The records of measured freeness values in the head box indicate some variation, for example, 270 to 400 C.S.F for HVS 45,280 to 400 C.S.F for HVS 60,300 to 345 C.S.F for HVO 80 and 370 to 435 C.S.F for CS. There is a correlation between the freeness in the head box and number of sheet breaks. The higher the freeness, the oftener the sheet break occurs. If the freeness can be maintained at a level of 300 ± 20, the sheet break occurring at the higher freeness of 360 to 380 C.S.F could be reduced by 40%. This correlation is shown in Fig. 7-1-5.

(3) Importance of freeness

Freeness is an important control index of fiber dispersion (sheet formation, sheet strength and dewatering degree = speed) on the wire part. Also, the dewatering degree on the wire part influences the water splash on the dandy roll and moisture content at the press inlet, and the efficiency of paper machine (sheet break troubles and others) and steam consumption are greatly dependent on it.

(4) Plan for improving freeness stability

a. Acquisition of having stabilized quality pulp
b. Adoption of DDR for the primary refiner
c. Installation of freeness tester

*The freeness control (= refining control) can be made closer by installing a freeness tester at the job site and measuring the freeness value by operators themselves with it.

7-1-6 Equipment for Chemicals Additions and Control

(1) The first requirement of the equipment for chemicals additions is the ability of constant rate of furnish to the pulp flow (ADt/h).

At present, the chemical adding rate is checked at a rate of once per hour, which is close enough, but the control (adding at a fixed rate) against the pulp flow (ADt/h) is insufficient. Especially, the adding quantity of sizing is inconsistent and it varies greatly.

Data on the current situation is given in Fig. 7-1-4.

(2) It is assumed from the above data that the quantity of chemicals for addition is determined based on the quantity of pulp being passed.

However, we must point out that the pulp consistency varies from time to time. In other words, we believe that the quantity of chemicals for addition must be determined based on "pulp flow rate × consistency = pulp ADt".

The importance of this should be clearly understood because of the fact that the BRPP standard also sets the rate of chemicals for addition on the basis of the quantity of pulp, ADt.

At present, each chemical is added to (virgin pulp + dry broke), and we agree that this is a basically good control method. This is because, once pulp is made into paper and part of it is recycled as broke pulp, the effect of chemicals is lowered extremely.

(3) Places of chemical adding

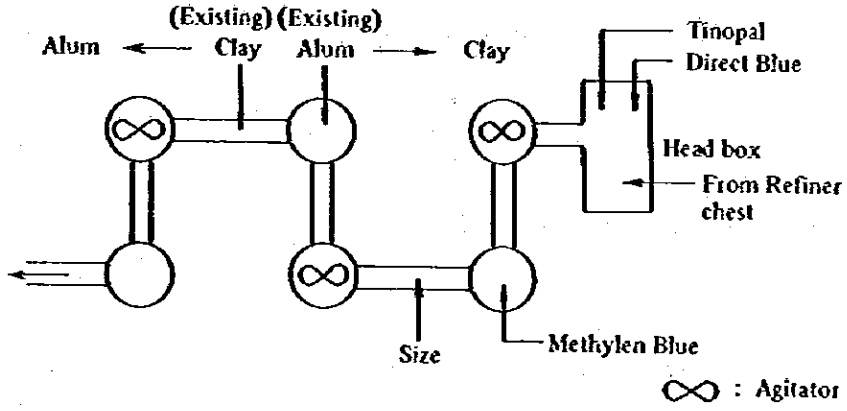
a. The mixer is equipped with a strainer (40mesh) for various chemicals, and this strainer is very useful in eliminating foreign matter.

There is no particular point that we note improper on the whole flow of mixer, but we recommend a change on the alum adding method and dilution method.

In other words, we think that alum should be added at the last stage of mixer because of the relation with other chemicals and the problem of precipitation.

We recommend that the adding positions of clay and alum should be changed each other.

The existing flow of mixer and our improvement plan are shown below.



b. At present, alum is added as the measures of pH value control. We think it better to change the current standard of head box pH 4.1 ± 0.2 to pH 4.5 ± 0.2 in consideration of the precipitation and yield of alum, thereby reducing the alum consumption and ultimate cost.

c. On chemical dilution, we think that dilution should be conducted at the chemical adding part of mixer in consideration of its mixing with the pulp.

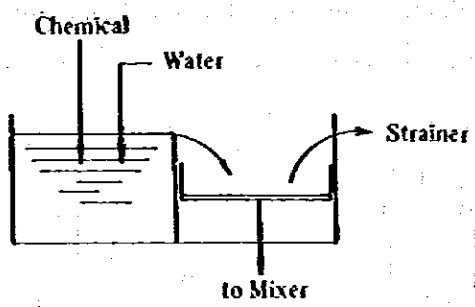
The dilution rate should be controlled to about double as this will prove more uniform mixing.

The concentrations of chemicals added to the mixer at present and our recommendation are as follows.

	Existing	* Improvement plan
Clay	10%	5%
Alum	10%	5%
Size	4.5 – 5%	2.5%

* Add water at the mixer inlet, changing the existing concentration of 10% to 5%

The dilution method is illustrated below.



The above box type is very suitable.

(4) Studies on other chemicals

a. Study on paper strength improving agent

The lower paper strength resulting from the trend toward lower basis weight and change of paper strength caused by fluctuation of pulp furnish ratio are the partial reasons for more frequent break of the web on the machine. Also, judging from the test result of the products, the tensile strength is MD/CD = 3.5/1.3, picking is F/W = 7 – 10/5 – 6 for HVS 45g/m² and HVS 50g/m², and F/W is 3/3 or lower for Cyclo style 70g/m².

Although use of a paper strength improving agent (for example, polyacron) will increase the chemical cost, but the disadvantage should be covered by a greater reeling efficiency when a large-scale production of lower basis weight paper expected for the future is taken into consideration.

b. Study on yield improving agent

The measured result of wire retention of existing HVS 50g/m² production is 53%, and we think this should be increased to at least 60%. In order to improve the yield with the current facilities, equipment and inlet concentration, a yield improving agent (for example, polymin) must be added.

If to employ other method, change of the wire specifications (wire mesh) and increase of pulp consistency in flow box and installation of hydro foils must be considered.

On the clay adding process applied at present, we see that it is added in the continuous mixer and at the same time, about 25% of the necessary quantity is distributed and added in the mixer before No. 1 fan pump. We do not think this method is proper. We think it advantageous that clay is added in the continuous mixer only and alum is added in the mixer before No. 1 fan pump.

7-1-7 Stabilization of Broke (Waste Paper) Furnish Combination

The quantity of waste paper (broken waste, trimming waste, and finishing waste) varies with the situation of sheet break and finishing, and when using the broke pulp, the furnish combination of it to the refiner chest must be changed according to the grade of paper being made at the time.

The prime reason for this is to maintain the pulp strength in the flow box. Another reason is that, if dry broke of a high ash content (for example, HVS 80g, 12.8%) is mixed in the stock for the paper of a low ash content (for example, HVS 45g, 5 – 6%), it may cause frequent sheet break affected by floating blocks of fibers and the like.

The pulp furnish combination must be adjusted to maintain the ash content of the paper constant.

7-1-8 Paper Quality

The paper quality and standards are described in Chapter 5-6.

Table 7-1-8 Standard of BRPP & Recommendation

Grade	Fr's[cc]	Standard (Nowadays)	Actual	Recommen-dation
HVS 45	Thickener		610 - 660	
	Steel ref.	430 ± 10	385 - 525	420 ± 20
	Stone ref.	360 ± 10	310 - 390	330 ± 20
	Head box		270 - 400	300 ± 20
HVS 50	Thickener			
	Steel ref.	420 ± 10	400 - 520	420 ± 20
	Stone ref.	350 ± 10	300 - 460	330 ± 20
	Head box		180 - 350	300 ± 20
HVS 60	Thickener		640 - 705	
	Steel ref.	420 ± 10	400 - 480	420 ± 20
	Stone ref.	350 ± 10	340 - 460	330 ± 20
	Head box		280 - 400	300 ± 20
HVS 80	Thickener		615 - 600	
	Steel ref.	450 ± 10	400 - 490	450 ± 20
	Stone ref.	380 ± 10	320 - 440	360 ± 20
	Head box		345 - 425	320 ± 20
HVO 80 (Offset)	Thickener		650 - 700	
	Steel ref.	430 ± 10	400 - 470	430 ± 20
	Stone ref.	360 ± 10	330 - 360	340 ± 20
	Head box		300 - 345	300 ± 20
Cyclo. 70	Thickener		630 - 670	
	Steel ref.	490 ± 10	470 - 510	480 ± 20
	Stone ref.	430 ± 10	400 - 475	400 ± 20
	Head box		370 - 435	360 ± 20

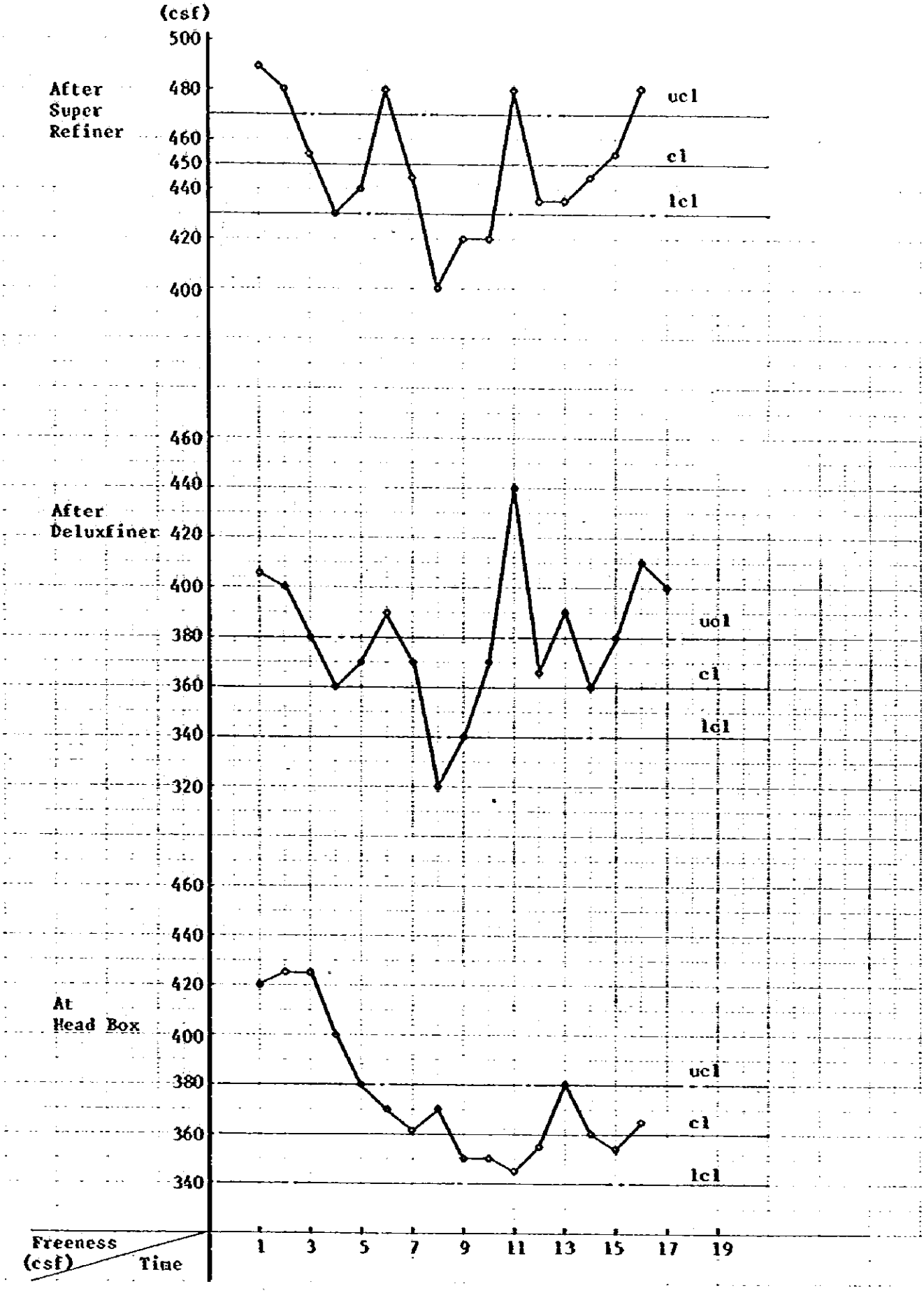


Fig. 7-1-1 Freeness HVS 80 g/m^2

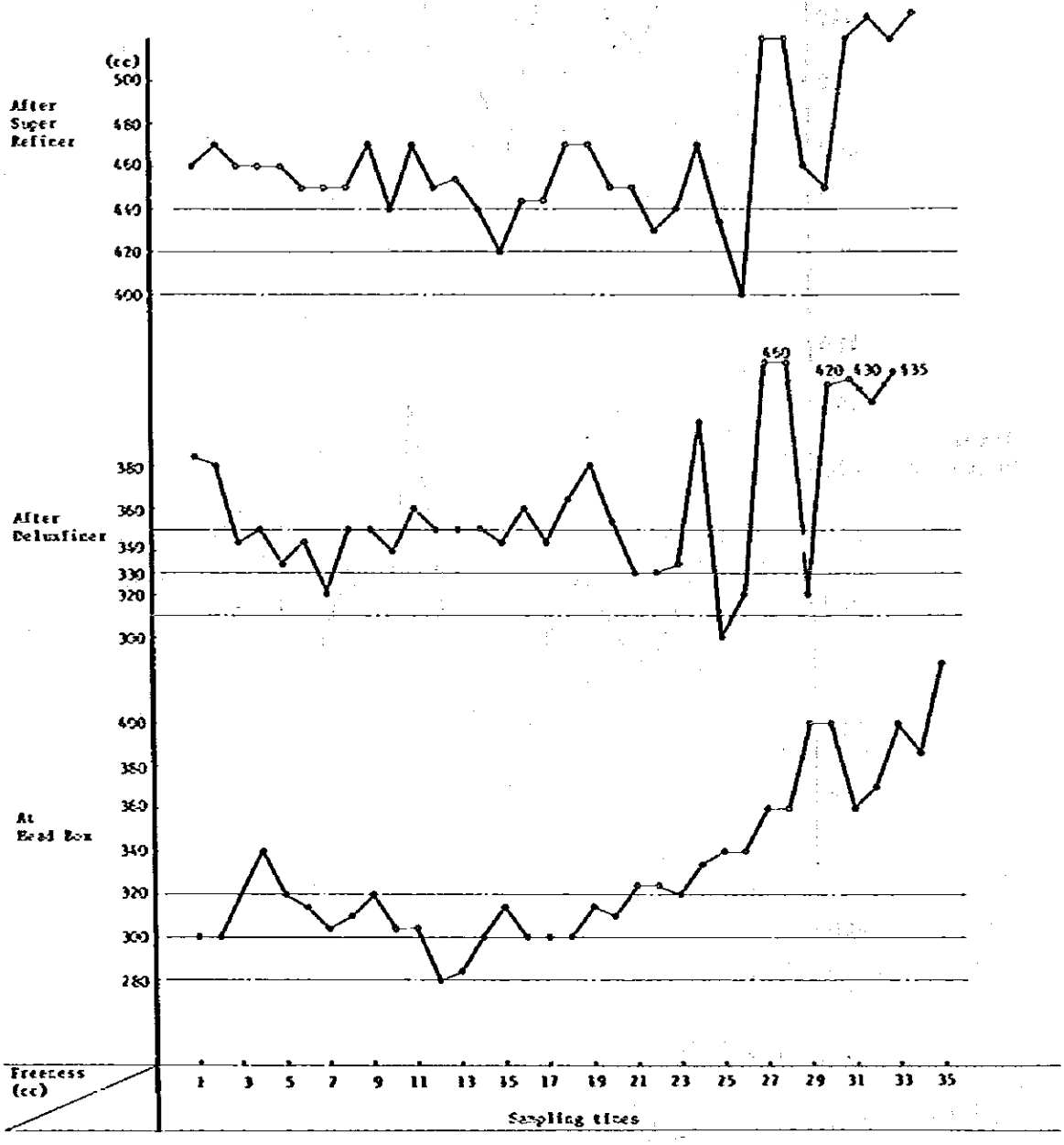


Fig. 7-1-2 Freeness HVS 60 g/m^2

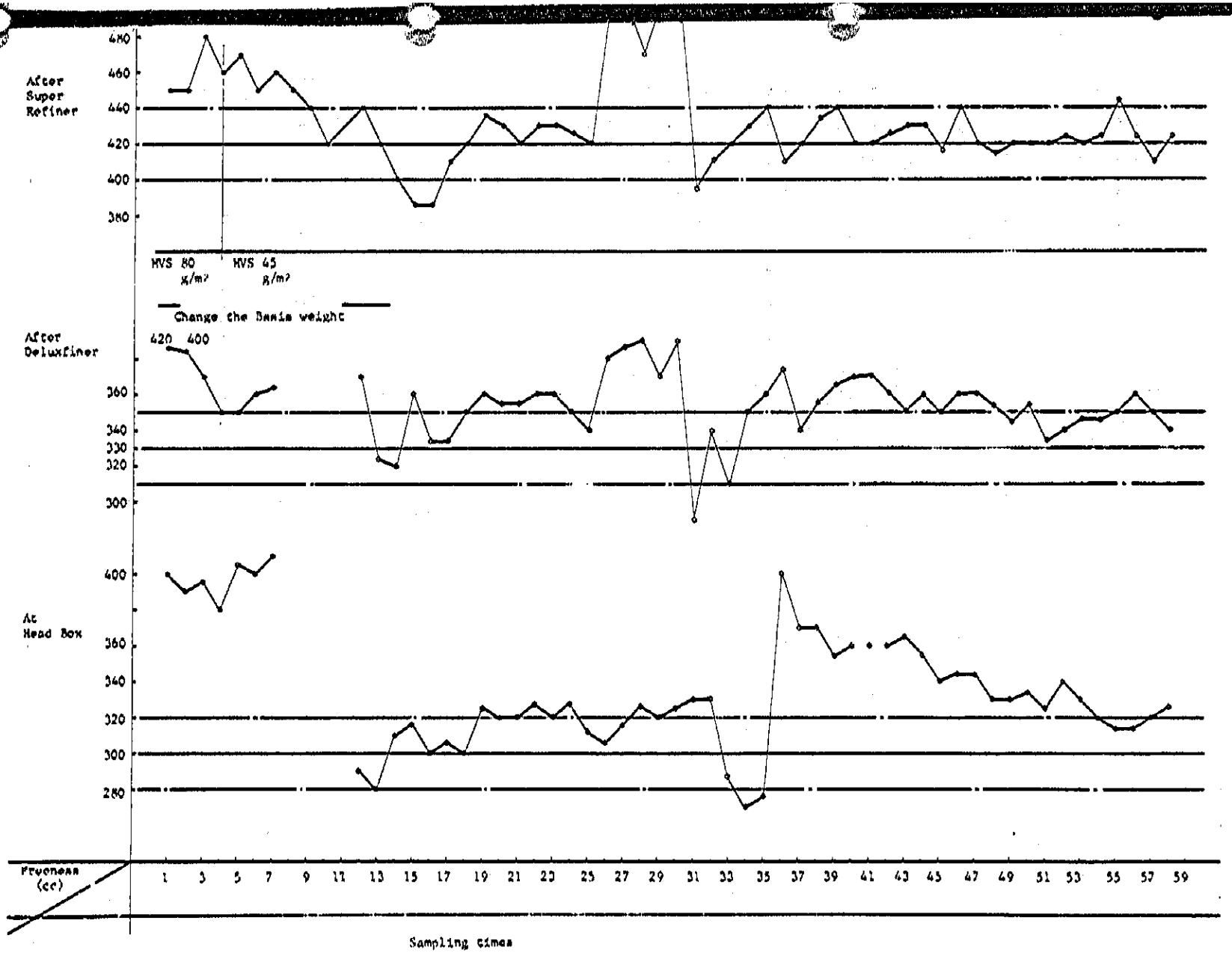


Fig. 7-1-3 Freeness HVS 45 g/m²

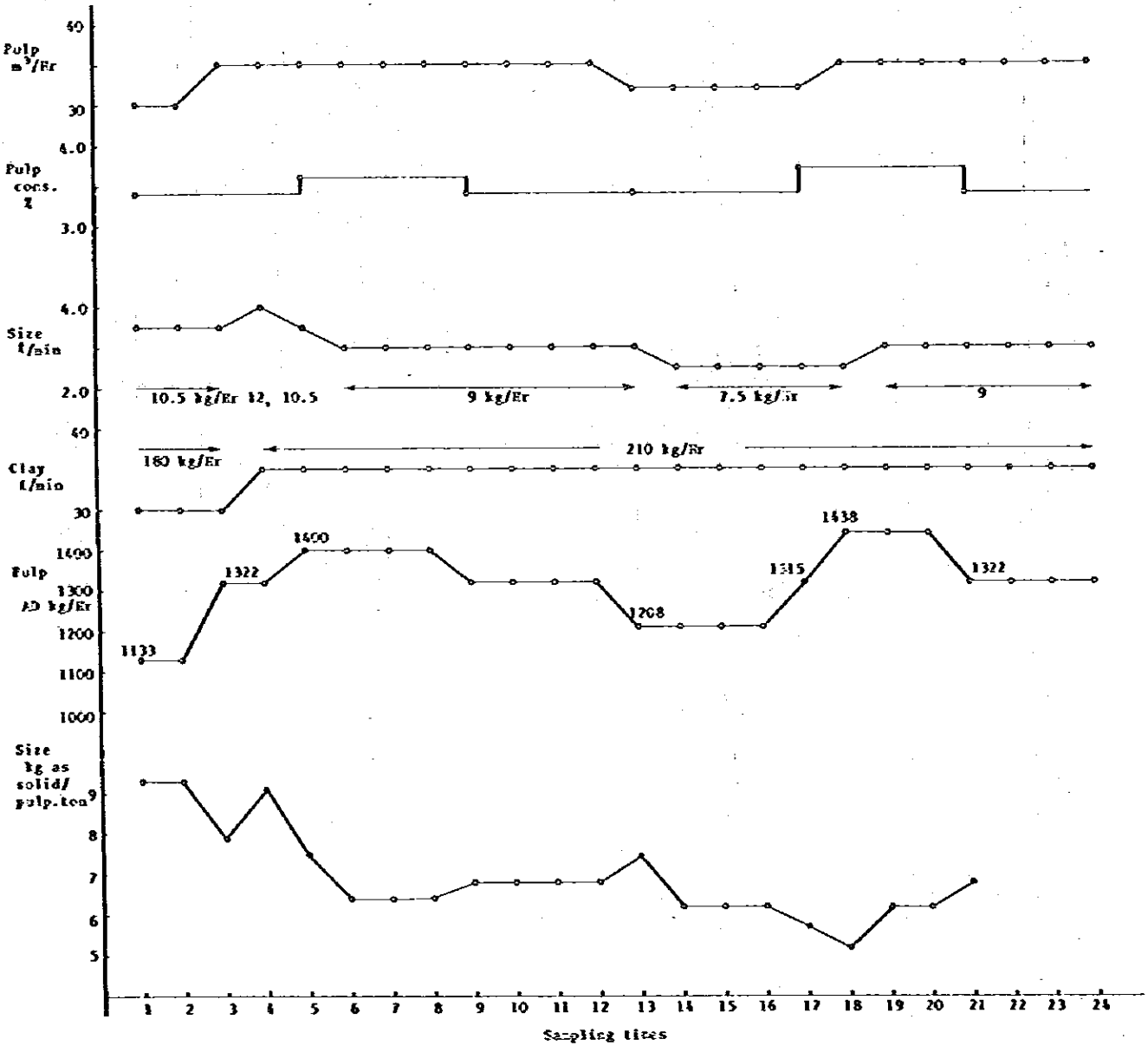


Fig. 7-1-4(a) Actual Chemical Add. HVS 45 g/m² '84-MAR-7

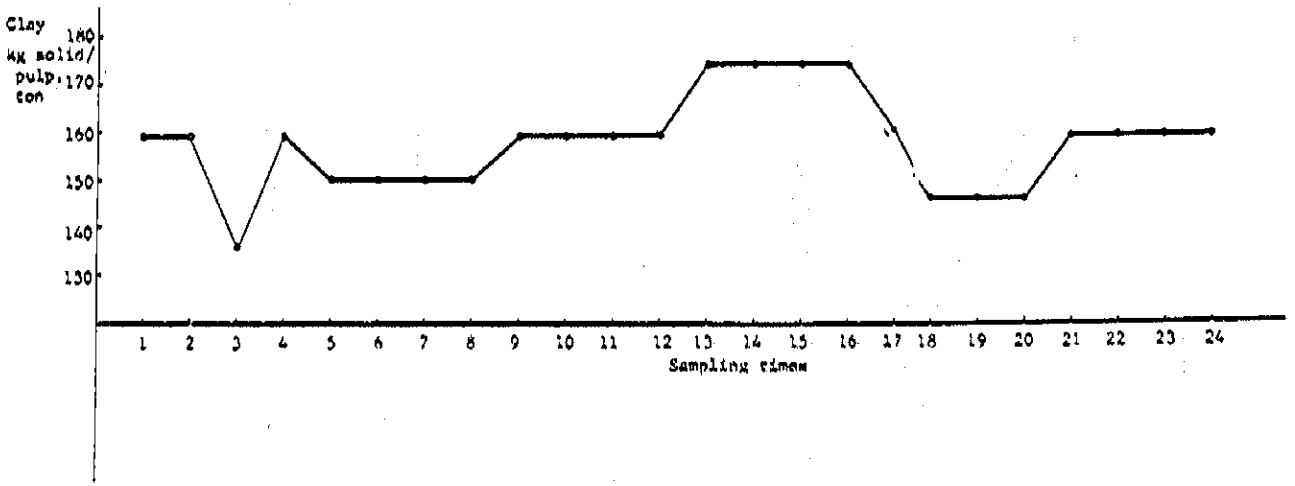


Fig. 7-1-4(b) Actual Chemical Add. HVS 45 g/m^2 '84-MAR-7

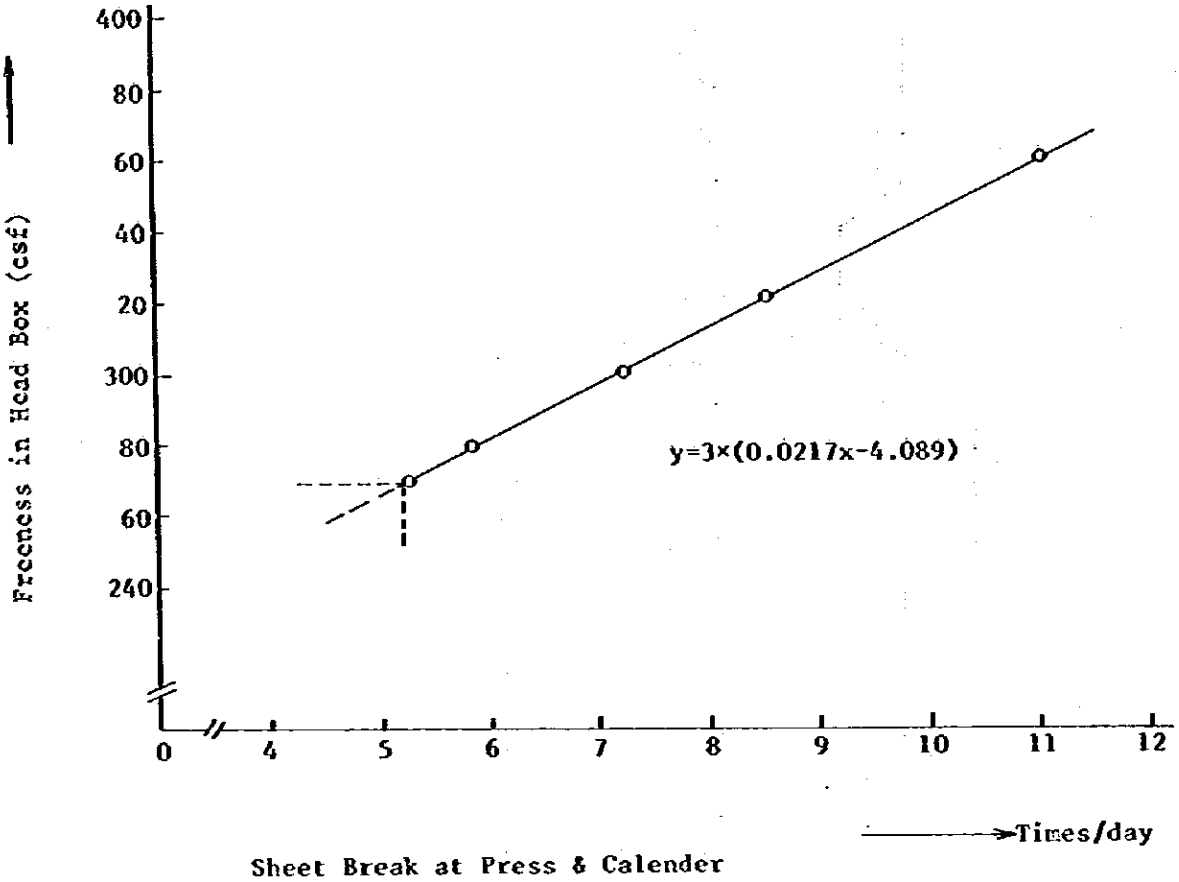


Fig. 7-1-5 Freeness & Sheet Break Times

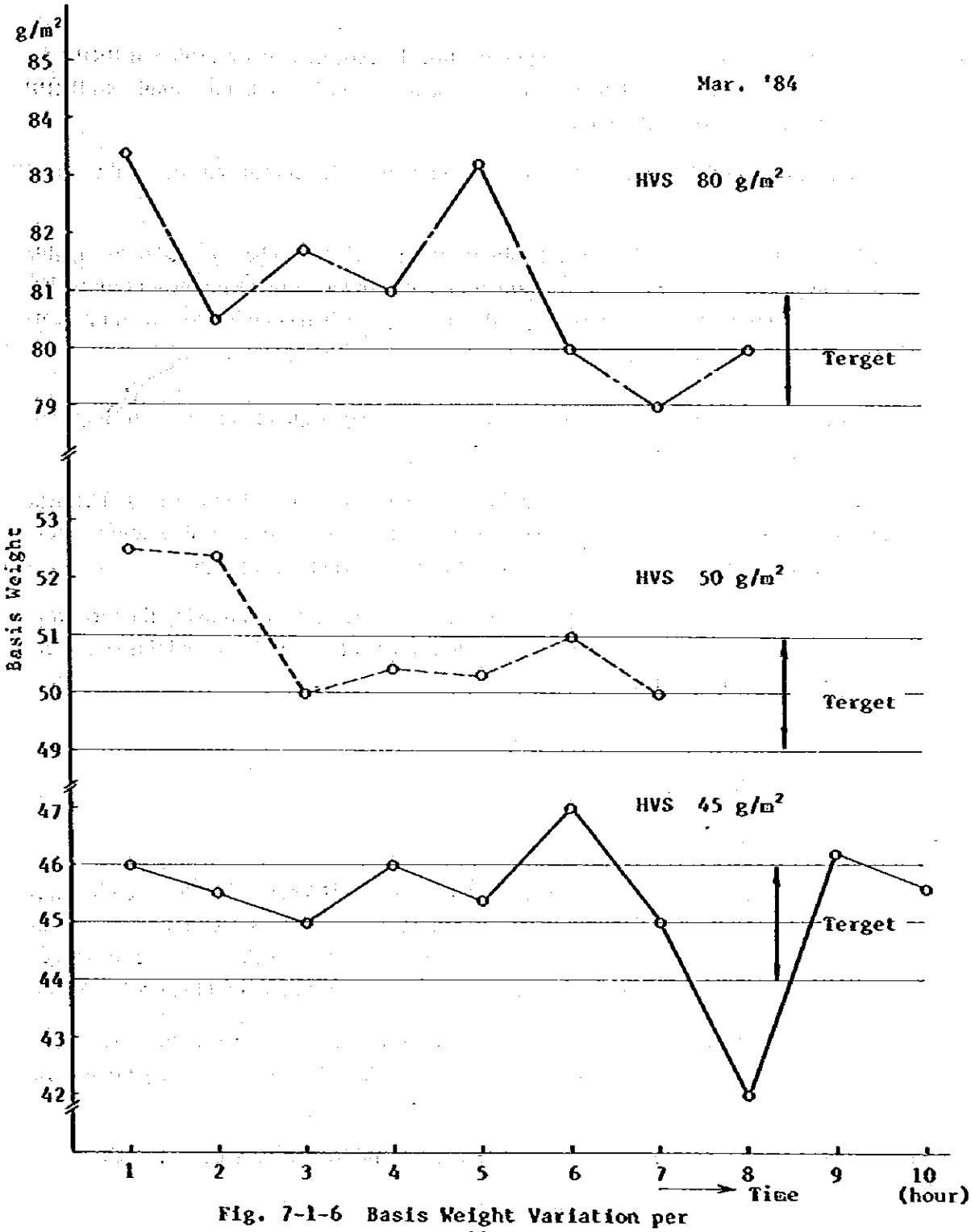


Fig. 7-1-6 Basis Weight Variation per Paper Roll at Reel

7-2 Operation and Facilities of Paper Machine and Problems

7-2-1 General

(1) The operation conditions and major equipment of the existing paper machine of BRPP are summarized in Table 7-2-1. Data of two Japanese paper machines that are similar to BRPP machine is also shown in the table.

The specifications of the wire part of M/C-A can be regarded completely identical to those of BRPP.

Based on the data shown in the table, the BRPP paper machine can be regarded to be capable of making paper at a rate of 300 to 350m/min. Accordingly, our recommendation is that the machine be remodeled to have high productivity by renewing and improving equipments that are short in the capacity.

(2) The major problems on the operation are unstabilized paper quality and poor reeling efficiency (=frequent sheet break).

On the equipment, the most important point is the improvement of the press part. The next problems are defective cutting and lower accuracy of diameter on the roll winding. These result in a larger rate of off-grade product and lower average sale price.

On the other hand, the stock is distributed properly on the wire part, making the sheet formation quite satisfactory, even comparing with products of competitors, and this good performance must be maintained.

7-2-2 Approach Equipment

(1) Dust removing equipment

BRPP has 2-stage dust removing equipment of Type 623-4EH Vorject and 2mm dia-Vertical Selectifier screen plate, but their dust removing performance is low since they cannot maintain an appropriate differential pressure. This is proven by the fact that the paper produced by BRPP contains four times as much dust as that of competitors products (Table 5-6-1, 5-6-2).

However, the existing dust removing equipment (Vorject screen and Selectifier screen) can be used satisfactorily if the defective parts are replaced, and thus, we can rely upon their functions.

The causes for poor dust removing performance and the remedy are outlined below.

Problem	Cause	Symptom	Remedy
Improper pressure (differential pressure) balance	Shortage of pump capacity Inadequate maintenance	Decrease of pressure at inlet and outlet	Renewal of pump

The pressure (differential pressure) balance at the existing operation is shown in the below figure. In it, proper pressure values are shown in parentheses.

The secondary cleaner inlet pressure is 1.9 – 2.0kg/cm² and that of outlet is 18cmHg. (The pressure of primary cleaner vacuum is 62cmHg.) Many tailings (long fiber, wood and vinyl fragments) are noticed on the Selectifier screen.

Generally, the normal differential pressure standard is 2.0kg/cm² (inlet 2.5kg/cm² and outlet 0.5kg/cm²). As an actual example, we know a case in which excellent dust removing performance is achieved by controlling the differential pressure at 1.3 to 1.5kg/cm² on the primary cleaner (4.8 – 5.0kg/cm² vs. 3.5kg/cm²) and at 0.65 to 0.75kg/cm² on the secondary cleaner (0.9 – 1.0kg/cm² vs. 0.25kg/cm²).

The up-flow water pressure of the secondary cleaner currently applied is 0.9 to 1.1kg/cm², but we recommend that the up-flow water pressure should be adjusted by looking at the contents of the rejects.

(2) Selectifier screen

The specifications of the existing screen are as follows:

Basket size: 600mm diameter×600mm height
Hole diameter: 2.0mm
Horsepower: 11kW×6P×300rpm×2sets

The diameter of 2mm for the basket holes is appropriate and this screen can be used.

However, the actual operation state is not good and it must be improved. Our proposal for the improvement is shown below.

Table 7-2-2 Problem of Selectifier Screen

Problem	Cause	Symptom	Remedy
1. Improper pressure (differential pressure balance)	Shortage of pump capacity Inadequate maintenance	Decrease of pressure at inlet and outlet	Renewal of pump
2. Clearance between basket and rotor	Error on clearance setting Basket deformation	Clearance: #1 screen: 7 mm #2 screen: 5 mm	1) Adjust clearance to 3 – 4 mm. 2) Renewal of basket
3. Malfunctioning of screen reject system	Since no removal device is given, impurities once removed recycle.	Basket holes are plugged with much impurities.	New installation of vibration screen

(3) Flow box (Inlet)

The existing flow box (Nakano Iron) is a single tube distributor type, and it seems to be effective in the stock distribution at the flow box inlet. However, the slice lips in the flow box have a large interval and this creates a problem to correct thick/thin profile.

Also, we have noticed tailings sticking to the upper and lower lips, and there are possibilities of sheet break and cracking.

a. At present, 13 slice lip adjusters are installed to a slice width of 2,740mm, and they are installed in the intervals of 90mm – 140 – 140 – 250 (8 intervals) – 140 – 140 – 90mm counting from the front side. This layout of flow box must be changed to 50mm pitch at both edges and 100mm pitch at the middle part if production of thin papers is planned.

b. Sticking of tailings to the lips

A large amount of stock tailings are sticking to the upper and lower lips. In consideration that about 20% of sheet breaks is caused by floating scum, the flow box must be thoroughly cleaned when the machine is stopped.

Also, since scales are recognized on the liquid level of flow box and scales are also recognized at the single tube outlet, chemical cleaning (NaOH 3%, etc.) must be conducted in the whole system including the stock approach line.

c. Horizontal level of lips

The lower lip has no problem as a result of our test using a leveler. We checked the upper lip by measuring the distance to the lower lip using a taper gauge, and no distortion was found.

d. Consistency in flow box (Inlet)

Table 7-2-3 shows the current consistency of the stock in the flow box for each grade.

Table 7-2-3 Actual State and Recommendation of Consistency in Flow Box

Grade		Actual	Average	Recommendation
HVS	45	0.45 – 0.60%	0.527%	0.6 – 0.7%
HVS	60	0.43 – 0.58	0.530	0.7 – 0.9
HVS/O	80	0.62 – 0.78	0.695	0.9 – 1.0
Cyclo	70	0.50 – 0.60	0.563	0.8 – 0.9

The data in the table shows that the consistency in the flow box is rather thin. In order to improve the runnability, we recommend raising the consistency slightly, thereby achieving the following effects:

i) Reduction of dewatering load of the wire part, contributing to an increased paper machine speed
ii) Improvement of the wire retension, contributing to improvement of the quality and yield

e. Distribution in flow box (Inlet)

Judging from the low consistency at the inlet and the use of the single tube type distributor, we consider that the stock is fairly uniformly distributed in the inlet.

Our assumption can be proven by the fact that the formation of BRPP product is stabilized when compared with other products although forced dewatering is given by the wire part of the table roll type.

However, to study regulating initial dewatering by the wire part, improvement of the yield and reduction of the moisture content at the press inlet, an increase of the consistency at the inlet is indispensable.

Accordingly, we believe there will be a necessity of the use of a flow box in which the stock distribution in the inlet can be kept at a favorable level, the flow speed can be increased, and reflocculation of pulp fiber can be suppressed.

f. Ratio of jet/wire speeds

The ratio of jet speed/wire speed (J/W) at the time of making HVS 45g grade is measured at 0.917. The operation conditions at the time were:

Wire speed:	240m/min
Jet speed:	220m/min
Lip opening:	17mm

The standard J/W ratio is "1", and adjustment is to be given depending on the formation being developed.

g. Others

At present, when the grade is changed or for basis weight control, the operator adjusts the circulation valve installed to the circulation line (to # 1 Fan Pump) at the Selectifier screen outlet side. However, it is essential that a magna-flow meter and CIC are installed and controlled by a BM meter is given as measures to control the basis weight profile and moisture content profile.

Also, for stock re-cycling system before the flow box, since the re-cycling valve controls the flow speed and flow rate in the inlet to constant values, a stock overflow valve must be attached to the single tube type distributor.

7-2-3 Wire Part Equipment

(1) The equipment specifications of the existing wire part are shown in Table 7-2-1-a.

Table 7-2-4 shows comparison of equipment, between BRPP and others, which influence the effect of dewatering load at the wire part.

Table 7-2-4 Comparison of Wire Part Dewatering Equipment

	BRPP	M/C – A	M/C – B
Forming length	11,800 mm	7,370 mm	12,175 mm
Table roll	1.78 roll/m	1.76 roll/m	1.72 roll/m
Hydro foil 3 blade	–	0.27 unit/m	0.33 unit/m
Hydro foil 4 blade	–	0.14 unit/m	0.16 unit/m
Vacuum foil 5 blade	–	0.41 unit/m	0.08 unit/m
Suc. box (Vacuum width on the basis of 200 mm)	0.59 unit/m	1.76 unit/m	0.82 unit/m

(2) Problems related to one-pass retention (initial retention)

At present, the one-pass retention at the wire part is 50 to 55% and that during production of HVS 50g/m² (March 9, 1984, 240m/min) was 53.13%.

Table 7-2-5 Comparison of One-pass Retension Rates

	Basis weight	Ash %	Flow box consistency	One pass retention
M/C – A	70 kg/m²	15 ±1%	1.10 – 1.30%	60 – 65%
	51	12 ± 1	0.90 – 0.95	63 – 68
M/C – B	70	5 ±1	0.75 – 0.85	65 – 70
	60	25 ± 1	0.95 – 1.05	50 – 58
BRPP	50	10.6 (9 – 11)	0.67	53.1

The product formation is especially dependent on the initial dewatering, and therefore, this is a critical issue in order to proceed with production on lower basis weight, improvement of the yield and speeding up the paper machine.

Accordingly, in order suppress the initial dewatering and to stabilize the stock yield, a series of hydro foil and vacuum foil must be installed, and the wire part must be improved including reinforcement of the suction box.

On proceeding with hydro foil, naturally, the target of machine speed must be set to at least 300m/min, and on the suction box reinforcement, resistance of the wire against abrasion, related with the ash content, must be studied.

(3) Problems on dandy roll

The dandy roll used at present is 45m/s × 510ϕ × 3025 long, but we recommend changing this to a 40m/s wire to control the water splash.

Also, there is a roll that has a straight joint, but a spiral joint is more desirable.

Since we have recognized deformation of the rim, the roundness must be checked. As the measures to control water splash, (1) the consistency at the inlet must be raised and (2), SAVE ALL for the dandy roll must be improved.

(4) Problems with wire shower

As shown in a side-view drawing, in addition to the shower for trim knock-off, five fan-type showers and one needle shower are used at present.

The improvement step to be taken is raising the needle shower pressure (10kg/cm² or higher). The trim nozzle pressure must also be raised.

As to the shower setting, the current nozzle pitch is 100mm and the distance from the wire is 100mm. When the shower pressure is raised, the distance must be changed to 150mm so as to reduce the damage to the wire.

7-2-4 Press Part Equipment

(1) Press nip and wet-web moisture content

The number of presses (1 – 3) is sufficient for the current production capacity, but the nip pressure (kg/cm²) of the press is weak, much moisture being carried into the dry part. This naturally increases the load to the dryer.

Table 7-2-6 Current Situation of Nip Pressure and Moisture Content (HVS 45 g/m²)

	Suc. – Couch	No. 1 P	No. 2 P	No. 3 P	Smoother
Nip pressure (Maximum) kg/cm	–	27	41.2	41.2	41.2
Nip pressure (Actual) kg/cm	–	9.8	38	27.5	10
Moisture content %	80 – 82	72	65	64	62 – 63

From the viewpoint of the latest equipment, the moisture content of 62 – 63% at the S.M. outlet (dryer inlet) is too high, and the press part must be reinforced so as to reduce the moisture content at the dryer inlet to 56 – 57%.

The following measures are conceivable to achieve it:

1) 1P nip: 40 – 50kg/cm
   2P nip: 60 – 70kg/cm
   3P nip: 90 – 100kg/cm
   Smoother: Removed
2) Grooved rolls should be adopted for 2P and 3P bottom rolls. The hardness of the rolls must be JIS hardness 100° or super-hard roll of P&J 0 – 1°.
3) Adoption of suitable felt to meet super-hard rolls and high pressure nip.

4) As the nip pressure is raised, the felt suction box must be reinforced and a cleaning needle shower must be installed.

5) Since the felt moisture content is high, grooved rolls must be installed, and a scavenging shower must be installed to remove impurities.

Also, periodical cleaning by chemicals is essential.

(2) Blowing trouble

There is excessive blowing of wet-web in the inlets of 1P and 2P at present. Although this does not seem to create any problem during the production under the current nip pressure, as the speed becomes faster and the nip pressure is increased in the future, creasing of paper and sheet break are very likely to occur.

Therefore, the drawing force must be increased. Also, felt run improvement must be studied by making the position of felt rolls at the press inlet raised.

(3) Crown of bottom roll

As the press nip is improved, the crown (see side-view) of bottom rolls should be modified.

(4) Press doctors

At present, a stainless steel doctor is used for 1P and bakerite doctor is used for 2P and 3P. However, to control the tailings around the press roll, all doctors must be changed to stainless steel and the nip pressure must be controlled within a range of 300 to 500g/cm.

At present, the auxiliary doctor is contacting the top roll. A clearance of 2 to 3mm must be secured.

7-2-5 Dryer Part Equipment

(1) Problem of drawing trouble on dryer part

At present, the amperage of motors at the dryer part frequently fluctuates, causing sheet breaks. Therefore, in order to avoid sheet breaks at the time of drawing trouble, the drawing tension between the last dryer and the machine calender is increased, which to the contrary, is causing break of the paper.

The conceivable causes for this trouble are improper maintenance of the sectional motors and improper drainage system in the dryers.

(2) Problem related to unit consumption of steam

The average consumption rate of steam at present is 3.1 T/T as on Reel Production, but on recent machines of the same type, the consumption is 1.8 to 2.2 T/T in most cases.

The following steps must be taken to reduce the steam consumption:

a. Reduction of moisture content carried over to the dryer part by improving the press part.

b. Adoption of a high permeability canvas and increase of the canvas tension ($1.0 - 1.2 kg/cm^2$).

c. Improvement of the dryer drainage system and centralized control by a control panel.

d. Repair of steam flowmeter

e. Implementation of moisture content profile control by installing BM meter.
At present, when a paper roll on the pope reel is touched, the backside is hot and the front side is normal in the temperature, indicating a large degree of temperature gradient. The reason for this may be that the setting position of siphon pipes for drainage in the dryers is located samely. This must be checked immediately.

7-2-6 Calender Part Equipment

(1) Problems related to doctor

The doctor of each chilled roll in the 6-stage calender has not a proper touch. This causes the winding trouble frequently when paper is passed through, causing the loss time greater. Especially, the bakerite doctor used for the bottom roll at present must be changed to a stainless steel blade to improve the contact.

(2) Problems related to paper threading

Currently, paper threading from the final dryer to the calender and then to paper reel takes a long time, lowering the production efficiency.

Therefore, the following steps must be taken:

a. Alteration of paper threading method, or to stop threading the paper across the whole width.

Paper is to be threaded through from the wire part to #26 final dryer in a width of 400 to 500mm. After that the paper is to be threaded through the calender and pope reel in the same width, and the sheet is widened after completing these processes.

This reduces the amount of broke and is more desirable from the viewpoint of safety.

b. Also, when the paper is fed through, it is apt to be caught by the expander roll before the pope reel and air chute pipe.

Therefore, adoption of a lift by air cylinder must be studied.

7-2-7 Pope Reel Equipment

(1) Problems related to the secondary arm device

The press used at present is a self-weight type and the tension cannot be controlled.

Therefore, when paper is wound, troubles like tighter winding on one side, loose winding, etc. are apt to occur. A pneumatic control device for pressing may be necessary.

7-2-8 Clothing Materials

(1) Wire cloth

A plastic wire cloth of 65 (mesh) × 2850 (width) × 26m (length) is used at present. However, for one-pass retension and to control the difference of quality between face side and back side of paper, the wire mesh must be re-studied.

Based on our own experience, a wire cloth of the following specifications is recommendable:

Wire cloth specifications

Strand thickness M.D./C.D.:	0.175/0.200mm
Mesh:	92/60
Number of meshes:	5,520
Open area:	19.3%
Dewatering degree:	30.1cc/cm²/sec
JIS air permeability:	277.0cc/cm²/sec
Kind of weave:	1/3 four-shed twill weave or single-layer weave

When selecting a wire, the freeness and drainage of the stock and dewatering degree and air permeability of the wire itself must be taken into consideration.

(2) Felt selection

The felt used at present is HM/M 500 Batt on mesh type, with the following specifications.

	1P · Felt	2P · Felt	3P · Felt
Synthetic	100% 12 d	100% 12 d	100% 12 d
Base	345 g/m²	345 g/m²	345 g/m²
Batt/Base	62/38	61/39	61/39
Weight	900 g/m²	850 g/m²	850 g/m²
	57.7 kg	62.9 kg	43.6 kg
$L^{(M)} \times W^{(mm)}$	$22.5^{M} \times 2{,}850$	$26.0^{M} \times 2{,}850$	$18.0^{M} \times 2{,}850$

To expect and realize an increase of the machine speed and reduction of moisture content of wet-web, the felt must be endurable to high nip pressure. When selecting a felt, the weight and fabrication of felt must be determined referring to the nip of each part.

Based on our own experience, we recommend that the following types of felts be studied:

No. 1 P: 950 – 1000g/m², plain weave, Batt/Base = 70:30
Batt ratio (front/back) = 4 – 5/1, monofilament

No. 2 P: 1300g/m², plain weave, Batt/Base = 75:25
Batt ratio (front/back) = 5/1, monofilament

No. 3 P: 1400g/m², double-layer weave

On this renovation project, the press part will be wholly changed and the felt specifications will also be changed.

In this case, the felt specifications will be as follows:

Pick-up felt: 1250g/m², Batt on Base

No. 2 P felt: 1350g/m², Batt on Base

(3) Canvas selection

The canvas used at present is a monofilament polymer canvas made by Hyck having an air permeability of 10,000cc/cm²/min for both of the main dryers and canvas dryers.

In order to further improve the dryability and surface property, we recommend the use of a canvas having an air permeability of 20,000 to 30,000cc/cm²/min, made of the same monofilament polyer.

In the case of 1D canvas, the use of a canvas, on which the air permeability at the both sides can be controlled, will have to be studied.

For example, a canvas having the following air permeability should be considered:

Both ends 600mm wide – 8000cc/cm²/min
Central part 20,000cc/cm²/min

(4) Life of clothing materials currently used

Name	Part		Life	Remarks
Wire cloth	Wire part		3 – 4 months	In case of bronze Wire: 21 days
Felt	No. 1 P		3 – 4 months	
	No. 2 P		3 – 6 months	
	No. 3 P		3 – 6 months	
Dryer	1D	U	1 – 1.5 years	
		B	1 – 1.5 years	
	2D	U	4 – 6 months	
		B	1 – 1.5 years	
	3D	U	1 – 2 years	
		B	1 – 2 years	

∴ U) Upper Dryer Canvas
B) Bottom Dryer Canvas

Note: Since the upper canvas of No. 2 dryer does not last long because of the defective joint, it must be replaced with a plastic spiral canvas.

7-2-9 Current Situation and Problems of Finishing Equipment

(1) The cutter has become old and the cutter setting device is not accurate. Therefore, 5 to 10% of the products are set aside as second grade for the reasons of improper size, sheet deformation and paper dust mixed after cutting. These troubles are the kinds disliked by users, which are printers, the most since they greatly disturb the workability and printability.

The current cutter is in use for close to 20 years, and it looks as if the accuracy cannot be restored by partial repair only. Accordingly, we recommend that the whole equipment be replaced.

(2) Problems related to finishing at the cutter end

At present, the cut sheets are piled up after cutting and such piles become uneven ( or ) affected by non-uniformity of thickness.

In order to neatly pile the sheets, the dry broke is put together and inserted for adjustment of the unevenness of the piled sheets. This, however, causes partial unevenness ( or ) of creases, resulting in the generation of off-grade products.

We recommend that board paper is cut into specific sizes and a number of the pieces of sheets be provided for insertion into the sheets for neat piling.

Table 7-2-1(a) Operating Condition of Paper Machine

	B R F P	M/C - A	M/C - B
1) Speed	170 - 240 M/MIN	300 - 350 M/MIN (av.343)	320 - 365 (av. 353)
2) Basis weight	45 - 80 g/m²	50 - 80 g/m²	60 - 70 g/m²
3) Product	Ave. 34 T/Day	Ave. 54 T/Day	Ave. 70 T/Day
4) HEAD box fr'a	270 - 435 cc	300 - 345 cc	300 - 340 cc
5) Flow box cons.	0.5 - 0.85%	0.9 - 1.3%	0.75 - 1.05%
6) Forming length	11,800 mm	7,370 mm	12,175 mm
7) WIRE cloth	65 m x 2850 w x 26 ML	80 m/s x 2360 w x 25 ML	80 m x 2750 w x 35 ML
8) One pass retension	50 - 55%	60 - 75%	50 - 75%

9) Wire suction box (mmHg)																
	#1	0	#7	160-170	(1VF)	0.(240)	#7	90-115	(1VF)	0	#7	0.(110)				
	2	0	-		(2VF)	0.(210)	8	90-115	(2VF)	100-110	8	20-110				
	3	20-60	-		(3VF)	0.(180)	9	120-140	(3VF)	0	9	20-80				
	4	50-65 (120)	-		(4VF)	0	10	0.(120)	4	0	10	40-120				
	5	165-180	-		(5VF)	0.(100)	11	100-110	5	85-90	11					
	6	210-220	-		(6VF)	90-110	-		6	50-90						

1. Suction Box or V.F in ( ) of M/C-A and M/C-B installed before Dandy Roll.
2. VF mean Vacuum Foil

10) Suction couch	485 - 505 mmHg			600 - 620 mmHg			650 mmHg					
11) 1P suction	490 - 520 mmHg			520 mmHg			500 mmHg					
12) Press NIP (Max)		NIP	Moisture (%)		NIP	Moisture (%)		NIP	Moisture (%)			
	1P	27 kg/cm	70 - 71	1P	50 kg/cm	60 - 63	1P	50 kg/cm	-			
	2P	41²	65	2P	100	50 - 53	2P	70	54 - 56			
	3P	41²	64	-			3P	100	49 - 51			
	SM	41²	62 - 63	-			-					
13) Drying ratio	8.19 kg water/m²-Hr/on reel 7.0 - 7.5% of Moisture			15.8 kg water/m²-Hr/ 5.5 - 6.5% of Moisture			16.4 kg water/m²-Hr/ 4.5 - 5.5% of Moisture					
14) Size press	None			Installed			Installed					
15) Utility consumption (Recent data)	STEAM	3.1 T/ADt. on reel		STEAM	1.5-1.8 T/ADt. paper		STEAM	1.5 - 1.8 T/Adt. paper				
	ELECTRIC	893 kWh/ADt. paper		ELECTRIC	540-560 kWh/Adt. paper		ELECTRIC	500 - 520 kWh/ADt.paper				
	WATER	193.7 m³/ADt. paper		WATER	30 m³/Adt. paper		WATER	36 m³/ADt. paper				

16) Efficiency		OPERA.	REEL	WIDTH	FINISH	TOTAL	OPR.	REEL	-	FINISH	TOTAL	OPE.	REEL	-	FINISH	TOTAL
	%	93.7	93.0	97.0	92.9	78.5	99.0	98.5	-	94.0	91.7	99.0	98.2		94.0	91.4
	(Recent data)	(82-97)	(90-95)	-	(90-96)	(67-84)										
17) Sheet breaks	4 - 10 Times/Day (ave. 6)						Average 2 Times/Day					Average 2 Times/Day				

Table 7-2-1(b) Operating Condition of Paper Mahcine

Grade	P. T. BASUKI RACHMAT MILL										MC-A (Japan)	
	HVS 45 g/m²		HVS 50 g/m²		HVS 80 g/cm²		CYCLO 70 g/m²					
Date	7 Mar. '84		10 Mar. '84		5 Mar. '84		4 Mar. '84					
M/C speed	235 M/MIN		240 M/MIN		170 M/MIN		176 M/MIN				330 - 350 M/MIN	
Paper width	2300 MM/FINISH 2235		2390 MM/2325		2400 MM/2340		2445 /238.5					
Speed of each part	m/min	Draw ratio %	m/min	Draw ratio %	m/min	Draw ratio %					Draw ratio %	
couch	-		-		-							
1P	231.5		239.5		164.8							
2P	233.0		240.0		166.8							
3P	235.0	1.5	243.5	1.7	169.6	2.9						
SM	233.0		244.0		170.0							
1D	234.0		237.0		170.5							
11D	237.8		243.4		171.2							
26D	236.4	2.1	243.6	1.7	170.8	3.6						
Calender			243.8									
Pope reel	236.4	2.1	241.5	0.84	170.3	3.3						1.9
Trim	mm	%	mm	%	mm	%	mm	%	mm	%	mm	%
Couch	2490	-	2550	-	2540	-	2560	-	1970	-		
After 1P	2480		2540		2530		-		1950			
After 2P	2470		2538		2525		-		1940	1.52		
After 3P	2460	1.20	2525	0.98	2515	0.98	2548	0.47	-			
After dryer	2320		2380-2385		2400		2446		1890-1895			
Pope reel	2322	6.75	2385-2390	6.39	2400	5.51	2446	4.45	1885	4.31		
NIP (Press)	kg/cm		kg/cm		kg/cm		kg/cm				kg/cm	
1P	9.8		9.8		20.0		-				40.0 - 45.0	
2P	38.0		25.5 as front side 22.3 as back side		26.0		10.5				90.0 - 100.0	
3P	27.5		39.5		31.0		-				-	
SM	10.0		17.0 as back side 10.0 as front side		33.0		-				-	

CHAPTER 8 EXISTING SITUATION AND PROBLEMS ON MAINTENANCE CONTROL

CHAPTER 8 EXISTING SITUATION AND PROBLEMS ON MAINTENANCE CONTROL

8-1 Maintenance Control (Mechanic)

8-1-1 Repairing Cost

The current situation of repairing cost is shown in Table 8-1-1. Repairing cost occupy about 8% or more of the paper selling price. This ratio is no greater than 4 or 5% normally, and even if the regional characteristics of BRPP are taken into consideration, the ratio is just too high.

About 85 to 90% of the repairing cost are material cost.

8-1-2 Mechanical Trouble

Table 8-1-2 shows the down time of paper machine in recent three years caused by mechanical, electrical and instrumental troubles which are attributable to the work of maintenance department. The annual down time total is 146 hours in 1981, 70 hours in 1982 and 190 hours in 1983, and these are at least about twice as longer as typical standards.

The contents of major troubles are cyclic or respective troubles on the press roll bearings, vacuum equipment, electricity in the sectional drive parts etc., and they can be easily preventive.

8-1-3 Number of Existing Equipments to Control

Machinery	About	150units
Common used equipment (pump, fan, agitator GM, etc.)	About	500units
Rolls	About	200rolls
Motors	About	600units
Instrument	About	160units
Total	About	1,610units

These equipments are controlled by 77 persons of the maintenance department, or one person is to take care of 22units.

The number of repairing in 1983 based on repairing job cards is about 300 by the mechanics (among which about 140cases required long shutdown).

8-1-4 How to Improve Maintenance Control in BRPP

There are two important points on the maintenance control, one is how to decrease stoppage hours of paper machine by cases of maintenance trouble, other one is how to decrease the repairing cost. We think actual stoppage hours in BRPP are not so good.

The target of stoppage hours of paper machine caused by maintenance troubles should be set as follows:

Stoppage hours, caused by mechanical troubles	40hours
Stoppage hours, caused by electrical troubles	30hours
Stoppage hours, caused by instrument troubles	4hours
Stoppage hours, caused by other reasons	6hours
Total	80hours

The following steps are needed to accomplish this target:

(1) Establishment of a periodical (monthly) repair day on each equipment and exact execution

(2) Preparation of an execution plan for the above

(3) Adoption of a budget system on repairing cost and control of the budget by the maintenance department

(4) Thorough studies causes of trouble and positive introduction of new technologies

If these details are systematized and actually conducted, the stopping of paper machine caused by maintenance troubles will be substantially reduced.

Item (1) is conducted even now, but the main purpose at present is to change the consumable goods or main roll, and not for the equipment maintenance.

Item (2) will be very effective to improve the maintenance control technology. That is to say, in order to prepare an execution plan, essentially efforts must be made to maintain complete equipment record, machinery historical record, and spare parts list, as well as preparation of drawings and acquisition of new technologies, so that the replacement cycles of each parts can be determined based on such data.

Item (3) is effective to reduce the repairing cost. That is, repair plans must be established within budget and equipment will be controlled more carefully.

8-1-5 Quality of Maintenance Control

When all these items are executed, the maintenance control of BRPP will really be converted from BM (Breakdown Maintenance) to PM (Preventive Maintenance), and in a near future, it should be converted to TPM (Total Preventive Maintenance).

8-1-6 References

As reference documents, the repairing job card flow chart and existing organization of maintenance department are given in Fig. 8-1-1 and Fig. 8-1-2.

Table 8-1-1 Repairing Cost

Unit: 1,000 Rp

Year	Product t/y	Net sales	Repairing cost			Repair. cost Rp/kg paper	Av. sales price Rp/kg paper	Ratio of repair. cost vs. sales %
			Material	Wage	Total			
1976	9,726	2,932,005	30,505.6	28,800.1	333,851.6	34.33	301.5	4.6
1977	10,913	3,596,222	339,963.2	34,958.2	374,921.8	34.36	327.7	5.1
1978	12,129	3,800,441	323,315.7	38,562.2	361,877.8	29.84	313.3	4.9
1979	12,511	5,398,586	373,693.7	52,743.9	426,437.6	34.09	431.5	5.8
1980	12,873	6,527,696	429,849.8	101,887.8	529,737.6	41.15	522.5	7.2
1981	12,702	7,289,849	459,740.2	73,441.0	533,181.7	41.98	573.9	7.3
1982	12,595	7,253,057	683,406.3	56,946.8	740,353.1	58.78	575.9	10.2
1983	11,787	6,693,723	489,231.0	67,082.9	556,313.9	47.20	567.9	8.2

Table 8-1-2 Analysis of Paper Machine Stopping Time for Causes Attributable to Maintenance Department

1. Causes by Maintenance Section

1-1 Maintenance Trouble

(1981)

Month, Day	Stopping Time	Cause
Jan. 6	9:25	Replacement of No. 1P bottom roll, western side Brg. for breaking caused by grease shortage
7	1:35	Continued repairing of the above
10	30:14	Break of drive shaft, No. 3 dryer section
Apr. 19	0:29	Repair of dandy roll Brg.
May 22	0:20	Repair of nozzle cutter at wire part
26	0:30	No. centering of 1P Top roll
Jun. 13	6:26	Replacement of Brg. at suction couch roll vacuum pump
14	9:35	Continued repairing of the above
Nov. 19	4:14	No. 706 pump repair
26	3:51	Replacement of wire streatcher roll for eastern side Brg. breaking
Dec. 5	10:20	Repair of western Brg. at No. 1P bottom roll by water entered from oil seal
6	15:15	Continued repairing of the above
Total	92:14	

(3.843 days)

(1982)

Month, Day	Stopping Time	Cause
Mar. 16	1:54	Repair of streatcher chain at No. 2 dryer section canvas
May 1	2:32	Centering of No. 821-2 pump
Aug. 11	2:00	Repair of vertical screen shaft
12	3:10	Continued repairing of the above
26	9:35	Repair of vacuum pump Brg. at suction couch roll
Sep. 4	3:08	Repair of vertical screen strainer (Western side)
6	1:27	Replacement of vertical screen
17	1:07	Repair of vertical screen strainer (Western side)
Nov. 8	0:24	Repair of hose for calender lubrication oil
Dec. 15	0:30	Repair of pulley for carrier rope
Dec. 24	2:00	Repair of vertical screen strainer
Total	27:47	

(1.158 days)

(1983)

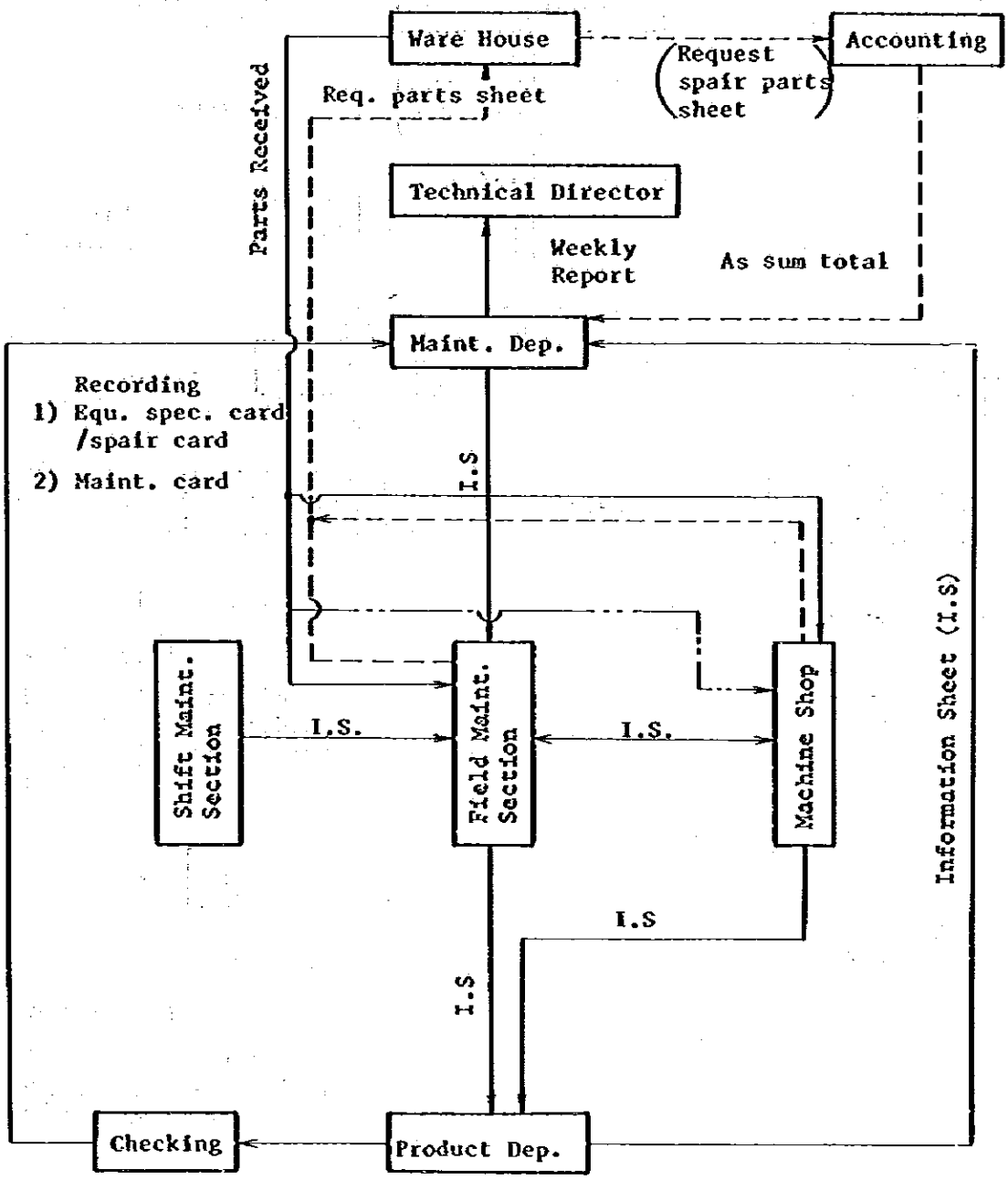
Month, Day	Stopping Time	Cause
Jan. 3	5:00	Replacement of No. 1P top roll
16	3:00	Repair of Brg. at VRS vacuum pump
19	0:32	Repair of No. 2 dryer section gear
Feb. 10	4:58	Repair of rotary shower shaft at flow box
16	1:30	Change Brg. of felt roll
Mar. 5	1:00	Repair of felt roll surface
15	0:13	Repair of 3-ton crane wire rope
31	2:07	Repair of No. 1 VRS pressure gauge mounting pipe
Apr. 1	9:15	Replacement of damaged wire streatcher roll □
29	4:07	Repair of suction couch roll inner box
May 9	0:42	Repair of VRS pipe leakage
Jun. 23	1:24	Change of No. 805 pump casing bolt for breaking ○
24	1:37	Change of VRS pump casing bolt
Jul. 1	1:06	Repair of loose calender paper roll support
Aug. 2	2:18	Pressure drop of Hydraulic Pump-No. 1
15	0:58	Change of No. 805 pump casing tightening bolt ○
17	2:29	Repair of No. 2 dryer drive gear that has become loose △
18	1:05	Second repairing of the above △
Oct. 6	3:20	Repair of Brg. at streatcher roll □
7	1:38	Repair of rotary shower shaft at flow box
26	1:40	Repair of Brg. at No. 3P upper stage paper roll
Nov. 19	0:07	Repair of pipe reel handle
Total	50:06	

(2.086 days)

1-2 Out of Maintenance Section

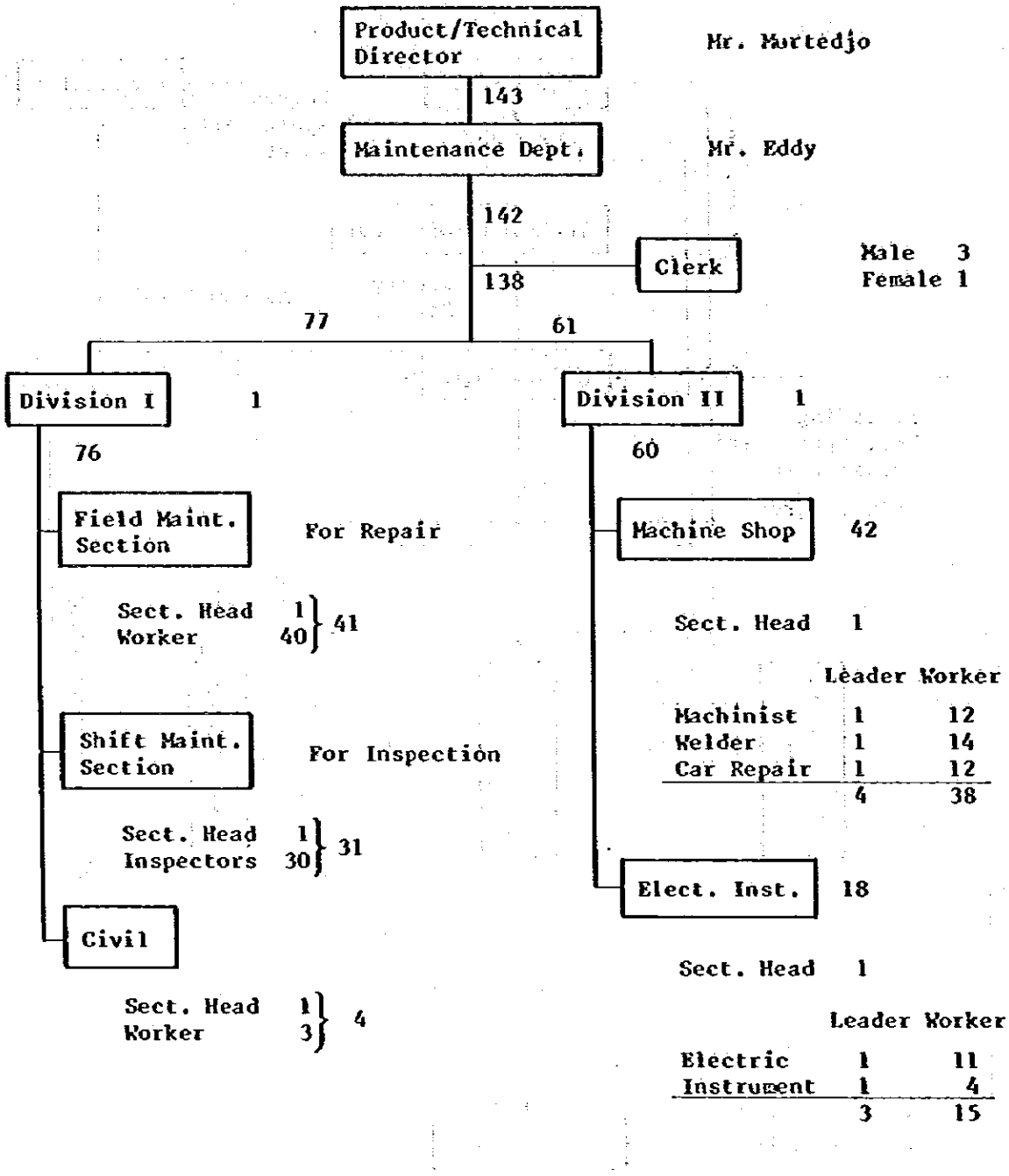
	1981		1982		1984	
	Count	Time	Count	Time	Count	Time
Calender Doctor Blade Replacement/Repair	10	2:43	3	2:28	21	6:45
No. 1 Doctor	–	–	1	1:00	–	–
No. 2 Doctor	2	0:33	–	–	1	–:08
No. 3	–	–	–	–	3	1:00
No. 4	2	0:30	–	–	3	–:40
No. 5	1	0:15	1	0:10	5	1:38
No. 6	2	0:35	–	–	3	–:54
Bottom Doctor	3	0:50	1	1:18	2	1:25
Others					4	1:00
Sub total	10	2:43	3	2:28	21	6:45
Press Part Doctor (No. 1 Press)	1	0:20	3	2:04	1	0:38
Dryer Doctor	–	–	–	–	–	–
Calender roll change for paper change	1	0:30	5	3:40	5	6:20
Total		3:33		8:12		13:43

Table 8-1-3 Information sheet (Job card) Flow Chart in BRPP



I.S: Information Sheet

Fig. 8-1-1 Organization in Maintenance Department, BRPP



8-2 Electric Section

8-2-1 General

BRPP is equipped with the independent power plant which whole electric power necessary in the mill is satisfactorily covered.

The power generating capacity is 9,920kW in total by five main generators.

At present, the power necessary in normal operation is covered by two units of generators of 1,500kW and 2,710kW respectively.

As loaded equipments, there are three units of high tension motor as 6,300voltage (680kW in total), about 600units of low voltage motor as 380voltage (5,400kW in total), one unit of electrolysis process for make up chemical (1,200kW), and one unit of sectional drive system for paper machine (273kW in total).

The operation started in 1969 with three units of 1,500kW generator, and, in 1976, additional two units of 2,710kW generator were installed to cover the power for newly-installed electrolysis process for make up chemical and increase quantity of paper production (45ton/day of paper after increase). The electric power is being supplied to existing 9 feeders and newly-installed 2 feeders. Refer to Fig. 8-2-1.

It is about 20 years since most of electric equipment were operated and it seems that they have been operated under rather good maintenance. Generator equipments are not many equipments which must be replaced in early time due to deterioration.

8-2-2 Present Situation of Electric Equipments

8-2-2-1 Power Source

Up to now, five cases of troubles of independent power source equipments occurred 4 troubles in 1982 and 1 trouble in 1983. They were all caused by mechanical reason and any problem has not been remained. The problem by vibration, which occurred in past, has been also settled.

Since there is, so to speak, over-supply situation at present as far as the power generation, it is possible to make the operation and maintenance cycle for generators sufficiently.

8-2-2-2 Sectional Drive System for Paper Machine

We explain about the summary and problems as follows.

The drive system for paper machine is the draw control method by centralized draw stand designed by SHINKO ELECTRIC CO., LTD. and consists of 11 sections (including one helper driving) having the total D.C. motor capacity of 273kW. The common power source is a 250kW D.C. generator which is driven by a 300kW induction motor.

The method of draw control (refer to Fig. 8-2-2) is ward Leonard system. The problem of this equipments are as follows.

(1) The operating condition of control equipment can be easily checked visually. Many of mechanical parts such as speed reducer to rotate the large disc, friction transfer part with the small disc, friction contact part of field resistance, etc. have become shaky due to deterioration and abrasion resulting in reduced control accuracy.

(2) The carefully thought out maintenance must be carried out because there are many rotating items, and besides, it takes much time for each maintenance.

(3) Over ten years elapsed since manufacturers discontinued production and it is very much difficult to obtain the repairing parts at present.

8-2-2-3 Distribution Equipments

There is not remarkable problem in deterioration of each generator cubicle, 6.3kV feeder cubicle and individual distribution board in each field. Only if the issulating oil is correctly maintained, O.C.B is still usable satisfactorily. The transformer is indoor type and there is not remarkable problem in deterioration from its operation situation and external view.

Also, there is no problem for the simplified load center of 380 V line (NFBs are installed on one panel according to number of circuit).

Each unit of motor switch such as knife switch with fuse, magnetic switch, push button switch, etc. is housed in a steel box and mounted on the wall of the building.

In the cooking and bleaching departments, it is desirable to centralize such boxes into the simplified control center in which NFB is used from the control of maintenance.

8-2-2-4 Distribution Line

6kV main line is three-core cable (NYFGby) and laid under the ground. There seems not to be any trouble for it so far as the external view and a part of cable end condition of the cable in the pit is inspected. The secondary side of the transformer is connected to EV cable and distributed through rack rail or duct. There is not any remarkable problem.

The wiring from the switch to the motor is made by under floor piping, or by rack rail or duct and then under floor piping near the motor.

In the cooking and bleaching departments, it is desirable to change wiring as new in order to minimize the corrosion of pipe at the rising part from the floor.

8-2-2-5 Load Equipments

(1) Induction motors

On the average, two motors are damaged by burning each month. So it need re-inspection of protection circuit. And some of them show excessive vibration which may be caused by improper centering accuracy.

(2) D.C. motors

The insulation deterioration of field winding may be found. From experience, this trouble causes after 20 years of start of operation, when the coil is replaced. Therefore, it is necessary to carry out the replacement of coil and the overhaul of stator in order.

8-2-2-6 Electrolysis Plant Equipment

There is not any problem for the 1,200kW thylistor type electrolyzing equipment only if the quality of cooling water is properly controlled (measurement of low resistance). Also it has surplus capacity.

8-2-3 Analysis of Electric Trouble

Accidents or trouble, which affected the operation of paper machine and were recorded, are analyzed as follows:

8-2-3-1 Analysis of Accidents in Past Three Years

Refer to Tables 8-2-1 and 8-2-2.

In these three years, 116cases of accident have occurred. The most numerous trouble is related to the sectional drive (91 times: 78.4%) and then 3ton crane (8times: 6.7%), common motors and diesel generator (7times each: 6%).

As far as the stoppage time is concerned, 83H 49Min (43.5%) was from the sectional drive, 56H 55Min (31.1%) was from the vacuum suction couch, switch panel including short-circuit inside panel, and cable, 28H (15.3%) was from the 3ton crane, and 8H 28Min (4.6%) was from the diesel generator.

The following analysis was for the sectional drive where the occurrance of trouble was most remarkable:

No.	Cause	No. of case	Time
1	Speed hunting, Trip	47 (51.6%)	25 H 36 M (30.6%)
2	Trip in operation	26 (28.6%)	8 H 18 M (9.9%)
3	Rotating devices	13 (14.3%)	41 H 56 M (50.0%)
4	Switch board, Cable wiring	5 (5.5%)	7 H 59 M (9.5%)
	Total	91 (100%)	83 H 49 M (100%)

For the trip in operation of 2 in the table, there was not positive evidence and therefore they may be included in No. 1 of above table.

The trouble of 3 shows that the stoppage time is long for the number of case.

8-2-3-2 Trouble Analysis by Year

Many failures and accidents have occurred in 1983 (refer to Table 8-2-3). The number of occurrence and time are shown in the figure. (refer to Tables 8-2-4 and 8-2-5). The analysis is started from the most numerous trouble.

(1) Speed hunting trouble of sectional drive

Refer to Table 8-2-6.

The speed hunting trouble which occurred frequently in 1981 (7 times in No. 3 press and once each in No. 2 press and smoother press has reduced its occurrence sharply in 1982 (once for unusual speed of 3D (3rd Dryer) and once for abnormal motor operation).

However, again after June 1983, hunting troubles have occurred through whole section (10times in total, once for abnormal draw). The defective AVR which is the common power source is regarded as the cause. Besides, trips have occurred 4times in No. 3 Dryer twice in couch roll and once in No. 3 press roll.

(2) Trips in sections which are regarded as troubles of operation.

There are troubles such as draining failure of dryer, etc. and are classified in accordance with the electric engineer's advice to the list presented.

1981	6 times at 2nd Dryer, 2 times at Couch roll, 2 times at 3rd Dryer
1982	3 times at 2nd Dryer, 3 times at 3rd Dryer, 1 time both 1st Press, and 1st Dryer
1983	3 times at 3rd Dryer, 2 times at Smoother Press, 1 time both Suction squeeze roll, and 1st Dryer

They are all trips by OCR and regarded as overload for short time.

The following table shows the situation of comparative large load current in normal operation picked up from Table 8-2-9.

Section	Ratio against rating (%)
Suction couch roll	100.7
Suction squeeze roll	42.0
No. 3 press	35.7
Smoother press	39.5
1st Dryer	80.3
2nd Dryer	60.7
3rd Dryer	57.1
Calender	53.2

More trips occurred in 3rd Dryer and then Calender.

Overspeed occurred once each in Calender (1981) and Reel (1983). It is unknown whether the abnormal speed in 3rd Dryer (1982) was overspeed or not.

(3) Rotary equipment and cable for sectional driving

The stoppage for long time in 1st press of 1983 is supposed to have occurred as follows:

- March 21 Cable ends were short-circuited resulting in unusual condition in OCR.
- April 26 This OCR trouble stopped 2 Hr.
- July 12 When the motor was replaced due to abrasion of commutator, the treatment and connection of cable ends were not perfect.
- July 14 Such defectiveness resulted in the damage by burning of cable ends for field.

(Some mismanagement in working such as replacement, repairing, ect. might be made.)

1981	Stoppage due to defective commutation; each one time at 3rd Press, Smoother Press, and Reel.
1982	1 time at 1st Press.
1983	1 time at 250 kW generator.

- As far as the result in these three years is concerned, there is not found any yearly increasing tendency of troubles in any specific section.
- It is now necessary to perform corrective grinding on commutator face of the following 8 motors from the standpoint of abrasion condition:
  Suction couch, 1st Press, 2nd Press, 3rd Press, Smoother Press, 2nd Dryer, Calender, Reel

(4) Diesel generator

Mechanical troubles which occurred frequently from March to December 1982 were all mechanical failures and were settled within the year.

In 1983, one case of trip occurred in No. 5 generator.

(5) Motors except sectional driving

- In 1982, a trouble occurred in the motor with reducer for slice-roll. It is unknown whether that was an unforeseen accident or not. The replacement was not carried out during the planned shut-down period. The stoppage time was 9H 29min.
- The cause for fusing of motor for CRC 801 occurred in 1983 is unknown.

- A failure of bearings of motor for pump was found in 1983. It had to be prevented by the patrol.
- In 1982, OCR for No. 1 VRS pump tripped. It was not failure.

(6) Switch boards

There was a short-circuit trouble in the vacuum suction couch panel. It took 51H 30M to recover. The cause would be incorrect inspection.

(7) 3 ton crane

In 1983, troubles of breaks have occurred one after another. The planned shut-down was not correctly performed and same type of trouble was repeated due to unenoughly emergency measures.

8-2-3-3 Countermeasures for Accidents and Failures

(1) Renovation or renewal of equipments

The sectional driving equipment should be replaced with the thyristor power source type.

(2) Improvement of maintenance method

a. The planned maintenance should be carried out for important electric equipment. (certain performance based upon the planned shut-down)

b. Perform certain analysis for accidents and failures for proper countermeasures. (preparation of working criteria, training and meeting for members of electric)

c. The repairing method for commutators and surroundings of D.C. motors should be improved.

8-2-4 Points of Maintenance and Control for Electric Installations

8-2-4-1 Present Situation of Maintenance

In this plant, a maintenance system has been established, preparing ledgers for motors, transformers, etc., and periodical inspection is normally carried on in accordance with the inspection schedule, check list, etc.

The condition of service of measuring instruments and tools, and keeping of spare parts and others are comparatively good. And, the record of result of inspection, services, and faults, collection and keeping of operation data of the power station, sectional driving, etc. are also comparatively good.

There is a shut-down once a year for 4 days in the papermaking division and for 1 to 2 weeks in other divisions. The planned works seem not to be done completely unless the maintenance is made according to plan.

8-2-4-2 Points of Maintenance and Control

(1) The instruction manual criteria is not sufficiently arranged, and in some cases, the method of inspection also limit figures are not clearly specified.

(2) The analysis of accidents, faults, etc. seems not to be sufficient. Therefore, in some cases, it can not be useful for improvement of electric installations, working methods, etc.

(3) Preparation of drawings for maintenance

They are dependent upon drawings submitted by manufacturers such as wiring diagram, flow chart, wiring diagram between equipment, etc. The revision or change after reconstruction and keeping of original drawings are not satisfactory.

(4) The control of insulation resistance, current, vibration, temperature, etc. of equipments, which may change as time elapses, is not satisfactory.

In some cases, the change can not be forecasted.

(5) It is necessary to check the accuracy and to make calibration of various kinds of mass volume control instruments. It is also necessary to check the accuracy of measuring instruments and standard instruments, specially measuring instruments of kWh, Voltage and Amper meter, power-factor, etc. which are used as control data.

(6) Table 8-2-10 shows existing testing and measuring instruments.

8-2-4-3 Control of Spare Parts

The purchase and storage section is doing standard stock control. Concerning the D.C. motors and D.C. generators, rotors of their single units are kept in stock. Stored rotors are for 55, 37, 30, 15, and 11kW.

As single units, generator of 250kW, Ex. of 15kW, master of 2kW, etc. are prepared. As far as general A.C. motors are concerned, various types of spare units are prepared under good service condition.

Among other general electric equipments, the supplement of items, which are not available due to model-change by makers, is not satisfactory.

There are some old spare parts which seem not to be used due to unsatisfactory keeping condition.

8-2-4-4 Present Situation of Maintenance Cost

When considering the present condition of electric equipment, the cost of maintenance seems to be appropriate, however, some positive investment for materials for improvement, instruments, etc. may be necessary.

The maintenance costs for these two years are as follows:

Unit: million Rp

	1982	1983
Material Cost	58.5 KRp	135.0 KRp
Wage cost	53.0	51.0
Total	111.5	186.0
Ratio to turn over (%)	1.53	2.78

8-2-4-5 Measure of Maintenance and Control

Some fundamental points of maintenance and control are as follows:

For the tentative control, the numerical target should be set up.

A. To suppress the occurrence of down-time of electric equipments

B. To reduce the cost of maintenance (cost minimum)

However, A should be given priority.

(1) Equipments should be ranked in accordance with their importance. The following three grades of ranks should be arranged based upon possible effects for decrease production by stoppage of equipments, safety, environment, etc. down.

a = Object of important PM

b = Object of PM (preventive maintenance)

c = Object of BM (breakdown maintenance)

(2) Inspection and repairing work

The quantitative measurement should be made at need under the programm established for necessity; daily (every day), normal (once a week or month, and detailed inspection (one every 1 to 4 years). Specially the control of insulation resistance, load current, vibration, temperature, etc. are essential.

Check points, criteria, methods, periods, etc. should be clearly specified in the check sheet. (The review should be made once a year approximately).

The detailed inspection must be done in accordance with the scheduled shut-down of plant.

(3) Ledger and work plan table

In the ledger for each equipment, the control No., method of inspection, period, flow, and other necessary data should be specified. In addition, it is useful for the centralized control of plan and execution if it serves as a career ledger too by including records of repairing and faults.

The monthly personal working plan should be made based upon the maintenance results, production schedule, situation of equipments, etc. of the preceding month.

(4) Countermeasures for secular deterioration

It is necessary to check the situation of deterioration periodically and to renew deteriorated parts or equipments according to plan based upon information from manufacturers and past experiences. Such renewing should be prepared as soon as possible considering the delivery time of parts. It is also desirable to examine the possibility of improvement whenever equipments are renewed.

(5) Troubleshooting

By using the statistical method, the fault should be analyzed for proper countermeasures.

When any period is necessary for investigation, register the content in a card specifying time limit until the trouble is cleared and the progress should be checked every month.

8-2-5 Unit Ratio of Power Consumption and Energy Saving

(1) Table 8-2-11 shows the change of the unit ratio of power consumption from 1981 to 1983.

Year	Paper on reel kWh/ton	Finish paper kWh/ton
1981	1454.38	1808.46
1982	1457.53	1792.40
1983	1500.06	1799.53
$\bar{x}$	1470.66	1800.13

Remarks: kWh means the generated power

(2) There is not examined any measures for energy saving at present. It is also shown by the change of unit ratio of power consumption mentioned in (1). Therefore, considerable cost-down can be expected after now through giving awareness and practice of energy (electric power) saving.

8-2-6 Efficiency and Cost of Diesel Engine

A rough comparison is made about the fuel consumption rate of diesel engines at the beginning of operation and the present. (Refer to Table 8-2-23 for calculation)

(1) NIIGATA Engine

The trial calculation for 1964, the beginning of operation, and for February 1984 shows the following result.

Year	Consumption rate gr/kWh	Specific gravity of fuel	Load ratio
1964	227	0.85	74.1%
1984.2	260 (-15%)	0.8646	74.1%

(2) M.B.L. Engine

Year	Consumption rate gr/kWh	Specific gravity of fuel	Load ratio
1976	216	—	78.8%
1984.2	259 (-20%)	0.8646	78.8

(3) Remarks

Since the calculation was made, for both of NIIGATA and M.B.L., based upon monthly fuel consumption and average load ratio, it cannot be regarded as an exact comparison. However, it is not always said that the consumption rate of NIIGATA engine has been getting worse so extremely because there is not remarkable difference in fuel consumption rate between M.B.L. and NIIGATA engines.

When considering the initial cost, it is preferable to use the existing machine continuously for the time being under the specified maintenance. This engine has such low revolution rate as 375r.p.m. (M.B.L. 500r.p.m.) and shows high durability. And, stable supply of parts will be guaranteed by the manufacturer at present.

For the reference, Table 8-2-13-2 shows the fuel consumption rate of the newest NIIGATA engine.

The consumption rate of newest machine has been improved by about 3.7% at the load of 75% and by 6.2% at the load of 100% in comparison with 20 years before.

8-2-7 Summary of Points to be Improved

8-2-7-1 Electric Equipments

(1) Renewal of sectional driving equipment

It is recommended to replace the existing sectional driving equipment of centralized draw-stand type with common power source with the latest type with individual thyristor reonard control system of high precision and reliability.

a. Rotary machines

As the existing paper machine speed is designed of 300m/min. Table 8-2-16 and 17 show the trial calculation for the renovation plan.

When the insufficient capacity needs new one, the separate type should be selected rather than the gear/motor unit which have certain inconvenience for maintenance.

The M.G. set should be replaced with the thyristor power source type from the standpoint of electric power saving. (Refer to Table 8-2-24 for merit estimation).

b. Power source and control panel

The equipment must have the power potentiality for the final target of 350m/min. The control accuracy of draw should be 0.05% (the designed value of existing is 0.1%).

c. Accessories

Operation Stand, Digital Tachometer, Cooling Fan (for additional volume)

8-2-7-2 Maintenance

(1) Every inspection for each section motor and cable end of control panel of sectional drive should be made and replace them if necessary.

The D.C. motor should be machined by lathe for correction at its commutator face.

(2) Indicating instrument should be calibrated. Accuracy of meters for current, voltage, power, etc. should be checked precisely.

(3) It should be necessary to utilize the latest maintenance and control method in order to level up the existing maintenance method.

It seems to be also necessary to give training based upon OJT by professional technician in order to cope with newest electric equipments.

8-2-7-3 Recommended Spare Electric Items

	Items	Specification	Q'ty
1.	3 ton crane electric parts		1
2.	High voltage breaker	7.2 kV 600 A 150 MVA	1
3.	High voltage magnetic switch	7.2 kV 200 A	1
4.	Low voltage magnetic switch	for 90 kW, 55 kW, and 37 kW	3
5.	Inverter power source	for 22 kW	1
6.	Induction motor	75 kW 8p – 15 kW 2p	8
7.	D.C. motor	75 kW – 2.2 kW	5
8.	Motor control box (rear of machine wire part)	500 W x 1000 H x 250 D (approx.)	1
9.	Air conditioner (for D.C. motor controller)		2
10.	Cable, terminal material		1

8-2-7-4 Recommended Electric Items for Maintenance

	Item	Specification	Q'ty
1.	Portable recorder with current probe	2-pen YEW 3057 100 A, 300, 1000 A	2
2.	Oil tester	50 Hz, 0 – 50 kV	1
3.	Portable vibration meter		1
4.	Synchro scope	2-way, 50 MHz	1
5.	Strobo scope	0 – 20,000 r.p.m.	1
6.	Digital counter	with 5-figure preset	1

8-2-8 Measures for Power Source Accompanied with Renovation Works

Table 8-2-18 shows expected addition and reduction of equipment of load. Some equipment will be added in the stock preparation and paper machine, where power source equipments should be added or rearranged. In the pulp plant and chipper plant, existing equipments will be sufficient for demand since only a little addition is made.

The following comments about the stock preparation and paper machine.

8-2-8-1 Stock Preparation Plant

There are two units of transformer of 650kVA for each at present and the load is totally covered by 380V. After renovation, the total increased power for added instruments is 240kW including 2 units of 220kW motor for DDR. Generally, 6kV power source is used for the capacity of 220kW as low voltage, so high voltage distributor should be installed.

As existing two units of 110kW motor are not operated, the load for 650kVA is reduced accordingly.

It is unnecessary to replace the power cable 3C×150 sq. from the power station.

8-2-8-2 Paper Machine

There are expected four cases of renewal or renovatin in this division.

(1) Renovation of sectional driving equipment

As shown in the renovation plan of Table 8-2-16, the equipment capacity of D.C. motor is expected as 477.7kW for the maximum speed of 350m/min.

Therefore, the necessary power source capacity is 716kVA, resulting in the transformer of 750kVA.

(2) Addition at finishing room

a. The existing induction motor of 37kW 4P for the rewinder is replaced with 55kW D.C. motor.

b. One unit of 300kW D.C. motor for the supercalender and two units of 22kW D.C. motor are newly installed making total 344kW.

c. The equipments capacity for finishing room becomes 399kW and the necessary power source capacity is 599kVA. Therefore, selection is made for 750kVA transformer.

(3) D.C. conversion of motor for fan pump

The induction motor of 190kW 4P for the fan pump is replaced with 150kW D.C. motor to control the revolution of pump.

At present, the high voltage switch panel for motor is located in the site comparatively close to the motor. Therefore, this high voltage switch panel can be used as the transformer panel (300kVA against necessary power source of 225kVA of 150kW), "Plan No. 1".

And, the power source for the sectional driving equipment mentioned in (1) can be used for this purpose, "Plan No. 2". The equipment capacity in this case is 477.7 + 150 = 627.7kW, while the necessary power source capacity is 941.6kVA. Therefore, the transformer of 1,000kVA is selected.

(4) The above mentioned situation is summarized as follows:

Case	Application	Present capacity kW	300 m/min kW	350 m/min kW	Transformer capacity kVA
1.	Sectional drive	273	380	480	716 → 750
2.	Rewinder	*37	55	55	600 → 750
	Super calender	0	344	344	
3.	Fan pump	*190	150	150	255 → 300
4.	Sectional drive	273	380	480	945 → 1000
	fan pump	*190	150	150	

* = A.C. motor

8-2-8-3 Countermeasures for Power Source

The load for No. 5 feeder panel of the power plant is expected to increase by approx. 400kW at the speed of 350m/min.

Though there is no difficulty in the capacity of OCB, CT must be changed. The power cable 3C×250 sq. can be used as it is.

8-2-9 Presumption of Increased Power Consumption after Renovation Works

The approximate power consumption is determined in accordance with data submitted by the renovation team of BRPP.

(1) The own pulp production is decreased from 8,862.64BDt-BKP/y in 1983 to 8,426BDt/y.

(2) The paper production is increased from 11,786.94ADt/y in 1983 to 14,245ADt/y.

(3) There is not remarkable increase or decrease in other divisions.

(4) The increased electric power is summarized in Table 8-2-20 by using Table 8-2-19.

Though the increase of 25.4% is presumed as total, the power generating capacity will satisfactorily cover the necessary power.

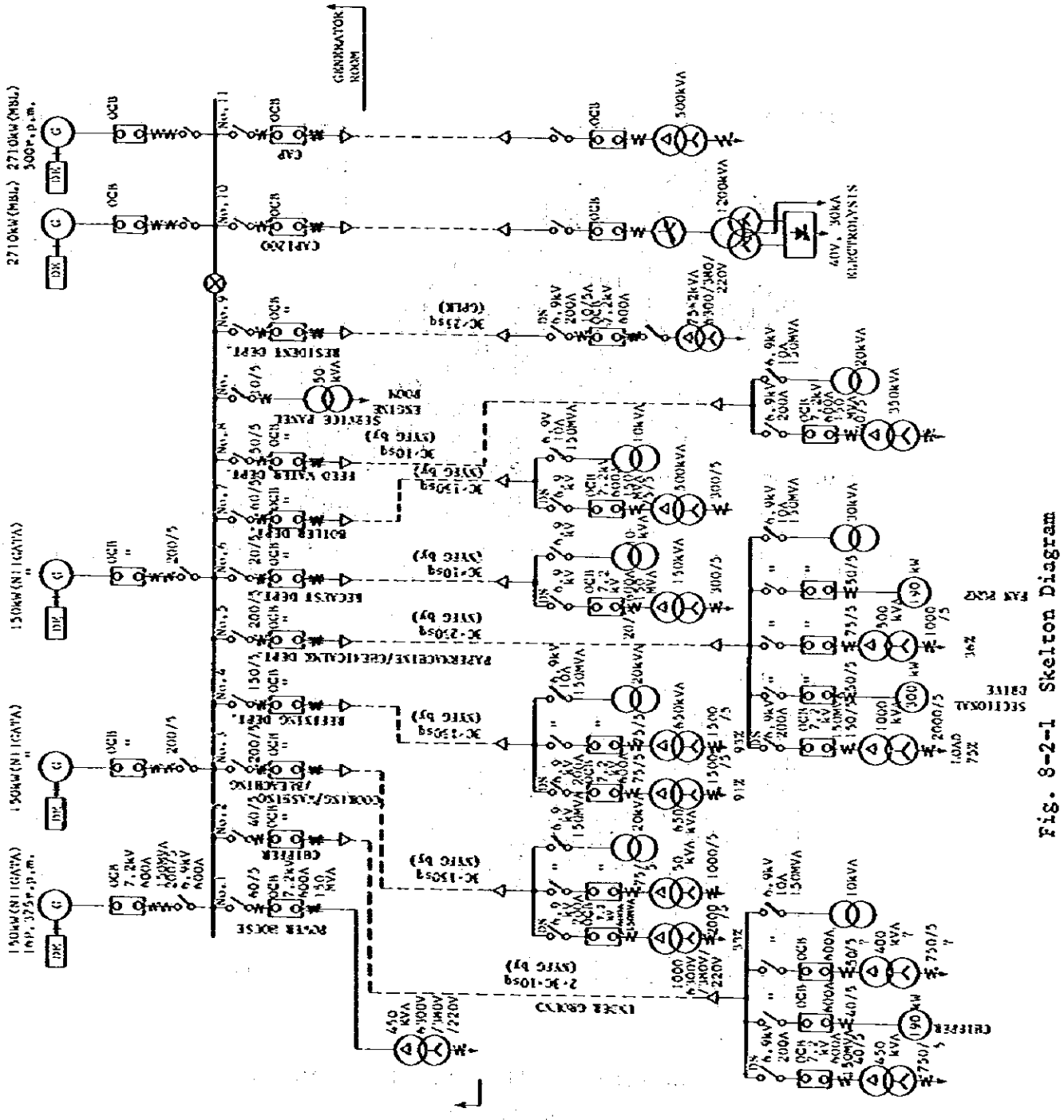
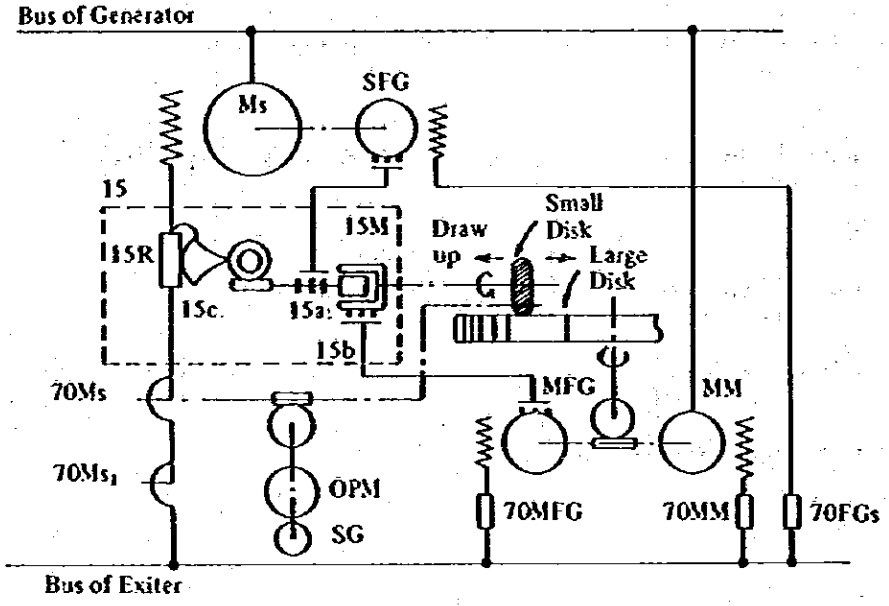


Fig. 8-2-1 Skelton Diagram



– Explain –

Ms : Section Motor
MM : Master Motor
SFG : Section Frequency Generator
MFG: Master Frequency Generator
15 : Auto Draw Regulator
15M : Differential Mechanism
15a : Rotor of Differential Mechanism
15b : Stator of Differential Mechanism
15c : Sector
15R : Control Resistance
70 : Field Resistance
OPM : Operation Motor
SG : Selsyn

Fig. 8-2-2 Illustration of Sectional Drive Draw Control Mechanism
– Existing – Shinko System

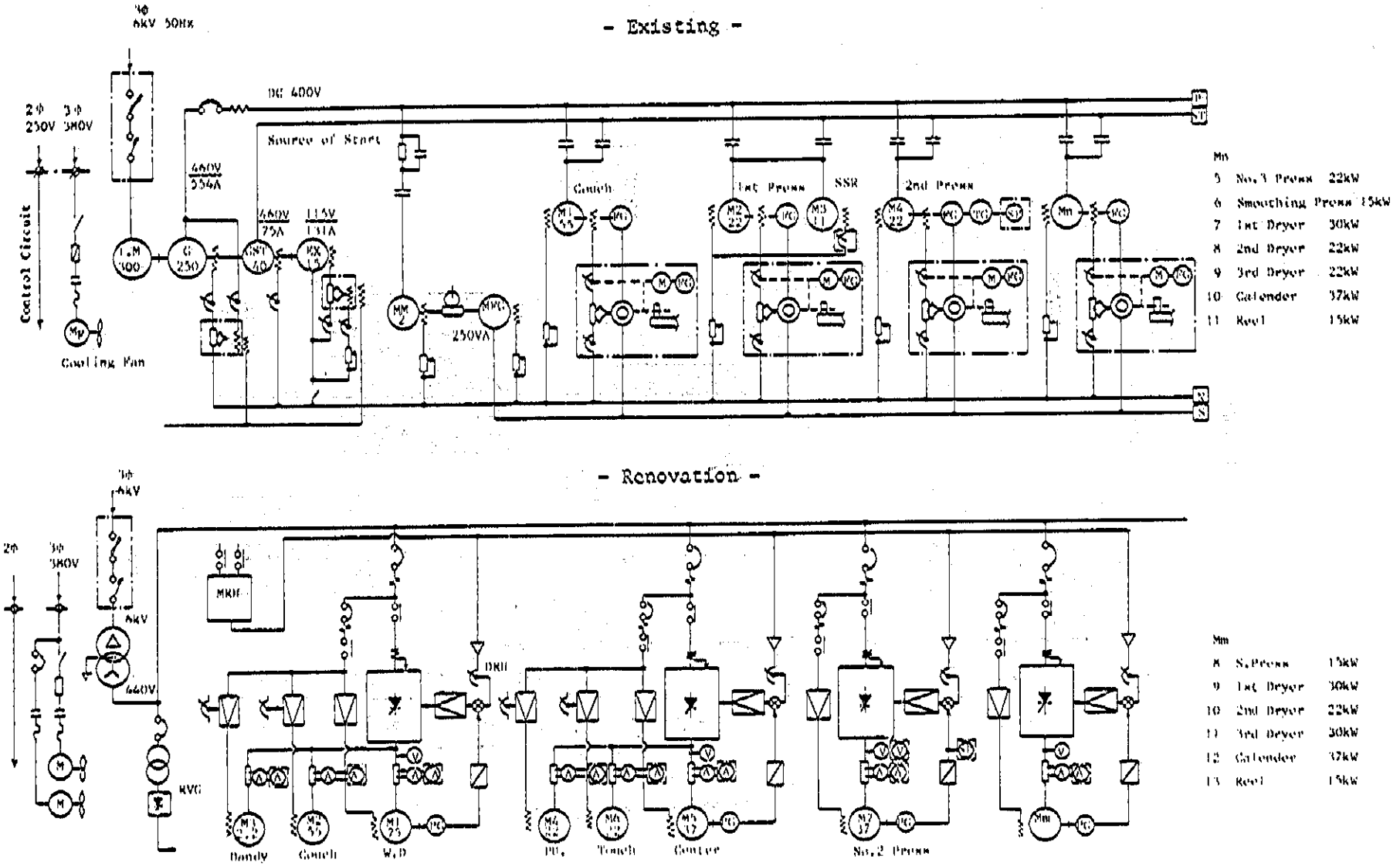


Fig. 8-2-3 Skeleton of Sectional Drive

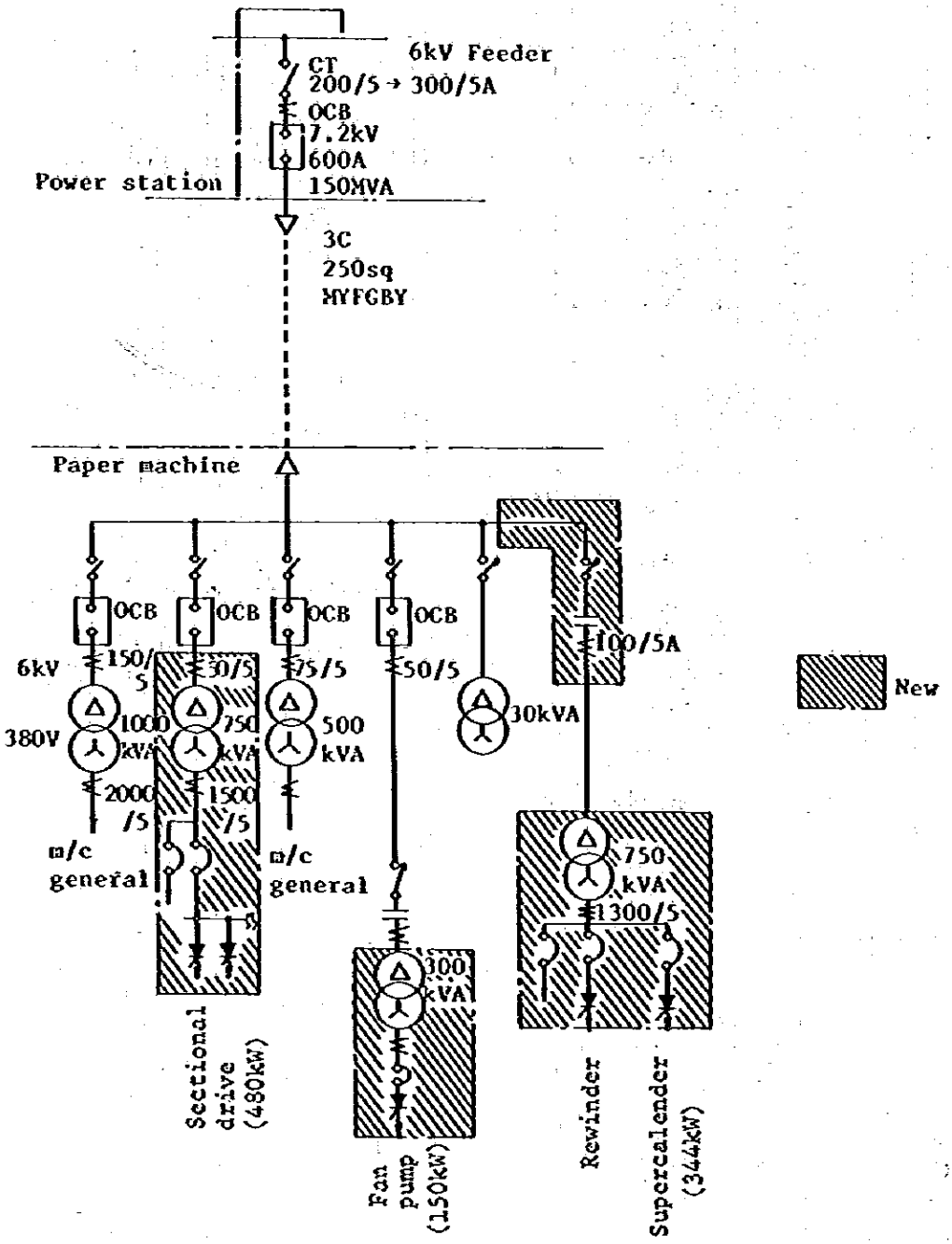


Fig. 8-2-4 (1) Reconstruction Paper Machine Power Plan 1

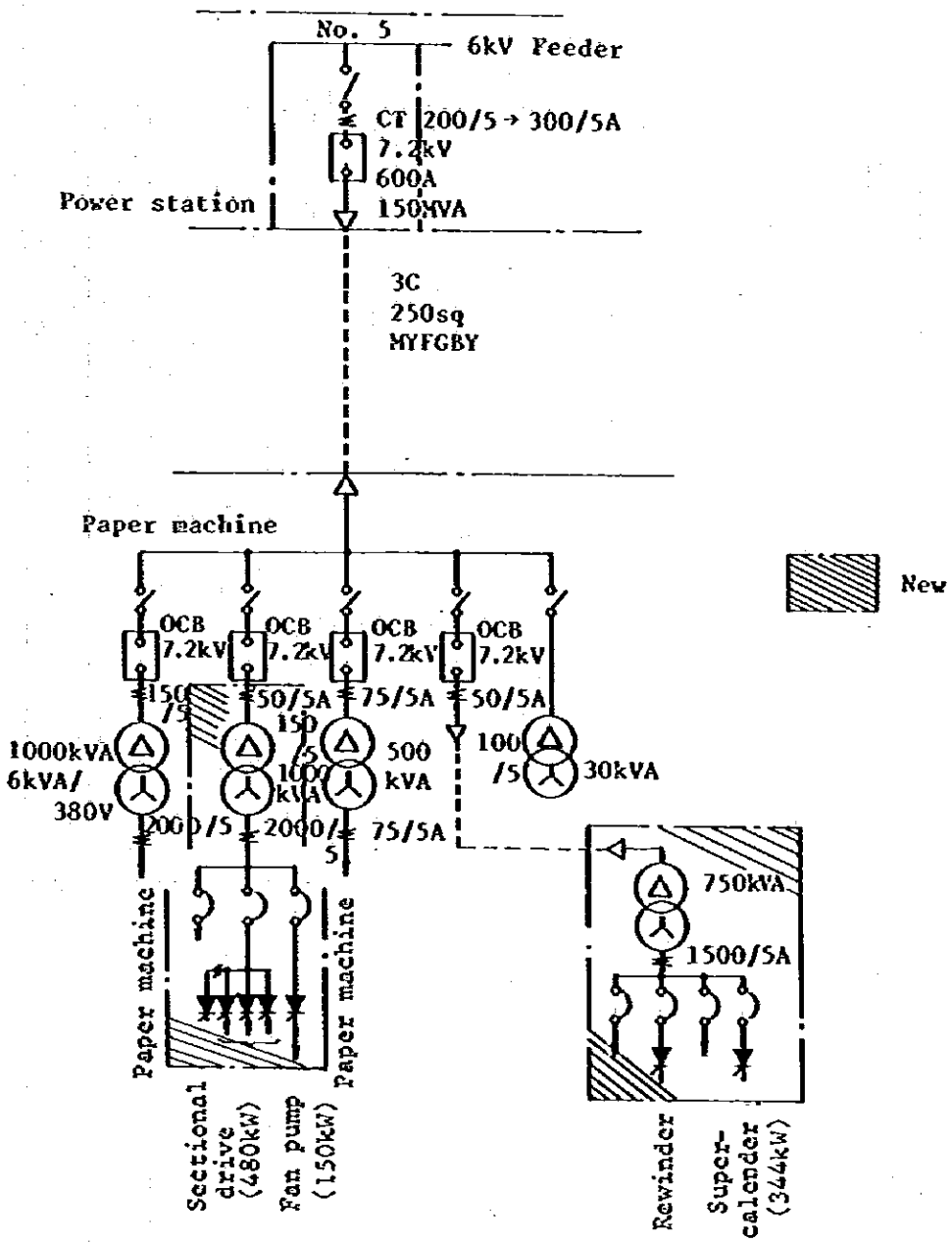


Fig. 8-2-4 (2) Reconstruction Paper Machine Power Facility Plan 2

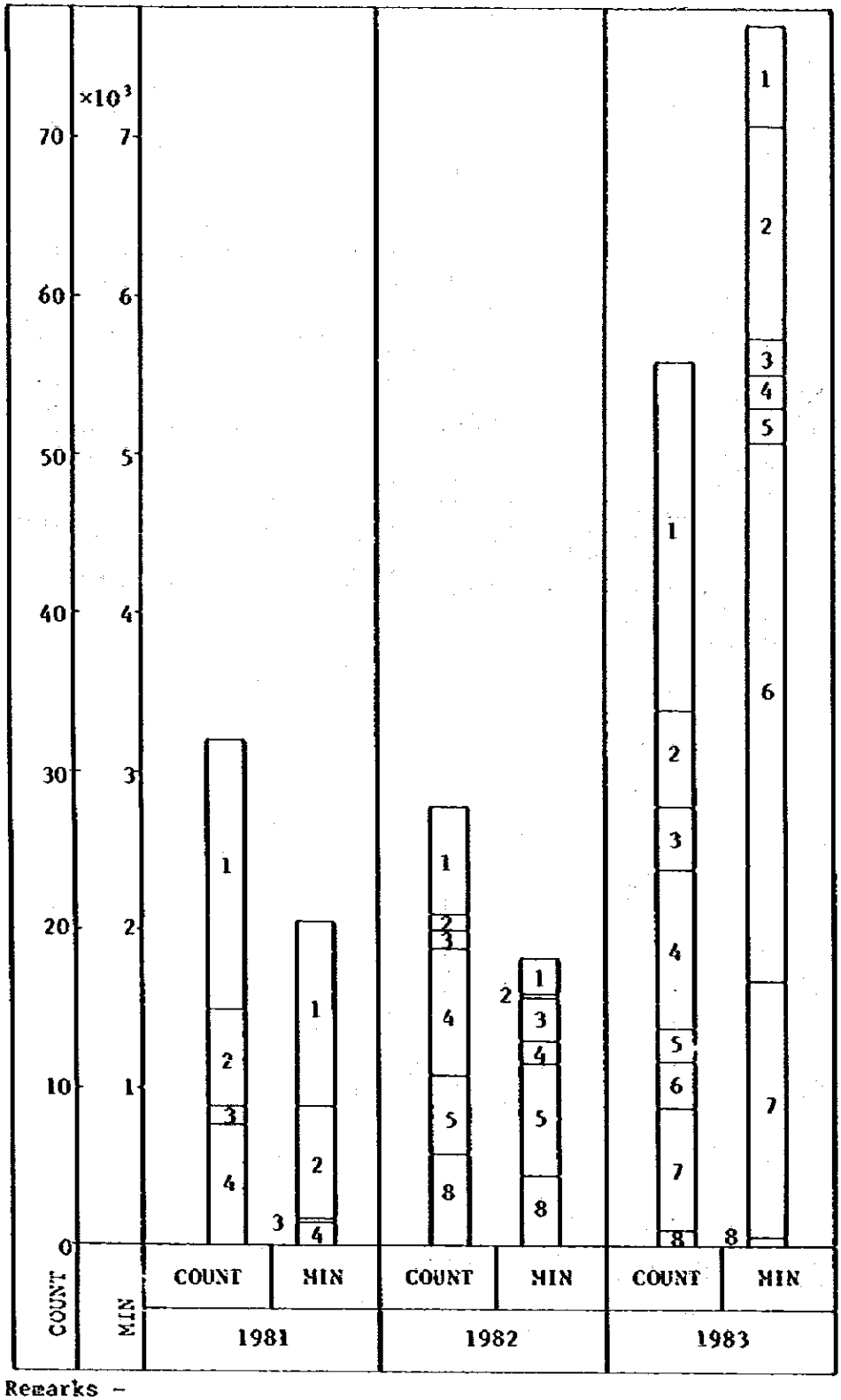
Table 8-2-1 Statistic of Accident and Problem of Electric

Q: Count, °: Hour, ': Minit

Mark	Item	1981		1982		1983		1981 to 1983		Average		Sectional Drive Only	
		Q(count)	Hour	Q	Hour	Q	Hour	Q	Hour	Q	Hour	Q(%)	Hour(%)
○ 1	Speed, Ampere, Hunting and Stop of Sectional Drive	17	11°39' 699'	7	3°44' 224'	23	10°13' 613'	47	25°36' 1536'	15.7	512'		
		53.1%	34.4%	25.0%	12.3%	41.1%	8.0%	40.5%	14.0%			51.6	30.6
⌂ 2	Motor and Generator Excite AVR and ADR of S. Drive	6	19°18' 1158'	1	10'	6	22°28' 1348'	13	41°36' 2516'	4.3	839'		
		18.8%	56.9%	3.6%	0.6%	10.7%	17.5%	11.2%	17.5%			14.3	50.0
▽ 3	Switch Board and Cable of S. Drive	1	13'	1	4°20' 260'	3	3°26' 206'	5	7°59' 479'	1.7	160'		
		3.1%	0.6%	3.6%	14.2%	5.3%	2.7%	4.3%	4.4%			3.5	9.5
△ 4	Problem of Operation of S. Drive	8	2°45' 165'	8	2°10' 130'	10	3°23' 203	26	8°18' 498'	8.7	166'		
		25%	8.1%	28.6%	7.1%	17.9%	2.6%	22.4%	4.6%			28.6	9.9
⌂ 5	Motor without S. Drive	0		5	12°11' 731'	2	3°25' 205'	7	15°36' 936'	2.3	312'		
				17.8%	40.0%	3.6%	2.7%	6.05%	8.5%				
▽ 6	Switch Board and Cable without S. Drive	0		0		3	56°55' 3415'	3	56°55' 3415'	1.0	1138'		
						5.3%	44.0%	2.6%	31.1%				
□ 7	5 ton Crane	0		0		8	28°00' 1680'	8	28°00' 1680'	2.7	560'		
						14.3%	22.0%	6.7%	15.3%				
⌀ 8	Diesel Engine Generator	0		6	7°52' 472'	1	36'	7	8°28' 508'	2.3	169'		
				21.4%	25.8%	1.8%	0.5%	6.05%	4.6%				
	Total	32	33°55' 2035'	28	30°27' 1827'	56	128°26' 7706'	116	192°68' 11568'	38.7			
	Total of Sectional Drive (1 ~ 4)	32	33°55'	17	10°24'	42	39°30'	91	83°49'				
		100%	100%	60.8%	34.2%	75.0%	30.8%	78.4%	43.5%				

Table 8-2-2 Total of Accidents (1981 - 1983)

Table 8-2-3 Histograph of Accident of Paper Machine



- Remarks -

1. - Sectional drive speed, ampere hunting and stop
2. - Sectional drive motor and generator
3. - Sectional drive switchboard and cable
4. - Sectional drive operation
5. - Motor without sectional drive
6. - Switchboard and cable
7. - 3 tone crane
8. - Diesel generator

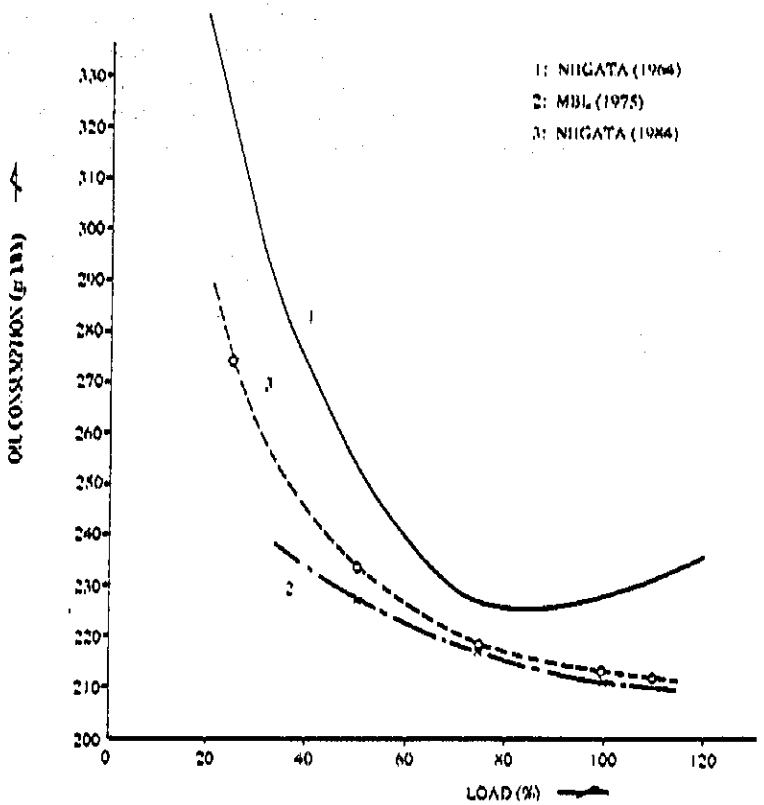


Fig. 8-2-5 Diesel Engine Generator Characteristic Curve

Table 8-2-13-1 Niigata: Data of Fuel Consumption Rate of Diesel Engine Generator

1964 Test Data No. 50006, 50112, 50113

Load	%	25	50	75	100	110
Fuel consumption rate	gr/PSh	222.5	179.4	161.6	162.0	164.6
Fuel consumption rate	gr/kWh	321.5	253.5	226.8	227.4	230.9

Table 8-2-13-2 Niigata (latest): Fuel Consumption Rate of Diesel Engine Generator – As of Jan. 1984

Load	%	25	50	75	100	110
Fuel consumption rate	gr/PSh	180	151	152	149	148
Fuel consumption rate	gr/kWh	274.1	234.2	218.5	213.3	211.9
Generator efficiency	(%)	89.3	93.5	94.6	95.0	95.0

Conditions:

- Capacity of generator: 1,500 kW, 1,000 R.P.M.
- Fuel: Heavy oil 10,200 kcal/kg, Specific gravity of 0.85
- Circulation pump, each equipped with one air intercooler
- Air temperature: 32°C or below at inlet, 27°C or below at outlet
- Elevation: 150 m or below
- Load rate: 0% to 50%
- Moment: 10%, Voltage setting: 5%

Table 8-2-13-3 MBL Fuel Consumption Rate of Diesel Engine Generator Made in 1975 (Theoretical value)

Load	%	25	50	75	100	Remarks
Fuel consumption rate	gr/PSh		163	156	152	Conversion by Hosaka
Fuel consumption rate	gr/kWh		227	217	211	

Conditions:

- Capacity of generator: 2,710 kW, 50 R.P.M.
- Fuel oil: 10,220 kcal/kg
- Elevation: 150 m or below

Table 8-2-4 Pareto Diagram of Number of Accidents by Part

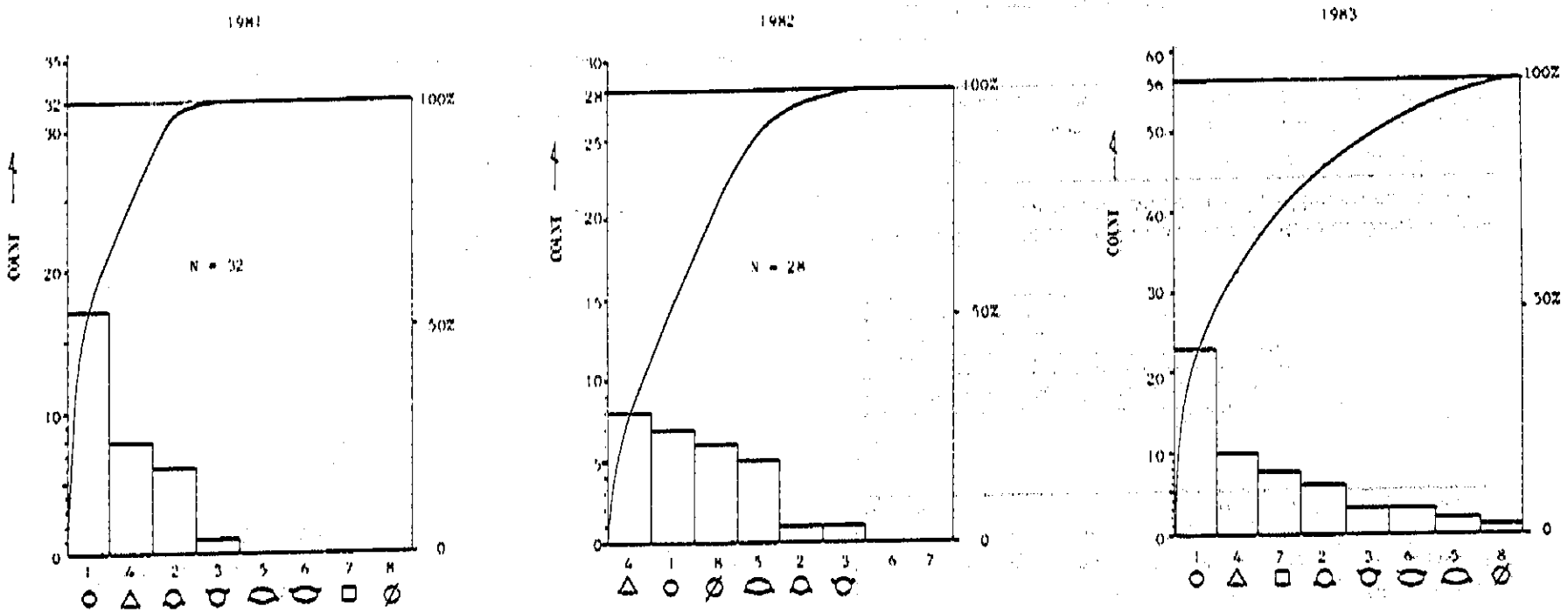
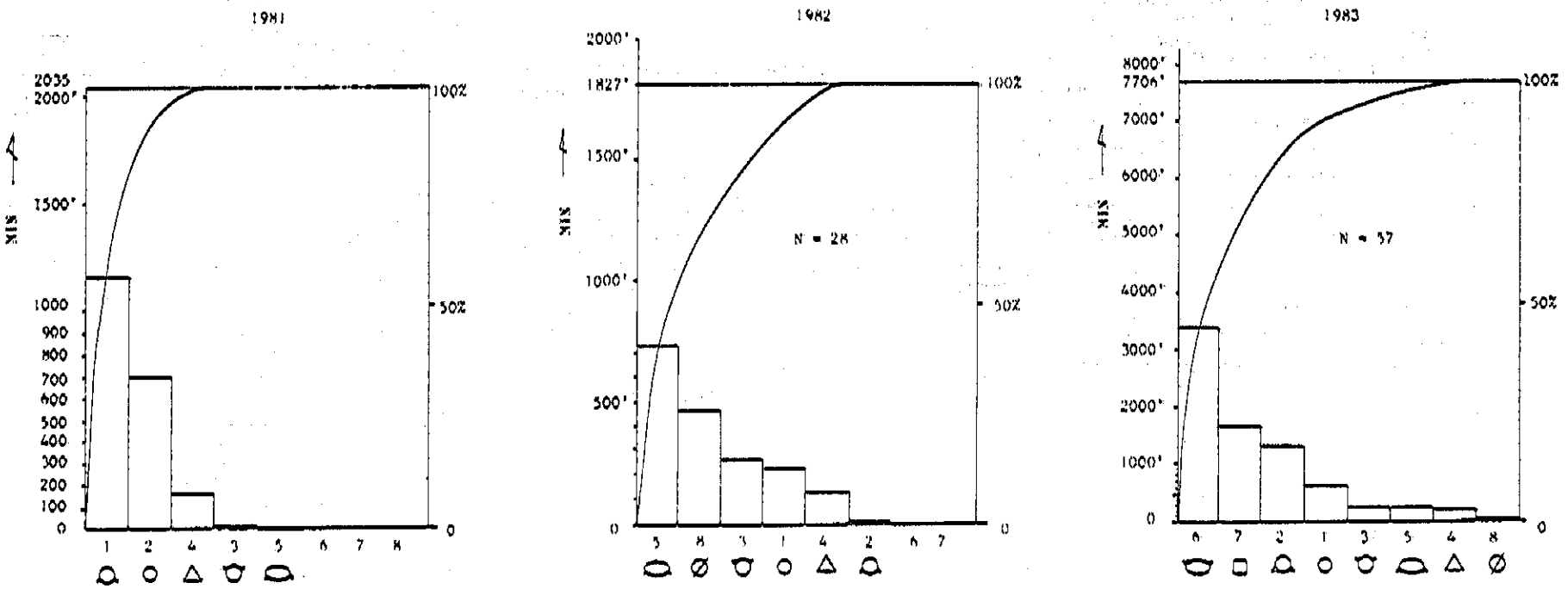


Table 8-2-5 Pareto Diagram of Time of Occurrence by Part



1 Speed ampere hunting and trip of sectional drive
2 Motor, generator and avr of sectional drive
3 Switch board and cable of sectional drive
4 Problem of operation of sectional drive
5 Motor without sectional drive
6 Switch board and cable without sectional drive
7 3 ton crane
8 Diesel engine generator

Table 8-2-6 Trouble Analysis of Sectional Drive

Classification	1981		1982		1983	
Speed hunting ○	1. Section with much current/ speed hunting 3rd Press: 7 times/$3^{H}2'$min* (Whole section: 1 trip) 2. Section with various troubles Calender: 6 times/$5^{H}32^{min}$ Excessive speed: 1 Trip: 1 ADR failure: 1 Draw fault: 2 Speed hunching: 1 3. Miscellaneous trouble • 2nd Press: Current hunting 1 time/36 min • 1st Dryer: Draw fault 1 time/20 min • Smoother Press: Draw fault 1 time/20 min • Smoother Press: Draw fault 1 time/14 min • 2nd Dryer: Draw fault 1 time/$1^{H}20^{min}$ 4. Trouble that affected the whole section No. 4 press: Imperfect sliding contact	16 times/ $11^{H}9^{min}$ *At the same time 1 time/ 30 min	1. Section with much trip Calender trip: 3 times/57 min* (Motor failure) 1 time/15 min 2. Miscellaneous trips • 1st Press: 1 time/10 min • Reel: 1 time/27 min* • 3rd Dryer Speed fault: 1 time/15 min Same as left 1. ACB Trip: 2 times	6 times/ $1^{H}37^{min}$ *At the same time 1 time/ $2^{H}7^{min}$	1. Section with many trips 3rd Dryer: 3 times/$1^{H}45^{min}$ (RH failure) 1 time/30 min 2. Miscellaneous trips • 1st Press: OCR failure 1 time/2^{H} • Calender: 2 times/32 min (Either one: trip of whole section) • 3rd press: 1 time/15 min • Reel: 1 time/15 min • 1st Dryer: 1 time/35 min Same as left 1. Speed hunting: 10 times/$3^{H}20^{min}$ 2. Draw fault: 1 time/15 min	12 times/ $6^{H}32^{min}$ 11 times/ $3^{H}41^{min}$
Trouble on operation △	Trip 1. 2nd Dryer: 4 times/$1^{h}20^{min}$ 2. 3rd Press, 2nd Dryer: 2 times/$1^{H}5^{min}$ 3. Calender: 2 times/20 min	8 times/ $2^{H}43^{min}$	Trip 1. 3rd Dryer: 3 times/1^{h} 2. 2nd Dryer: 3 times/40 min 3. Smoother Press: 1 time/15 min 4. 1st Dryer: 1 time/15 min	8 times/ $2^{H}10^{min}$	Trip 1. Couch: 2 times/55 min 2. 3rd Dryer: 3 times/45 min 3. S.S.R.: 1 time/40 min 4. Smoother Press: 2 times/38 min 5. Calender: 1 time/15 min 6. Reel: 1 time/10 min	10 times/ $3^{H}23^{min}$
Motor and generator ⏢	1. Repair of Motor Chain of ADR: 1 time/$12^{H}3^{min}$ 2. Repair with AVR Spare Parts: 2 times/$3^{H}19^{min}$ 3. Smoother press: Spark arrest 1 time/$2^{H}36^{min}$ 4. Replacement of Reel: Spark arrest 1 time/48 min	6 times/ $19^{H}18^{min}$	1. 1st Press: Commutator cleaning 1 time/ 10 min	1 time/ 10 min	1. AVR • Repair of failing ADR machine: 1 time/$1^{H}42^{min}$ • Adjust: 1 time/$2^{H}18^{min}$ • Spark arrest of rolling contact: 1 time/32 min	6 times/ $22^{H}28^{min}$

Table 8-2-6 Trouble Analysis of Sectional Drive

Classification	1981		1982		1983	
	5. No. 3 Press: Replace Brush of Motor 1 time/30 min				2. 1st press: Exchange of DCM 1 time/$10^{H}4^{min}$ (Aeration of commutator) 3. Repair of coupling 250 kW Generator between 40 kW Generator: 1 time/$3^{H}50^{min}$ 4. 250 kW Generator: Replacement of Brush Holder 1 time/$3^{H}19^{min}$	
Switch board and cable	1. Calender Imperfect contact of terminal	1 time/ 13 min	1. Damage of Cable between ADR and M.F.C.	1 time/ $4^{H}20^{min}$	1. 1st press cable • Short circuit at Terminal: 1 time/2H • Damage of Cable: 1 time/51 min • During of fild cable: 1 time/35 min	3 times/ $3^{H}26^{min}$
Total sectional		32 times/ $23^{H}55^{min}$		22 times/ $10^{H}24^{min}$		42 times/ $39^{H}30^{min}$

Table 8-2-7 Sectional Drive Trouble Analysis (1)

*: Hour ': Minute
H M

◇ Item/Y	1981	1982	1983
Speed. Amp. Hunting	16 times 11°09'	6 times 1°37'	12 times 6°32'
Couch		1 time 10'	1 time 2°
1st Press	1 time 36'		
2nd Press	7 times 3°27'		1 time 15'
3rd Press	2/		2 times 35'
Smoothing Press	1/		
1st Dryer	1/	1 time 15'	4 times 2°35'
2nd Dryer			2 times 32'
3rd Dryer		4 times 1°12'	1 time 15'
Calender	x 6/5°32'		
Reel			
S.S.R	1/1 4/1 25/1 16/2 8/3 19/3 21/3 24/4 25/4 3/5 6/5 16/5 23/6 31/10 20/11 15/12	29/1 13/3 27/3 5/5 14/11 23/12	26/4 16/8 17/8 21/8 15/9 26/10 16/11 20/11 5/12 7/12 9/12
	30' 1°20' 20' 15' 25' 20' 30' 1°01' 2°22' 36' 54' 20' 36' 1°20' 14' 6'	15' 10' 20' 10' 27' 13'	2° 23' 50' 25' 15' 40' 12' 27' 40' 25' 15'
	Trip restart disabled; Draw abnormal; Current hunting; Speed hunting; " " " "	Speed abnormal; Trip; Trip; "; Trip	QCR failure; Speed/current hunting; Trip R3 Start Hunting at start; Trip start delay; " "
	Overspeed; ADR Speed hunting; ADR failure; Speed hunting; Current hunting; Draw abnormal; " "	Motor abnormal	Trip, ADR failure; Trip; Trip start delay; Trip restart delay; Overspeed
All section Hunting or abnormal stoppage ⊗	⊗ 6/1 Failure of No. 6 press field sliding contactor 30'; 1/6; ⊗ Trip; 1 time 30'	⊗ 8/12 Two-time ADR trip 2°07'; 1 time 2°07'	x x x x x x x x x ⊗ x x; 17/6 28/6 29/6 20/7 30/7 31/7 1/8 7/8 8/8 1/10 11/10; 17' 10' 40' 25' 38' 8' 26' 7' 25' 10' 15'; Imperfect cooling contact; Trip; Draw hunting; 11 times 3°41'
Total	17 times 11°39'	8 times 3°44'	23 times 10°23'

Table 8-2-7 Sectional Drive Trouble Analysis (2)

*: Hour ': Minute

Item/Y	1981	1982	1983
Rotary machine			2 times 7°09'
250 KW generator			× × 1 time 10°47'
1st Press motor		×	×
2nd Press motor			
3rd Press motor	×		1 time 30'
Smoothing press motor	×		1 time 2°36'
2nd Dryer motor			
Reel motor	×		1 time 48'
	7/5 30/8	1/4	4/1 18/5 12/7
	30' 2°36'	10'	3°19' 3°50' 10'47'
	Brush change Large spark on commutator	Commutator cleaning	Large spark on brush holder Coupling failure between 250KW and 40KW Abrasion of commutator
ADR	× 1 time 12°05'		3 times 4°32'
AVR	× × 2 times 3°19'		× × ×
	4/6 5/6 2-3/10		6/1 22/1 27/6
	1°31' 1°28' 12°05'		1°42' 2°18' 32'
	AVR replacement AVR rejection Repair of motor chain for ADR		Mechanical failure Adjustment Rolling contact spark
	6 times 19°18'		6 times 22°28'
Switch board, cable, etc.	×	×	× × ×
	17/12 13' 1 time 13'	3/12 4°20'	21/3 51' 2/6 °° 14/7 35' 3 times 3°20'
	Imperfect terminal contact	Damage of cable between ADR and MFG	Short circuit, at No. 1 press cable terminal Damage of No. 1 press cable Burning of cable terminal for No. 1 press field (on motor side)

Table 8-2-8 Sectional Drive Trip under Operation

*: Hour *: Minute
N M

Item \ Y	1981									1982									1983									
Couch																											2 times 55'
1st press																											
2nd press																											
3rd press	×		×					2 times (35)'	*								1 time 15'		×							2 times 38'	
Smoothing press															×		1 time 15'			×				×			1 time 1/10*
1st Dryer																×	3 times 40'					×	×		×		3 times 45'
2nd Dryer	×		×	×		×	×	×	6 times 2*25'	* ×	×	×					3 times 1*				×						1 time 15'
3rd Dryer													×	×	×												
Calender	×	×			×			2 times 20'													×						1 time 40'
Reel																						×					
S.S.R																											
Month/Day	1 23/1	2 30/1	3 12/6	4 6/7	5 7/7	6 11/8	7 14/10	8 22/12	Total 8 times	1 10/2	2 11/2	3 10/8	4 8/11	5 9/11	6 6/12	7 7/12	8 15/12	Total 8 times		1 7/1	2 17/1	3 21/1	4 16/2	5 31/3	6 20/4	7 24/5	8 22/8	9 23/8	10 12/12	Total 10 times
H* M'	25'	10'	40'	15'	10'	15'	25'	25'	2*45'	10'	10'	20'	25'	15'	20'	15'	15'	2*10'		30'	10'	40'	15'	20'	20'	28'	08'	05'	27'	3*23'
			Restart delay				2 times					Stoppage restart delay	Restart disabled											Drain					

Table 8-2-9 Max. Load of Actual

No.	Section	DC motor cap. rating		6/3/'84 8:00		6/3/'84 22:00		Remarks
		kW	A	A	%	A	%	
1	Suction couch	55	139	*140	100.7	130	93.5	
2	1st Press	22	56	14	25	14	25.0	
3	Suction squeeze	11	28.5	*12	42	8	28.2	Helper
4	2nd Press	22	56	*24	42.9	21	37.5	
5	3rd Press	22	56	*20	35.7	20	35.7	
6	Smoother Press	15	38	*15	39.5	12	31.6	
7	1st Dryer	30	76	40	52.6	*61	80.3	
8	2nd Dryer	22	56	22	39.3	*34	60.7	
9	3rd Dryer	22	56	26	46.4	*32	57.1	
10	Calender	37	94	29	30.9	*50	53.2	
11	Reel	15	38	*25	65.8	15	39.5	
	Total	265		367		397		
	Main (250 kW DC GEN.)	380V		330V		330V		
	Speed (m/min)			235		235		
	Kind of paper			HVO/S 80 gr		HVO/S 80 gr		

* Max. Load

Table 8-2-10 Test Instrument & Tool Set

- Existing -

No.	Name	Specification	Qt.	Explanation
1	Tachometer	TACLOCK, 0 - 1000 rpm	2	1 Damage
2	Multimeter	SANWA, 0 - 1000 V, AC & DC	4	1 Damage
3	Megger	SANWA, 500 V	1	OK
4	Ditto	YEW, 1000 V	1	OK
5	Earth tester	YEW, 0 - 30 V	2	80%
6	Transistor checker	SANWA,	1	85%
7	Clamp tester	VERANTI, 0 - 150 A	1	60%
8	Cycle counter calibrator	YEW, 0 - 50 Cycles x100	1	OK
9	Volt meter	YEW, 0 - 600 V AC	1	OK
10	Amp. meter	YEW, 0 - 25A AC	1	OK
11	Micro meter	YEW, 0.01 - 25 mm	1	50%
12	Mano meter	DIGITAL TYPE	1	
13	Clamp tester	Soar No. 2200	1	
14	Over load Relay & Circuit-breaker Test set		1	
15	Cable fault finder	Model FF-2E	1	
16	Watt hour meter Calib./Test Equipment			
17	Digital solid state Relay tester		1	

Table 8-2-11 Unit Ratio of Power Consumption Transition Table

	1981			1982			1983			
	Electric energy (generation) kWh	Production ton on reel	Unit kWh/ton	Electric energy (generation) kWh	Paper production ADt	Unit kWh/ton	Electric energy (generation) KWh	Paper production ADt	Unit kWh/ton	Average
(1)	20,053,115	13,788,085	1,454.38	19,939,263	13,680.175	1,457.53	17,663,643	13,108.535	1,500.06	1,470.66
(2)		11,088.497	1,808.46		11,124.344	1,792.40		10,927.086	1,799.53	1,800.13

Note) Quoted from "DATA TAHUNAN PENAKAIAN BAHAN UNTUK PRODUKSI KERTAS".
(1) means case of Paper production on Reel (ADt/y)
(2) means case of Finished Paper production (ADt/y)

Table 8-2-12-1 Generating Cost of Diesel Engine in Feb. 1984

	NIIGATA		M.B.L.		Total
	Quantity	Cost	Quantity	Cost	
1. Oil	lit.	Rp	lit.	Rp	
L.D.C.	226,407	45,790,196	411,611	83,256,480	
M.Y.D.	4,200	2,260,129	-	-	
Formula	-	-	1,200	781,063	
Total	-	48,050,325	-	84,037,543	Rp 132,087,868
2. Generation (kWh)	791,600	-	1,439,300	-	2,230,900
3. Cost of oil (Rp/kWh)	-	60.7	-	58.38	59.31
4. Total cost including fixed cost Rp/kWh		70.79	-	66.47	68.00
5. Unit ratio (kWh/lit.)	3.496	-	3.497	-	-

Table 8-2-12-2 Load Factor of Diesel Engine Generator
(Feb. 1984)

		NIIGATA	M.B.L.	Total
Generated Energy	kWh	791,600	1,439,300	2,230,900
Operation time	Hr	712	674	712
* Average Generated Power	kW	1,111.8	2,135.5	3,247.3
Load factor	%	74.1	78.8	77.1

Note:

1. Average Generated Power

1-1 Case of NIIGATA = 791,600/712Hr=1,111.8kW

Operated No.1 Generator = 296 Hr
Operated No.2 Generator = 416 Hr
Total 712 Hr/Feb.

1-2 Case of M.B.L. = 1,439,300/674Hr=2,135.5kW

Operated No.6 Generator = 674 Hr/Feb.

2. Design Capacity

NIIGATA = 1,500 kW x 3 sets
M.B.L. = 2,710 kW x 2 sets

3. Load Factor

3-1 Case of NIIGATA = $\frac{1,111.8}{1,500} \times 100 = 74.1\%$

3-2 Case of M.B.L. = $\frac{2,135.5}{2,710} \times 100 = 78.8\%$

Table 8-2-14 Efficiency of Diesel Engine Generator

Item	Unit	1981	1982	1983	Average	Feb. 1984			
						NIIGATA	M.B.L.	Total	
Oil consumption	ℓ/Y	5,704,492	5,630,098	5,575,300	5,636,630	226,407	411,611	638,018	
Power generation	kWh/Y	20,053,115	19,939,263	19,663,643	19,885,340	791,600	1,439,300	2,230,900	
Oil consumption	ℓ/kWh	0.2845	0.2824	0.2835	0.2835	0.28601	0.28598	0.28599	
Oil consumption case of s.g. 0.85	gr/kWh	241.83	240.04	240.98	240.95	243.11	243.08	243.09	
case of s.g. 0.87	"	247.52	245.69	246.65	246.65	248.83	248.80	248.81	
case of s.g. 0.8646	"	245.98	244.16	245.11	245.08	247.28	247.26	247.27	

Note) For the data of oil consumption and power generation in 1981 through 1983, follow the "DATA PRODUKSI DAN PEMAKAIAN BAHAN UNTUK KERTAS".

Table 8-2-15 Operation Data of Sectional Drive

Section	Item	Motor: Normal (KW)	Motor: Normal (A)	Date: 13-7-83 1:00	10-3-83 7:00	7-3-84 4:00	6-3-84 22:00	12-3-84 10:00	2-3-84 16:00	- -	6-3-84 8:00
	Kind of paper			HVS	HVS #1	HVS	HVO/S #2	Cyclo 70	Cyclo 70	HVS #1	HVO/S #2
	(g/m^2)			60	50	45	80	70	70	50	80
	Speed (m/min)			240	240	240	235	240	170		
	High tension board										
	Voltage (V)			6,000	6,000	6,000	6,000	6,000	5,950		6,000
	Current (A)			17	19	19	14	19	13		14
	DC contactor panel Voltage (V)			320	340	340	330	340	250		340
	Current (A)			378	400	412	389	384	292		340
	Excitor Voltage (V)			114	109	110	110	109	110		109
	" Current (A)			86	72	73	73	73	70		71
1	Suction couch	55	139	136A	130	135	130	132	120	112-138	140
2	1st Press	22	56	11	13	12	14	12	8	12- 15	14
(3)	Suction squeeze	11	28.4	13	10	12	8	10	5	10- 11	12
4	2nd Press	22	56	19	21	20	21	20	19	21- 23	24
5	3rd Press	22	56	28	18.2	19	20	18	-	18- 20	20
6	Smoother Press	15	38	13	8	8	12	10	2.5	8- 9	15
7	1st Dryer	30	76	45	56	60	61	54	43	50- 56	40
8	2nd Dryer	22	56	34	37	36	34	41	28	37- 40	22
9	3rd Dryer	22	56	26	37	48	32	32	23	33- 46	26
10	Calender	37	94	40	46	45	50	35	18	35- 46	29
11	Pope reel	15	38	19	25	18	15	21	30	18- 25	25
	Helper										

Table 8-2-16 Sectional Drive Modification Plan

Section name	Existing max. 250 m/min					Modification plan case of 300 m/min						Case of 350 m/min			
	kW	r.p.m.	Roll dia. (mm)	Actual gear ratio	Speed m/min	kW	Standard draw (%)	Speed m/min	Roll dia. (mm)	Calculation output (r.p.m.)	Calculation gear ratio	kW	Speed (m/min)	Calculation output speed (r.p.m.)	Calculation gear ratio
1. Wire drive						*75	94	282	650	138.168	13.028	75	329	154.336	11.663
2. Couch roll	55	1800	800	14.979	301.863	55	94	282	800	112.261	16.034	55	329	125.398	14.354
3. Dandy roll						*2.2	94	282	610	147.228	12.226	2.2	329	164.457	10.945
4. Pick up roll (No. 1 Press.)	22	1800	600	11.955	312.030	22	94	282	810	110.875	16.234	22	329	123.267	14.602
5. Center roll						*37	94	282	850	105.658	17.036	37	329	171.766	10.479
6. Touch roll (No. 3 Press.)	22	1800	660	11.955	312.030	22	94	282	610	147.228	12.226	30	329	171.766	10.479
7. No. 2 Press.	22	1800	660	11.955	312.030	*37	96	288	610	150.360	11.971	37	336	112.131	11.021
8. Smoothing Press.	15	1800	660	11.818	315.647	15	96.5	289.5	660	139.693	12.885	22	337.5	162.855	11.053
9. 1st Dryer	30	1800	1524 (41/180) 347.133	6.246	314.121	30	97	291	1524 (41/180)	266.973	6.742	37	339.5	311.465	5.779
10. 2nd Dryer	22	1800	1524 (41/180) 347.133	6.221	315.383	22	98	294	1524 (41/180)	269.725	6.673	37	343	314.680	5.720
11. 3rd Dryer	22	1800	1524 (41/180) 347.133	6.221	315.383	*30	99	297	1524 (41/180)	272.478	6.606	30	346.5	317.891	5.662
12. Calender	37	1800	610	10.683	322.730	37	100	300	610	156.625	11.492	75	350	182.729	9.851
13. Reel	15	1800	1070	18.992	318.431	15	100	300	1070	89.291	20.159	18.5	350	104.173	17.279
Total	262					399.2						477.7			
14. Rewinder	0					55						55			
15. Supercalender	0					300 22x2						300 22x2			
Total						399						399			

*New

Table 8-2-17 Estimated Load at Speed up

Kind of paper: 45-70 g/m2

No.	Section Name	Motor Rating DC 440V		Existing				Future Expectation			Remarks
				170 m/min		240 m/min		③	300 m/min	350 m/min	
		kW	A	A	① kW	A	② kW	(②-①)/70	kW	kW	
1	Suction Couch	55	139	120	30.0	130	44.20	0.2028	*56.4	*66.5	
2	No.1 Press.	22	56	8	2.0	13	4.42	0.0346	6.5	8.2	
(3)	Suction Squeeze	11	28.5	5	13.0	13	4.42	0.0446	7.1	9.3	
4	No.2 Press.	22	56	19	4.8	21	7.14	0.0334	9.1	10.8	
5	No.3 Press.	22	56	-	4.8	20	6.80	0.0286	8.5	9.9	
6	Smoother Press.	15	38	2.5	0.6	13	4.42	0.0546	7.7	10.4	
7	1st Dryer	30	76	43	10.8	60	20.40	0.1371	28.7	*35.5	
8	2nd Dryer	22	56	26	7.0	41	13.94	0.0991	19.9	*24.8	
9	3rd Dryer	22	56	23	5.8	48	16.32	0.1503	*25.3	*32.9	
10	Calender	37	94	18	4.5	50	17.00	0.1786	27.7	36.6	
11	Pope Reel	15	38	30	7.5	25	8.50	0.0143	9.4	10.1	
	(Total)	(273)			90.8		147.60		206.3	214.9	
	Remarks			DC ctt. 250V		DC ctt. 340V			② + (300 - 240) × ③	② + (350 - 240) × ③	

( ): Helper

* Overload

Table 8-2-18 Expectation of Increase/Decrease of Load after Renovation

Part	Existing facilities KW	Qn'ty	Expected facilities kW		Remarks
	(1,200)		0		
o Chemical	87	28	0		
Power station	107	26	0		
o Chipper	565	33	+35		600
o Cooking	241	19	+65	+45	306
Washing	165	26	-25		140
Screening	191	14	0		191
Bleaching	734	52	+5		739
Refining	1,017	38	+240		1,257
Paper machine	1,519	69	-25	+490	1,494
Sectional	273	11	110		383
S. calender			350		350
Rewinder			55		55
o Recaust	160	43	0		
o Evaporator	90	23	0		
R. boiler	294	39	0		
M. boiler	95	14	0		
Feed water	231	19	0		
Others	570	155			
Perumahan	-		-		
Total (Motor)	6,339	609	+810		

Table 8-2-19 Expectation of Power Consumption by Kind of Paper after Renovation

Kind of paper	Production		Unit	Electric		Remarks
	t/d	t/y	kWh/Adt	kWh/d	kWh/d	
HV 45	35	1,015	890.3	31,160.5	903.654.5	
50	41	4,305	890.3	36,502.3	3,832,741.5	
60	50	3,050	890.3	44,515.0	2,715,415.0	
HVO 60	50	1,700	890.3	44,515.0	1,513,510.0	
80	50	400	890.3	44,515.0	356,120.0	
CS 70	50	1,300	840.3	42,015.0	1,092,390.0	
GP	16	400	2,000	32,000.0	800,000.0	
BP	25	625	2,000	50,000.0	1,250,000.0	
FP	50	1,450	1,800	90,000.0	2,610,000.0	
		14,245			15,073,831.0	

Table 8-2-20 Expectation of Increase of Consumption of Electric Energy after Renovation

Section	Item		1983	Renov.	Up/Down	
Pulping (include CAP)	Production	BDt-BKP/y	8,862.64	8,426		
	Electric	kWh/y	8,367,572.93	7,955,323.60	-5%	
	Unit	kWh/BDt-BKP	944.14	944.14	--	
Paper machine (include Stock prep. and finish)	Production	ADt/y	11,786.94	14,245		
	Electric	kWh/y	9,665,998.02	15,073,831.00	+56%	
	Unit	kWh/ADt	820.06	1,058.18		
Boiler	Electric	kWh/y	874,537.54	1,630,072.05	0%	
Water	Electric	kWh/y	324,589.29			
Others	Electric	kWh/y	430,945.12			
Total	Electric	kWh/y	*19,663,643.00	24,659,226.65	+25.4%	

* Quoted from the data submitted by the BRPP renovation team.

Table 8-2-21 Reference Data on Power Generation and Load

(July 10, 1983)

Time	Feeder (kW)											Diesel generator (kW)			
	P. plant	Chipper	Cook & W/SC	Refining	P. machine	Recount	MB & FB	F.W	Perumahan	500 KVA	1200 KW	G1	G2	G1 + G2	Momentary value
	*	*	*	*	*	*	*		*	*	*	*	*	*	
7	10	50	300	500	1,000	70	190		40	200	610	1,100	1,300	2,400	3,300
8	20	60	300	600	1,100	70	180		20	240	560	1,000	2,100	3,100	3,200
9	10	50	400	500	1,000	70	160		20	210	520	1,000	2,100	3,100	3,250
10	20	50	400	600	1,000	40	200		20	240	600	1,000	3,300 *1	4,300	3,180
11	20	10	400	500	1,000	40	170		30	200	510	900	1,000	1,900	3,200
12	10	30	500	600	1,200	30	210		30	250	620	1,200	2,600	3,800	3,200
13	20	30	300	600	1,000	30	200		30	210	490	900	2,100	3,000	3,075
14	10	0	400	500	950	30	190		30	260	590	4,000	2,300	3,300	2,725
15	20	10	400	600	1,250	70	210		30	160	120	1,000	2,500	3,500	2,815
16	10	40	300	400	900	40	170		40	180	340	800	700	1,500	3,010
17	10	40	400	500	1,000	70	160		40			1,100	1,800	2,900	3,100
18	20	20	400	600	1,200	80	210		50	410	830	1,300	1,000	2,300	3,315
19	10	30	300	400	800	50	120		40	220	530	1,000	1,500	2,500	3,365
20	15	40	400	300	600	50	250		50	110	520	400 *1	2,300	-	3,225
21	15	20	400	900	1,500	70	190		50	330	690	1,900 *1	2,700	-	3,225
22	10	5	300	400	1,200	30	200		40	200	580	1,200	1,800	3,000	3,165
23	10	10	400	600	1,200	70	200		40	210	470	1,100	2,000	3,100	3,150
0	15	5	400	600	1,100	70	200		30	230	540	1,100	2,100	3,200	3,200
1	15	5	300	400	900	60	170		40	180	450	1,100	2,100	3,200	3,130
2	10	5	400	600	1,050	55	190		40	200	480	1,000	1,000	2,000	3,090
3	10	5	300	450	950	35	170		35	200	240	1,100	1,900	3,000	3,070
4	15	5	400	550	1,200	40	200		50	185	490	1,100	2,000	3,100	3,090
5	10	5	400	600	1,000	40	205		30	125	460	1,100	1,800	2,900	3,210
6	15	5	400	600	1,200	20	210		35	240	690	1,300	3,400*1	4,700	3,070

$\bar{x}$ 3,140 kW

cos φ = 0.79 ≒ 0.8

Note) * Calculated from the hourly reading of kWh meter

*1 : Abnormal value

G1 = NIIGATA
G2 = M.B.L.

Table 8-2-22 Reference Data on Actual Load of Feeder

Feeder	14/3/84 Load data (A)	Actual load kVA	Actual load kW	12/3/84 (A)	Actual Load kVA	Actual Load kW	13/7/83 Load data (A)	Actual load kVA	Actual load kW	Remarks
Power station	5950V 5A	51.5	41.2	5A	54.6	43.6	8A cosφ 0.8	84.5	67.6	
Chipper	8	82.4	66.0	19-22	24.0	192.0	20	211.3	169.0	
Cooking Washing Screening Bleaching	50	515.3	412.2	20	218.4	174.6	53	560.0	448.0	
Refining	59	608.0	486.0	65	709.0	567.4	75	792.4	633.9	
Paper machine	115	1185.1	948.1	122	1331.2	1065.0	125	1320.7	1056.5	
Recoust	8.2	84.5	67.6	7.2	78.6	62.9	10	105.7	84.5	
Boiler	25	257.6	206.0	24	261.9	209.5	24	253.6	202.9	
Feed water	3	30.9	24.7	3	30.9	24.7	6	63.4	50.7	
Perumahan	2.4	24.7	19.8	3.3	36.0	28.8	49	51.8	41.4	
Chemical 500 kVA	6120V, 29A cos φ 0.8	307	246	6300V, - cos φ 0.8	-	-	6100V, 27A cos φ 0.8	283.3	226.6	
1200 kW	86A "	911	729		-	-	60	633.9	507.1	
									3488.2	
Remarks							G2 138A cos φ 0.8	1458.0	1166.4	
							G6 272 "	2873.7	2299.0	
								4331.7	3465.4	

Table 8-2-23

Fuel Oil Consumption Rate of Diesel Engine

1. Fuel Oil Consumption Rate of Niigata Engine

Recently used fuel oil specification are as follows:

Specific gravity: 0.8646
Calorific value: 9,270Kcal/ℓ

Calculation base on Feb. 1984:

$$\frac{226{,}407\ell \times 0.8646}{791{,}600\text{kWh}} = 247.3\text{gr/kWh}$$

On the other hand, performance on start up (data of 1964) was 227gr/kWh with 10,200Kcal/kg.

Revised Fuel oil consumption rate is

$$\frac{10{,}721.7}{10{,}200} \times 247.3 = 259.9\text{gr/kWh}$$

9,270/0.8646 = 10,721.7

Therefore recently Fuel oil consumption rate is 14.5% (259.9/227 = 1.145) higher than original.

2. Fuel Oil Consumption Rate of MBL

Performance (data of 1976) was 216gr/kWh with 10,220Kcal/kg of calorific value.

Calculation base on Feb. 1984:

$$\frac{411{,}611\ell \times 0.8646}{1{,}439{,}300\text{kWh}} = 247.3\text{kWh}$$

Revised Fuel oil consumption rate is

$$\frac{10{,}721.7}{10{,}220} \times 247.3 = 259.4\text{gr/kWh}$$

Therefore recently fuel oil consumption rate is 20% (259.4/216 = 1.20) higher than original.

Table 8-2-24

Calculation of merit case of static type DC power supply unit for sectional drive in paper machine instead of existing MG set.

1. Existing Specification

250kW Generator
300kW AC motor

2. Comparison of Electric Power Loss

Existing		New Type	
1. Power loss of 300 kW AC motor as 10%:	15.8 kW	1. Power loss of static type DC power supply unit as 3%:	3.8 kW
2. Power loss of 250 kW generator as 7%:	9.5 kW	2. Power loss of transformer as 1%	1.4 kW
Loss of total:	25.3 kW	Loss of total:	5.2 kW
		∴ Diff. = –20.1 kW	

3. Cost of Power Consumption

As 335 days/year operation

20.1kW × 24Hr × 335d × 46.14Rp/kWh = 7.456million Rp/y Decrease

4. Estimate Investment

300kVA transformer:	5.0million Rp
300kW power unit:	36.0million Rp
Erection:	5.0million Rp
Total:	46.0million Rp

∴46/7.456 = 6.2 years

Thus merit is obtained in 6.2 years.

8-3 Instrumentation

8-3-1 General

Most of the instrument equipments used at the Mill are pneumatic type made in Japan. Comparatively advanced instruments were introduced at the beginning of operation. In addition, the paper machine was speeded up in 1976. The instrument equipment for the drainage system in the paper machine and the instrument equipment for improving the capacity were partially introduced. However, most of the equipment has not been reconstructed or changed in model so far without a chance of introducing new instruments.

Therefore the used instruments for the processes of cooking, washing, bleaching and recausticizing under a bad atmosphere have considerably deteriorated. Since it is difficult to obtain their spare parts, most of the instruments have not functioned well.

The instrumentation of Mill is on an old-type. From the viewpoints of productivity, quality control and maintenance, we must therefore hasten to replace the deteriorated instruments, improve the flows important loops and introduce the equipment for quality control.

In the process of papermaking, especially, it is important to stabilize the consistency of pulp stock and the flow rates at the machine inlet. It is also necessary to maintenance of instruments for Mass volume control.

It is recommended to introduce the equipment for measuring the basis weight and moisture content of paper in an on-line in the final process because such a system has been commonly used all over the world.

In the Control, a common maintenance system is adopted for inspection and repair but does not show a sufficient effect.

It seems that the reason is not only that the correct handling and adjustment of instruments are not standardized but also that failure analysis, equipment control based on statistical techniques, working methods and facility improvement are insufficient. Even if excellent instruments are introduced, poor maintenance control not only fails to maintain their performance or reliability for a long time but also leads the plant operations toward a wrong direction. The instrumentation techniques and basic education on quality control are therefore required to improve the technical level of instrumentation engineers of the Mill.

8-3-2 Failures

The failures of instrument equipment of Mill are listed below. According to the list submitted, 90% of failures that stopped the paper machine are related to the auto guider. Most of the failures are due to the damage of its diaphragm.

Year	Trouble times	Stoppage of paper machine
1981	2	1H25M (Auto guider)
1982	4	6H47M (Auto guider)
1983	4	3H (Auto guider)

Above failures was three times at upper canvas of 2nd Dryer by caused improper materials or un-enoughly repairing works. The failures occurred once each at other parts from 1981 through 1983.

Most of those failures should be reduced to change the diaphragm of the auto guider, if it changes as periodical.

8-3-3 Present Problems of Instrument Equipment

8-3-3-1 Deterioration of Equipment

The major instruments for the processes such as cooking, washing, bleaching and recausticizing have deteriorated and it is difficult to purchase their spare parts or use alternate parts. Thus the machines are operated under the low reliability of instruments for Mass volume control and production control.

Table 8-3-5 lists the failing instruments to be replaced with new ones.

As the uniform phenomena of indicators and recorders, there are instruments that became poor condition of linearity or reproducibility due to flexibility of Bouldon tubes or Bellows. In the bleaching plant, extremely typical phenomena are the corrosion of outer cases of electromagnetic flowmeter and transmitter and the deterioration of parts of amplifiers.

8-3-3-2 Chip Belt Scale

This is in a comparatively good condition and can be used for a while. A test chain for calibration must be made.

8-3-3-3 Consistency Controller

Generally, there are few consistency controller that are operated in a normal condition.

(1) The consistency transmitter (19C) of 2CRC-5 (Blow tank outlet) inline type is used. This is easily affected by a flow rate. The dilute solution is not controlled at a constant pressure and no constant flow rate is obtained even at a constant valve opening angle.

(2) For the consistency transmitter of 501CRC (Bleach inlet) open type, its screw and transmitter are left removed. Both indicator and recorder fail.

(3) For the concentration transmitter of 521CRC (Bleach) open type, its screw and transmitter were removed about one year ago. The recorder also fails.

(4) The consistency transmitter (F16C) of 714CRC (Refiner chest outlet) is used. It is in an uncontrollable condition due to its failing transmitter.

(5) For the consistency transmitter of 801CRC (machine inlet) open type, its transmitter fails.

As flow problems,

CRC is performed by feeding white water into the stock pump inlet for the head box. The overflow of pulp stock of head box flows into the finished stock chest. The pulp stock passes the head box and then flows into the mixer.

The return from the settling tank or from the clay supply tank into the mixer results in an overflow that causes a consistency fluctuation after CRC.

It may be considered that a consistency detecting screw hunting results from the Old-designed head box and the fiber attached to the box sometimes flows out, thus causing a consistency fluctuation.

(6) For the consistency fluctuation, the causes and countermeasures are described in 8-3-5-1.

8-3-3-4 Felt Guider

Most of failures that caused the paper machine to stop during the past three years are due to the damage of felt guider diaphragm (8times out of 10 during the past 3 years). It seems that the life of diaphragm reached its limit. It is better to decide when the diaphragm is replaced according to its statistical life.

According to Table 8-3-2, the life of diaphragm is at least three years. It is considered that the repeated trouble at the same portion is due to improper materials or imperfect replacement.

8-3-3-5 Moisture Meter

The online dry meter at the outlet of paper machine is in a good condition. It is available for operation control for a while. The spare parts are short. It is desired to replace to the B/M system (mention later).

8-3-3-6 Instrument for Digester

This is not provided with an automatic controller. All operations are controlled manually.

It is considered that the temperature recording meter of No. 1 digester fails and the level indicators of white liquor tank and cooking liquor tank fail.

8-3-3-7 Flowmeters

The typical failures of flowmeters on the important line are as follows:

(1) 2FRC-5 (for stock at the outlet of blow tank)
The coils of electromagnetic flowmeter are burnt or the ink of recorder runs short for two years.

(2) 2FR-9 (for DIG steam)
The olifice type flowmeter's transmitter fails.

(3) 520FRC-1 (for bleach stock)
The controller fails.

(4) 520FI (for bleach chemical)
The electromagnetic flowmeter, body, transmitter and amplifier fail. The exposed portions are remarkably corroded.

(5) 702FR (for the outlet of bleach stock chest)
The electromagnetic flowmeter, body and transmitter fail.

8-3-3-8 Level Meter

Many air-purge tubes are used for the level detection of tanks or chests. It is frequently seen that an indication failure possibly caused by clogging occurs. The method and period of maintenance must be improved. It is also seen that a chest not equipped with LC or LIA results in an excess of level (e.g., No. 225 WL tank and No. 528 white water tank).

8-3-3-9 Instrument Panel

The bleach instrument panel of graphic board panels is considerably deteriorated. Its inside has fairly rusted away. It is considered that the panel need not be replaced but has only to be painted.

8-3-3-10 Instrument Air Source

The air sources listed in Table 8-3-4 can be mutually connected to pipes for backup. Now, the air compressor of cooking plant is removed due to its failure. The capacity of facility has redundancy even at the occurrence of such a failure because of a comparatively small load.

It is considered that the ordinary maintenance of air dryer has no problem for a while.

8-3-4 Problems of Maintenance Control for Instrument Equipment

8-3-4-1 Maintenance

Maintenance is executed according to a planned shutdown of paper machine. Judging from failures or instruments at the site, however, it seems that troubleshooting and analysis are not done sufficiently. Thus a similar failure recurs.

General maintenance cards are prepared. Daily inspection and periodic inspection are performed as scheduled. However, it seems that proper action is not taken if a failure or its symptom is found. The plant being operated is sometimes shut down at the occurrence of a failure such as requires only a planned shutdown. It is insufficient to procure repair parts. These result from the fact that the work standards for maintenance do not fit the present situations.

8-3-4-2 Control of Instrument Tools and Measuring Instruments

It seems that the above tools are handled comparatively gently but the calibrating instruments such as a manometer are not maintained sufficiently.

It is necessary to create the standards for maintenance control and to purchase instruments required. Table 8-3-3 gives the list of instruments for maintenance.

Table 8-3-8 lists recommendatory instruments to be purchased.

8-3-4-3 Control of Spare Parts

In case of a sudden failure, quick action minimizes the influence on operation.

At present, it can be said that the stock control for spare parts is insufficient. A periodic check on stored spare parts and stock control are required.

For this reason, stocks, order and quantity must be efficiently controlled in cooperation with a person in charge of material control.

It is desired to store on the instrument room the spare parts of the major equipment that frequently causes trouble.

As the countermeasures against the deterioration of spare parts being stored, it is necessary to put the parts in a vinyl bag or to make anticorrosive treatment including material warehouses.

In addition, it is not sufficient to order the substitutes for the equipment that becomes unavailable because of the maker's model change.

8-3-4-4 Problem of Maintenance Control

Almost the same as the electrical problems.

8-3-4-5 Training

The technical level of instrumentation members are not low by no means but it is necessary to improve the equipments and train the staff as an engineer for work design and a trainer for maintenance engineers. OJT (On the Job Training) is to be held at the Mill by the maker's engineers or instrumentation engineer engaged in papermaking.

The trainers mainly train instrumentation members and operators. Mainly based on the OJT, hold the meetings for all instrumentation members and for chiefs and higher-post persons of instrument division once a month in order to solve problems.

8-3-5 Provisions for Basis Weight Stabilization

8-3-5-1 Causes of Consistency Fluctuation and Action Against It

(1) Pressure fluctuation of dilution water

As being used for sealing, washing and cooling, the dilution water line is now in a condition that easily causes a pressure fluctuation.

(Countermeasure)

It is desired to install a dilution water tank for an exclusive use in order to eliminate a pressure fluctuation. Except the CRC at the outlet of finished stock chest that does not require accuracy so much, provide a dilution line for an exclusive use or move the source of a pressure fluctuation to another fresh water line.

(2) If the consistency fluctuation of pulp stock is over the controllable range

This case occurs on the batch control or when the plant is stoppage due to an accident or failure.

(Countermeasure)

Depending upon the status of indication of CRC's recorder, the operator's manual intervention is required according to the alarm.

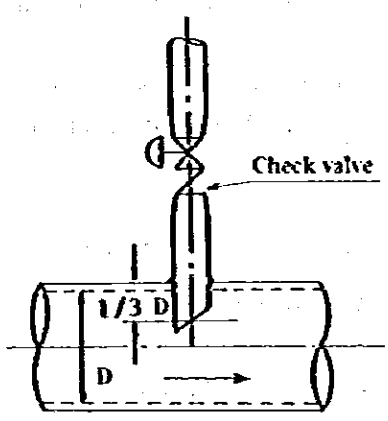
(Some operator may be unaware of the occurrence of a consistency fluctuation).

(3) If dilution water is not uniformly mixed with pulp stock

This arises from a problem of the dilution water pipe connected to the pulp stock pipe.

(Countermeasure)

The piping method as shown here is used.



(4) Open type consistency controller for inlet of machine

a) Control of consistency is not suitable because the pulp stock does not flow smoothly because of the structure of head box.

(Countermeasure)

Use a cylindrical head box equipped with a evener plate. Also use a comparatively small box in order to improve the sensitivity of detection.

b) The consistency of pulp stock in the chest becomes lower gradually because the pulp stock diluted by the consistency controller returns to the chest.

(Countermeasure)

Provide a circulating pump line and a isolation plate in the head box to establish a system that does not return the diluted pulp stock to the chest as much as possible. In addition, greater effects are obtained by controlling the level.

8-3-5-2 Flow Rate at the Inlet of Slice Box

Provisions for flow rate stabilization

(1) Flow adjusting of stock flow volume be done by manual type gate valve after Head box. It has no flow control device in this line. As result, stock level in Head box take easy fluctuations especially when be changing the paper grade.

(Countermeasure)

a) Should be change the new type basis weight valve.

b) Should be change DC motor of Fan pump instead of induction motor (existing).

8-3-5-3 Measurement and Control of Basis Weight and Moisture Content

A basis weight and a moisture content are available as a factor for deciding the final quality of paper. The loose control of basis weight and moisture content loses the competitive power on the market in quality.

It is recommended to introduce the B/M measuring system into the plant in order to:

- Improve the profile of paper in the direction of width
- Eliminate periodic disturbance
- Catch the dynamic characteristics of paper machine

In addition, the basis weight and moisture content of paper will be controlled at a constant rate in future.

It is said that the drop of raw material costs due to the reduction of basis weight and moisture dispersion is about 2% of amount of paper production.

It can be expected at the starting operation or grade change, that adjustment time of basis weight and moisture content of paper can be decreased, the yield is improved and the operating techniques are advanced.

The features of B/M system are briefly described as follows:

(1) Improvement of profile in width direction of paper

The profile of paper can be adjusted by matching the states of basis weight and moisture content (displayed in the CRT screen) with the slice lip positions.

(2) Elimination of periodic disturbance

The basis weight and moisture content can be seen at a random point in the width direction to allow the analysis of the cause of a short periodic disturbance.

(3) Function

Average bone dry and average moisture content can be hard-copied in all width direction of paper, and to allow the operations of pulp stock valve and setting of steam pressure.

8-3-6 Improvements

8-3-6-1 Countermeasure Against Deterioration and Failing Instruments

Replace the minimum number of failing instruments for mass volume control and production control with new type ones. Stock the available parts of replaced instruments as spare parts. Table 8-3-5 lists the instruments to be replaced.

8-3-6-2 Countermeasure for Quality Control

(1) Model change of consistency controller

It is necessary to check the consistency controller which is being used or not used at each portion to change its model and improve the method of control thoroughly. Especially, use

a control system with high accuracy to regulate the consistency at the outlet of finished stock chest that determines the final quality of paper (Refer to Fig. 8-3-1).

(2) Adjusting of more small volume of pulp stock into Head box

(3) Introduction of basis weight/moisture measuring system (B/M 800)

It is recommended to introduce the B/M 800, though expensive, for controlling basis weight and moisture content in the directions of flow and width of paper in order to enhance competitive power.

Use the B/M 800 as a monitoring device at the beginning of introduction. In future, adopt a system that allows easy functional improvement for basis weight and moisture control.

8-3-6-3 Countermeasure for Mass Volume Control

(1) Service and replace the important instruments being used.

(2) Instruments to be newly purchased:

- FRCQ of White liquor for cooking
- FRCQ of No. 2 Blow tank
- FRCQ of Bleached stock chest (Only CQ newly installed)
- FIQ of steam at paper machine

8-3-6-4 Miscellaneous

Table 8-3-6 lists the instruments for new installation and renovation.

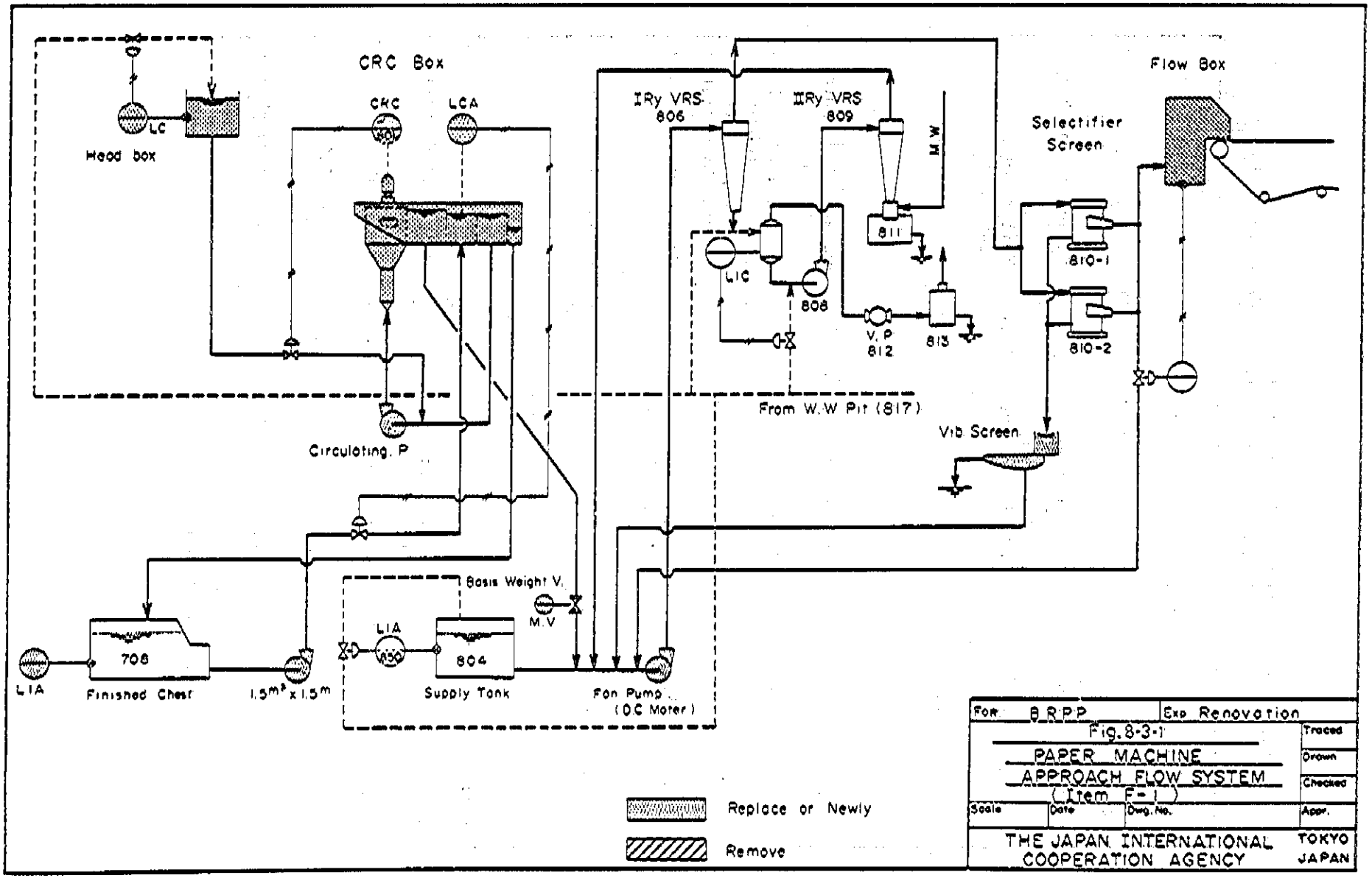

CRC Box
Head box
LC
CRC
LCA
IRy VRS 806
IIRy VRS 809
M.W
Flow Box
Selectifier Screen
811
LIC
808
V.P 812
813
810-1
810-2
From W.W Pit (817)
Circulating. P
Vib Screen
Basis Weight V.
M.V
LIA
LIA
708
804
Finished Chest
1.5m³ x 1.5m
Supply Tank
Fan Pump (DC Motor)
Replace or Newly
Remove
For B.R.P.P
Exp Renovation
Fig. 8-3-1
PAPER MACHINE APPROACH FLOW SYSTEM
(Item F-1)
Traced
Drawn
Checked
Scale
Date
Dwg. No.
Appr.
THE JAPAN INTERNATIONAL COOPERATION AGENCY
TOKYO JAPAN

Table 8-3-1 Instrument Failure List
(Influensed on the Operation of Paper Machine)

Date	Shutdown time H:M	Mark	Result		Cause
1981					
19/Jan	:55	o	Auto Guider (for upper Canvas of 2nd Dryer)		Damage of diaphragm
11/May	:30		CRC-801 Output failure		Failure of transmitter
Total	1:25				
1982					
2/Feb	:57	o	Auto Guider (Felt II)		Damage of diaphragm 2 times
4/Feb	4:08	o	Auto Guider(Press II)		Short circuit of micro switch in box at pressure washing by operator.
24/Mar	:55	o	Auto Guider (Canvas II, upper)		Damage of diaphragm
13/Apr	:47	o	(Canvas II, upper)		Damage of diaphragm
Total	6:47		(Canvas II, upper)		
1983					
25/Jul	2:27	o	Auto Guider (Canvas II Lower)		Damage of diaphragm
19/Sep	:25	o	Auto Guider (Felt I)		Leak 
23/Oct	:23	o	Auto Guider (Felt I)		
21/Dec	:45	o	Auto Guider (Felt I) (Canvas III Upper)		Damage of diaphragm
Total	3:00				

Failure of transmitter

Mark o : Reference to Auto Guider

Table 8-3-2 Instrument Trouble Analysis

Item/Y	1981	1982	1983	Note
Auto guider				
Felt I			× ×	⊗: Without diaphragm
Felt II		×		×: Diaphragm broken
Press II		⊗		H: Hour
Canvas I (Upper)	×			M: Minite
Canvas I (Lower)				Ex) 19/1=Jan. 19 1981
Canvas II (Upper)		×		
Canvas II (Lower)		× ×	×	
Canvas III (Upper)			×	
Canvas III (Lower)			27/2 19/9 23/10	
			$2^{H}27^{M}$ 25^{M}	
	19/1 1 case	2/2 4/2 24/3 13/4 4 cases	27/2 19/9 23/10 21/12 4 cases	
	55^{M} 55^{M}	57^{M} $4^{H}08^{M}$ 55^{M} 47^{M} $6^{H}47^{M}$	$2^{H}27^{M}$ 25^{M} 23^{M} 45^{M} $3^{H}00^{M}$	
Others	5/11 30^{M} CRC891 Transmitter			
Total quantity	2 cases	4 cases	4 cases	
Hour	$1^{H}25^{M}$	$6^{H}47^{M}$	$3^{H}00^{M}$	

Table 8-3-3 Test Instrument & Tool Set - Existing -

No.	Name	Specification	Qt.	Explanation
1	Mano meter	YEW, TYPE-I, 0-1200mmHg	1	50%
2	Mano meter	YEW, Type-U, 0-1000mmHg	1	50%
3	Vaccum tester	0-76cmHg	1	50%
4	Dead Weight tester	0-30kg/cm^2	1	40%
5	Mini meter tester	0-150mmH_2O	1	50%
6	Phenumatic calibrator	YEW, Type 65-120	1	60%
7	Magnetic flow calibrator	Model 8120-5	1	OK
8	DC potensio meter for temperature	-	1	OK
9	Dekade resistor tester	Rotary type	1	OK
10	Ditto	Stic type	1	OK
11	Meggohm meter	YEW, 500V	1	OK
12	Osciloscope	Trio	1	OK
13	DC volt/amp. tester	YEW, 50mV, 50 , JISC1102	1	OK
14	Transmitter checker	Sencore, TC-28	1	OK
15	Ampere meter (AC)	YEW, 0-5A, 0-10A	1	OK
16	Ditto	YEW, 0-10A, 0-50A	1	OK
17	Ohm volt miliampere tester (AC, DC)	YEW, 0-5V, 0-10V, 0-15V	1	OK

Table 8-3-4

1. Compressed Air Device and Dryer System for Instrument

Dpt.	Maker	Type	Press.	Cap.	Motor			Air Dryer
			kg/cm^2	$m3/min$	kW	R.A	A.A	
Pulp	Ingersol Rand	ESV8 x 7/ (Non lubri-cated)	7	4	30	58	32	Refriger-ated air dryer
P. Machine	Ingersol Rand	"	7	4	30	58	32	"
Recaust.	Origin	DNL. 45	7	0.87	7.5	15	11	Dehumix
M.B. & R. Boiler	Origin	VS-11	7	1.29	7.5	15	11	Dehumix
Water	Hitachi	BP-5,5TN	5.5	0.205	1.5	3.4	1.5	Dehumix

∵ R.A = Rated ampere, A.A = Actual ampere

2. Other Compressed Air Device

Dpt.	Maker	Type	Press	Cap.	Motor		
			kg/cm^2	m^3/min	kW	R.A	A.A
P. Machine	Origin	VS-37	7	7.98	37	74	52
Refining	Hitachi	BP-10T	10	0.46	2.2	4.7	2.1

Desctiption of Symbols

Instrument

M	Sensor, measurement
T	Transmitter
I	Indicator
R	Receiver
C	Controller
V	Control valve, actuator

Condition

×	Defect
Δ	Half defect

Recomend changemark

o

Table 8-3-5 Renewal Instruments (Provisions against Deterioration and Failure)

Section	Tag No.	Service Name	Location of Prob.							Replacement	Remarks
			M	T	I	R	C	V			
Cooking	2LI-1	White Liquor Tank LI		X						Parts	
	2LI-2	Cooking Liquor Tank LI		X						Parts	
	2LC-12	Drain Tank LC	X	X						Parts	
	2LIC-4	Hot Water Tank LIC			X					Parts	
	2LI-3	Blow Tank LI		X						Parts	
	2PR-7	No.1 Digester Press. Rec.		X		X				Complete	
	2PR-8	No.2 digester Press. Rec.		X		X				Complete	
	2FR-9	Steam Flow Rec.		X						Parts	
	2TR-10	Steam Temp. Rec.	X							Parts	
	2FRC-5	Pulp Flow Rec. Control	X			X				Parts	
	2CRC-5	Pulp CRC Outlet Blow Tank	X	X		X				Complete	
Washing	309LIC1	B.L. Tank No.1 LIC			X					Parts	
	2	B.L. Tank No.2 LIC			X					Parts	
	3	B.L. Tank No.3 LIC			X					Parts	
	309FR-2	Hotwater Flow Rec.				X				Parts	
	309TR-1	B.L. Tank No.1 Temp. Rec				X				Parts	
Bleaching	501CRC	Pulp CRC Inlet Bleaching	X	X	X	X				Complete	
	520FRC-1	Pulp Flow RC	X	X	X					Complete	
	520LIA-1	Tower No.1 LIA		X	X					Parts	
	520LIA-2	Tower No.2 LIA		X	X					Parts	
	3	Tower No.3 LIA		X	X					Parts	
	4	Tower No.4 LIA		X	X					Parts	
	520FI-1	Chemical Add. FI (Hypo)		X	X					Complete	Model change
	520FI-3	Chemical Add. FI (NaOH)		X	X					Complete	Model change
	520FI-8	Chemical Add. FI (Hypo)		X	X					Complete	Model change
	520FI-9	Chemical Add. FI (NaOH)		X	X					Complete	Model change
	520FI-7	Hotwater FI			X					Parts	

Table 8-3-5 Renewal Instruments (Provisions against Deterioration and Failure)

Section	Tag No.	Service Name	Location of Prob.							Replacement	Remarks
			M	T	I	R	C	V			
Bleaching	520TRC-1	Single Mix No.1 TRC				X				Pending	
	520TRC-2	Single Mix No.2 TRC				Δ				Pending	
	520TRC-3	Single Mix No.3 TRC				Δ				Pending	
	520TRC-4	Single Mix No.4 TRC				Δ				Pending	
	521CRC	Pulp CRC Mix. Tank	X	X					Non use		
	621FI-1			X	X					Complete	Model change
	621FI-2			X	X					Complete	Model change
	702CRC	Pulp CRC Inlet Refiner	X	X						Complete	
Refining	714CRC	Pulp CRC Outlet Refiner Chest.	Δ	Δ						Complete	
	714FK	Pulp Flow Rec.	Δ	Δ						Complete	
	704PS	P. Switch of S. Refiner Cont. System	X							Parts	
Evaporator	916LIC-1	B.L. Effect No. 1		X			X			Parts	
	-3	B.L. Effect No. 3		X			X			Parts	
	-4	B.L. Effect No. 4		X			X			Parts	
	916LC-1	Drain Flash Tank No.1					X			-	
	-2	Drain Flash Tank No.2					X			-	
	-3	Drain Flash Tank No.3					X			-	
	916TR-1	6Pen Temp. Rec.				X				Complete	
	-2		X								
	916SIA	Sarino Meter	X		X					Complete	
	916DIC	Density Form Tank	X						Non use		
K. Boiler	976TI	4Pen Temp. Indicator	X							Parts	
M. Boiler	1124TRC	Deaerator Tank				X				Parts	
P. Machine	850LIC-6	White Water Tank	X				X			Complete	
	850AFC-3	Micro Switch, Press. Felt Guider	X							Parts	

Table 8-3-6 Instruments for New Installation and Renovation

	Section	Tag No.	Service Name	Remarks
	Cooking	TIC-1	Circulation Liquor Line No. 1 TIC	
		TIC-2	Circulation Liquor Line No. 2 TIC	
		FI-1	Circulation Liquor Line No. 1 FI	
		FI-2	Circulation Liquor Line No. 2 FI	
		FI	W.L. & C.L. Tank to Digester	
		FRCQ	W. Liquor FRCQ	
		LI	Blow Tank No. 2 LI	
		FRCQ	Blow Tank No. 2 FRCQ	
		CRC	Blow Tank No. 2 CRC	
		HC-1	Relef Valve Digester No. 1 H.C.	Pending
		HC-2	Relef Valve Digester No. 2 H.C.	Pending
	Washing	TR	B. Liquor to Eva. TR	
		LIA	Unbleached Stock Chest (411-1)	
		LIA	Unbleached Stock Chest (411-2)	
		309LIC-1	B. Liquor Tank No. 1 LIC	Add "Alarm"
		-2	B. Liquor Tank No. 2 LIC	Add "Alarm"
		-3	B. Liquor Tank No. 3 LIC	Add "Alarm"
	Bleach.	LIA	Bleached Stock Chest (530-1) LIA	
		LIA	Bleached Stock Chest (530-2) LIA	
		LC	W.W. Tank (528) LC	
		PI	Steam PI	
		TI	Steam TI	
	Refining	FR702	Bleached Stock Chest (530-2) FRCQ	Add "CQ"
		801CRC	Finished Stock Chest CRC	System change
	P. Machine	BW800	Basis Weight & Moisture of Paper Measuring System	Pending
		FIQ	Steam FIQ	
		HC	Basis weight valve with remote control	

Note: Each 1 set

Table 8-3-7 Panels for Model Change

	Section	Equip.	Size (Approx.) Wide x Light x Depth	Remarks
1	Cooking	Panel	1,000 x 2,400 x 800	1 set
2	Screen & bleaching	Panel	1,200 x 2,400 x 800	1 set
3	Refining	Control desk (Storn R.)	Same as existing	3 sets

Table 8-3-8 Recommendatory Maintenance Instruments/Tools

1)	Portable recording meter (Equivalent to YEW 3057, 2 pen)	1set
2)	Air to Electric Transducer (Equivalent to YEW ALD201B)	1set
3)	Precision pressure gauge 150ϕ {0.2 – 1kg/cm² {0 – 20kg/cm²	2sets
4)	Kubota test chain for belt scale (for 5/10kg)	1set
5)	Digital multimeter (Equivalent to YEW 2441) 8Functions (Analog/Digital readout)	2sets
6)	Portable manometer (Equivalent to YEW 2658) 0 to ± 1,000kg/cm²	1set
7)	Instrument tool set Mechanical tool set and Electrical tool set	1set

CHAPTER 9 SPECIAL REMARKS FROM TECHNICAL VIEWPOINT

CHAPTER 9 SPECIAL REMARKS FROM TECHNICAL VIEWPOINT

9-1 Optimum Quantity of Pulp Production

9-1-1 Trend of Raw Materials for Pulp

(1) BRPP was established to effectively use the bamboo resources available in the surrounding district, and the mill has been fulfilling the duties finely. However, in the operation period of the past 15 years, the bamboo resources have decreased year by year, and the plan established in 1984 foresees that the share of bamboo will drop to 10% of the total raw materials in the year of 1984 and will become zero in five years from now.

(2) The portion of bamboo decrease is being covered with wood resources of coniferous trees and broadleaved trees.

However, since the mill was established to use bamboo wholly, it has pulp production facilities of one line only. BRPP has managed this problem by applying mixed cooking and bleaching of bamboo chips and wood chips.

(3) However, changes of mixing ratio of different kinds of chips invite unstabilized quality of bleached pulp, eventually affecting the paper quality, as well as greatly affecting the own-made pulp cost. Measures must be taken immediately to rectify the present situation in terms of operation manner and facilities.

9-1-2 Raw Material Acquisition Plan and Price Delivered to Mill

(1) Raw material collection and price delivered to the mill largely depend on the policies of KEHUTANAN (Forestry Agency) and PERHUTANI (Regional Forestry Offices). The recent collection of raw materials is shown in Table 9-1-1 with breakdown of species and collection areas. The estimated collection of raw materials by species and collection areas for the future is shown in Table 9-1-2.

Table 9-1-3 shows the raw material prices delivered to the mill with breakdown of species and collection areas. The locations of collection sites are shown in Map 9-1-1.

As these tables indicate clearly, the most important point is how to collect cheaper and better raw materials for pulp making from the district close to the mill to save the transportation expenses.

(2) PERHUTANI (Regional Forestry Offices) plant trees on a scheduled basis. Therefore, in order to keep steady operations of BRPP in the future, close communication must be kept with PERHUTANI and the optimum pulp production quantity should be determined in consideration of the raw materials that can be obtained at a reasonable cost.

(3) We have attempted a rough trial calculation based on the following estimates:

Annual collection of pine	56,000SM
Unit requirement of pine (Quantity of pine per BKP BD.ton)	15.7SM
Mixing rate of NBKP	37.6%
Number of operating days per year	327days

These assumptions lead to the following production capacity:

NBKP annual production:	56,000 ÷ 15.7 = 3,567tons
BKP annual production:	3,567 ÷ 0.376 = 9,487tons
BKP daily production:	9,487 ÷ 327 = 29.0 BD.tons = 32.2 AD.tons

9-1-3 Capacity of Chemical Recovery Department

(1) To determine the optimum production scale of pulp, the current capacity of the chemical recovery department (washer process, evaporator process, recovery boiler process and causticizing process), which is another important part of a KP plant, must be checked.

At present, the chemical recovery rate is extremely low at 60 to 70% because of variation of raw material mix ratio, overcooking and unsteady operation of washer, necessitating replenishing a large amount of cooking chemicals. Also, since the pulp is not washed thoroughly, an excessive amount of bleaching chemicals is consumed. All these excessive consumption of chemicals raise pulp production cost. The low recovery of chemicals increases the COD and BOD loads in the waste water of the plant as well.

(2) As described in detail in Chapter 6, based on the investigation, we consider that at least the washer must be completely replaced in order to maintain a commonly acceptable chemical recovery rate (95%), and the capacity of the existing facilities after the replacement of the washer is estimated to be 30 AD. ton of BKP a day.

While the capacity of cooking process can be increased to about 50 A.D. ton a day with minor renovation, capacity increase of the chemical recovery equipment is not possible unless the facilities are thoroughly reinforced.

Fundamental improvement of the chemical recovery equipment requires a substantial amount of investment. When it is taken into consideration that BKP is an international market commodity, we cannot consider that renovation of this department by investing a large amount of money will not bring a profitable return, even if the production may be increased to some extent.

9-1-4 Proper Pulp Quality

As described earlier, the most urgent thing is to eliminate the quality fluctuation caused by fluctuation of raw material mixing ratio.

Furthermore, for production of specialty papers, the pulp must be selected for the paper grades to be produced. This means that, even if the improvement has been achieved to the level of producing pulp in uniform quality, whether or not it is proper to produce the whole quantity of pulp to be consumed on a self supply basis must be carefully studied in the aspect of assuring a proper quality required for specialty papers.

9-1-5 Self-made Pulp Cost and Profitability

(1) Whether or not self-made pulp is advantageous in comparison with imported pulp is greatly affected by the price of imported pulp, which is an international commodity, and the duty on the imported pulp, that is, the policy on tariff of the Indonesian government.

(2) The cost of self-made pulp is trially calculated as follows:

Cost of pine delivered to mill	Rp8,612/SM
Unit requirement of pine (Quantity of pine per BKP BD.ton)	15.7SM
Cost of NBKP per BD.ton	Rp434,200 (US$434)
Cost of NBKP per AD.ton	Rp390,780 (US$391)

Breakdown

Raw materials	8,612 × 15.7 = 138,200
Utilities	120,000
Chemicals	80,000
Fixed expenses	96,000
Total	434,200

The price of imported pulp delivered to the mill is a total of the C&F Surabaya price plus 20% of it to cover the inland transportation, insurance and interests. Accordingly, the C&F Surabaya price of imported pulp, that would make about the same cost as the production cost, is as follows.

C&F Surabaya price (AD.ton):

Rp391,000 ÷ 1.2 = Rp325,830 = US$325.8

This calculation proves that the self-made pulp is very advantageous in view of the current international pulp market price. In addition, since it is almost determined by the Indonesian government that 10% import duty will be charged to imported pulp from July, 1984 and raising of the duty up to 30% is expected for the future, self-made pulp will be even more advantageous cost-wise.

9-1-6 Optimum Production Quantity

In this renovation project, the main aims are set to stabilization of the product quality by stabilizing the BKP quality and cost reduction of self-made pulp by improving the chemical recovery rate, and we have not adopted any plan for production increase of pulp since it would require a large amount of investment to the chemical recovery department facilities and it causes uncertainty in the collection of raw materials in the BRPP district.

The optimum production quantity at this point is recommended to be 30 AD. tons of BKP per day.

Table 9-1-1 List of : Purchasing of Raw Material 1981 - 1983

Estimation of Purchasing Raw Material 1984 - 1985

No.	Raw Meteriac	Unit	1981		1982		1983		1984		1985		Remarks
			Quantity	Average ϕ	Quantity	Average ϕ	Quantity	Average ϕ	Quantity	Average ϕ	Quantity	Average ϕ	
1	KAYU PINUS (Pine)	sm M^3	20,351 18,645	5-17 cm 18 cm up	16,245 7,765	5-17 cm 18 cm up	20,065 12,153	5-17 cm 10 cm up	30,000 13,000	5-17 cm 18 cm up	40,000 15,000	5-17 cm 18 cm up	
2	BAMBU (Bamboo)	smb	28,876	3 cm up	11,679	3 cm up	7,898	3 cm up	16,700	3 cm up	8,000	3 cm up	
3	KAYU MAKSOPSIS (Kinds of hard wood)	sm M^3	4,707 10,437	5-17 cm 18 cm up	1,394 1,301	5 cm up 18 cm up	- -	- -	- -	- -	- -	- -	
4	KAYU LAMTOKO (IPL IPC)	sm	7,155	4 cm up	5,278	4 cm up	2,100	4 cm up	5,000	4 cm up	2,000	4 cm up	
5	KAYU ALBAZIA (Kinds of hard wood)	sm M^3	5,565 -	5 cm up -	596 -	5 cm up -	3,338 1,975	5-17 cm 18 cm up	- -	- -	2,000 -	15-17 cm -	
6	KAYU TURI (Kinds of hard wood)	sm	24,980	5 cm up	12,151	5 cm up	10,137	5 cm up	2,000	5 cm up	1,000	5 cm up	Private
7	KAYU KALIANDRA	sm	4,175	4 cm up	-	-	-	-	23,500	2 cm up	-	-	
8	KAYU BAKAU (Mangrove)	sm	3,369	5 cm up	5,389	5 cm up	3,134	5 cm up	6,600	5 cm up	7,500	5 cm up	Private
9	KAYU VENIS LAIN-2 (Kinds of hard wood)	sm M^3	4,045 591	4 cm up 18 cm up	- -	- -	- -	- -	500 -	4 cm up -	1,000 -	4 cm up -	Private
10	CHIP KAYU LAMTORO (IPIC IPIL chip)	TON	2,686	-	8,998	-	9,228	-	9,260	-	9,600	-	

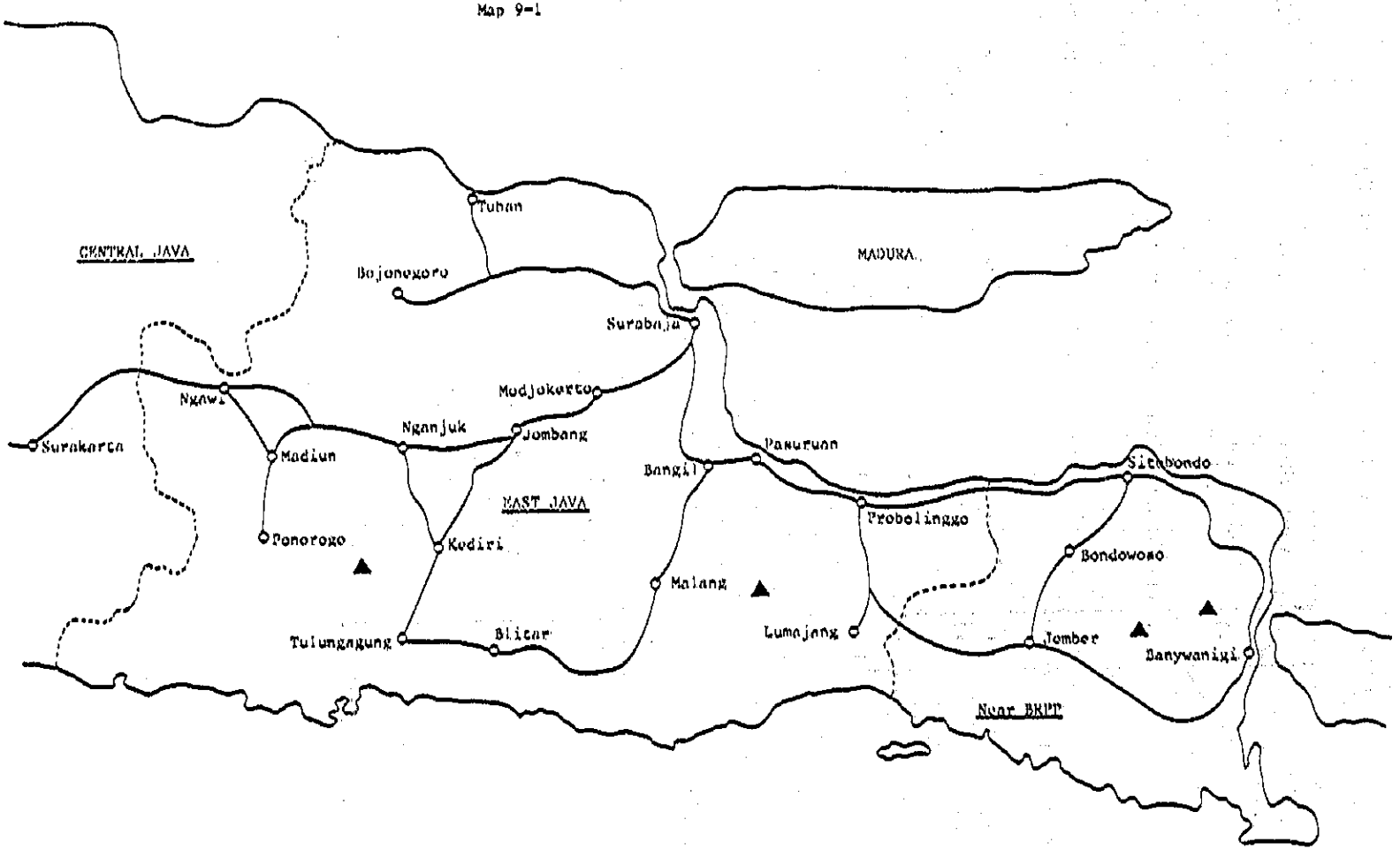
Table 9-1-2 Estimation of Available Raw Material Quantity in near BRPP

	1984	1989	1994	Remarks
Pine	56,000 SM	56,000 SM	56,000 SM	PERHUTANI (plantation)
Ipil - Ipil	10,000 SM	15,000 SM	15,000 SM	PERHUTANI (plantation)
Hard wood	45,000 SM	50,000 SM	50,000 SM	PERHUTANI (plantation) and PRIVATE
Bamboo	16,500 SM	0	0	PERHUTANI (90%) and PRIVATE (10%)
Chip (Ipil - Ipil)	9,200 ADt A.D(70%)	10,000	10,000	PRIVATE

Table 9-1-3 Raw Material Cost (unit Rp/SM)

		Near BRPP	East JAVA	Central JAVA
	(1)	Wood price (Rp/SM)	Wood price (Rp/SM)	Wood price (Rp/SM)
	(2)	Transportation cost	Transportation cost	Transportation cost
	(3)	Total price	Total price	Total price
Pine	(1)	3,167	3,162	3,167
	(2)	5,445	8,000	16,700
	(3)	8,612	11,167	19,867
Ipil - Ipil	(1)	3,300	3,300	-
	(2)	1,700	4,200	-
	(3)	5,000	7,500	-
Hard Wood	(1)	3,300	3,300	-
	(2)	1,700	4,200	-
	(3)	5,000	7,500	-
Bamboo	(1)	Rp35.50/kg		
	(2)			
	(3)	Moisture conert (30%)		
Chip (Ipil-Ipil)	(1)	700	-	-
	(2)	1,700	-	-
	(3)	4,400	-	-

Map 9-1


CENTRAL JAVA
Tuban
Bojonegoro
MADURA
Surabaja
Ngawi
Modjokerto
Nganjuk
Jombang
Surakarta
Madiun
Pasuruan
Bangil
Sitobondo
EAST JAVA
Probolinggo
Ponorogo
Kediri
Bondowoso
Malang
Lumajang
Tulungagung
Blitar
Jember
Banywangi
Near BALI

9-2 The NCR

9-2-1 Trend of the NCR

The demand for the NCR will continue to increase further. In Japan also an increase of demand is estimated at about 10% on an annual basis, while the export increase is forecast by 10% – 13%. The NCR therefore is as promising as it may be involved in a severe competition of price and quality. Under these circumstances, as a matter of course some rigorous restrictions have been set up and a number of specifications have been established for the base paper.

9-2-2 Key Points for NCR Base Papermaking

The main stocks of the NCR base paper are wood chemical pulp, NBKP and LBKP. Its basis weight has a wide range from 30g/cm² – 157g/m², the standard being 40g/m² in Japan and 50g/m² in other countries. The following points should be taken into account.

(1) The NCR base paper must have a good formation.

An imperfect formation will produce spotting upon coating with water soluble coloring agent and/or developer.

(2) No dirt nor impurities are permitted by any means.

It is necessary to make a perfect dust removal off the stock pulp and before the paper machine. If the base paper has some protruding impurities, microcapsules cannot be applied evenly. Dirt and impurities may also be confused with periods and/or commas, which may cause an erroneous reading.

(3) No pinhole is allowed.

If a pinhole is produced, microcapsule developer will have a strike through causing some troubles.

(4) It must have an even thickness.

Since the NCR paper is used in piles as slip forms, its bulkness is an important factor. Therefore, a stricter control of allowable thickness limits is required for this type of paper than for other general-use papers.

(5) Being used for slip or voucher forms, a higher stiffness is required for the NCR paper, compared with the basis weight.

Application of a certain chemical additive in the pulp stock and a starch agent, this last one by means of a sizing press, is required.

(6) It is required to inspect the full width of paper surface with a spot-hole-detector during papermaking.

(7) As the base paper is processed in roll form, it should have no unevenness in thickness and bulk density for both cross and machine directions. If the base paper is not smooth, creasing and spotting will be produced during application of microcapsules by a coater.

(8) The base paper should have dimentional stability. As the paper is used folded or in piles, any insufficient dimentional stability may cause irregular slip forms.

(9) The base paper must have a wet strength to a certain degree.

The wet paper strength is required to prevent breakage during application of water coloring agent and developer.

9-2-3 Future Considerations on the NCR

(1) The most important requirement is the examination on equipment problems.

(2) It is required to select a type of pulp with less dirt, shives and specks.

(3) Considerations must be given to the capacity of NCR paper machines. In Japan the minimum required capacity for this type of paper machine is 50t/d.

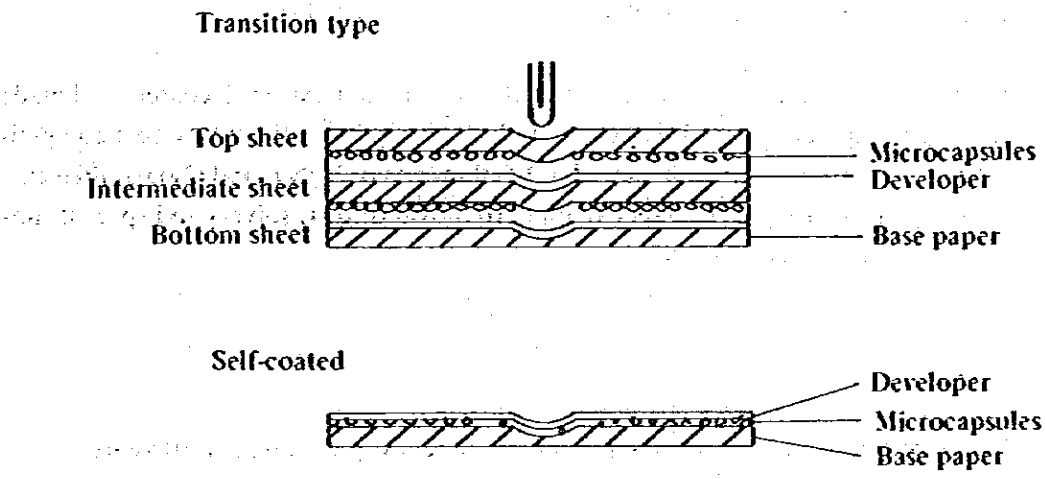
(4) Installation of a size press is required for ensuring the quality of paper.

(5) It is necessary to build up quality control during papermaking.

(6) The future trend of the NCR should be investigated and all possible information should be obtained.

9-2-4 Formation of Coloring Mechanism of the NCR and the Method of Processing

(1) Formation



The base paper includes top sheet, intermediate sheet, bottom sheet, and self-coated sheet and its top sheet.

(2) Coloring mechanism and processing

For the top sheet, microcapsules are applied to the wire-side of the base paper. (Microcapsules have achromatic dye which colors by electron donation; nonvolatile oil solution is covered with a polymeric material such as gelatine, etc.)

For the intermediate sheet, electron-accepting active clay or other similar developer is applied to the felt-side of the base paper and microcapsules to its wire-side in the same way as for the top sheet.

When more than 3 copying papers are required, the number of this intermediate sheet is increased.

For the bottom sheet, the same developer as for the intermediate sheet is applied to the wire-side of the base paper.

The coloring mechanism upon copying is based on the principle that the microcapsules, when they receive local pressure by means of a writing pen or typing are broken, the achromatic dye solution inside transfers to the developer layer and is absorbed for coloring.

For self-coated sheet, microcapsules and developer are applied on the felt-side of the base paper.

9-2-5 Applicator

Capsules are susceptible to breakage due to mechanical pressure and/or friction, therefore, an air knife coater is usually used. Recently capsules made of synthetic polymeric materials have been developed and these capsules allow a high-density application. For these capsules the gravure or offset type of coating is used at some plants.

For developers an air knife coater is used when active clay are applied. Also roll coaters and blade coaters are used when resin developers are applied. To be competitive in the future cost competition, a manufacturer must use a coater with a speed of 1,000 m/min or higher, and also requirements will be more rigorous as to base paper quality stability (removal of dirt, shivers and specks), improvement of strength (wet strength), etc.

9-2-6 Other Conditions

(1) Copied letters of notes and certificates should not fade away at least for 10 years.

(2) Shelf life of unused paper sheets

(3) Lightfastness of copied letters and characters

(4) Printability

As described above, there are many requirements for the NCR papermaking, and the demand is on the increase everywhere in the world. Therefore, a severe competition exists. A careful planning and stable quality maintenance is indispensable even at stage of base papermaking.

The NCR paper is not so profitable in Japan because of very strict quality requirements considering the relatively low selling price of ¥217/kg of the base paper.

9-2-7 Proposals and Future Countermeasures

We have described quality requirements and manufacturing conditions for the NCR paper above.

Our recommendation is that commercial purposes should be eliminated at the initial stage and that for example, a test coater can be installed in the Institute of Fiber Technology and production technologies for capsules, developers etc. can be introduced while production tests are conducted using imported base papers, and then to test-make a base paper fit to such a coater machine. In this case, it is not necessary to follow the mass production, but it will be enough to consider a production volume suitable for the production cost of the machine. From the viewpoint of quality, a special attention should be paid to dust, moisture-resistant strength, thickness, sheet-break at paper machine, etc.

Such trial products are to be delivered to the market to know the evaluation of the customers in the market, thus taking time to achieve a full-scale installation on a paying basis.

9-3 Installation of No. 2 Paper Machine

Although this is a subject outside of the purport of this renovation project, we would like to outline our thoughts on installation of No. 2 paper machine.

9-3-1 License for Producing 6,000tons of Specialty Paper a Year

Anybody will have a doubt on the constant profitability of BRPP operation for the future if BRPP continues the production of general writing/printing paper, a typical mass-production item, based on the current system of one paper machine.

As described in Chapter 3, not only at present but also in the future, overproduction is forecasted on the writing/printing paper. To make the matters difficult, the current production of BRPP is 40tons a day, and it must be pointed out that the productivity of the paper machine is very low from the viewpoint of the international level for a machine that produces writing/printing paper. Also, when the handicap of being away from the consumption area is taken into account, we cannot help having a doubt in the competitive ability of BRPP in the writing/printing paper grade.

In order to overcome these circumstancial problems, to plan maintaining a firm foundation of BRPP operation, and to fulfill the mission of regional development, the government determination of giving the license to BRPP to produce 6,000tons of specialty paper a year is very meaningful.

9-3-2 BRPP's Studies on Installation of No. 2 Paper Machine

(1) BRPP has been serious of the comprehension of the circumstantial situation.

(2) BRPP has been eagerly studying and making efforts to maintain the mill profitability for the mill to continue to exist and to contribute to developing the regional society.

As one of the most effective measures to solve the problem, BRPP has prepared a plan to install No. 2 paper machine and the plan has already been submitted to DGBCI.

We have reviewed the plan and would like to express our opinion in the following.

9-3-3 Basic Plan of BRPP (Production and Sales Plans)

The Program – Perluasan Perun Kertas Basuki Rachmat Banyuntang I of March 7, 1981 outlines the following basic plans.

(1) Production plan

Pulp department:	Increase of UKP daily production from 43.2 BDt to 52BDt
Papermaking department:	Installation of a tissue paper production facility for 20ADt a day or 6,200ADt a year

(2) Sales plan

Manifold paper	30%	1,860t
Glassine paper	25%	1,550t
Onion-skin paper	20%	1,240t
Litho paper	10%	620t
Oil-proof paper	15%	930t
Total	100%	6,200t

9-3-4 Basic Plan of BRPP (Facilities)

(1) Improvement and expansion of existing facilities

a. 3-shift operation on wood preparation process and installation of one additional chipper

b. Alteration of operating conditions and some improvement on the facilities of the cooking process

c. Addition of one stage in the washer process, changing the current 3-stage system to 4-stage system

d. Renewal of screen on the unbleached screen process. Improvement of the bleached screen process

e. Alteration of operating conditions and some improvement on the facilities of the bleaching process

f. Adoption of higher-consistency diluted black liquor at the inlet and some improvement on the facilities of the evaporator process.

g. Adoption of higher-consistency diluted black liquor at the inlet and some improvement on the facilities of the recovery boiler process.

h. Installation of an additional boiler in the main boiler process

i. The shortage in the capacity of causticizing process is managed by procuring the necessary chemicals from outside.

j. Adoption of a higher operation rate on the electrolytic process. The caustic soda (NaOH) that becomes short is to be procured from outside. The excess chlorine gas is to be sold in the market.

k. Adoption of a higher operation rate on the power generator. Shortage of the power is to be supplied by the power company.

(2) Paper machine (New installation)

Daily production:	20ADt (basis weight: 28g/m²)
Basis weight:	15 – 75g/m²
Speed:	110 – 320m/min
Wire width:	3,400mm

(3) Finishing equipment (New installation)

Supercalender	1unit
Sheet cutter	1unit
Winder	1unit

(4) Water consumption

Increase of water supply from current 172lit/sec to 265lit/sec. (Minimum flow rate of Sukowidi river: 330lit/sec)

9-3-5 Progress

(1) The plan was submitted to DGBCI in August, 1980.

At the time, the plan was to use a secondhand paper machine to make the investment to the minimum.

The planned investment and internal rate of return (IRR) were as shown below:

Loan	Rp 7,400million (US$11,840,000)
Equity	Rp 3,196million (US$ 5,110,000)
Total	Rp10,596million (US$16,950,000)
IRR	14.83%

(2) Since the government had the policy not to use a secondhand paper machine at the time, DGBCI requested submission of a new plan of using a new paper machine in November, 1980.

(3) A calculation sheet for using a new paper machine was submitted to DGBCI in October, 1982.

The planned investment and IRR were as follows:

Loan	Rp 9,413million (US$15,060,000)
Equity	Rp 7,673million (US$12,180,000)
Total	Rp17,086million (US$27,240,000)
IRR	11.8%

(4) Procurement of the fund has not been realized yet.

9-3-6 Review Results of BRPP Plan

(1) Sales plan

As described in Chapter 3, specialty papers consist of a variety of different types of paper in small lots, and even with paper of the same type, the specific quality of paper as required by the customers may vary in many cases.

Therefore, we do not consider it proper to plan producing the entire quantity of specialty papers that is being imported at present.

Also, since a long time has passed since the quantities of onion-skin paper and litho paper were taken into the planning, the sales plan must be restudied.

(2) Optimum pulp production

As described in Chapter 7, consideration must be given constantly to the optimum quantity of pulp to be produced by BRPP.

We consider it wise to maintain the current pulp production scale even if a determination is made to install a new paper machine, depending on imported pulp to fill the shortage.

(3) Daily production of paper machine

In consideration of the growth of specialty paper consumption and profitability, we recommend that a daily production of 20tons is the minimum production quantity even the grades are to be specialty papers.

(4) Utility water

Judging from the minimum flow rate of Sukowidi river and the fact that the river water is used for irrigation also, we must point out that a thorough water-saving plan must be established in advance by implementing operational and technical improvements on the existing facilities.

(5) Accumulation of technical and selling knowhow

BRPP has ample experience of producing and selling writing/printing paper, but unfortunately it has no experience of producing and selling specialty papers. This is only because the current products are the only grades that can be produced with the existing facilities and these facilities do not allow producing any grades of lightweight papers or specialty papers even if BRPP wanted to.

Therefore, when BRPP wishes to enter into the field of specialty papers, BRPP must accumulate the technical and selling know-how concerning specialty papers.

9-3-7 Relationship with this Renovation Project

Installation of No. 2 paper machine is a very important subject to be studied always for the future of the mill. However, there are too many problems involved in it to determine implementation of the plan at this stage of this renovation project.

Therefore, we recommend that facility improvement is conducted on this renovation project as the first step to do so that the mill will become possible to produce some of the specialty papers. In other words, shift of the production from commodity papers to specialty papers should be realized gradually, so that the profitability improvement can be realized, the technologies of producing specialty papers can be accumulated and the market of specialty papers can be developed.

We consider that this is the short-cut to realize installation of No. 2 paper machine for eventual production of specialty papers.

CHAPTER 10 FACILITY RENOVATION PLAN

CHAPTER 10 FACILITY RENOVATION PLAN

10-1 Basic Policy

The major grades being produced in BRPP at present are HVS and HVO (printing/writing paper) which is averaging products of 34.1ADt/d and amount of 12,000ADt/y.

The sales share of BRPP on HVS and HVO in the Indonesian domestic market is only about 6%, and BRPP's business can be easily affected by the sales policies of private enterprises.

If BRPP operates continuously as making HVS and HVO only for the future, the managerial foundation of BRPP will be very weak. Accordingly, BRPP must gradually change the production from the existing grades to grades with higher added value to stabilize the management.

10-2 Selection of Kind of Paper

The subject of selecting products with higher added values are described in Clause 8-6 of Chapter 3, in consideration of the capacities of existing equipment and results of market research.

10-3 Capacity Balance of Existing Plant

The ratio of actual operation to the nominal or designed capacity of existing equipment, quality and efficiency are shown in Table 10-3-1.

As the table indicates, in the pulp producing division and the chemical recovery process, the washer, evaporator and recovery boiler, are being used for the full extent of their capacities.

The papermaking division still has some allowance. Especially, on the paper machine, the dewatering capacity of wire part and drying capacity of dryer are important factors to determine the paper machine capacity. The actual production of 60 to 70g/cm^2 printing/writing paper in Japan by a paper machine having the nearly same specifications is 50 to 60ADt/d, maximum production speed 350mm/min. Therefore, the existing BRPP paper machine can be operated at a faster speed of up to 300 to 350mm/min.

10-4 Basic Policy on Planning of Equipment Renovation

As described in 10-1 and 10-2, the existing paper machine must be renovated to be able to produce higher added value products. On the other hand, because of the main purpose of this investigation and production scale of BRPP, the amount of investment will be subjected to some restriction.

Currently (as of 1983), the self-made pulp accounts for 86% of the total pulp needed by BRPP. Therefore, if the pulp division can produce more, the total production cost can be much reduced. However, to increase the pulp production, investment must be made on machinery which amounts to 700 to 800 million yen on FOB Japan basis, and to create a profit after investing such a vast amount will become difficult.

Therefore, the pulp production is to be limited to 27 BDt-BKP/d (matching the actual capacities of evaporator and recovery boiler), and the investment is to be made for the minimum necessities for quality improvement, cost reducing measures and operation stabilizing measures.

The paper machine will be renovated so as to be capable of producing higher added value products, and at the same time, energy-saving measures will be taken. When producing HVS and HVO with the existing paper machine, the dewatering capacity of wire part and drying capacity of dryer permit a speed up to 300 to 350mm/min. Accordingly, we plan to increase the production by increasing the speed to 300mm/min as the first step.

10-5 Production Plan

10-5-1 Production Plan

The production plans of the existing and after the renovations are compared with Tables 13-2-1 and 13-3-1. The efficiencies of both cases are shown in Table 5-4-4-1.

The number of operating days for each grade, shown in Tables 13-2-1 and 13-3-1, are results of calculation based on actual working days in 1983 with the number of days used for production of other minor grades excluded.

Comparisons of data related to the paper production are given in Tables 10-5-1, 10-5-2, 10-5-3, 10-5-4, 10-5-5 and 10-5-6.

10-5-2 Pulp Preparation Plan

The annual pulp preparation plan is shown in Tables 10-5-7 and 10-5-8.

The production of self-made pulp after the renovation is 8,426BDt/y, which is equivalent to 95% of the production in 1983. The quantity of purchasing pulp will increase substantially, but this is a natural increase because of a larger production of paper.

Generally, the price of purchased NBKP pulp is higher than that of LBKP by about US$50. Accordingly, BRPP should be producing more NBKP rather than LBKP.

10-5-3 Chemical Adding Rate

Table 10-5-9 shows a comparison result of chemical adding rates necessary to produce self-made pulp and paper.

The chemicals for cooking has substantially decreased for the following reasons.

(a) Better washing performance owing to renewal of the washer: −4,779kg/d

(b) Decrease of chemical loss for reducing effluent volume from process to be operating as normal (27BDt-BKP/d): −2,700kg/d

(c) Improvement of dust exhaust device of precipitator (Recovery boiler): −324kg/d

The chemicals losses in the above are converted into Na_2SO_4. All these chemicals are recovered and reused (Table 6-4-11).

10-6 Unit Consumption

Table 10-6-1, 10-6-2 and 10-6-3 show comparisons of units of consumption.

The steam consumption for cooking will slightly decrease, and this is because of a shorter time allowed for cooking.

The decrease steam consumption of paper machine is because of the improvements on the nip pressure at press part and dryer drainage system.

10-7 Details of Equipment Renovation

The details of renovation on major equipment are given in Table 10-7-1.

10-8 Boiler

The steam consumption and capacity of the boilers after renovation are as follows.

(1) Boiler capacity

Recovery boiler	6t/h (Nor)×24 = 144t/d
Main boiler	10t/h (Nor)×24 = 240t/d
Total	384t/d (Max 444t/d)

(2) Steam consumption

Pulp plant	6.98t/BDt×27 = 188.5t/d
Paper machine (HVS HVO)	2.5 t/BDt×50 = 125.0t/d
Paper machine (F.P)	(3.0 t/BDt×50 = 150.0t/d)
Total	313.5t/d (338.5t/d in the case of high add. value paper)

As a result, the boilers can operate at about 82% of the total capacity on normal operation (HVS and HVO production). When producing high add. value paper, 88% of the capacity is needed, but operating days during which high add. value paper is produced is only 29 days a year, and we do not think will create any problem for boiler operating.

The peak of steam consumption at the time of cooking and papermaking is about 120% of the normal consumption, but this is within the boiler capacity. Therefore, installation of an additional boiler is not planned.

10-9 Electrical Plant

10-9-1 Power Consumption

The estimated power consumption after the renovation is as follows.

Pulp plant	8,425t×944.14 = 7,956,000kWh/y
Preparation room (stock) Paper machine	15,074,000kWh/y
Boiler	900,000kWh/y
Water treatment	325,000kWh/y
Building, lighting, etc.	431,000kWh/y
Total	24,686,000kWh/y

The total power consumption in 1983 was 19,663,643kWh/y, and the estimate after the renovation is an increase of about 26%.

10-9-2 Generator

BRPP has five generators at present. The number of generators which were normally operating in 1983 was two and three generators worked only during the time of peak. Therefore, the necessary power can be sufficiently generated by three generators only.

10-9-3 Transformer for Each Equipment

The natural increase of power consumption as a result of faster paper machine operation and increase of the production is about 56%. Therefore, new transformers must be installed in the paper machine room. The transformer capacities are as shown below.

Equipment name	Transformer	
	Designed value	Capacity arranged
Sectional drive	480 KVA	1000 KVA (including fan pump)
Supercalender and rewinder	400 KVA	750 KVA
Fan pump	(150 KVA)	–

10-10 Mill Water

The consumption of mill water by BRPP is as shown below.

Table 10-8-1 Estimation of Mill Water Consumption

Description		Actual in 1983	Estimate after renovation
1. Paper production	ADt/y	11,787	14,245
2. Self-made pulp production	BDt-BKP/y	8,862.6	8,426
3. Bleaching	m^3/BDt-BKP	125.0	140.0
	m^3/y	1,107,825	1,179,650
4. Paper machine	m^3/ADt-paper	200	150 0
	m^3/y	2,357,400	2,136,750
5. Others	m^3/ADt-paper	122.83	100.0
	m^3/y	1,447,760	1,424,500
Total (3 – 5)		4,912,985	4,740,900

Thus, the consumption of mill water will remain about the same as before.