should be changed from a three-plate to a five-plate type, in order to prevent the bend of the wire and reduce the wear of water.



(2) The width of slit should be almost the same as that of the slice lip. Both sides should be about 20 to 30 mm, with holes 13 mm in diameter. The spreaded part of the paper stock should be sucked in by the hole portion.



7) Jacket couch roll

The major problems connected with the jacket couch roll are the sheet breaks and the formation of holes due to the staining of the jacket, and also moisture variation specks in the cross direction caused by the stained jacket. These problems particularly require the strengthening of process control. The proper or improper jacket roll control has a great bearing upon the efficiency of the paper machine; therefore, it is important that the fitting of the jacket be made as tight as possible. Poor fitting of the jacket to the roll will cause rubbing and depilation of the jacket, resulting in dehydration spots and nonuniform moisture distribution in the cross direction. This brings differences in the thickness of paper at the Pope reel and results in reduced efficiency of the finishing operation on the cutter.

Countermeasures

(1) The inside of the jacket should be adequately singed before setting, and care should be taken in the way of setting the jacket, since depilation can result from even a slight looseness.

(2) Since a continuous washing device is not installed, prompt washing at the time when the stain occurs is impossible. This constitutes a cause of reduced sheet making efficiency.

(3) Since the roll is obsolete and has reached the limit of its usefulness (as in the case of PM 1), the change to a suction couch is necessary.

8) Press

Dewatering by the No. 2 press is not uniform in the cross direction.

Countermeasures

The press roll should be re-ground at least once every six months. Appropriate measures, at the early possible stages in the manufacturing process, are required prior to taking place of moisture variation in the paper.

9) Drier part

Pieces of the broke remain in the doctors of the driers. Also, such pieces sometimes drop on the web as a result of static electricity in the canvas, thereby causing the sheet breaks.

Countermeasures

Pieces of the broke adhering to the canvas and paper dusts on the doctors should be removed without fail during downtime for changeover of grades and whenever the sheet breaks occur.

10) Reel part

The reel part is most important in determining the quality of the paper. It is important to strengthen watching work as a means of quality control in order to reduce troubles in and increase the efficiency of the finishing process. Adequate control should be effected with respect to three points, i.e., basis weight, thickness and the moisture distribution in the cross direction. Special care should be taken to effect proper control of the basis weight in both cross and machine directions, since inadequate control of basis weight may result in a weight loss of the product and low total yield.

Countermeasures

(1) Process control should be effected in the same manner as for PM 1.

(2) Ten spool rolls, common to PM 1 and 2, should be provided.

11) Drive (Refer to the Fig. 6-5-1 attached.)

The paper machine has a robust construction and can be operated up to about 150 m/min., but the operation rate is held low because of the latest problems such as wear of the drive part and the lack of horse power of the motor.

(Countermeasures)

In order to supplement the lack of the starting torque of the driving motor and to provide the foundation for the increased production capability, it is necessary to adopt DC motor for driving the existing line shaft.

6-5-5 Operating Characteristic of Both PM by Producing of Banderol 60 g/m²

(1) On March 21, 1984, Banderol 60g was made with PM 1 and PM 2 and the characteristics were compared.

Item \ Paper machine		PM 1	PM 2
Operating speed	m/min.	50	50 – 60
Basis Weight	g/m²	$\bar{x}$ 60.44 MAX 61.02 MIN 59.98	$\bar{x}$ 56.53 MAX 62.27 MIN 52.66
Thickness	1/1,000 mm	$\bar{x}$ 85.00 MAX 88.4 MIN 80.0	$\bar{x}$ 76.93 MAX 82.0 MIN 72.8
Density	g/cm³	$\bar{x}$ 1.4	$\bar{x}$ 1.36
Total amount of pulp stock	BD kg	3,240	2,160
Production	BD kg	2,620	1,780
Reeling yield	BD/BD %	80.86	82.41
Sheet making efficiency	BD/BD %	87.55	72.27
Moisture content on reel	%	$\bar{x}$ 6.25	$\bar{x}$ 5.13
Draw rate	%	7.2	5.5
Shrinkage	%	4.25	3.14
Refiner outlet freeness	cc	$\bar{x}$ 252 MAX 260 MIN 250	$\bar{x}$ 226 MAX 270 MIN 180
Cons. of white water (Fiber + ash)	%	$\bar{x}$ 0.042	$\bar{x}$ 0.012

Consideration

1. As for Basis Weight

   It is stable with PM 1, but it fluctuates so much with PM 2 that it is out of the standard value 60g ± 3g and there is also a quality problem.

   Especially thick paper should not be produced for PM 2 depending on the brand.

2. Sheet making efficiency

   Both PM 1 and PM 2 are not efficient, and especially PM 2 has an interior value as 72.27%.

   Unfamiliarity with the thick paper by PM 2 is one reason, but from the viewpoint of sheet breaking rate, there may be trouble of clothing materials.

3. Reeling yield

   It remains a question that PM 1 shows the yield of 80.86%, about 2% lower than the PM 2 which has higher sheet breaking rate. (White water cons. for PM 1 is 0.03% higher than that for PM 2 which will require another analysis.)

(2) Comparison of operating characteristics between paper machines for Banderol 60g

The comparison of operating characteristics was made by producing Banderol 60g with PM 1 and PM 2 on March 21, 1983.

Item \ Characteristics	Wet sheet dryness %		Operating speed m/min.		Paper width mm	
	PM 1	PM 2	PM 1	PM 2	PM 1	PM 2
Flow box	0.677	0.713				
Jacket couch	15.47	22.0	51.0	52.0	2,210	1,910
No. 1 press	28.33	32.27	52.0	53.0	2,200	1,900
No. 2 press	33.50	36.96	53.0	54.0	2,190	1,900
No. 3 press	35.20		53.6		2,180	
No. 1 dryer	38.41	38.23	54.0	54.8		
No. 3 dryer	48.14	47.43				
No. 5 dryer	77.07	63.10				
No. 7 dryer	95.49	87.97	54.5			
No. 9 dryer		97.07		56.0		
Pope reel	93.75	94.87	55.0	55.0	2,110	1,850
Draw %			7%	5%		
Shrinkage %					4.52	3.14

Consideration

1. Draw

   There is no sheet breaks due to the draw difference and 2% difference between the two machines does not pose any special problem.

2. Wet sheet dryness

   The wet sheet dryness at couch outlet for PM 1 is 6.5% lower than that of PM 2 probably because the wire length of PM 1 is 500mm shorter.

   For the press part of PM 1 which consists of 3 stage press part, the wet sheet dryness is 1.8% lower than PM 2. The cause may be the contamination of the press felt.

3. Shrinkage

   PM 1 has higher shrinkage probably because the dewatering of the press part is mild.

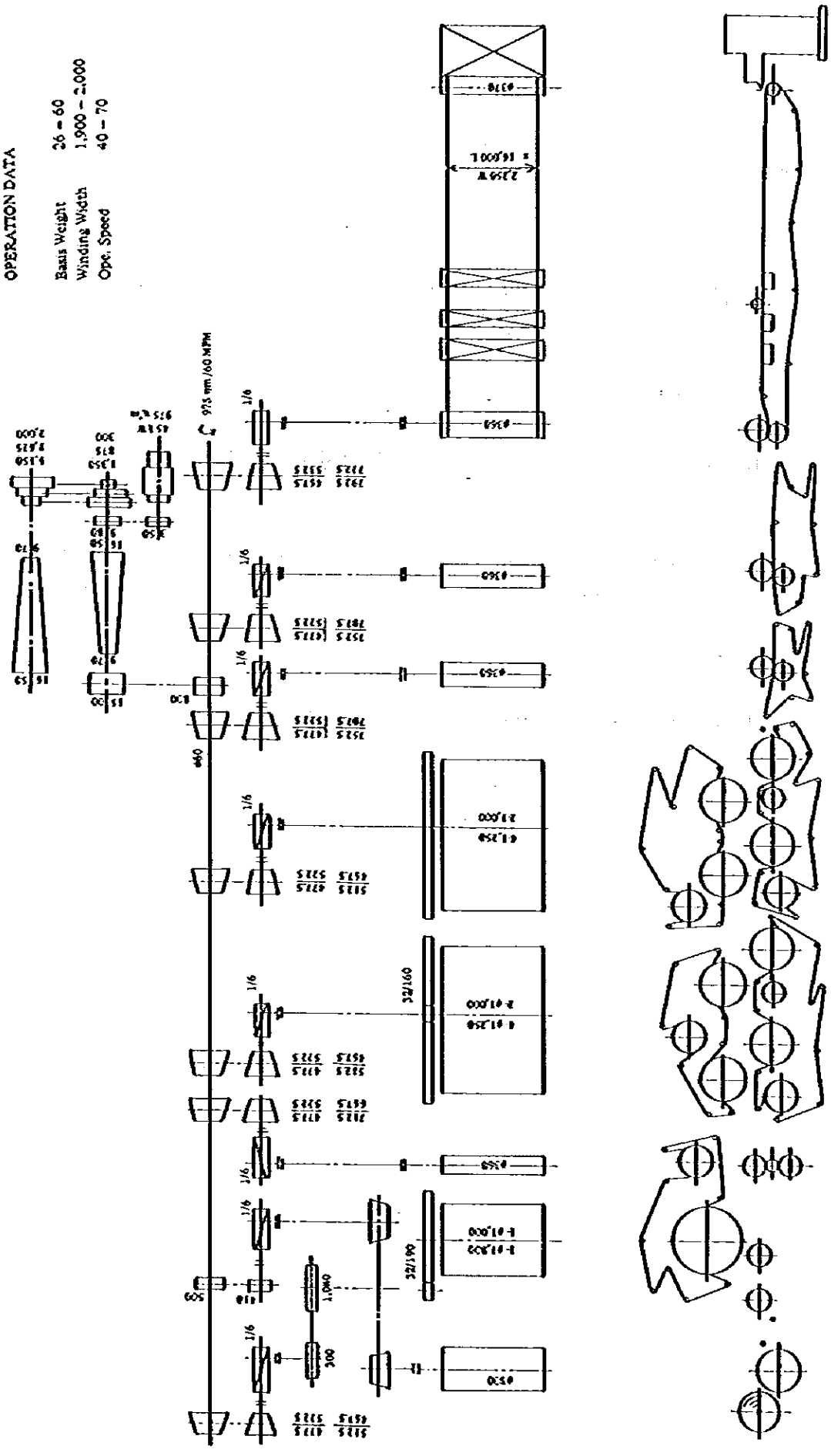


Fig. 6-5-1 PM2 Outline of Existing Driving System

Table 6-5-1 Performance Analysis Data of PM 2 Actual Operation

Date	Brand	Basis weight g/m²	Operation speed m/min	Paper width on reel mm	Production on reel kg	Theoretical production reel kg	Operation Hour			Sheet making Efficiency %	Remarks
							Sheet making min	Sheet Breaks min	Operation stop min		
3/2	DOORSLAG WAXNA	28	60	1,910	3,440	4,608	1,440	365		74.65	
3	DOORSLAG warna	28	68	1,910	3,960	5,237	1,440	340		76.39	
4	DOORSLAG warna	28	68	1,910	3,520	5,237	1,440	462		67.92	
5	DOORSLAG warna	28	64	1,910	2,550	3,675	1,050	321	390	69.43	Cleaned Ware Part
6	DOORSLAG warna	28	70	1,910	3,720	5,391	1,440	452		68.61	
7	DOORSLAG warna	28	70	1,910	4,060	5,391	1,440	360		75.0	
8	DOORSLAG warna	28	44	1,910	1,080	1,224	510	60	930	88.24	Redair wire change & mechanical
9	DOORSLAG warna	28	60	1,910	2,900	4,176	1,305	399	135	69.43	Clutch down
10	DOORSLAG warna	28	70	1,910	2,700	4,440	1,200	470	240	60.83	Change jacket couch roll
11	DOORSLAG warna	28	70	1,910	4,120	4,440	1,440	86		94.03	
12	DOORSLAG warna	28	68	1,910	4,110	5,237	1,440	313		78.26	
13	DOORSLAG warna	28	70	1,910	4,630	5,391	1,440	206		85.69	
14	DOORSLAG warna	28	70	1,910	4,250	5,391	1,440	308		78.61	
15	DOORSLAG warna	28	72	1,910	4,500	5,545	1,440	268		81.39	
16	DOORSLAG warna	28	72	1,910	4,400	5,545	1,440	294		79.58	
17	DOORSLAG warna	28	72	1,910	3,350	5,545	1,440	563		60.90	
18	DOORSLAG warna	28	72	1,910	3,740	5,545	1,440	463		67.85	
19	DOORSLAG warna	28	72	1,910	4,160	5,545	1,440	355		75.35	
20	DOORSLAG warna	28	72	1,910		468	120		240	-	* Cleaned ware part
	BANDEROL	60	55	1,910	3,800	6,350	1,008	405	72	-	So much sheet breaks one to
21	BANDEROL	60	55	1,910		977	155		145	-	Stained jacket couch rool
	DOORSLAG	28	60	1,910		3,608	1,140				Cleaned wire part
22	DOORSLAG		60	1,910	3,190	3,608	1,440	131			
							Total	6,621		73.12	

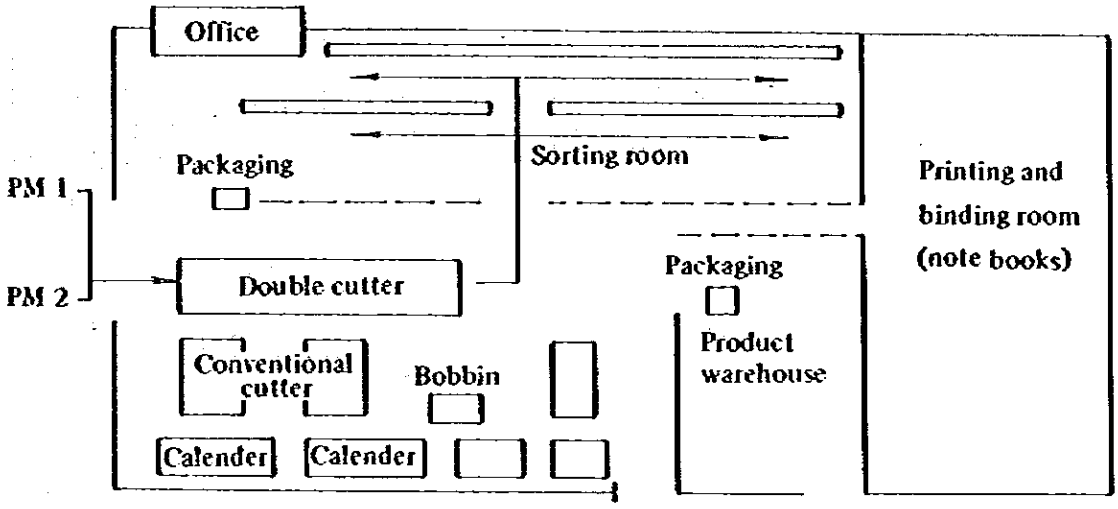
6-6 Unit I Finishing Plant

Here, the equipment still remains as it was when operations were initiated in 1924. A double cutter, which was newly introduced in 1975, is working full time on a three-shift basis and handles products of both PM 1 and PM 2, most of which are in sheet.

The layout and working efficiency are poor, one reason being that the new cutter was installed in the compound of old facilities. The area in the vicinity of the cutter is especially untidy and inappropriate from the aspect of dry broke treatment. The rejected paper (broke to be recycled) from the double cutter is spread in front of a reel stand, and is frequently treaded upon with shoes, since no other passageway is available. The product warehouse and the job site are located in the same place, resulting in reduced working efficiency due to restrictions of space. First of all, the streamlining of the job site requires the establishment of a proper passageway. Packed products should be stored in a separately built warehouse. Old equipment which is not to be used should be removed as far as possible in order to enlarge the available working space. As regards the finishing section, appropriate countermeasures to solve these problems should be implemented immediately. It is hoped that all of the operators should develop increased awareness of the importance of the products to be sold in the market. It is also necessary to possess due confidence in the quality of the products manufactured and to have colored labels on the wrapper made larger so that they can be adequately distinguished at a distance.

6-6-1 Operating Conditions

Schematic Drawing of Finishing Room



1) Machine jumbo rolls are cut by means of a newly installed double cutter and sent to the sorting room, whereupon they are sorted, wrapped, packaged, and then stored in the warehouse. The newly installed double cutter is working full-time on a three-shift basis, and the flow up to the cutter is comperatively smooth. However, the part of the area between the sorting room and the machine room is used as storage space for unfinished and partially finished products (already sorted), just barely allowing the passage of the hand-lift truck. In particular, the rejects from the cutter are stored around the cutter and block the passageway. The product warehouse is narrow and packaged products are stacked in five or six layers, thus hindering packaging work. Among the old items of equipment, although the calenders and bobbin slitter are sometimes employed for finishing the products in a roll form, the old cutters are seldom operated.

2) Status of cutter operation

(1) MANIFOLD 28 g

Reel No.	Accepted weight kg	Machine Trim mm	Cutter trim mm	Trimming %	Number of joints per reel (number of occurrence)
58	320	1,914	1,820	4.9	31
59	270	1,931	1,820	5.7	14
60	330	1,911	1,820	4.8	10
61	125	1,912	1,820	4.8	8
64	270	1,960	1,820	4.2	20
65	280	1,895	1,820	3.9	14
Total	1,595				97
$\bar{x}$		$\bar{x}$ 1,910		$\bar{x}$ 4.7	

(2) Finished state

Input to the cutter	1,595 kg
Trimming loss	75 kg
Net quantity cut	1,520 kg
Reject from the cutter	95 kg
Quantity sent for inspection	1,425 kg
Reject occurring at inspection	252 kg
Quantity of finished products	1,173 kg

(3) Finishing yield 77.2%

The sheet breaks on the machine constitutes the major cause of reduced finishing yield.

6-6-2 Equipment and Operation Problems

1) At present, cutter operation, packaging and storing of the products are done in the same area of the finishing room. Consequently, a proper passageway cannot be maintained, hence the handling of semi finished products is difficult, and the finishing room is in an extremely disorderly condition.

Countermeasures

(Refer to the attached Dwg. AP 7-6.)

The floor of the finishing room should be radically improved by constructing a separate product warehouse and removing old unused equipment in order to maintain an adequate passageway and facilitate handling operations.

2) Double cutter

This cutter entails no problems as an equipment itself, but does present a minor problem from the viewpoint of mechanical management. Loosened screws of the air bleed roll at the cutter inlet result in a depression in the center of the roll, causing creases to the paper.

Countermeasures

The set screws of the bleed roll should be tightened periodically. Any depression in the center of the roll should be rectified by periodicaly flat finishing of the wodden roll surface to prevent generation of creases in the paper.

3) Deformation problems (adjustment of squareness of cutting section)

The occurrence of a deformed cutting with the cutter constitutes an operational problem.

Countermeasures

Non-squareness of the cutting section results from differences in the dimensions of the paper between the pinch roll exit and the fixed blade of the cutter; care should

be taken to avoid the adherence of slips of paper to the slide plate. Reels which have comparatively less joints should be selected and installed, especially for lower stage reels for unreeling.

4) Sorting and inspection in the finishing process

Finishing inspection constitutes the final stage of the production process and must be executed with due care. The finished products determine the prestige of the factory, and therefore the increase or decrease of demand for the products depends upon the thoroughness of the inspections carried out by this section. The responsibility of this section is of great importance by virtue of its functions of accurate inspection, assessment of the cause of failures, and appropriate feedback to the preceeding processes. Therefore, sorting standards should be determined according to the grades manufactured, and precise inspections should be performed.

5) Handling of rejects for recycling

The handling of the rejects is unsatisfactory, resulting in frequent contamination by foreign matter. For example, broke is carried to the pulper by dragging it over the floor, hence dust and foreign matter adheres to the broke. Even the rejects constitute a usable material for re-pulping. Thus, poor handling of broke causes troubles in paper production, and therefore careful handling is absolutely necessary.

Countermeasures

(1) The floor of the job site should be cleaned twice daily, i.e., before the starting of operations in the morning and afternoon.

(2) Rejects should be classified into two groups, namely, those for recycling and the others to be thrown way (stained with oil, etc.). The two groups should be adequately distinguished and handled accordingly; the re-usable rejects should be transported to the pulper in packages containing a fixed quantity (15 – 20 kg), using a packing baler.

6) Measures for improvement of finishing room

(1) Idle equipment should be removed and adequate work space should be allocated for the bobbin slitter, etc.

(2) Construction of additional product warehouse

The present space used for the packaging work and also for the storage of the products is too narrow. When the amount of stock increases, the area originally allocated for sorting and cutter operation becomes a storage space for partially finished products, and even the maintenance of a proper passageway becomes difficult. Therefore, a separate product warehouse should be constructed and the present warehouse should be used as temporary storage space for packaged products.

(3) Maintenance passageway

A passageway at least about 2 m wide should be maintained and properly marked with signs to facilitate the passage of carrier vehicles.

(4) Pavement finishing of floor

The stone paved floor surface originally built during the period of Dutch influence is extremely uneven and irregular and is, therefore, most unsuitable for product transportation and floor cleaning. Therefore, the floor should be properly paved to improve the functioning of the finishing room.

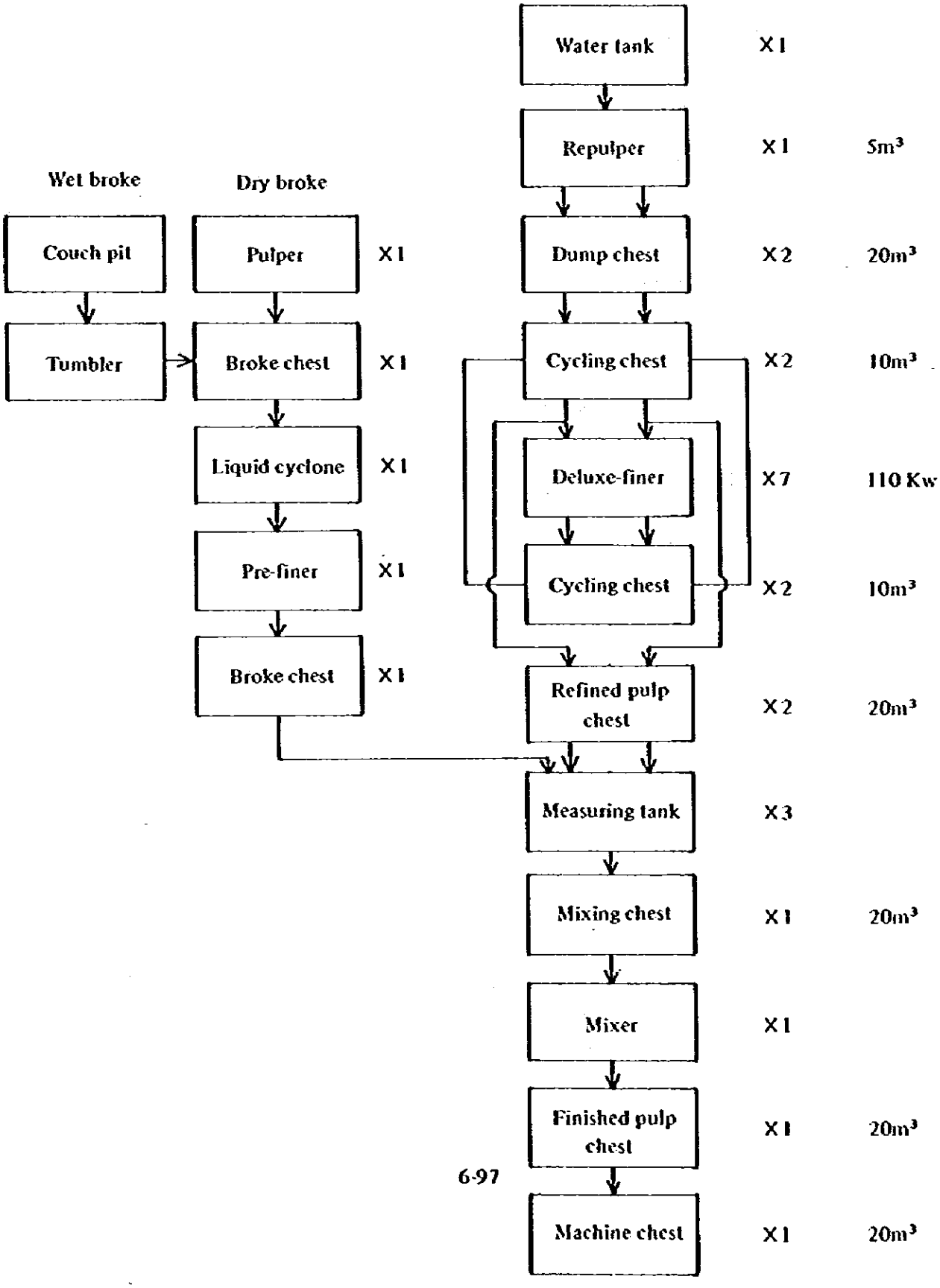
6-7 Stock Preparation Section – Unit II

The Unit II is equipped with one hydra-pulper and 7 deluxe-finers as well as instrumentation for repulping, refining and mixing. This Unit II is designed exclusively for cigarette paper making. The Unit started its operation in 1975 with 5 deluxe-finers that provided initial production volume of 5t/day and has now achieved to produce 10t/day (2 times of the initial production volume) with 2 additional deluxe-finers.

The equipment is very modernized maintaining an appropriate degree of refining to ensure the quality of cigarette papers, nevertheless, its high electric power consumption rate for refining operation is a problem. This problem is common to the making of thin papers. If the plant considers a future extension of this Unit II, it is recommended to install some double-disk refiners or conical refiners so as to ensure reduction of electric power consumption rate and also to alleviate occurrence of wrinkles in the sheet upon drying.

With respect to product quality while appreciations are given to the plant's endeavors to develop some high-quality products such as those having Flax mix, it is observed that proper considerations have not been given to the raw material($CaCO_3$) for common grades. On the other hand, a high level of slime generation causes lowering of operating efficiency (webs are broken on the machine many times during production process) and reduction in quality value.

6-7-1 Machines and Equipment; Process Flow



6-7-2 Personnel

One chief, daytime

5 operators x 3 shifts in 4 groups:

For Pulper	: 2 operators
For chemical preparation	: 1 operator
For stock preparation	: 2 operators

6-7-3 Operating Conditions

1) Operating Standard

(1) Pulp mixing standard

(2) Filler mixing standard

(3) Freeness standard

2) Current situation

(1) Repulping consistency:

3.45% average, 3.7% Max., 2.8% Min.

Values fluctuate, most of them being lower than the standard value of 3.5%.

(2) Pulp freeness:

32cc average, Max., 34cc Min. 28cc

There is no large fluctuation between values, and an appropriate freeness which has been assigned upon starting the operation is observed, considering the increase in machine speed by 40%.

(3) Filler consistency:

15.9% average, 17.5% Max., 13.8% Min.

(4) Ash content (See Fig. 6-7-1, 6-7-2, 6-7-3 attached.)

EAGLE: : 15.2% average, 16.5% Max., 13.0% Min.
GOLDEN BIRD : 13.9% average, 14.7% Max., 13.0% Min.
SILVER BIRD : 12.78% average, 13.56% Max., 11.75% Min.

(5) Refining capability:

Cycling \ Brands		Eagle	Golden bird	Silver bird
No. 1 cycle	110kWX4kg/day	4,430	4,889	5,492
No. 2 cycle	110kWX3kg/day	4,827	4,387	4,809
Total	kg/day	9,257	9,276	10,301

(6) Basis weight: (See Fig. 6-7-1, 6-7-2, 6-7-3 attached.)

EAGLE : 26.8g average, 28.3g Max., 25.3g Min.
GOLEN BIRD : 25.77 g average, 27.2 g Max., 23.7g Min.
SILVER BIRD : 26.05g average, 28.5g Max., 25.2g Min.

(7) Opacity: (See Fig. 6-7-1, 6-7-2, 6-7-3 attached.)

EAGLE : 78.24 average, 86.0 Max., 79.4 Min.
GOLDEN BIRD : 78.24 average, 82.0 Max., 74.6 Min.
SILVER BIRD : 72.24 average, 75.6 Max., 70.0 Min.

6-7-4 Problems with machines/equipment and opreation; proposed countenneasures

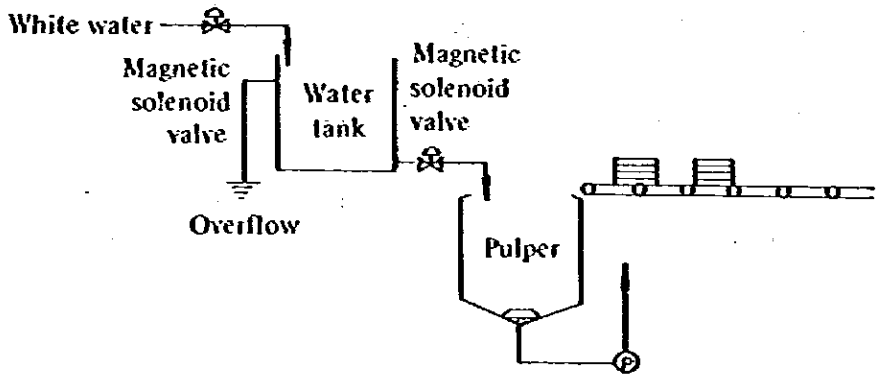
1) Tumbler

The tumbler currently used can scarecely meet the requirement for increased production, in terms of this capacity. Because of the tumbler's insufficient dewatering capacity, which may result in a lowered consistency of the broke in couch pit, the operator is regulating the amount of water at the inlet of the tumbler. Therefore, the level control valve of the couch pit does serve for nothing although it works.

The wet broke from the couch pit sometimes goes into the wire shower pit and is delivered to the settling tank, thereby disturbing settlement in the tank and causing the fluctuation of the basis weight.

Countenneasures

It is recommended to replace the existing tumbler with a new equipment with higher dewatering performance, such as a vacuum filter.



Currently water volume is regulated through control of overflow and valves are interlocked as follws:

Pulper feed valve opened ----- white water valve closed
Pulper feed valve closed ----- white water valve opened

However, after flowing of the pulp stock to the dump chest, water is poured again into the pulper; this does not only cause a variation of the pulp consistency in the dump chest, but also reduces the consistency.

Countermeasures

Automatization of discharge and stop of the pulper operation is recommended by setting a timer after the pulper starts to operate. The operator should only take charge of water feeding, pulper starting and pulp feeding.

3) Refining capacity – Freeness

It is desirable to maintain the beating degree as it is in consideration of pinholes, formation, etc. However, our observation indicates that the refining capacity of the equipment has already reached its upper limit. In case the production volume is to be increased, installation of an additional refiner will be required to prevent the reduction in beating degree and support the proper freeness of the pulp; acquisition of a adjustable constant-gap disk refiner or conical refiner is advisable, preferably the latter from the viewpoint of equipment cost.

4) Unit ratio of Power consumption

Usually unit ratio of power consumption becomes high with production of cigarette papers and other similar ones because of high degree of beating is required. The unit ratio of power consumption in the Unit II is 18% higher, compared with the average rate in Japan. This high rate may be attributable to a relatively high temperature of the pulp to be refined from the beginning, but much more to the insufficient maintenance of the refiner blades.

Countermeasures

Refiner blades of deluxe refiners should receive more careful and frequent maintenance. (specifically, burrs of the edge should be removed); such a care in a cycle of 2 or 3 months for each refiner is advisable.

5) Variation in filler consistency

A relatively large variation is observed in solution consistency of the filler, with values of 15.9% average, 17.5% Max. and 13.8% Min. The product quality, including

ash content, opacity, etc., is significantly affected by the consistency of the filler. More strict consistency control is desirable.

Countermeasures

It is recommended to set up the standard value of the filler consistency at 15%±1% which should be strictly observed.

6) Ash content and opacity

33 of 59 measured samples had an ash content out of control limit; 14 of 22 measured 'SILVER BIRD' samples (64%) had an opacity out of control limit.

Countermeasures

Our recommendation is more strict cntrol on the application of filler; also the quality of the filler should be reviewed.

7) Filler (Calcium Carbonate)

It is necessary to handle Calcium Carbonate with care since this is an additive containing elements affecting the quality of cigarette papers. Especially, such a kind of Calcium Carbonate that is characterized by its rapid settlement must be averted in consideration of pinholes, burning rate, sheet formation, ash content, opacity and filler yield, etc. If circumstances require the use of local products, positive arrangements with a certain domestic products or producers of this chemical is suggested for improvement of the quailty.

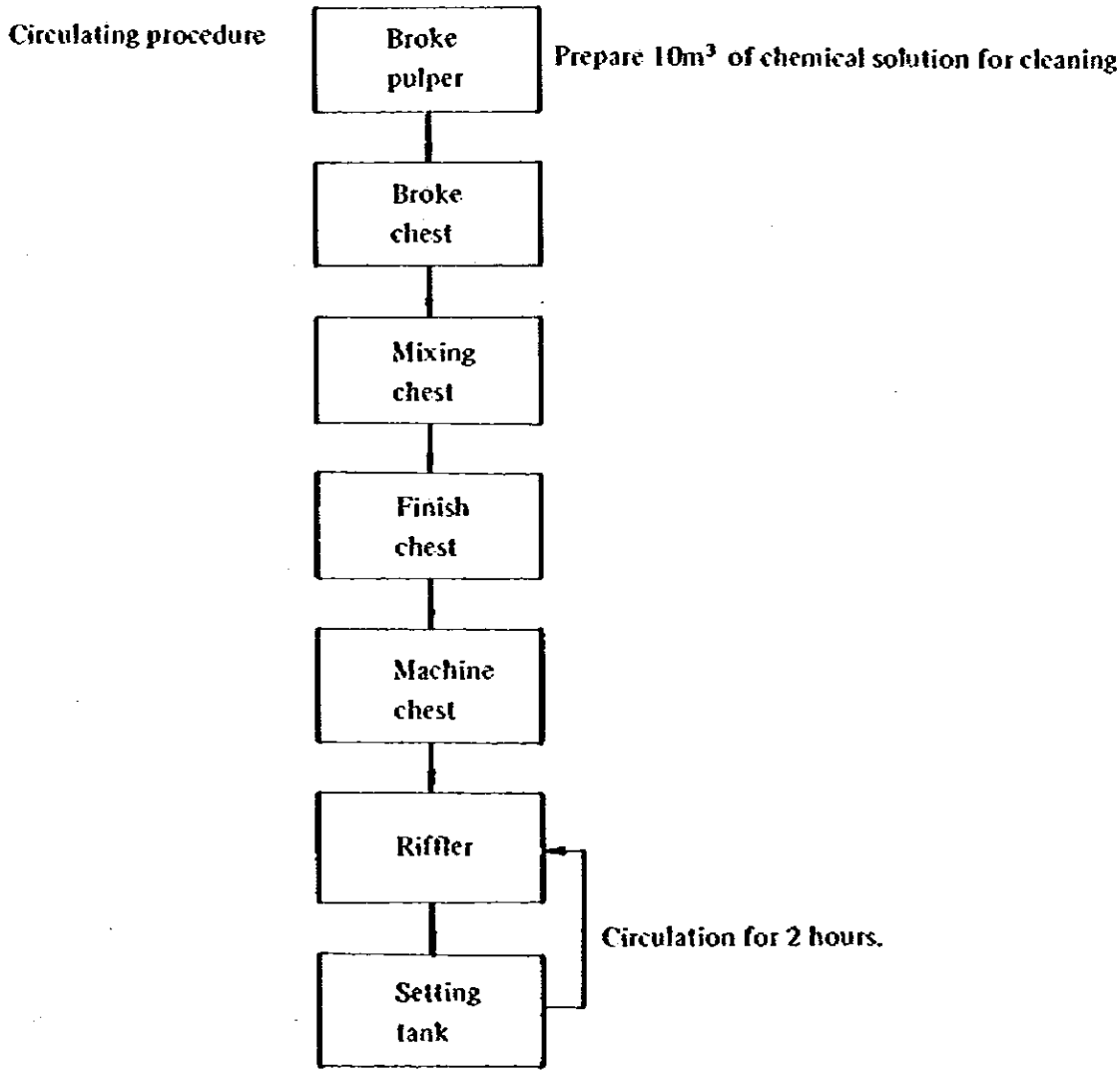
8) Slime

The growth of slime is more active when the water temperature is between 28°C and 42°C, being most activated with the temperature of 32°C and pH value of 7.5. This growth of slime is unavoidable with a cigarette paper machine.

Countermeasures

(1) Use of some slime control agent (Find out an effective chemical.)

(2) Monthly water cleaning and circulation of low consistency bleaching solution (Cl_2 3.5%) or low consistency Caustic Soda solution (5%) through the piping system after the mixing chest.



Complete cleaning with fresh water after circulation of solution

(3) Weekly cleaning with water through the piping system after the rifflers.

6-7-5 Proposed Plan for PM 3 Cigarette Papers (EAGLE) in Padalarang Plant

1) Current situation

Pulp mixing (Standard)

NBKP	: 85%
Flax	: 15%
Calcium Carbonate (imported from Japan)	: 27%
Titanium white (TiO_2)	: 3%

PM 3 cigarette papers in Padalarang plant are made on the basis of the above composition of fibers. These papers are said to be less soft and thick than those made in France. This difference seems to be the effect of the calcium carbonate used.

2) Comparison of Calcium Carbonate Types

Item \ Calcium carbonate		Indonesia	Imported from Japan (currently used)	French
Moisture content	%	1.0	0.8	0.5
Calcium content	%	93.3	95.8	96.7
Brightness	%	90.5	100.0	94.0
Residue, 200 mesh		0.12	0.44	0.02
Speed of settlement	5 min.	60ml	87ml	92ml
	10 min.	32ml	77ml	79ml
	15 min.	27ml	64ml	65ml
	20 min.	21ml	59ml	55ml
	25 min.	19ml	52ml	51ml
	30 min.	17ml	46ml	48ml
	Time (min.)/20ml	21 min.	120 min.	1,440 min.

In the comparison of settlement, the Calcium Carbonate imported from Japan (currently used in the plant) shows almost no difference from the French one till it elapses 30 minutes. However, the settling time for 20mℓ of Calcium Carbonate indicates a great difference between the two products mentioned: 120 minutes with the Japanese and 1440 minutes with the French. This big difference comes from the fact that the French product has very high rate of pores among its particles, and therefore, very bulky, with less specific gravity and more soft. We feel the lightness of French product when it is placed on hand. It is said that this type of Calcium Carbonate is naturally produced in France and Spain.

3) Test plan

Assuming that the Flax currently mixed is substituted with the LBKP, that is, only the LBKP is used as raw material , then an amount of Rp. 142,512 is saved in the cost of pulp. With this saved amount allowed to the use of French $CaCo_3$ and if it costs Rp. 900/kg or less, an amount of about Rp. 15,297 will be reduced per each ton of product.

4) Predicted chang of quality

1. Improved softness
2. Bulky paper
3. Higher permeability
4. Higher burning rate
5. Less large-sized and more small-sized pinholes

Comparison of Raw Material Cost per 1,000kg, for Cigarette Paper "EAGLE"

Raw material	Unit price (Rp/kg)	Current (Actual)		Test plan (Proposal) 1		Test plan (Proposal) 2	
		%	Amount (Rp.)	%	Amount (Rp.)	%	Amount (Rp.)
NBKP	574.35	85	488,027	85	488,027	85	488,027
LBKP	542.25			15	81,338	15	81,338
FLAX EX	1,235.01	10	123,501				
HEMP	2,006.97	5	100,349				
Cost of pulp			711,877		569,365		569,365
CALCIUM CARBONATE [$CaCo_3$]							
Indonesian	225						
Imported (Japanese)	382.5	24.6	94,095				
France	900			24.6	221,400	26.44	237,960
Titanium white [TiO_2]	1,450	2.84	41,180	2.84	41,180	1	14,500
Filler			136,275		262,580		252,460
Total cost			847,152		831,945		821,825

*Current mixing proportion is based on the record in 1984.

Less Rp. 15,207 for Test plan (Proposal) 1
Less Rp. 25,327 for Test plan (Proposal) 2

It is assumed that the opacity will be improved using the French Calcium Carbonate, therefore, the test plan 2 proposed may also be feasible.

Table 6-7-1 Table of Operating Standard for PM 3

Kind of paper	Basis weight (g/m²)	Mixing ratio of pulp				Filling pulp	Consistency	Freeness	Pigment	Calcium carbonate			Tio	Ash Content	Capacity	Remarks
		LBKP (%)	LBKP (%)	Frax (%)	Straw (%)	BD kg/batch	(%)	(cc/32)	(g/t)	Consistency (%)	Import (%)	Home (%)	(kg/t)	(%)	(%)	
1 Eagle	24 – 25.5	85		15		200	3.5	28±1	216	15	270		30	17±1	80.5 up	
2 Golden Bird	25 – 25.5	65	32.5	25		200	3.5	32±1	108	15	116	174	12	15±1	79±3	
3 Silver Bird	25 – 25.5	65	35			200	3.5	33±1	108	15		300		13.5±1.5	77±3	
4 Coklat	25 – 25.5	65	35			200	3.5	33±1		15		149				

Table 6-7-2 Actual Operation Record of PM 3 Cigarette Paper

Kinds of paper	Basis weight	Consistency	Mixing ratio of pulp			No. 1 Cycline				Production Capacity	No. 2 Cycling				Production Capacity	Remarks
			NBKP	KBKP	Frax		Cycling	Retention minute	Freeness			Cycling	Retention minute	Freeness		
	(g/m²)	(%)	(%)	(%)	(%)	(BDkg)		(min)	(cc)	(BDkg/d)	(BDkg)		(min)	(cc)	(BDkg/d)	
Mar 5 Golden bird	25	$\bar{X}$ 3.26 max 3.60 min 3.10	85	12.5	2.5	320	$\bar{X}$ 8.1 max 9 min 9	$\bar{X}$ 88.5 max 98 min 83	$\bar{X}$ 33.9 max 35 min 33	5,206	320	$\bar{X}$ 10.3 max 12 min 10	$\bar{X}$ 118 max 126 min 103	$\bar{X}$ 34.3 max 35 min 34	3,905	1. No. 1 Cycling DF 4 Stand 2. No. 2 Cycling DF 3 Stand
6 Golden bird	25	$\bar{X}$ 3.5 max 3.6 min 3.4	85	12.5	2.5	320	$\bar{X}$ 9.7 max 11 min 8	$\bar{X}$ 105 max 133 min 96	$\bar{X}$ 32.2 max 34 min 30	4,388	320	$\bar{X}$ 9.6 max 10 min 6	$\bar{X}$ 100 max 107 min 65	$\bar{X}$ 34.8 max 43 min 31	4,608	
7 Eagle	25	$\bar{X}$ 3.36 max 3.45 min 3.20	85		15	320	$\bar{X}$ 9.4 max 10 min 9	$\bar{X}$ 104 max 111 min 90	$\bar{X}$ 28.6 max. 30 min 27	4,430	320	$\bar{X}$ 8.1 max 11 min 6	$\bar{X}$ 87.5 max 120 min 64	$\bar{X}$ 31 max 44 min 27	5,266	
8 Eagle	25	$\bar{X}$ 3.53 max 3.60 min 3.50	85		15	320	$\bar{X}$ 9	$\bar{X}$ 104 max 105 min 105	$\bar{X}$ 28 max 29 min 27	4,430	320	$\bar{X}$ 8.5 max. 9 min 8	$\bar{X}$ 105 max 109 min 88	$\bar{X}$ 30 max 34 min 29	4,388	
9 Silver bird	26	$\bar{X}$ 3.46 max 3.60 min 3.0	75	15	Straw 10	320	$\bar{X}$ 7	$\bar{X}$ 76.3 max 80 min 75	$\bar{X}$ 33.9 max 35 min 33	6,039	320	$\bar{X}$ 8.5 max 9 min 8	$\bar{X}$ 91.6 max 101 min 85	$\bar{X}$ 34 max 35 min 33	5,030	
10 Silver bird	26	$\bar{X}$ 3.39 max 3.50 min 3.30	75	15	Straw 10	320	$\bar{X}$ 8	$\bar{X}$ 89 max 98 min 84	$\bar{X}$ 32.4 max 33 min 32	5,177	320	$\bar{X}$ 9	$\bar{X}$ 102 max 111 min 98	$\bar{X}$ 32.7 max 34 min 32	4,517	
11 Silver bird	26	$\bar{X}$ 3.64 max 3.78 min 3.60	65	25	10	320	$\bar{X}$ 9	$\bar{X}$ 85.6 max 88 min 80	$\bar{X}$ 32.5 max 33 min 32	5,446	320	$\bar{X}$ 9	$\bar{X}$ 94.9 max 99 min 86	$\bar{X}$ 32.8 max 33 min 32	4,855	
12 Silver bird	26	$\bar{X}$ 3.35 max. 3.70 min 3.0	65	25	10	320	$\bar{X}$ 8	$\bar{X}$ 86.5 max 97 min 80	$\bar{X}$ 32 max 33 min 31	5,327	320	$\bar{X}$ 9	$\bar{X}$ 95.3 max 99 min 87	$\bar{X}$ 32.5 max 33 min 32	4,835	
15 Golden bird	26	$\bar{X}$ 3.16 max 3.80 min 3.20	70	30	0	320	$\bar{X}$ 7.8 max 8 min 7	$\bar{X}$ 90.8 max 111 min 81	$\bar{X}$ 32.4 max 34 min 30	5,074	320	$\bar{X}$ 8.6 max 9 min 8	$\bar{X}$ 99.1 max 109 min 92	$\bar{X}$ 32.6 max 34 min 30	4,649	

Table 6-7-3 PM 3 Actual Operation Data (in 1984)

Date	Hour	Consistency		
		Refining Chest (%)	Machine Chest (%)	Head Box (%)
Mar. 13	14.0	3.3	3.9	0.77
	18.0	3.4	3.7	0.68
	24.0	2.8	3.7	0.68
	3.30	3.0	3.6	0.66
14	7.30	3.65	4.05	0.84
	10.30	3.55	4.10	.078
	14.30	3.7	4.0	0.65
	17.00	3.7	3.9	0.64
15	7.15	3.3	3.94	0.70
	11.30	3.65	4.0	0.71
	13.30	3.42	4.02	0.78
	18.30	3.7	4.15	0.75
	21.40	3.65	3.8	0.68
	24.40	3.65	4.1	0.72
16	7.45	3.36	4.3	0.75
	11.45	3.34	3.95	0.73
x		3.45	3.96	0.72
Max.		3.7	4.3	0.84
Min.		2.8	3.6	0.64

Fig. 6-7-1 Comparison Figures of Cigarette Paper Quality (in 1984)

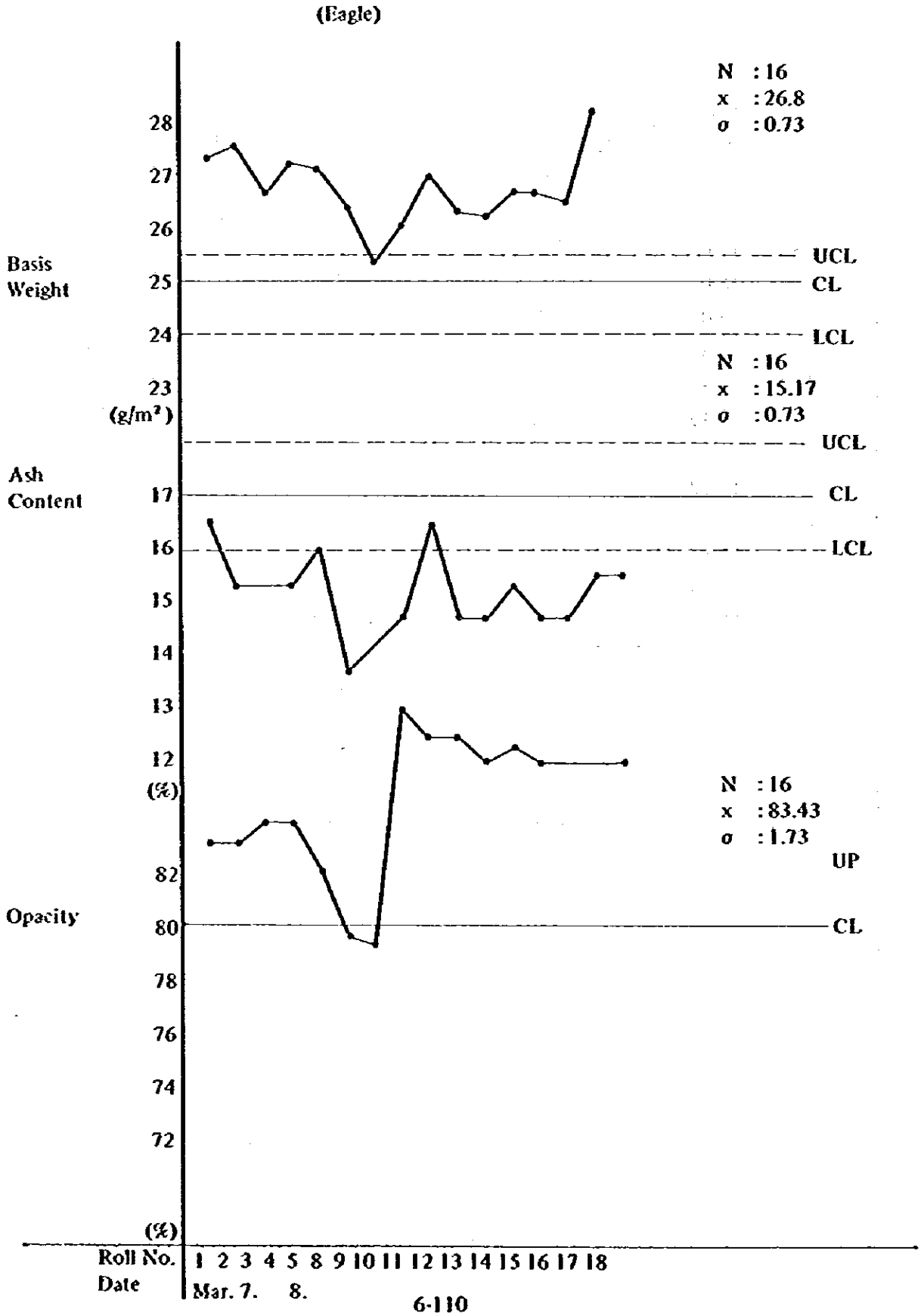


Fig. 6-7-2 Comparison Figures of Cigarette Paper Quality (in 1984)

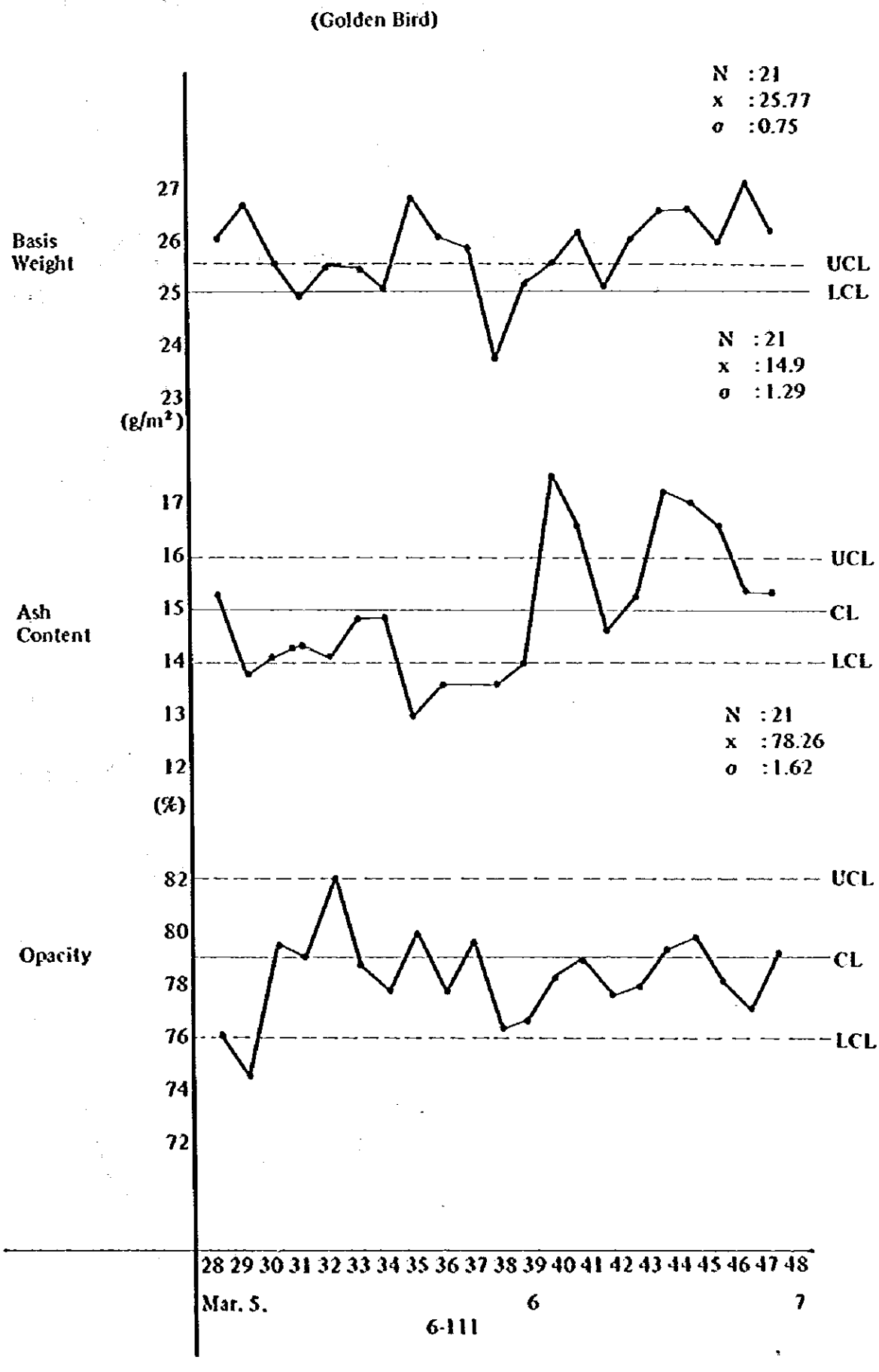
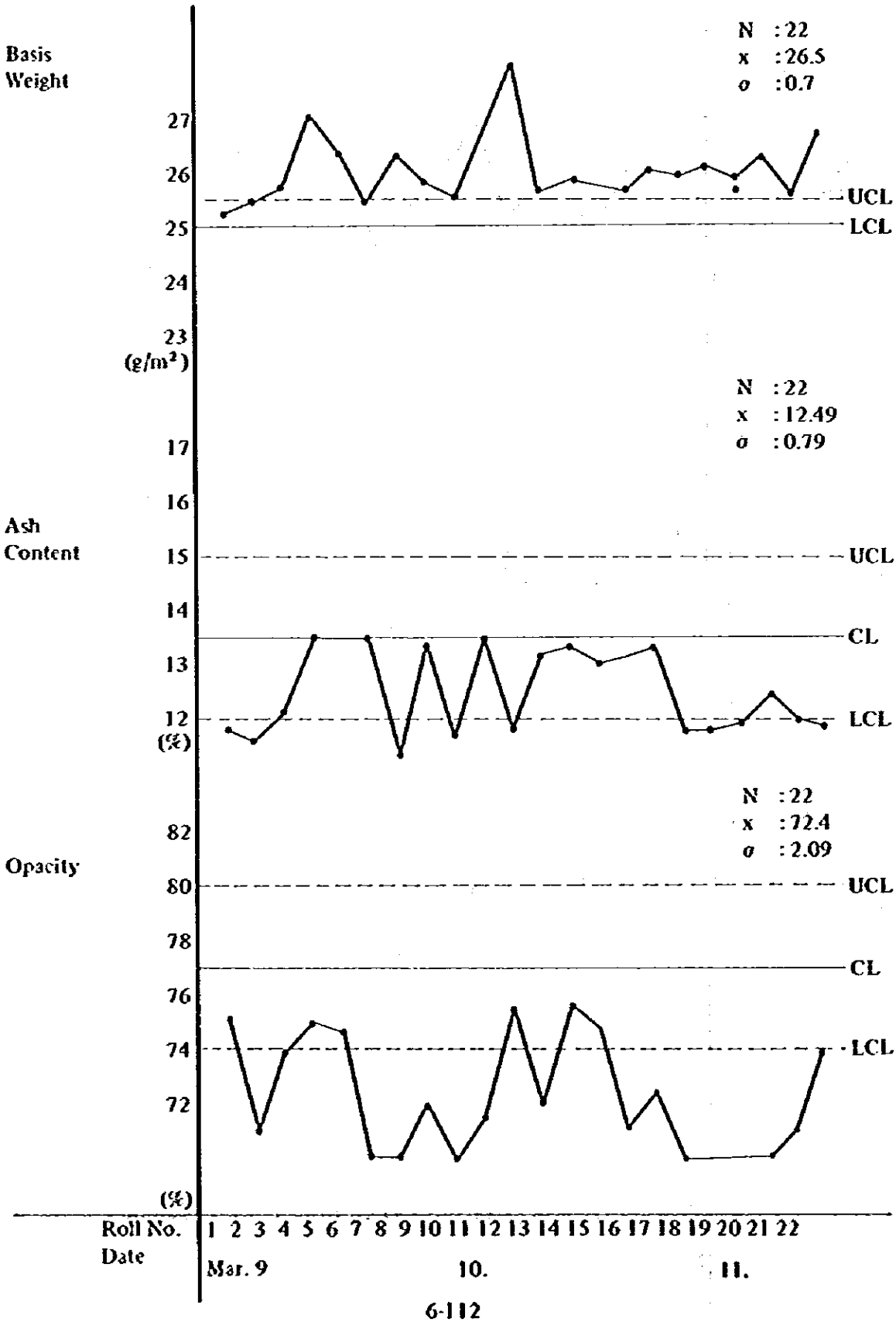


Fig. 6-7-3 Comparison Figures of Cigarette Paper Quality (1984)

(Silver Bird)



6-8 PM 3 Plant in Unit II

The PM3 is used exclusively for cigarette paper making. This equipment has been designed for starting production at 5t/day, and currently after 9 years from its startup, its production volume reached 10t/day theoretically.

Although a rapid technological progress is observed, it stands somewhat behind in terms of product quality and production control.

For example, slime control agent is not used while the use of this agent is indispensable for a stable operation. It is recommendable to strictly follow this kind of the requirements, since the paper making is performed under operating conditions with a large amount of filler mixed and high water temperature. In addition, a constant attention should be paid to the pinholes of the cigarette paper, which can only be lessened by upgrading of the filler.

6-8-1 Machinery and Equipment; Process Flow

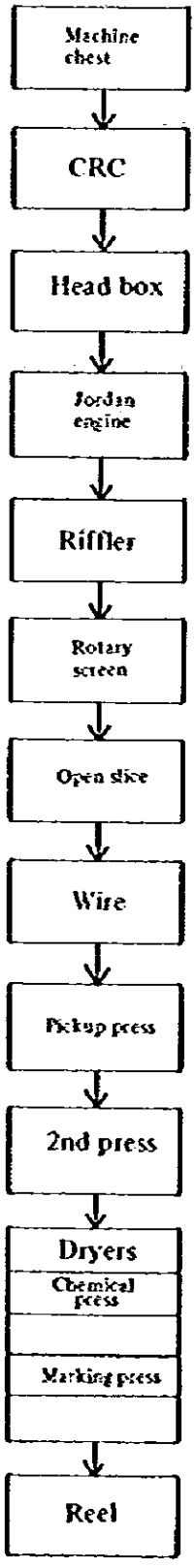
6-8-2 Personnel

One chief x 3 shifts in 4 groups
5 operators x 3 shifts in 4 groups

6-8-3 Operating Conditions

1) Operation Standard

Reeling: 2,150 mm
Machine speed: 120 – 140 m/min
Basis Weight: 24g – 26g



Machine chest	x1	30m³
CRC	x1	Inline type
Head box	x1	
Jordan engine	x1	55kw
Riffler	x1	
Rotary screen	x1	Bird type
Open slice		
Wire		Width: 2,440mm
Pickup press	x1	Unipress type
2nd press	x1	Straight through grooved type
Dryers	x10	1,524mm
Chemical press		Chemical press x 1 set
Marking press		Marking press x 1 set
Reel		Surface type

2) Current situation (See Table 6-8-1 attached):

Cigarette paper operating efficiency is 93.26% (Average percentage obtained during our study).

EAGLE ..... Basis weight: 26 g/m² ; machine speed: 120 m/min
GOLDEN BIRD ..... Basis weight: 26 g/m² ; machine speed: 140 m/min
SILVER BIRD ..... Basis weight: 26 g/m² ; machine speed: 140 m/min

Our inspection of the GOLDEN BIRD surface appearance (with basis weight of 26 g/m²) recognized 23 spots having an area of 0.3mm² or more of dirts, specks and slime, per m² of the sheet. Such a condition degrades the paper's appearance quality.

6-8-4 Problems on Equipment/Operation and Proposed Countermeasures

1) Inside walls of the mixing box and the riffler are not clean, thereby generating slime, and also the interior of the rotarty screen is very stained. As a whole, as a machine used exclusively for cigarette paper making, the equipment PM 3 is held too dirty.

Countermeasures:

(1) Although routine cleaning is carried out every 10 days, actually it seems that the cleaning method is not appropriate. With the present state of dirts and stains it is not enough to clean the equipment with hypochlorite solution (CaOC12). Our recommendation is to clean the equipment with caustic soda (NaOH) solution (with 5% of concentration) and then to wash it with fresh water.

(2) Since 9 years have passed from startup of the equipment, it is necessary to carry out a thorough and complete cleaning of the white water piping.

(3) It is also recommended to use an appropriate bactericidal agent for slime control. This is a countermeasure of sheet breaks due to contaminated parts and the slime generated.

2) Wire part:

In the wire part, it is observed that the couch pit is used in an unsuitable way, thus causing a variation in the consistency. When paper is broken on the machine, the white water under the couch overflows into the pit beneath the wire and then it is sent to the settling tank to be recovered into the riffler. Therefore, the white water recovered into the settling tank has a fluctuation of its consistency, and this attributes to the fluctuation of the stock consistency in head box.

The overflow from the couch pit is attributable to the insufficient capacity of the tumbler. Furthermore, unnecessary amounts of white and fresh water are delivered to the couch pit.

Countermeasures:

(1) To suspend continuous fresh water showering currently, being performed for the full width of paper.

Side edges of wire should be showered in a width of about 300 mm each, and the full width showering should be conducted only when the sheet breaks take place.

(2) To make a modification so that the white water from the couch saveall shall flow down to the wire pit below the wire.

(3) To replace the 100-mesh wire currently used for the tumbler, with a new 60-mesh one.

(4) To control the level in the couch pit before the wet broke is delivered to the tumbler.

(5) To install an additional vacuum filter in order to cover the insufficient capacity of the tumbler.

3) Chemical coater and marking press:

In the cigarette paper making process, the paper is coated with burning agent by a chemical coater and then is marked by a press. It is therfore very important to make a careful control of rolls of these devices. The build-up of operation supervision system and a prudential handling of such rolls are indispensable as the slightest abnormality of the rolls affects the quality of paper.

Countermeasures:

(1) The coating roll for the application of burning agent must always be smooth so that a uniform coating can be performed across the width of paper. It is recommended to set up a maintenance standard to grind this roll every 3 months.

(2) The marking roll must also be subjected to the routine cleaning with water. Water cleaning of this roll should not be failed during the stoppage of the paper machine. If a backup roll is used, the grinding of the main marking roll shall be done every 2 months.

4) Steam pressure of the dryer:

A low steam pressure is used for the dryers, the steam pressure currently used being lower than the operating pressure for steam traps. When drain gathers in the dryers, its load is applied to the motor and gear, resulting in a trouble, and furthermore, the performance of dryers may be reduced.

Countermeasures:

It is recommended to establish an effective control system of the steam trap, by building up routine monitoring and checking to minimize overload troubles. The vacuum drainage is very effective for a dryer used with low steam pressure.

5) Felt stretch:

The dry felt stretch does not work effectively.

Countermeasures:

As it is a gravity type stretch, a constant checking of the stretch weight is necessary through the observation of felt stretching.

If a constant felt pressure is not maintained, drying unevenness may be produced in both machine and cross directions of paper, and therefore the operating efficiency in finishing process will be reduced.

6) Study on the speed at each part:

(Study based on SILVER BIRD brand, 26g/m²)

Part	Speed (m/min)
Wire	137
No. 1 press	138
No. 2 press	141
No. 1 dryer	144
No. 3 dryer	144
No. 5 dryer	144
No. 7 dryer	144
Reel	144
Draw difference	4.86%

There is a draw difference between the presses and No. 1 dryer (2.1%), but no draw difference within dryers. Since these parts concern the drying process and the wet paper is contracted upon drying, the paper will be broken in the dryers if there is a draw difference within dryers.

The equipment is well adjusted with a correct draw.

7) Use of sealing water in pumps:

Sealing water into packing gland of pumps is used for protection of pump packings and maintaining of shaft sleaves. An appropriate amount of water must be poured into the pump and discharged from the sealing outlet.

If this sealing water is tapped at the sealing outlet so as to impede its discharge, the water will run into the system, so affecting the consistency of the stock. In addition, upon the water running into the system, dirt and foreign mater resulted from the wear of packings may be introduced together into the stock, thus the finished paper will have a lowered quality containing such dirt and foreign matter.

On the other hand, entering of pump sealing water into the stock may result in the use of an excess amount of white water, causing a loss of energy. Then the amount of stock wasted away will increase and the total production yield will be reduced.

By discharging the sealing water of the pumps constantly to the sealing outlet, its volume can be confirmed. This measure may also allow the verification of packing conditions and the abnormal conditions, if any, of the runners and/or shaft through observation of the discharge volume.

6-8-5 Slime Formation: Troubles and Corrective Actions

1) What is slime?

"Slime" is a general term for thick and viscous mudlike substance formed by agglomeration of microorganisms. In the papermaking process, slime is especially formed in the white water circulating system where the pulp consistency is low. The slime so formed adheres to the system walls, growing up there, and then falls off therefrom with the flow speed, to be mixed in the stock. This slime, when mixed in the stock may cause troubles such as specks, pinholes, fisheyes, or offensive odor attached to the stock. It may also plug up wire and belt cloth, stain rolls and contribute to the corrosion of machines and equipment, thereby disturbing the operation.

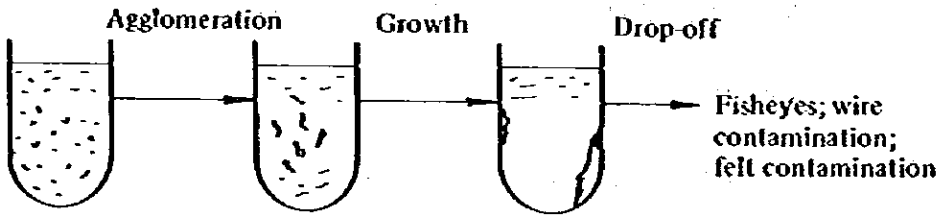
2) Slime formation

The principal bacteria contributing to the multiplication of slime-forming microorganisms are unicellular organisms. These slime-forming microorganisms or bacteria take in saccharides which are wool extracts in the white water and join with oxygen to decompose the said saccharides serving as nutrients. Through this decomposition process they get energy for multiplication. Many of these slimeforming bacteria have their cells covered by proteins or polysaccharide viscous substances for protection of their own biomasses, and because of such a viscosity they agglomerate and grow rapidly to form slime.

3) Troubles causable by slime

Usually microbes agglomerate and grow when the number of bacteria becomes more than 10^4/ml in the white water and a viscous mudlike substance, that is, the slime, is produced.

The agglomeration of slime-forming microbes or bacteria makes up mucous membrane layers consisting of viscous proteins and polysaccharides around their cells. These mucous membrane layers stick each other, or adsorb talc, clays or other fillers, so that they grow up.



4) Conditions under which bacteria propagate most:

30°C ± 5°C (Bacteria can propagate in high temperature.)
White water pH value: 5 – 7 (Bacteria propagate most with these pH values.)
Stock pH value: 7 – 8

5) Relation between the number of bacteria and the period for generation of fisheyes and the break of web

No. of bacteria m/l	No. of days for generation of the break of web
10^3	20 – 30
10^4	7 – 14
10^5	5 – 10
10^6	3 – 5
10^7	2 – 3

It is obvious from the above Table that the white water system left as it is without using any slime control agent allows multiplication of bacteria that results in troubles.

6) Control methods

The multiplication of bacteria as described above can be controlled by use of a slime control agent which will constantly keep the number of bacteria in the white water at a level of 1×10^5 or less; or an impact microbicide method can be adopted to impede the generation and implantation (adhesion) of slime in the white water: these are continuous desinfecting treatment by means of some antibacterial (antimicrobial) chemicals or impact desinfecting treatment by means of some bactericide (microbicide) chemicals.

For those machines in which slime has already been formed, it is recommended to analyze the relevant bacteria or microbes so that either an antibacterial agent or bactericide can be selected and used for prevention of further slime formation.

7) Actual conditions and problems observed

The mixing box and riffler walls of the PM3 are very stained, the situation of which is susceptive to slime formation. Also the interior of its rotary screen remains stained. The status of the PM3 is not therefore in a good shape as a cigarette paper machine.

Table 6-8-1 PM 3 Performance Analysis Data of Actual Operation

Date	Brand	Basis Weight	Oper. Speed	Production on Reel	Theoretical Production on Reel	Operation Hours			Sheet Making Efficiency	Counted Numbers of Sheet Breaks
						Sheet Making	Sheet Breaks	Operation Stop		
		g/m²	m/min.	kg	kg	Min.	Min.	Min.		
Mar. 2	Golden Bird	26	140	8,536	11,217	1,440	334		76.80	34
3	"	"	"	10,576	"	"	83		94.23	2
4	"	"	"	10,750	"	"	59		95.90	
5	"	"	"	10,590	"	"	81		94.39	5
6	"	"	"	10,236	"	"	126		91.25	14
7	Eagle	26	120	6,338	7,069	1,020	105	420	89.70	10
8	Silver Bird	26	140	8,500	11,217	1,440	349		75.76	10
9	"	"	"	10,705	"	"	66		95.42	6
10	"	"	"	10,700	"	"	66		95.42	
11	"	"	"	10,745	"	"	61		95.76	5
12	"	"	"	11,115	"	"	13		99.10	2
13	"	"	"	11,060	"	"	20		98.61	10
14	Golden Bird	26	140	10,896	11,217	1,440	41		97.15	17
15	"	"	"	10,751	"	"	60		95.83	
16	"	"	"	10,150	"	"	137		90.49	37
17	"	"	"	9,204	"					16
18	"	"	"	10,604	"	1,440	79		94.51	17
19	"	"	"	10,730	"	"	63		95.62	5
20	"	"	"	8,809	"	"	52		96.38	9
21	"	"	"	10,700	"	"	66		95.42	18
22	Silver Bird	26	140	10,925	11,217	1,440	37		97.43	14
									x 93.26	

8) Corrective actions

Periodical cleanings are carried out every 10 days, however, the actual conditions of the PM3 indicate that these cleanings are not implemented effectively. Calcium hypochlorite ($CaOCl_2$) will not clean up adequately the existing line. It is required to use caustic soda solution (NaOH, with concentration of 5%) and then to complete each cleaning with water flushing.

Having passed 9 years of operation, the equipment requires a thorough cleaning/ washing of its white water piping system as a whole.

6-9 Finishing Plant -- Unit II

This Section was designed as part of construction works for the PM3 in 1975, and is suitable for sorting operation of high-class papers like cigarette papers, with its spacious work area and good natural lighting. From the operating viewpoint, however, cutting of tissue papers is not worked satisfactorily as yet, producing many papers creased upon cutting. Also streamlining of the work is still to be achieved in handling these products. The increase in production of products in bobbin is forecast in a near future, and then some bobbin slitters and rewinders have to be installed. It is recommended to reconsider the layout of this section at that opportunity.

6-9-1 Operating Conditions

The double cutter is operated in 2 shifts, and cuts and sorts all 10 rolls of paper made on the previous day. The main sorting work is to reject creased pieces of paper produced during reeling and cutting. After sorting the quantity is checked, and then four sides of paper are trimmed by a Guillotine cutter per each 2 reams. The finished papers are bailed and packed for shipment.

6-9-2 Problems on finishing process and operation and its countermeasures

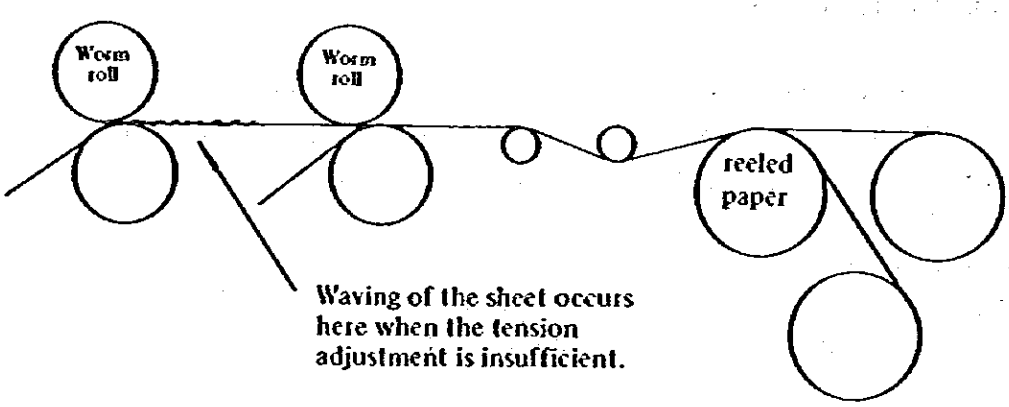
1) It is important to keep sheet tension of reels upon cutting, to watch the paper flow constantly and adjust the said tension according to such a flow.

A double cutter requirs a special attention to this point; otherwise, creases may be produced. An effective operation control standard must necessarily be established as maintaining proper web tension against reels respectively.

Countermeasures:

Upon setting reels to the unreel stand, a reel with less variation in sheet softness and without sheet breaks in the reel should be placed on the bottom unreel stand. A reel with a lot of breaks in it usually has a variation in moisture content.

Especially, the feeding to worm rolls needs a careful leading adjustment.



2) Finish inspection:

The cigarette papers currently made contain much slime and dirt, and many foreign matter, shives and specks mixed in the sheet reducing the product value. A careful inspection of finished products is required, and the sheet containing any irregular and non-conforming defects must be rejected.

Countermeasures:

Some standards for sorting limits should be set up for respective brands. It is recommended to prepare actual samples showing such standard sorting limits which are distinguishable by everyone so as to avoid sorting discrepancies among individuals in charge of the inspection. These sorting limit samples should include all those products which contain foreign matter or residues, dirt, shives and specks, holes, creases, imperfect marks and any other irregularities.

3) Layout of finishing room:

The existing finishing room has a baling space located between the sorting table and the cutter. The packaging space has, on its both sides, carrying passages where pieces of packing materials, fragments of pallets, torn vynil sheets and other miscellaneous things are scattered. These things are taken into the pulper together with the dry broke for recycling, and therefore, the dry broke has many impurities.

In addition, the waiting area for delivery trucks is unpaved, and sands, adhered to fork lifts, enter into the finishing room.

Countermeasures:

The following corrective actions are suggested:

(1) To change the flow in the finishing room. (Refer to the attached Dwg. AP 7-7.)

(2) To take measures for smooth carriage of semi-finished products after cutting, taking into consideration the layout for bobbin slitters and rewinders to be introduced in the future.

To establish a more smooth flow of sorting – baling – packing (casing) – shipment so as to ensure nonentering of impurities in the dry broke to be recycled.

(3) To determine the carriage passage for return broke, which should be kept clean at all times.

(4) To pave the waiting area for delivery trucks with concrete.

4) Handling of rejected sheets:

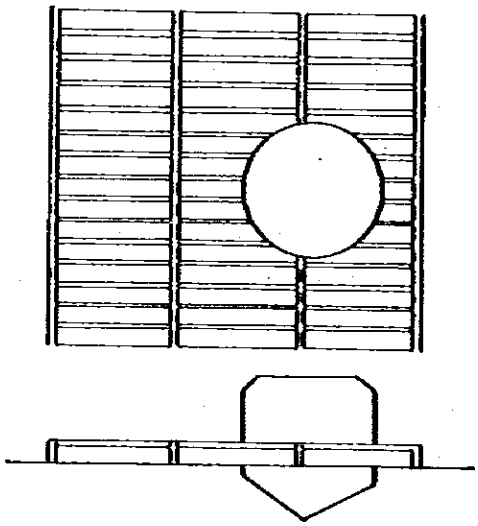
Sometimes fragments of bailing materials and vynil sheet pieces, etc. are mixed up with rejected sheets turned out as a result of cutting and sorting inspection. When these dry brokes are returned to the dissolving pulper, the said foreign matter is also fed to the pulper and causes break of web on the paper machine and also produces impurities on the paper surface, thereby deteriorating the quality of paper.

These rejects to be recycled are temporarily baled and placed in the warehouse. Our observation is that they are stored in under conditions, being left very dusty and stained. It is recommended that good care be taken of the storage place and also of the way of handling on carriage.

Also it is important to promote and encourage the awareness of operators who handle the dry broke and to educate those who operate repulpers.

In a papermaking mill, the problem of dust and impurities is a permanent pending subject, and therefore, should be tackled as a major subject for the entire plant with constant and positive countermeasures.

It is suggested to provide a gratings floor around the repulper for returened brode so that dust and impurities may fall under gratings (duckboards). The gratings or duck-boards must be cleaned periodically.



6-10 Test and Research Laboratory

The laboratory is provided with the minimum measuring devices required although some of the instruments serve since the inauguration of the plant in 1924 and therefore too aged to satisfactorily function, or damaged. Some testers including the opacity tester have deviations in their indications (for example, the opacity tester indicates about 6 points higher than the actual value). Therefore, it is necessary to make calibrations of these testers with the standard testers in the Institute of Fibre Technology at Bandong at least once a year.

The laboratory is staffed with 19 persons; 12 of these 19 work in 3 shifts to take charge of product testing and report the test results to the operation site. The remaining 7 persons take charge of test research, preparation of quality control data and other laboratory works related to testing.

Test and Research Laboratory

6-10-1 Testing and Measuring Equipments

1) Tensile strength tester x1 ..... Toyo Seiki Mfg.
2) Opacity tester (Photovoltaic) x1 ..... ditto
Brightness tester (common use of opacity tester)
3) Tearing tester x1 ..... Toyo Tester
4) Moisture tester (Kette) x1 ..... German
5) Analytical balance x3 ..... ditto
6) Balance x2 ..... Dutch
7) Paper weigher, 30g x1
8) Paper weigher, 20x20, 120g x1
9) Air permeability tester (Oken type) x1 ..... Asahi Seiko
Smoothness tester (common use with air permeability tester)
10) Thickness tester x1 ..... Dutch
11) Folding strength tester x1 ..... ditto
12) Freeness tester x1 ..... Toyo Seiki Mfg.
13) Sheet machine x1 ..... ditto
14) Oven x1
15) Electric furnace x1
16) Humidity-thermometer x1
17) Microscope, x400, x1

6-10-2 Personnel

19 researchers:

3 persons x 3 shifts in 4 groups
7 persons x 1 shift

6-10-3 Operating Conditions

3 persons working per shift conduct quality tests on each roll and submit test reports to the operation site; also make check on consistency of chemical additives including rosin, alum and fillers.

7 persons working daytime are engaged in testing, researches and preparation of quality control data.

Temperature and Humidity in Laboratory

Month	Room temperature (average) °C	Humidity (average) %
Jan.	25.0	78
Feb.	26.0	80
March		
April	26.6	78
May	25.5	81.5
June	27.0	65
July		
Aug.	26.0	
Sept.	27.0	60
Oct.		
Nov.	26.0	69
Dec.	26.3	77

Temperature: average . . . 26.2°C
max. . . . . 27°C
min. . . . . 25°C

Humidity: average . . . 73.56%
max. 81.5%
min. 60.0%

6-10-4 Problems on instruments/equipment and operation; proposed countermeasures

1) Thickness tester:

The gauge is too aged to function properly.

Countermeasures:

It should be replaced with a new one.

2) Folding strength tester:

It is aged and damaged.

Countermeasures

It should be replaced with a new one.

3) Sheet machine:

The body is sound, but its wire is damaged and a substitute wire is used. It is difficult to make test sheets with this machine (it is impossible to make a flat sheet).

Countermeasures:

It is recommended to purchase a spare machine.

4) Opacity tester (Brightness tester):

The tester has a problem in its precision because no calibration has been made since 1976. Comparison of Measurements of Padalarang Samples.

Brand	Item		Opacity	
	Meas'd. in Padalarang	Meas'd. in Japan	Meas'd. in Padalarang	Meas'd. in Japan
EAGLE	83.43	77.5	98.0	91.0
GOLDEN BIRD	78.24	72.5	97.0	88.3
SILVER BIRD	72.24	66.5	94.0	88.0

As shown above, measured values in Padalarang are nearly 6 – 7 points higher than those measured by us in Japan for both opacity and brightness. The tester has a reference plate stained and turned into yellow.

Countermeasures:

Calibration and repair of the reference plate after collating of the tester with the standard instruments in the Institute of Fibre Technology, Bandung.

5) All other measuring equipments and meters require yearly collating and checkup at the said Institute.

6) Conditioning of measuring room:

Both the temperature (26°C average) and the humidity (73.56% average) are too deviated from normal measuring conditions, namely, temperature at 20°C and humidity of 65%. It is advisable to install an air-conditioning system in the future.

7) Use of a porosity meter recommended:

Currently the plant's cigarette papers are tested by an air permeability tester, with measured values of air permeability expressed in seconds/100cc. Indication by porosity expressed in ml/min is more appropriate.

Comparison of Test Values

Sample / Tester		No. 1	No. 2
Bendzen tester (Bandong Institute)	ml/min	170 – 200	300 – 360
Emigliner (Japan)	ml/min	113 – 132	116 – 232
Air permeability tester	sec/110ml	60 – 75	27 – 46

Even with a difference between test values, it is recommended that a tester of the same type with the Bendzen tester owned by the Institute of Fibre Technology in Bandung be used.

6-11 Boiler Section

1) Both the Lancashire Model, flue-type boiler, which were constructed in 1922, the same year of the company's foundation, and smoke tube-type boiler for the marine installed additionally 10 years later, are still in operation, fulfilling their function in paper production.

   There are presently four boilers, including a water tube-type, package boiler installed at the time of an expansion of PM 3, which can meet capacity requirements, as well as, structural requirements for periodical inspection. These flue-type and smoke tube-type boilers have, however, very low heat efficiency.

2) During the past couple of years, oil prices in Indonesia, which is an oil producing country, have also been soaring. Fuel oil is no exception to this tendency, and its price is rocketing up to 200 Rp/ton in 1984 from 1983's 125 Rp/ton. (Source: "Handbook of Indonesia" – 1983 Edition, published by JETRO, and other information obtained by inquiry).

3) Under the circumstances as they are, steam production cost in factory stands, on an average, at as high as 21,670 Rp/ton, becoming the major factor in boosting up total production cost.

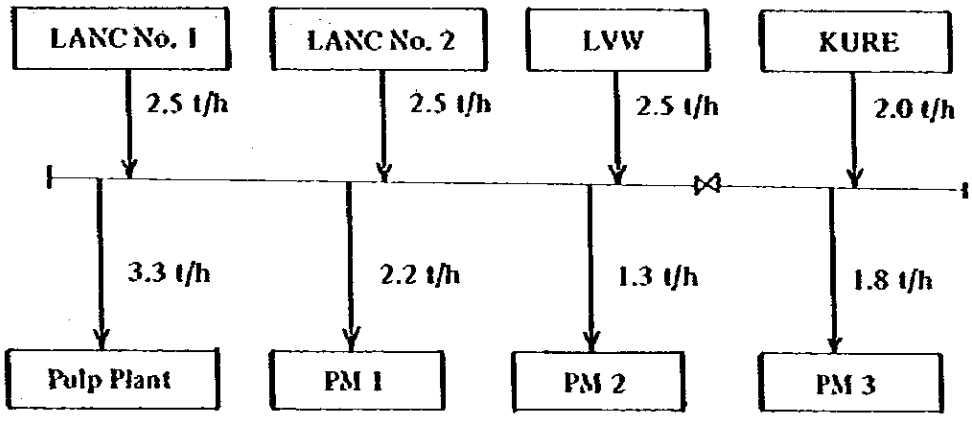
   In case of a recent water tube boiler use, this cost is estimated, in average, at 16,000 Rp/ton, when evaporation factor is taken into consideration. Assuming the volume of steam generation at 150 t/d, an estimated loss will amount to 850,500 Rp/d. On the basis of 300 operation days, a simple profit of 250 million Rp/year will be realized. Thus this section promises a very large investment effect.

6-11-1 The Present State of the Existing Equipment

1) Equipment Capacity and Oil Consumption

Lancashire No. 1 4kg/cm² x 2.5 t/h, 104ℓ/t
Lancashire No. 2 4kg/cm² x 2.5 t/h, 103ℓ/t
LVW (Smoke Tube) 4kg/cm² x 2.5 t/h, 103ℓ/t
KURE (Water Tube) 10 kg/cm² x 2.0 t/h, 87ℓ/t

2) Supply-Consumption Balance



1.5 t/d x 6 t/d x 6 t/t = 54 t/d	12 t/d x 3.8 t/t = 45.6 t/d	8 t/d x 3.8 t/t = 30.4 t/d	10 t/d x 4.3 t/t = 43 t/d

Supply Capacity Total of 4 boilers: 228 t/d Total of 3 boilers: 180 or 168 t/d

On the consumption side, 173 t/d steam is required, in average, under normal production condition.

On this basis, with combustion of 3 boilers, there may be some fear of pressure fall at peak times of the pulp plant operation. This will, however, be sufficiently taken care of by the KURE boiler which is capable of good follow-up performance.

3) Softened Water Supply Equipment

(1) Condensate Recovery Percentage

According to an information we have obtained, the mill's present average recovery percentage is about 30%, needing the supply of softened fresh water at the rate of 4 t/h.

On the assumption that there is no leakage loss on lines and process, the following points may be assured from the total steam consumption of 173 t/d (in average).

$$\frac{173-4\times24}{173} \times 100 = 44.5\%$$ (Condensate recovery percentage from the entire system)

Or, excluding the quantity of unrecoverable condensate for cooking purposes, we obtain

$$\frac{173-54-(4-54/24)\times24}{173-54} \times 100 = 64.7\%$$ (Condensate recovery percentage from paper machines only)

Presupposing that the supply of softened fresh water at the rate of 4 t/h is a fact, therefore, it is clear from the above that the actual recovery percentage is not 30%, but 45% in relation to the entire system, or, 65% in relation to paper making machines from which alone condensate is recoverable. Admitting that these values are on the low side, that may be considered possibly reasonable ones, if leakage from piping installations is taken into consideration.

(2) Water Softening Plant

The existing water softening plant, which was installed simultaneously with the additional installation of PM 3 in 1975, has a capacity of 10 t/h. Considering the current supply rate of softened fresh water at 4 t/h, this is a low rate of operation.

6-11-2 Operators and Process control

1) The "3 operators/shift x 4 groups, 3 shifts per day" system is adopted. The operators mainly take care of the operation and maintenance of boiler equipment, but they are not in charge of maintenance of steam supply piping system or expendable equipment.

2) They are not keen to exercise heat control as daily routine such as by being prepared for peak load, unexpected shutdown, etc., or, maintaining boiler pressure, stabilzing thermal efficiency, etc.

3) When the mill's high steam cost is considered, they seem to lack in positive posture with regard to maintenance or improvement of boiler thermal efficency.

For example, the water tube boiler additionally installed in 1975, already began to show a fall in performance at the rate of 7ℓ in terms of liter oil/ton steam.

Notes) New boiler .....80ℓ oil /ton steam
The existing KURE Boiler.....87ℓ oil/ton steam

4) No control is practised on combustion gas. There is an Orsat gas analyzing apparatus at site, but it is not utilized.

5) It is desired to incorporate QC circle system, etc. at job sites, discuss concrete measures to improve thermal efficiency, enhance "cost-down mind", among others.

6-11-3 Situation of Operation

1) Fuel Oil Consumption Rate per Unit Volume of Steam

(1) Fig. 6-11-1 shows developments of fuel oil consumption rates in 6 years, boiler unit respectively. With the sole exception of "KURE", which stands at 87ℓ/t, and other boilers stand at 104 ℓ/t.

(2) The 77 kg/t (80 x 0.96) lit/t, the Fig. shows the fuel oil consumption rate by a up-to-date water tube-type boiler.

In this case, evaporation factor (steam ton/oil ton) works out as follows:–

1,000/80 x 0.96 = 13.0 t/t

(3) The value for the three boilers in the Padaralang Mill works out as follows: –

1,000/104 x 0.96 = 10.0 t/t

2) Unit Ratio of Steam at Individual Plant

(1) Fig. 6-11-2 shows past record of unit ratio of steam at individual plant in 6 years.

(2) The horizontal lines in the Fig. (4.5, 3.5 and 4.0 t/t) show average expected values. These lines show the target values which are considered attainable by some measures for improvement.

(3) Unit ratios of the pulp plant range from 4.5 to 6.0 t/t. This is mainly attributable to steam leakage caused by faulty sealing at digester charging port.

Another contributing factor is increased consumption of steam to raise temperature in order to compensate cooling of stand-by boilers, caused by prolonged digesting cycle, as well as, cooling of the temperature of chemicals. This may also be concerned with the problem of relative comparison between given steam consumption and tons of finished pulp varying according to the pulp yield due to spoiled quality of raw straw.

Fig. 6-11-1 Fuel Oil Consumption Rate of Existing Boiler Unit in 6 years

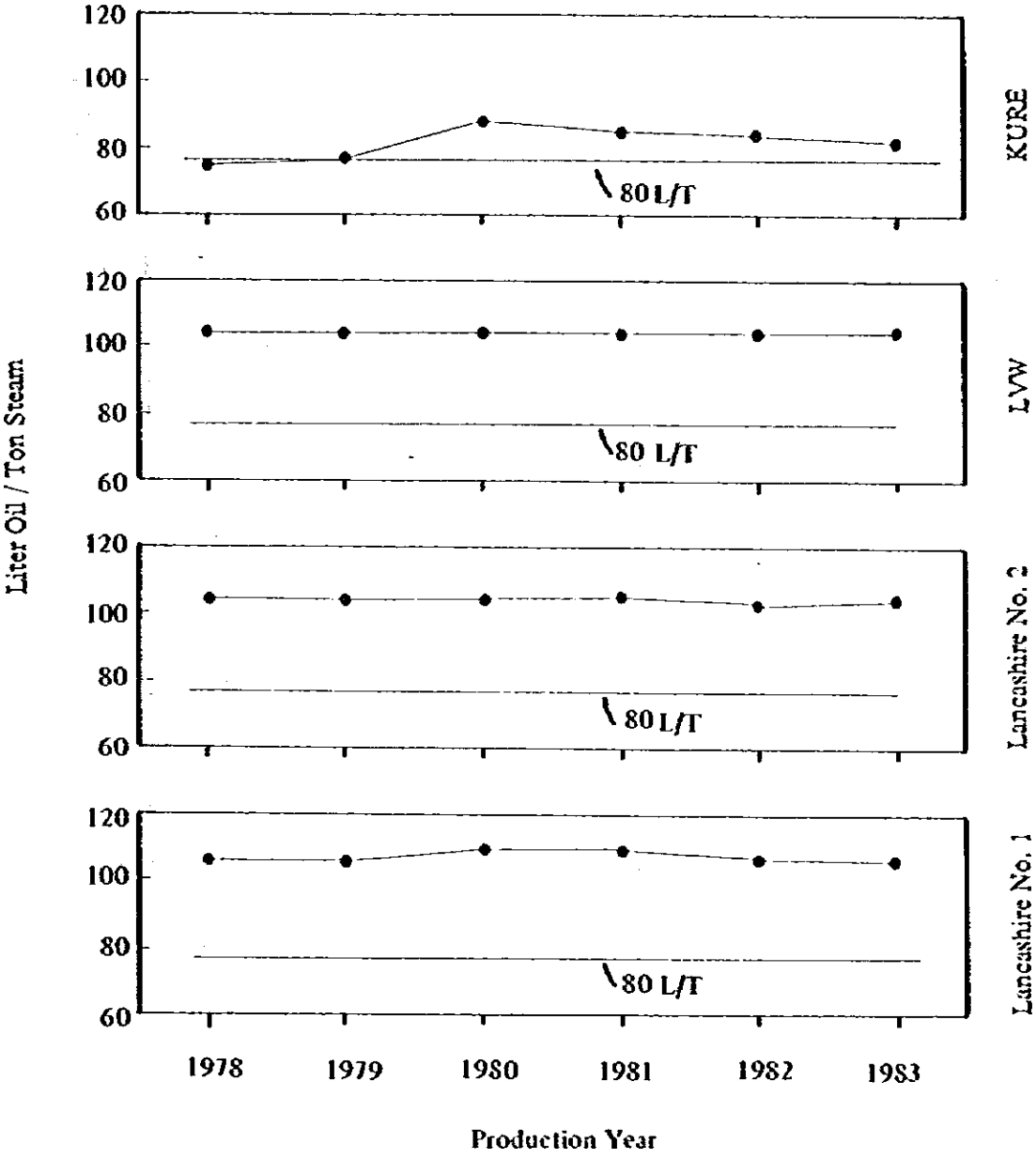
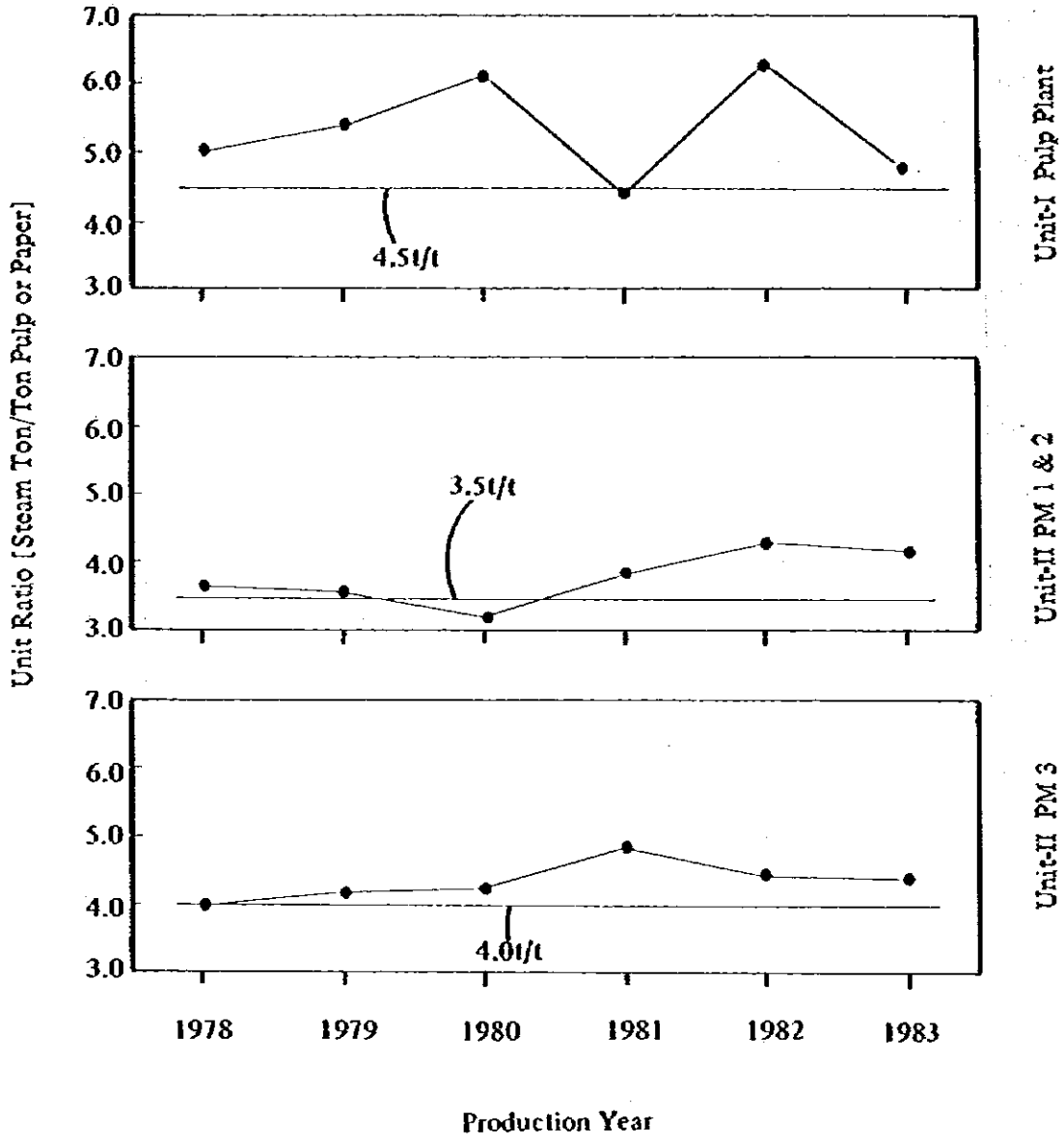


Fig. 6-11-2 Unit Ratio of Steam Consumption at Individual Plant in 6 Years



6-11-4 Problems and Corrective Measures Concerning Equipment and Operation

1) Problems Concerning Equipment

(1) Flue-Type and Smoke Tube-Type Boilers

Too low thermal efficiency causes waste of costly fuel oil

As against 85% thermal efficiency attained by an up-to-date water tube boiler, the current efficiency of the mill stands at as low as 63%.

(2) Steam Leakage from Pulp Plant Digester

At present, steam is not only discharged waste-fully, but also it takes time to raise pressure and temperature, resulting in higher consumption ratio.

2) Problems Concerning Operation

(1) Vigorous Practice of Heat Control

Analyses of purchased heavy oil, flue gas, etc. shall be made with a view to adjusting the required volume of combustion air supply. A suitable structure to this end must be formulated.

(2) Vigorous Practice of Daily Check on Steam Consumption Side

The situation on the steam consumption side including digester, paper machines, etc., is not sufficiently grasped. Besides, no action is taken to cope with any such findings.

3) Countermeasure

(1) Purchase one unit of 14kg/cm² x 14 T/H water tube boiler, with a view to improving steam production cost.

(2) In order to economize in steam consumption, carry out modification of digester charging port.

6-12 Electric Section

6-12-1 Outline of Electric Equipment

1) The power consumption of this mill is about 13,000MWh per annum and most of it is purchased power supplied from a substation of the Electric Power Corporation (P.L.N.) about 150m far from the 6kV receiving distribution center of the mill, and besides, about 0.2MWh per annum is supplied as emergency power with its own Diesel generators (275 kVA 3 units).

The purchased power is received in 6kV, stepped down to 380V at 3 transformer rooms in the premises, and distributed to the respective loads. (refer to Fig. 6-12-1)

2) The loads are approximately as follows.

Unit I (Pulp plant, PM 1 and PM 2) 214 motors 2,300 kW

Unit II (PM3) 110 motors 1,770kW and Sectional drive 12 sections (helpers 2) 130kW

Sectional drive 12 sections (helpers 2) 130kW

For the equipment of Unit I, the electrical equipment was partially renewed at the time of the rehabilitation work in 1973 and the expansion work of PM3 in 1975, but most of the other equipment are 50～60 years old and some of the equipment are necessary to be renewed for safety.

3) Due to the increased price of the fuel oil, the Diesel generators were switched from regular use to emergency use in 1980 and they were started 8 times in 1983 and the generated energy is small at 1,930kW. This is because the own generation cost is higher (101 Rp/kWh) than the purchased power rate (69 Rp/kWh) (as of March, 1984).

6-12-2 Problems in Operation and Countermeasures

1) Service interruption of P.L.N. and instantaneous voltage drop

Presently the operation efficiency has been reduced due to power trouble by about 1% of the production.

The power source trouble mainly cosists of power failure and instantaneous voltage drop due to natural phenomena such as thunderbolt, although the power failure related to the bad power supply situation of the P.L.N. and the expansion work of the transmission system (to be completed in 1988) is also included.

The scheduled power stoppage with notification is almost none and most of the power failures occur suddenly and are uncontrollable, and therefore, the power supply has low reliability as the power source for the manufacture of pulp and paper.

(1) Service interruption of P.L.N.

The frequency of power failures and the total time of power failure due to opening of the breaker for power receiving are shown in Table 6-12-1. That is they are as follows.

Year	Total frequency	Total time
1982	42	34.2h
1983	40	29.2h

(2) Instantaneous voltage drop of P.L.N.

Operation stops of Unit II due to instantaneous voltage drop in 1983 are shown in Table 6-12-2 (quoted from the data prepared by PPM).
That is, they are as follows.

PM 3	50 times
Stock preparation	40 times
Air compressor only	2 times

The number of stops of 50 times for PM 3 include 40 times of the stoppage for stock preparation, at the same time. The number of stops for paper machine only was 10 times.

In seems that they include the stops due to tripping of the contactor for distribution in the field while the breaker for power receiving is opened and those due to opening of the breaker for power receiving caused by the under-voltage relay, and the air compressor only seems to mean the opening of the electromagnetic contactor only of the motor.

(3) Countermeasures

Most of the power failures of the P.L.N. are caused by the natural phenomena such as thunderbolts occurring in various places and it is impossible to counter these failures.

The instantaneous voltage drop may be partially coped with by adding a delay release circuit (the circuit is retained for 1 – 3 seconds by means of the capacitor connected in parallel to the operating coil) to the hightension magnetic contactor for power transformers to the PM 3 and stock preparation etc., but is only effective when a similar circuit is added to the low-tension magnetic contactors for all the motors necessary for the operation.

Therefore, it is necessary to investigate and analyze in more detail the contents of the voltage drop before taking a proper step.

Ordinary values of the release voltage for the electromagnetic contactor and switch are shown below.

Type	% of rated voltage	Time (ms)
High-tension magnetic contactor	45 – 65	15 – 50
Low-tension electro-magnetic contactor	45 – 65	10 – 50
Auxiliary relay	35 – 60	5 – 40

The set value of the undervoltage relay used for the breaker for power receiving is presently tap 80V dial 4 and operates with the time limit of 2.8 seconds at the time of no-voltage. (See Fig. 6-12-2 Characteristic Curve.) Therefore, before this relay operates, the aforementioned load side switch is already opened.

The resetting operation of the breaker for power receiving and high-tension contactor opened by the voltage drop is manual and in order to meet the time loss, the set value of the undervoltage relay of the breaker for power receiving can be changed, for example to maximum 10 for the dial (operation with the time limit of 3.7 seconds at the time of no-voltage).

2) Driving Equipment for PM1 and PM2

(1) Presently the driving equipment for both paper machines are cone pulley, belt driving method or line shaft driving method using wound-rotor induction motors (45kW) (50 – 60 years old), and the Belt shifters are also the primitive manual field operation type without speed feedback control system.

There is play due to wear in many places and the operating speed is unstable being directly affected by the voltage fluctuation and the operation depends on the intuition and experience of the operator.

(2) Countermeasures

In order to improve the quality of paper, increase the production and increase the accuracy of speed control, they should be replaced partially or totally with new driving equipment.

PM1:

Sectional drive equipment (8 sections) with Thyristor Reonard Control system using DC motors should be adopted.

– Speed control accuracy ±0.5%

– with digital line speed meter

PM2:

Sectional drive equipment of 2 sections for suction couch (new installation) and for old line shaft, with thyristor Reonard Control system using DC motors should be adopted.

– Remote control of Belt shifters
– with digital line speed meter

3) Deterioration of substation equipment for Unit I

(1) Power transformer

The old substation (Electric Power Center) has 4 transformers, out of which 3 transformers of 500kVA (voltage ratio 5850, 5550/390V) were produced in 1921 – 1931 and recently they are receiving detailed inspection and maintea-ance by the manufacturer at the rate of about once in 5 years, but it is considered that the insulators are deteriorated and it is necessary to renew the insulators.

(Countermeasures)

It should give a problem of careful consideration to carry out the overhaul including renewal of the insulating materials of the present transformers as one of the measurement, but it is necessary long time stoppage for execution of working in view of the importance of reliability of the power transformers and also from the view point of energy saving, it is preferable to renew the transformers. The capacity should be 500kVA for 3 units.

The remaining one transformer of 630kVA is rented from P.L.N. The rent is cheap at 90,415 RP/month and it should be used in the future, too.

(2) Breaker

The breakers on the primary side of the power transformers in the preceding

clause is of manually operated oil type with the short-current capacity 1.5kA, rated voltage 12kV and rated current 200A and the breaking capacity is small. And it is old type which was installed at the same time when the power transformer was installed.

(Countermeasures)

The use of the breaker is continued but the disconnecting switch on its primay side should be replaced with the power fuse type disconnecting switch.

4) The load of the DC motor of No. 2 dryer group of PM3 is too big. As shown in Table 6-12-7 (1), it sometimes exceeds the rating current.

Comparison with Table 6-12-7-1 (2) of the data at the time of trial run reveals that the speed has been increased but the load characteristics of the dryer are such that the load current should not increase so much if condition of drainage is in good situation.

(Countermeasures)

It seems necessary to improve the machinery and equipment and to normalize the drainage.

5) Failure of air conditioner for PM3 sectional drive electrical room

Out of 2 wall type air conditioners of 1,440 kcal/h for cooling the thyristor control panels, one has been removed and the other has lost most of the cooling capacity, and the doors, windows and front doors of the panels have been opened.

It is necessary to service or renew them as soon as possible in order to prevent dust and to protect the semiconductor parts.

6) Improper environment for wall type switch group of Unit I

The wall mounted switches in the bleaching plant are located near the pit generating a vapor and the environment for the electrical equipment is bad.

(Countermeasures)

It is necessary to relocate the switches to a place with good environment in the future. As a makeshift measure, it is necessary to secure a space of 1.5m in front of the switches and to install roof, cover or fence to prevent splashing.

7) Bird pollution in transformer room for Unit I

Many birds (swallows) are flying in the building of this mill and they come into the transformer room and drop droppings and nest materials on the insulators of breakers, transformers and bus bars, and there is a fear of insulation failure leading to earthing or short-circuit accidents of the bus bars.

(Countermeasures)

It is necessary to install doors and nets.

8) Lack of safety measures for open-type motors for Unit I

Some of the open-type motors are seen with charging part exposed. Protection is required against moisture and for safety reason.

6-12-3 Problems of Control of Electric Power and Countermeasures

1) Contract Demand

The present contract demand is 3,120kVA and enough for actual maximum power demand that is about 2,600kVA.

Since the estimated maximum power increase due to the renovation work is about 210kVA, it seems unnecessary to increase the contract demand.

(Countermeasures)

It is desirable to install a demand meter and supervise the demand.

2) Improvement plan for purchased power voltage

The problem to increase the voltage from 6kV to 20kV already existed at the time of PM 3 expansion.

At that time when the power consumption was small, it was possible to connect to 6kV system through the negotiations with P.L.N. Due to the recent increase in power demand, P.L.N. is gradually promoting a change to 20kV system.

For this mill, too, it is necessary to consider a switch to 20kV system or 70kV system, and at the present rate of power consumption, the 20kV system will be enough. But since the PM4 expansion is planned in the near future, the total power consumption at the time should be calculated and the 70kV system should be adopted instead of investing now.

3) Power-factor improvement

The discount system for the power-factor is not adopted by P.L.N., but when the power factor becomes less than 80%, extra charges must be paid. The charges "x" can be obtained by the following formula.

$$"x" = [B - 0.75(A1+A2)] \times (A1 \cdot T1 + A2 \cdot T2)/(A1 + A2)$$

Where: B: Used kVarh

A1: Used kWh in WBP zone (18:00 – 22:00)
A2: Used kWh in LWBP zone (22:00 – 18:00)
T1: A1 time rate 96.50 Rp/kWh
T2: A2 time rate 60.5 Rp/kWh

Since the present power factor does not become less than 80% (minimum 82% according to the data for December 1983, normally 86 – 90%), it is impossible to reduce the cost by improving the power factor.

4) Electric charge by time zone

According to separate Fig. 6-12-3 Day's Load Curve, the load in the WBP zone is slightly small, and it is possible to reduce the cost by further reduction of the use of power in this zone.

(Countermeasures)

(1) It should be applied to the time for wire cleaning of machine and felt cleaning.

(Finishing yield and paper reeling efficiency can be improved by such cleanings.)

(2) It should be applied to the cutter knife replacement, etc. by stopping the straw cutter and belt conveyor, etc.

Example: If 50kW is reduced, the following will be saved.
50kW x (96.50 – 60.50) Rp x 4hr x 300d = 2,160,000 Rp/Y

5) Power consumption rate per unit of production

The unit ratio of power consumption in 6 years from 1978 are shown in Table 6-12-5 and such rates by grades (budget values for 1984) in plant Table 6-12-6.

The unit ratio of power consumption by division in the past 3 years are as follows.

	Pulp	Unit I	Unit II
This mill	534 kWh/ton	841 kWh/ton	2,434kWh/ton
Factory for comparison	–	*1 1,339 kWh/ton	*2 2,245kWh/ton

*1: Factory A of H company in Japan
*2: Factory B of H company in Japan
} Average for recent one year

After the renovation work, an increase of average power about 20kWh is expected for Unit I, but the total value is less than that for the mill for comparison and there is no problem in particular.

In the case of Unit II, the improvement can be made through the adoption of DDR as the refining equipment.

But in the manufacture of thin paper and specialty paper, the unit ratio of power consumption is normally high on the average and there is no problem.

6) Comparison in cost between purchased power and own generated power

The Power generated in this mill is now used for emergency and the cost is approximately as follows.

The values were obtained from the person in charge during the local survey.

Fuel consumption: 0.33ℓ/kWh
Fuel cost: 200Rp/ℓ 66 Rp/kWh
Lubricating oil cost
Maintenance cost 35 Rp/kWh
Labor cost

Therefore, it comes to 101 Rp/kWh.

On the other hand the purchased power is 73.72Rp/kWh on the basis of the PPM budget for 1984 and this is cheaper than the own generation.

7) Indications of instruments and control data

In many cases the indications of the instruments installed on the distribution panel in the Unit I electric power center are different from the measured values.

The following table shows the results of the actual measurements made with a multitester (measuring accuracy 0.3%) and clampin ammeter (measuring accuracy about 1%).

Transformer No.	Primary/secondary	Indication	Measured value
No. 1	Secondary voltage	404V	404V
	Secondary current	380A	360 – 370A
No. 2	Secondary voltage	385V	405V
	Secondary current	300A	250 – 260A
No. 3	Secondary voltage	nil	406 – 408V
	Primary current	13.5A	200
No. 4	Secondary current	440V	407V
	Secondary voltage	530A	513A
	Secondary current		

It is a problem that these are the instruments used for controlling the electric energy.

(Countermeasures)

Necessary instruments should be purchased and installed and it is necessary to calibrate the indicators at least once a year.

Because of the absence of the watt-hour meter, the electric energy is calculated on basis of the indications of the above indicators every hour and is used as the cost control data.

(Countermeasures)

Watt-hour meters for energy consumption control should be provided.

8) Control of power factor

There are 300kVA x 2 banks in the 6kV receiving distribution center and 380V 25kVA x 10 capacitors in the Unit I electric power center, and the ON/OFF operation is to be made manually. The electric power center has no power-factor meter.

(Countermeasures)

It is recommended that a power-factor meter and automatic power-factor controller be purchased and installed in the Unit I electric power center

6-12-4 Problems with Organization and Equipment Control and Countermeasures

1) Organization

The present personnel organization is as follows and it seems reasonable for the present situation.

- Worker: 2 for PM 1 & 2 section, 1 for PM 3 section, 1 chief each
- Maintenance 3, worker 2, staff 2, design (including instrumentation) 1
- Stagger 1

The average age is 36.7 and there are 6 high school graduates and the remaining are middle school and elementary school graduates, and many of them have long service. It may be a good idea to temporarily increase the maintenance workers to stress the productive maintenance by means of gathering the workers grouping now into two as Unit I & II, to omit their sectionalism.

2) Maintenance

A maintenance system exists but the standardization and planning are not done. The so-called "Plan-Do-Check-Action" is lacking.

The following points are problems.

(1) Check list and patrol method are imperfect.

(2) The operation standard for overhaul, testing method, etc. of equipment and job standard for revamping work, etc. are not properly prepared.

(3) Ledgers such as motor ledger and transformer ledger do not exist, and no control is made of the equipment by means of the control numbers.

(4) Drawings for maintenance (such as single-line diagram, flow chart and wiring diagram) are lacking and no correction is made after revamping.

(5) Necessary testing and checking equipment and recorder, etc. are not equipped.

(6) Housekeeping and filing are generally inadequate. Especially for spare parts and drawings.

(7) They have no drying oven used for drying the motor with deteriorated insulation after changing the winding of the burnt motor, and the drying is done by putting electric lamp in a cardboard enclosure.

It is necessary to have a drying compartment which can accommodate a 110kW class motor.

The maintenance control cannot be generalized and it is important to accumulate improvements suitable for each mill, but the following will describe the basic items.

3) Control method

As a short-term control target, a target by values should be set.

A. The occurrence of downtime of electrical equipment should be controlled.
B. Reduction of equipment maintenance cost (cost minimization).
Priority should be placed on A.

(1) The equipment should be ranked in accordance with the degree of importance. In consideration of the production, safety, environment and maintenance when the equipment is broken down, the following 3 classifications should be used.

a = Important P.M.
b = P.M.
c = B.M.

P.M. = Preventive maintenance
B.M. = Breakdown maintenance

(2) Inspection and repair

They should be divided into daily inspection (times/day), periodical inspection (times/week or month) and detailed inspection (times/year – times/4 years), and the quantitative measurement should be conducted with measuring instruments as required.

Especially important is the tendency control of insulation resistance, load current, vibration and temperature.

The check points, criteria, methods and implementation cycles should be clearly indicated in the check sheet (it is necessary to review it about once in a year).

The important point for the detailed inspection is to plan it to match the scheduled shutdown of the plant (at the time of wire change or shutdown).

(3) In order to achieve a complete individual control of the equipment, the equipment ledger should be prepared and necessary data such as control No., inspection method, cycle and flow should be written in it.

If this ledger is also used as a history ledger recording the details of the repair and failure, it is easy to unify the control of plan and do.

The action plan for each person should be made monthly on basis of the maintenance records of the previous month, production plan and conditions of equipment.

(4) Countermeasures against aged deterioration

Grasping the conditions of deterioration periodically and referring to the information from the manufacturers and the past records, renewal of the deteriorated parts or equipment should be planned, and in such a case the preparation should be started very early in view of the delivery time of the parts (especially non-availability of imported parts may happen due to discontinuation of the manufacture). When the equipment is renewed, it is necessary to consider the improvement always.

(5) Countermeasure against failure

The contents of the failure must be analyzed and proper steps must be taken, otherwise the same failure will occur again.

If any investigation period is required for a measure, it is convenient to record the contents in a dedicated card together with the scheduled date for completion of the measure until the problem is solved so that the monthly progress can be checked.

4) Control of spare parts

When a catastrophic failure occurs, it is necessary to minimize the effect on the operation by taking proper and prompt steps.

(1) In order to eliminate the shortage of the parts and to minimize the time to search them, it is necessary to conduct an efficient control of the stock amount, ordering dates and quantity ordered of the necessary parts obtaining the cooperation from the person in charge of purchasing.

(2) For the important equipment which often causes trouble, it is helpful to provide the jobsite (where 3-shift persons are stationed such as control room and substation) with the tools, drawings, spare parts and past cases of trouble-shooting which are required for the maintenance.

(3) In order to prevent the deterioration of the spare parts in storage, they must be put in plastic bags or given rustpreventive treatment before storing so that they may be used at any time. The insulation measurement of the spare motors, etc. should be periodically performed.

5) Control of tools and measuring instruments

It is advisable to put fixed Nos. on the equipment to be controlled and also the name Nos. on the storing shelf provided with partition plates and for the user to put his nameplate on the stored place.

The tools are measuring instruments now in possession are shown in Table 6-12-8.

6) Education and Training

(1) The meeting for all the members on improvement centering on the OJT and the meeting for staff and chiefs and higher echelons should be held at least once a month.

(2) In order to given basic education, the employees should be sent to P.L.N, manufacturers and educational institutions such as school and laboratory, as required, or outside lecturers should be invited.

(3) Visit to other factories and practical education

(4) OJT education to be given at the mill by manufactures' engineers or electrical technicians engaged in the paper making. Especially important is the upbringing of the engineers for equipment improvement, work design, supervision and inspection for acceptance, and then the upbringing of the engineers for maintenance technique. The education in the company should be planned and implemented mainly by these engineers for the level-up of all the members.

7) Maintenance cost

The total maintenance cost for electrical equipment and instrumentation in 1983 was 70 – 80 million Rp, about 1% of the turnover.

The average of this figure is to be about 1.5%, and the maintenance efficiency shoud be further enhanced through the positive investment in the spares and controlling instruments.

6-12-5 Countermeasures

1) Electrical equipment and measuring instruments

The recommended electrical apparatus to be purchased are shown in 3) and the recommended maintenance instruments to be purchased in 4) and the improvement should be made through the purchase of these apparatus and instruments.

2) Maintenance control

Modernization should be promoted through the introduction of the latest maintenance control technology. That is, the education and training matched with the level of the trainees should be given through the actual business.

3) Recommended electrical apparatus to be purchased

(1) Countermeasures against deterioration

-1. Power transformer

Unit I substation 3ϕ 500kVA 6kV/380V 3 sets

-2. High-tension powerfuse type disconnecting switch 3 x 3 sets

(2) Improvement in power use

– Power-factor meter and power-factor controller with accessories.

(3) Controlling instruments

– Integrating demand meter for Unit I 5 sets
with potential transformer and current transformer

(4) Recommended instruments for maintenance to be parchased

Spare motors 1 set. See the following page.

Spare Motor List

Kind	(kW)	P.	Type/Frame	Maker	Use	Q.	Mark
	0.035	2			Double Cutter Vibrator	4	O
	0.2	2			Double Cutter Oil Pump	2	O
Cyclo Motor	0.75	4	125.86: 1 ~ HAMI-53 37.94:1	SMTM	Holey Roll	1	O
I. Motor	3.7	4	FEVQ-5/FEV-5-112M	YSKW	Drain Pump	3	O
I. Motor	3.7	4	FEQ/FE-112M	YSKW	Superclone	3	O
I. Motor	7.5	4	FEF/FE-132M	YSKW	White Water Pump	2	X
I. Motor	7.5	4	FEF/FEL-5-132MD	YSKW	Cooling Fan (DCM)	1	O
I. Motor	7.5	6		YSKW	Prefiner	2	O
I. Motor	11	4	FET/FE160M	YSKW	Stock Pump	3	O
I. Motor	15	4	FEF/FE160L	YSKW	Stock Pump	2	O
I. Motor	18.5	4	FEF/FE180M	YSKW	Suct. Felt	3	O
I. Motor	75	6	BDK/BD-280SC	YSKW	Vacuum Pump	4	O
I. Motor	75	6	BDVR-/BDV-45TX	YSKW	Hydra Pulper	3	O
V.S. Motor	7.5	4	FELF-1J + VBOMN	YSKW	Wire Shake	1	O
DC. Motor	0.75			YSKW	Dandy Roll	1	O
	3.7			YSKW	1D, 2D, 3D	3	X
	5.5			YSKW	C.P, B.S	2	X
	7.5			YSKW	4D, R	2	X
	11			YSKW	M P, W.R.	2	X
	15			YSKW	Suct. P, 2P	2	X
	22			YSKW	Suct. Couch, W.D	2	X
Geard DC Motor	5.5		1/30	YSKW			O

Note: Mark Q: Number of Motor operated
Mark O: To be Needed

4) Maintenance Instruments Recommended for Purchase

(1)	Portable recorder Wigh current probe	100 mm width 2 pen 5/50/100A 250/500/1000A	1 set
(2)	Module checker Made by YASUKAWA		1 set
(3)	Low resistant measuring device Double bridge	YEW 2769	1 unit
(4)	Hand tachometer	0 to 20,000 r.p.m. ONO-HT340	1 pc
(5)	Synchroscope 2 sectors	50 MHZ	1 set
(6)	Portable wattmeter	YEW 2042 3φ	1 set
(7)	Portable AC ammeter	(To be arranged by PPM)	2 units
(8)	Portable AC voltmeter	(To be arranged by PPM)	1 unit

Table 6-12-1 PLN Power Failure Conditions

Season	Month	1983 Freq'cy	1983 Stop Time (min)	1983 Total (min)	1982 Freq'cy	1982 Stop time (min)	1982 Total (min)	Remarks
Rainy	Jan	5	8, (15), (60), 10, (25)	118	2	(15), (10)	25	EX) ○: Power failure by the thunderbolt influence
	Feb	6	15, 10, (10), (15), (5) 13	68	3	(10), (20), (18)	48	
	Mar	0		0	5	25, 25, 25, (75) 60	210	
Dry	Apr	3	(25), (260), (125)	410	5	5, 7, (100), 18, 45	175	
	May	7	(14), 30, (10), (20), 23, (40), 75	212	0		0	
	Jun	10	35, (110), (11), (20), (10) x 5, 68, (5), (110)	389	4	(10), (20), (15), (35)	80	
	Jul	0		0	2	(5), (20)	25	
	Aug	4	(50), (15), (10), 8	83	0		0	
Rainy	Spt	1	15	15	3	(5), (15), 10	30	
	Oct	3	(25), (6), (7)	38	4	25, (7), (25), (55)	112	
	Nov	2	(32), 5	37	3	615, 10, (30)	655	
	Dec	1	(680)	680	9	(12), (22), 5, (10), 10, (248), (10), (80), (5)	402	
	Total	42 3.5/M		2050 34H10M	40 3.3/M		1762 29H22M	

Table 6-12-2 UNIT II Power failure by instantaneous voltage drop (1983)

Month	P. Machine		* Stock Prep.	Air Comp.	Remarks
1		7	7		
2		6	6		
3		8	8		Within 1hr 2 times x 2
4	1	7	6		Within 1hr 3 times
5		4	4		Within 1hr 2 times
6		0	0		
7		3	3		Within 1hr 2 times
8	1	4	3		
9	3	3	0		P.L.N. overlapped once
10	3	4	1	1	
11	1	1	0	1	
12	1	3	2		
Total	(10)	50	40	2	
$\bar{X}$	4.17/month		3.33/month	0.17/month	

P. Machine Only

Note) The figure shown in this table means frequency.

Table 6-12-3 DATA OF VOLTAGE DROP FOR 6kV LINE

ON DEC. 1983

DAY	P.L.N.			P.P.M.			REMARKS
	HIGH (V)	LOW (V)	ΔV (V)	HIGH (V)	LOW (V)	ΔV (V)	
1	6,200	6,000	200	6,400	6.250	150	
2	6,200	6,000	200	6,450	6,250	200	
3	6,200	6,000	200	6,500	6,200	300	
4	6,200	6,000	200	6,500	6,200	300	
5	6,200	6,000	200	6,500	6,300	200	
6	6,400	6,000	200	6,480	6,300	180	
7	6,200	6,950	150	6,500	6,200	300	
8	6,200	6,000	200	6,500	6,200	300	
9	6,200	6,000	200	6,450	6,200	150	
10	6,200	6,000	200	6,500	6,200	200	
11	6,200	6,000	200	6,500	6,400	100	
12	6,200	6,000	200	6,500	6,300	200	
13	6,200	5,900	300	6,500	6,300	200	
14	6,200	5,900	300	6,510	6,250	260	
15	6,200	5,900	300	6,500	6,300	200	
16	6,200	6,000	200	6,500	6,300	200	
17	6,200	6,200	0	6,500	6,300	200	
18	6,200	6,200	0	6,580	6,300	180	
19	6,200	5,900	300	6,450	6,250	200	
20	6,200	6,000	200	6,450	6,250	200	
21	6,200	5,950	150	6,450	6,250	200	
22	6,200	5,950	150	6,480	6,350	130	
23	6,200	5,950	150	6,450	6,300	150	
24	6,200	6,000	200	6,480	6,300	180	
25	6,400	6,000	400	6,450	6,400	50	
26	6,200	5,950	150	6,450	6,250	250	
27	6,200	6,000	200	6,550	6,250	300	
28	6,200	6,000	200	6,500	6,300	200	
29	6,200	6,000	200	6,500	6,300	200	
30	6,200	6,000	200	6,500	6,300	200	
31	6,200	6,000	200	6,450	6,300	150	

Table 6-12-4 Data of Voltage for Incoming 6.0 kV P.L.N. on Dec. 1983

Unit: kV

D / H	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Jan.'84 1
0		6.40	6.40	6.40	6.50	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.35	6.50	6.40	6.45	6.45	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.30	6.40	6.40	–	6.40	6.40
1		6.40	6.40	6.40	6.50	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.35	6.50	6.40	6.50	6.40	6.45	6.40	6.40	6.40	6.40	6.40	6.40	6.50	6.45	6.40	6.40	–	6.40	6.50
2		6.40	6.40	6.40	6.50	6.48	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.50	6.40	6.50	6.50	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.50	6.45	6.50	6.40	–	6.40	6.50
3		6.40	6.40	6.40	6.50	6.48	6.40	6.40	6.40	6.45	6.45	6.40	6.40	6.40	6.50	6.40	6.45	6.55	6.40	6.40	6.40	6.40	6.40	6.40	6.41	6.50	6.50	6.50	6.50	–	6.40	6.50
4		6.40	6.40	6.40	6.50	6.45	6.40	6.40	6.45	6.45	6.50	6.40	6.40	6.50	6.50	6.40	6.45	6.55	6.40	6.40	6.45	6.40	6.40	6.40	6.45	6.50	6.50	6.45	6.50	–	6.45	6.50
5		6.40	6.40	6.40	6.50	6.45	6.40	6.45	6.40	6.40	6.50	6.40	6.40	6.45	6.40	6.40	6.45	6.50	6.40	6.40	6.45	6.45	6.40	6.40	6.45	6.50	6.50	6.45	6.50	–	6.40	6.50
6		6.40	6.40	6.40	6.40	6.45	6.40	6.50	6.45	6.40	6.50	6.40	6.40	6.40	6.45	6.40	6.40	6.50	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.50	6.55	6.45	6.50	–	6.40	6.50
7	6.35	6.30	6.30	6.45	6.40	6.40	6.20	6.20	6.30	6.35	6.40	6.40	6.40	6.40	6.35	6.40	6.40	6.45	6.45	6.40	6.40	6.35	6.35	6.45	6.40	6.40	6.35	6.30	6.50	6.40	6.40	
8	6.35	6.30	6.25	6.45	6.30	6.40	6.20	6.50	6.40	6.35	6.40	6.40	6.40	6.30	6.30	6.40	6.40	6.40	6.25	6.30	6.25	6.35	6.35	6.30	6.40	6.30	6.35	6.30	6.30	6.40	6.35	
9	6.25	6.30	6.20	6.30	6.35	6.45	6.40	6.35	6.30	6.30	–	6.40	6.40	6.30	6.30	6.30	6.40	6.40	6.35	6.35	6.30	6.35	6.30	6.40	6.40	6.30	6.30	6.40	6.40	6.40	6.30	
10	6.40	6.40	6.40	6.35	6.40	6.40	6.40	6.40	6.30	6.30	–	6.30	6.40	6.30	6.30	6.40	6.40	6.45	6.25	6.35	6.40	6.35	6.40	6.35	6.40	6.25	6.30	6.35	6.40	6.35	6.35	
11	6.40	6.40	6.40	6.45	6.30	6.40	6.40	6.40	6.30	6.40	–	6.35	6.30	6.30	6.30	6.40	6.40	6.40	6.25	6.30	6.40	6.40	6.40	6.40	6.45	6.35	6.35	6.35	6.40	6.40	6.40	
12	6.40	6.40	6.40	6.45	6.40	6.45	6.40	6.45	6.40	6.40	–	6.35	6.30	6.35	6.30	6.40	6.40	6.45	6.30	6.35	6.40	6.40	6.45	6.40	6.45	6.40	6.40	6.40	6.40	6.50	6.40	
13	6.30	6.25	6.40	6.40	6.40	6.45	6.20	6.40	6.45	6.40	–	6.35	6.30	6.25	6.30	6.40	6.40	6.45	6.40	6.25	6.30	6.40	6.40	6.45	6.45	6.45	6.25	6.30	6.30	6.40	6.45	
14	6.30	6.35	6.45	6.20	6.40	6.40	6.30	6.30	6.40	6.40	–	6.30	6.35	6.25	6.40	6.40	6.40	6.50	6.35	6.25	6.40	6.35	6.40	6.45	6.45	6.40	6.37	6.35	6.40	6.30	6.40	
15	6.40	6.40	6.40	6.30	–	6.35	6.35	6.25	6.40	6.40	–	6.30	6.40	6.35	6.40	6.40	6.45	6.58	6.40	6.40	6.40	6.40	6.40	6.40	6.45	6.40	6.37	6.40	6.40	6.30	6.40	
16	6.40	6.40	6.50	6.30	6.30	6.30	6.40	6.35	6.40	6.40	–	6.35	6.40	6.35	6.50	6.40	6.45	6.45	6.40	6.40	6.40	6.48	6.40	6.40	6.45	6.40	6.40	6.40	6.40	6.30	6.40	
17	6.40	6.40	6.40	6.35	6.35	6.30	6.50	6.30	6.40	6.35	–	6.40	6.45	6.35	6.35	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.35	6.35	6.45	6.40	6.37	6.40	6.40	6.40	6.35	6.45
18	6.35	6.40	6.40	6.20	6.40	6.40	6.30	6.40	6.40	6.40	6.40	6.50	6.45	6.40	6.35	6.50	6.40	6.40	6.40	6.45	6.40	6.35	6.30	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.35
19	6.30	6.40	6.40	6.40	6.40	6.30	6.35	6.40	6.40	6.50	6.40	6.50	6.50	6.40	6.30	6.50	6.40	6.45	6.40	6.45	6.40	6.45	6.30	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40
20	6.35	6.40	6.40	6.41	6.40	6.40	6.40	6.40	–	6.40	6.50	6.45	6.40	6.45	6.40	6.50	6.40	6.40	6.40	6.45	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40
21	6.35	6.45	6.45	6.40	6.40	6.40	6.45	6.40	6.40	6.40	6.50	6.45	6.40	6.50	6.35	6.50	6.45	6.45	6.40	6.45	6.40	6.40	6.40	6.48	6.40	6.40	6.40	6.40	–	6.40	–	
22	6.40	6.40	6.40	6.40	6.45	6.40	6.40	6.45	6.40	6.40	6.40	6.40	6.40	6.51	6.45	6.40	6.40	6.45	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	–	6.40	–	
23	6.40	6.40	6.40	6.50	6.40	6.40	6.40	6.45	6.40	6.40	6.40	6.40	6.40	6.50	6.45	6.41	6.40	6.45	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.30	6.40	6.40	–	6.40	–	
High	6.40	6.45	6.50	6.50	6.50	6.48	6.50	6.50	6.45	6.50	6.50	6.50	6.50	6.51	6.50	6.50	6.50	6.58	6.45	6.45	6.45	6.48	6.45	6.48	6.45	6.50	6.55	6.50	6.50	6.50	6.45	
Low	6.25	6.25	6.20	6.20	6.30	6.30	6.20	6.20	6.30	6.30	6.40	6.30	6.30	6.25	6.30	6.30	6.40	6.40	6.25	6.25	6.25	6.35	6.30	6.30	6.40	6.25	6.25	6.30	6.30	6.30	6.30	
ΔV	0.15	0.20	0.30	0.30	0.20	0.18	0.30	0.30	0.15	0.20	0.10	0.20	0.20	0.26	0.20	0.20	0.10	0.18	0.20	0.20	0.20	0.13	0.15	0.18	0.05	0.25	0.30	0.20	0.20	0.20	0.15	

Table 6-12-5 Transition Table of Electric Power Unit Consumption

Year	Supply power (kWh)			Pulp plant			Unit I PM1 + PM2		
	P.L.N.	Generator	Total	kWh	Pulp (ton)	kWh/ton	kWh	Paper (ton)	kWh/ton
1978	11,769,684	639,790	12,409,634	1,147,569	1,805.677	635.530	3,636,036	4,056.036	896.450
1979	11,366,377	473,780	11,840,157	552,474	1,587.213	348.080	3,766,848	4,407.866	854.570
1980	11,236,790	280,660	12,643,450	442,131	1,049.713	421.192	3,906,429	4,748.245	882.710
1981	11,248,388	175,710	12,424,098	686,630	1,241.157	553.210	3,544,645	4,361.050	832.790
1982	13,618,184	2,130	13,620,314	720,462	1,345.419	535.493	3,432,134	4,172.055	882.648
1983	12,859,348	1,930	12,861,278	682,187	1,329.387	513.158	23,491,262	4,617.595	756.082

Finishing I			Unit II PM3		
kWh	Paper net to (ton)	kWh/ton	kWh	Paper (ton)	kWh/ton
76,524	3,513.507	21.770	6,969,372	2,662.702	2,657.330
75,591	3,862.814	19.570	6,964,631	2,686.500	2,592.400
77,109	4,116.982	18.729	7,737,448	3,163.042	2,446.204
88,424	3,792.557	23.309	7,655,652	3,193.173	2,397.500
85,060	2,874.439	29.590	8,956,528	3,532.941	2,535.148
78,861	4,069.542	19.379	8,211,656	3,464.300	2,370.365

Table 6-12-6 Table showing Efectric Power Unit Consumption by Brands

∵ 1 KWh = 23.72 RP

No of P. Machine	Brand	Gross paper making kg	Finishing yield %	Finishing unit kWh/ton	Gross paper-making unit kWh/ton	E. Power cost RP/ton
	H.V.S. WARNA 85	1.250	89	1.125	900.0	82,935
	Water Mark Pth. 70	1.235	81	1.112	900.7	81,976.64
PM1	Kertas Water Mark Warna 70	1.235	81	1.112	900.7	81,976.64
	M.I Regd 80	1.350	89	1.125	900.0	82,935
	Bankcard 60	1.149	87	1.034	899.6	76,226.43
	Bankcard 50	1.149	87	1.034	899.6	76,226.43
	Reform 120	1.190	84	1.071	663.5	78,954.12
	S.P.B. Tropic Air Mail 80	1.250	89	1.125	900.0	82,935
	S.P.B. Base 80	1.220	82	1.098	900.4	80,944.56
	Cheque Pth 100	1.190	84	1.071	899.6	78,954.12
	S. ITB Garuda 130	2,000	59	1.800	900.0	132,696
	Post Wood 175	1.136	88	1.022	895.4	75,343.84
	Kasa Post ch. 175	1.136	88	1.022	895.4	75,343.84
	Kraftex Warna 100	1.190	84	1.071	542.5	78,954.12
	Overlay Warna 80	1.087	92	978	859.8	72,058.16
	Kraft Cellist 45	1.087	92	978	859.8	72,058.16
	Water Mark 120	1.350	89	1.125	900.0	82,935
PM1 and PM2	Offset Pth. 65	1.220	82	1.098	900.4	80,944.56
	Pth. 50	1.350	89	1.125	900.0	82,935
	Cyclostyle Pth 65	1.075	93	958	900.2	72,360.56
	Zerfroof 70	1.163	86	1.047	900.4	77,154.84
	Coverlux Warna 65	1.163	88	1.022	895.4	75,343.84
	Overlay Warna 200	1.087	92	978	859.8	72,058.16
	Overlay Bank Text 70	1.087	92	978	859.8	72,058.16
PM2	Doorslag Pth. 28	1.350	89	1.125	900.0	82,935
	Doorslag Warna 28	1.350	89	1.125	900.0	82,935
	Bank Post 44	1.220	82	1.098	900.4	80,944.56
	Corona 37	1.220	82	1.098	900.4	80,944.56
	Bible Telephone 36	1.250	89	1.125	900.0	82,935
	Sparco Pth. 36	1.355	83	1.125	900.0	82,935
	Sparco Newsprint	1.250	83	1.125	900.0	82,935
PM3	Golden Bird 26	1.130	88.5	2.769	2,453.6	204,330.68
	Silver Bird 26	1.333	90.0	2.772	2,449.8	200,565.94
	Sg. Eagle 26	1.143	87.5	2.830	2,453.0	206,416.00
	Sg. Cellist 26	1.143	87.5	2.830	2,453.0	206,416.00