CHAPTER 4 MILL DIAGNOSIS (CIPADUN MILL)

page

Tables and Figures

CHAPTER 4 MILL DIAGNOSIS (CIPADUNG MILL)

4-1 Raw Material, Production and Quality

The production machinery of Cipadung Mill was basically designed under the following concept. During the initial stage of establishment, the Mill was equipped with machinery to spin cotton carded yarn, and cotton/polyester blended yarn, and later, it started to spin polyester/rayon blended yarn using some machinery made in Japan.

This was followed by the introduction of BD-200 open-end Spinning Frames that were made in Czechoslovakia in the 1970's period when production of course count cotton yarn began.

4-1-1 Types of Raw Material and Their Consumption

The types of raw material that are currently used and the results of analyzing the quality of the raw material are as follows:

(1) Cotton

Production-district	Grade	Fiber-length
Arizona, U.S.A.	M to SM	1-1/32"
Indonesia SLMLS	" "	1-3/32"
Indonesia	" "	1-3/32"
India	M	1-3/32"

For use on the open-end spinning, a blend of 25% comber waste and 75% Indonesia 1-3/32" is used.

(2) Man-made Fiber

Type	Denier	Fiber Length	Purchasing Source
Polyester fiber	1.4	38 mm	REMPOA SOLO
		semi-dull	SYNTHETICS
Viscose rayon			SOUTH PACIFIC
-High tenacity type	1.5	38 mm	VISCOSE
-Regular type	"	"	

(3) Details of Raw Material Used

Table 4-1 Raw Material Used at Cipadung Mill

Product type	Raw material
Cotton Ne 20	Cotton SLM to M, 1-1/32" to 1-3/32"
Cotton OE Ne 20	Cotton Comber waste, M 1-3/32"
Polyester/rayon blended Ne 45	Polyester and viscose rayon:38 mm
Rayon Ne 30	Viscose-rayon High tenacity:38 mm
	Regular :38 mm

(4) Quantity of Raw Materials Used per Bale

The amount of raw materials used per bale that is obtained from Sandang and waste ratio are shown in Table 4-2.

Table 4-2 Amount of Raw Materials Used and Waste Ratio

Main products	Amount of raw materials used (kg/bale)	Waste ratio
Cotton Ne 20	196.15	7.5
Cotton (open-end spinning) Ne 20	201.6	10.0 (Estimate)
Polyester/rayon blended Ne 45	Polyester 121.6 Rayon 187.0	3.0 3.0
Rayon Ne 30	187.01	3.0

The waste ratio of cotton open-end spinning Ne 20 was estimated at containing 25% comber waste. The waste ratio of 3% for man-made fiber in the Table above is considered excessive, and an effort must be made to restrict the waste ratio below 2%.

Also the moisture content of viscose rayon must be constantly checked and the blending ratio must be compensated accordingly.

(5) Quality Analysis of Cotton Used

Quality analysis of cotton used shall be referred to Table 3-3 in Chapter 3,.

(6) Quality Analysis of Man-made Fiber

The polyester fiber used at Cipadung Mill is 1.4 denier 38 mm cut semi-dull from PT Tri Rempoa Solo Synthetics Factory and 1.5 denier 38 mm cut regular type and high tenacity type viscose rayon from PT South Pacific Viscose.

Analysis was performed in Japan on the collected fibers above, and the results are shown in Table 4-3.

(7) Evaluation of the Results of Analysis

The number of crimps for polyester fiber of Rempoa Solo is slightly high, and although it has a good card passage characteristics, there is a tendency of nep forming. This polyester also has a very large number of dark points where the majority of these lies in the cutting sections when the staples are stretched in the drawing process. Therefore, this may provoke unevenness in the dyeing process after weaving and knitting. The static and dynamic (2400cm) friction coefficiencies (measured by Radar method) of fiber/fiber are slightly high, which may cause a slightly high draft force in the spinning process.

The data of rayon is in general satisfactory, but the static and dynamic friction coefficiencies, are both slightly low, and there is a tendency of slippery phenomena of fibers occurring during the spinning process. As a result, the twisting coefficiency must be slightly increased.

Table 4-3 Analysis of Polyester and Rayon Fiber

Items		Polyester 1.4 X 38	Rayon-regular 1.5 X 38
Cut length		37.4mm	37.8mm
Denier		1.36	1.52
Dry tenacity	g/d	6.92	2.65
Dry elongation rate	%	24.9	16.1
Loop strength	g/d	5.42	1.68
Number of crimps	1/25mm	16.00	11.4
crimp Index	%	11.2	11.0
Percentage of absorbed oil	%	0.129	--
Stick fiber	mg/100g	0	--
Dark point	mg/100g	1159	--
Fiber/fiber friction			
- Coefficiency of static friction		0.352	0.211
- Coefficiency of dynamic friction	Md90cm	0.217	0.155
- Coefficiency of dynamic friction	Md2400c	0.50	0.281
Fiber/metallic friction			
- Coefficiency of static friction		0.224	0.194
- Coefficiency of dynamic friction	Md90cm	0.221	0.174
- Coefficiency of dynamic friction	Md2400c	0.451	0.301
Wet shrinkage		-0.2	-0.09
Melting point	° C	256.8	

4-1-2 Production Plans and Actual Results

(1) Production Plans and Actual Production Results of Cipadung Mill

Production plans and actual production records from 1986 to 1990 are shown in Table 4-4.

a) Spinning operation conditions are three-shift, four-group, working 24 hours per day. (actual working hours is 7 hours 30 minutes per shift)

b) Although predicting market requirements for polyester/rayon blended yarn may be difficult, there is a great gap of yarn count and production volume between planned and actual. With such a difference, there must have naturally been discrepancies resulting in the sales plan. To be realistic, plans must be modified for the following year by taking the actual records of the previous year into consideration.

(2) Production Plan and Actual Production Results for November 1990

The spun yarn market condition deteriorated from the latter half of 1990, and Cipadung Mill was also forced to partially reduce production. Consequently, a difference between the production capacity and the actual production volume is rising. A recent example of this situation can be seen in Table 4-5 in which the production plan and the actual production record for the month of November 1990 are shown.

Table 4-4 Production Plans and Actual Results of Production

	1990		1989		1988		1987		1986	
	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual
Cotton										
RF Ne 1		144		74		60		106		48
OE Ne 7				431						369
OE Ne 8	990					650	1,657		1,312	26
OE Ne10		342		289			2,349			64
OE Ne10/2				1						
OE NE12						1		933		682
OE Ne20	2,270	2,132	2,080	2,210	1,655	2,114		1,636	988	479
RF Ne16				139						
RF Ne20		1,117		382				657		789
RF Ne30						2		918	1,242	
Sub Total	3,260	3,735	2,080	3,526	1,655	2,827	4,006	4,250	3,542	2,457
(%)		29.0		23.9		22.3		33.0		23.3
Polyester/Rayon										
OE Ne20		559		534	1,928	16	3,223	827		1,034
RF Ne40		772		469		504		328		651
RF Ne30	773	3		1,229	1,186	461	1,259	710		113
RF Ne45	5,435	4,146	5,428	3,910	7,223	6,627	7,017	6,463	4,211	6,137
RF Ne40/2		42	2,170	672		943		85		
Reused Ne21		342		202		176		198		156
Sub Total	6,208	5,764	7,598	7,016	10,337	8,727	11,499	8,611	4,211	8,091
(%)		45.5		47.6		68.9		67.0		76.7
Polyester										
Ne40/2	2,123			11						
Rayon										
Ne10		215								
Ne20		161								
Ne30	966	2,404	1,138	4,145		1,105		3		
Ne18						10				
Ne40		181		39						
Ne40/2		314								
Sub Total	966	3,275	1,138	4,184		1,115				
(%)		25.5		28.4		8.8				
Total	12,557	12,875	10,816	14,738	11,992	12,670	15,505	12,864	7,753	10,547
Av. Y. Count Ne	33	31	38	31	36	36	29	34	33	35
Open End Yarn %		23.6		23.5		21.9		26.4		25.2

Table 4-4 Production Plans and Actual Results of Production.

Table 4-5 Production Plan and Actual Production Record for November 1990

Product types		Production bale/30 days	
		Planned	Actual
Polyester/rayon blended yarn	Ne 40	0	63
"	Ne 45	418	283
Rayon (100%) yarn	Ne 10	227	205
"	Ne 30	0	37
"	Ne 40	0	31
"	Ne 40/2	101	22
Cotton carded yarn	Ne 20	100	88
Sub-total		846	729
Cotton carded yarn (Open-end spinning)	Ne 10	215	201
"	Ne 20	0	7
"	Ne 21	0	47
Sub-total		215	255
Total		1,061	984

Cotton carded yarn Ne 21 is spun only by reused waste.

From the Table 4-5, the followings can be observed:

In order to achieve the above indicated production plan, a spinning calculation based on the spinning condition of each respective production machinery was performed and the results was compiled in Table 4-6. It is a matter of question why such differences in production arise between plans and actual.

Table 4-6 Calculation Table for Spinning Plan of Cipadung Mill

CIPADUNG

Process / Item	1	2	3	4	5	6	7	8		9		10	11	12	13	14	15	16	17
	Supply thickness Grain/yard	No of doubling	Draft	Produced thickness Grain/yard	Twist multiplier αe	Twist per inch TPI	Waste percent %	Delivery speed or Revolution		Package		Production 100% LBS per hour	Working hour	Working efficiency %	No of spindle /machine	Actual Production LBS/Shift	Required Production LBS/Shift	Calculated No of machine	No of machine
1 Blow Room Machinery				oz/yard				rpm	yds	mm	mL								
-1 Polyester/Rayon Blend				12.0			0.5	11.0	9.1	960	50	409.50	7.5	85	1	2610.56	1624.66	0.6	1
-2 Rayon Yarn				12.5			1.0	11.0	9.1	960	50	426.56	7.5	85	1	2719.34	1465.10	0.5	1
-3 Cotton Carded Yarn (RF)				14.0			2.0	11.0	9.1	960	50	477.75	7.5	85	1	3045.66	426.12	0.1	0.1
-4 Cotton Carded Yarn (OE)				12.0			2.5	11.0	9.1	960	50	409.50	7.5	85	1	2610.56	1005.99	0.4	1
-5 Cotton Carded Yarn (OER)				12.0			2.5	11.0	9.1	960	50	409.50	7.5	85	1	2610.56	223.75	0.1	0.1
2 Carding Machine	oz/yard			Grain/6yds			Reusable 0.5	rpm	yds	φ	mmH								
-1 Polyester/Rayon Blend	12.0	1	99.95	312			1.0	10.0	23.6	305	914	14.04	7.5	87	1	91.61	1608.41	17.6	18
-2 Rayon Yarn (A)	12.5	1	97.94	330			1.5	10.0	23.6	305	914	14.85	7.5	87	1	96.90	917.84	9.5	10
-3 Rayon Yarn (B)	12.5	1	101.00	320			1.5	10.0	23.6	305	914	14.40	7.5	87	1	93.96	525.28	5.6	6
-4 Cotton Carded Yarn (RF)	14.0	1	98.00	360			4.0	9.0	21.2	305	914	14.58	7.5	87	1	95.13	409.08	4.3	5
-5 Cotton Carded Yarn (OE)	12.0	1	99.75	300			5.0	9.0	21.2	305	914	12.15	7.5	87	1	79.28	955.69	12.1	13
-6 Cotton Carded Yarn (OER)	12.0	1	101.44	295			5.0	9.0	21.2	305	914	11.95	7.5	87	1	77.96	212.56	2.7	3
3 1st Drawing Frame	Grain/6yds			Grain/6yds				yds	m	φ	mmH								
-1 Polyester/Rayon Yarn	312	8	8.00	312			0.3	350.0	320	305	914	156.00	7.5	83	2	1942.20	1603.59	0.8	1
-2 Rayon Yarn (A)	330	8	7.76	340			0.3	350.0	320	305	914	170.00	7.5	83	2	2116.50	915.09	0.4	1
-3 Rayon Yarn (B)	320	8	8.26	310			0.3	350.0	320	305	914	155.00	7.5	83	2	1929.75	523.71	0.3	1
-4 Cotton Carded Yarn (RF)	360	8	8.00	360			0.3	273.4	250	305	914	140.61	7.5	83	2	1750.54	407.85	0.2	1
-5 Cotton Carded Yarn (OE)	300	8	8.00	300			0.3	273.4	250	305	914	117.17	7.5	83	2	1458.78	952.82	0.7	0.7
-6 Cotton Carded Yarn (OER)	295	8	8.14	290			0.3	273.4	250	305	914	113.27	7.5	80	2	1359.19	211.93	0.2	0.2
4 2nd Drawing Frame	Grain/6yds			Grain/6yds				yds	m	φ	mmH								
-1 Polyester/Rayon Yarn	312	8	8.00	312			0.3	350.0	320	305	914	156.00	7.5	83	2	1942.20	1598.78	0.8	1
-2 Rayon Yarn (A)	340	8	7.77	350			0.3	350.0	320	305	914	175.00	7.5	83	2	2178.75	912.34	0.4	1
-3 Rayon Yarn (B)	310	8	8.41	295			0.3	350.0	320	305	914	147.50	7.5	83	2	1836.38	522.14	0.3	1
-4 Cotton Carded Yarn (RF)	360	8	8.00	360			0.3	273.4	250	305	914	140.61	7.5	80	2	1687.27	406.63	0.2	1
5 Simplex Fly Frame	Grain/6yds			Grai/30yds				rpm		φ	mmL								
-1 Polyester/Rayon Yarn	312	1	7.80	200	0.84	0.94	0.5	700		114	279	1.1820	7.5	83	108	794.68	1590.78	2.0	2
-2 Rayon Yarn (A)	350	1	7.29	240	0.66	0.67	0.5	700		114	279	1.9900	7.5	83	108	1337.91	907.78	0.7	1
-3 Rayon Yarn (B)	295	1	7.38	200	0.74	0.83	0.5	700		114	279	1.3387	7.5	83	108	900.00	519.53	0.6	1
-4 Cotton Carded Yarn (RF)	360	1	6.92	260	0.72	0.71	0.5	600		114	279	1.7438	7.5	83	108	1172.35	404.59	0.3	1
6 Ring Spinning Frame	Grai/30yds			Ne				rpm		mmR	mmL								
-1 Polyester/Rayon Yarn	200	1	32.00	40	3.30	20.87	1.0	9300		50	254	0.0221	8.0	90	372	59.20	296.02	5.0	5.0
-2 Polyester/Rayon Yarn	200	1	36.00	45	3.20	21.47	1.0	9300		50	254	0.0191	8.0	90	372	51.15	1278.86	25.0	25.0
-3 Rayon Yarn	240	1	9.60	10	3.00	9.49	1.3	8000		50	254	0.1673	8.0	90	372	447.99	895.98	2.0	2.0
-4 Rayon Yarn	200	1	24.00	30	3.20	17.53	1.2	8800		50	254	0.0332	8.0	90	372	88.93	177.85	2.0	2.0
-5 Rayon Yarn	200	1	32.00	40	3.30	20.87	1.0	8800		50	254	0.0209	8.0	90	372	56.02	336.12	6.0	6.0
-6 Cotton Carded Yarn (RF)	260	1	20.80	20	4.17	18.65	1.4	8000		50	254	0.0426	8.0	90	372	113.98	398.93	3.5	3.5
-7 Cotton Carded Yarn (OE)	1500	1	60.00	10	4.97	15.72	1.1	21000				0.2651	8.0	93	200	394.50	907.36	2.3	2.3
-8 Cotton Carded Yarn (OE)	1500	1	120.00	20	5.29	20.24	1.0	24000				0.1177	8.0	93	200	175.09	35.02	0.2	0.2
-9 Cotton Carded Yarn (OER)	1450	1	121.80	21	5.49	21.47	1.1	20000				0.0880	8.0	93	200	131.00	209.60	1.6	1.6
7 Auto Winder	Ne			Ne				yds	m	mm	Angle								
-1 Polyester/Rayon Yarn	40	1		40			0.5	704	644	152	5.57	1.2571	7.5	65.0	60	367.71	294.54	0.8	1
-2 Polyester/Rayon Yarn	45	1		45			0.5	704	644	152	5.57	1.1175	7.5	65.0	60	326.86	1272.47	3.9	4
-3 Rayon Yarn	10	1		10			0.5	678	620	152	5.57	4.8429	7.5	70.0	60	1525.50	891.50	0.6	1
-4 Rayon Yarn	30	1		30			0.5	678	620	152	5.57	1.6143	7.5	70.0	60	508.50	176.96	0.3	
-5 Rayon Yarn	40	1		40			0.5	678	620	152	5.57	1.2107	7.5	70.0	60	381.38	334.44	0.9	1
-6 Cotton Carded Yarn (RF)	20	1		20			0.5	704	644	152	5.57	2.5143	7.5	65.0	60	735.43	396.93	0.5	1
-7 Cotton Carded Yarn (OE)	10	1		10			0.5	678	620	152	5.57	4.8429	7.5	70.0	60	1525.50	902.82	0.6	
-8 Cotton Carded Yarn (OE)	20	1		20			0.5	678	620	152	5.57	2.4214	7.5	75.0	60	817.23	1272.47	1.6	2
-9 Cotton Carded Yarn (OER)	21	1		21			0.5	678	620	152	5.57	2.3061	7.5	75.0	60	778.32	34.84	0.0	
10 Polyester/Rayon Yarn	Ne 40/2	2		40			0.5	678	620	152	5.57	2.4214	7.5	75.0	60	817.23	146.28	0.2	1
8 Doubler Winder	Ne			Ne				yds	m	mm									
-1 Polyester/Rayon Yarn	Ne 40/2	2		40			0.5	704	644	152	5.57	2.5143	7.5	85.0	120	1923.43	147.75	0.1	1
9 Ring Twisting Fram	Ne			Ne				rpm		mm	Angle								
-1 Polyester/Rayon Yarn	Ne 40/2	1		40		18.00	0.5	7000		152	5.57	0.0386	8.0	93.0	240	68.89	147.01	2.1	3

4-1-3 Method of Quality Control

Quality control is also being performed at the Cipadung Mill based on the unified standard test methods of Sandang I as was mentioned in Chapter 3 for the Banjaran Mill. Therefore, references regarding general points of issue and their countermeasures will not be mentioned here.

Shown in Table 4-7 is the test results of yarn quality performed by the Japan Spinners' Inspecting Foundation on a full cop yarn, which is currently spun at the Cipadung Mill.

The method of the test performed was in accordance with the general spun yarn test method of Japan Industrial Standards (JIS L-1095).

The standard characteristic values by the respective types of yarn in Japan are listed in Table 4-8, and achieving these values are indispensable.

The USTER charts and the spectrographs of polyester rayon Ne 30 and Ne 45 collected at the Cipadung Mill are shown in Figure 4-1. The spectrographs for both Ne 30 and Ne 45 have cyclic unevenness indicating requirements for adjustment.

Evaluation of the results of the yarn test is as follows:

1) Yarn count deviation percentage for polyester/rayon Ne 30 is considerably high (to the plus side), and the fluctuation of single yarn strength is also excessive. Stabilizing the lap weight and adjusting the drawing front roller part is necessary.
2) Polyester/rayon Ne 45 also shows low single yarn strength due to high significant yarn count deviation percentage (to the plus side), and this also requires lap weight stability and drawing front roller part adjustment. Also, to reduce the nep of IPI value, rubbing at the fiber passage part following roving must be minimized.

In the above tests for the two kind of yarn, the matter common to these types urgently requires adjustments for cyclic unevenness.

Although the spectrogram tester has not been utilized due to obsolete machine, evaluating the quality only by the value of U % is hazardous, and what is necessary to check is both the changing condition in the USTER chart and the condition of yarn unevenness at the sereplane. Further, a complete visual inspection of the draft part of the Draw Frames since they cause for the generation of yarn unevenness must be performed.

Table 4-7 Yarn Test Record

Test Items \ Specimens		Polyester/rayon blended yarn (P 65/R 35) Ne 30	Ne 45
a. Count			
Actual (Ne)		31.48	46.38
Deviation (%)		+4.9	+3.1
CV%		1.9	1.3
b. Breaking Strength; single			
Average (gf)		383.6	292.1
CV%		13.3	9.5
Elongation (%)		13.6	12.6
c. Breaking Strength; Lea			
Average (Kgf)		55.5	33.2
CV%		2.9	1.8
Elongation (%)		10.3	8.2
d. Twist			
Average (tpi)		18.4	23.0
CV%		9.3	8.5
e. U%		13.4	12.2
f. IPI Values (Piece /200m)	Thin	3	2
	Thick	2	9
	Nep	7	29

Table 4-8 Average Yarn Quality in Japan

		P/R blended Yarn		100% Rayon Yarn	
		Ne 40	Ne 45	Ne 20	Ne 30
Deviation of yarn count (%)		1.4	0	1.6	1.5
Yarn count CV %		2.4	1.9	2.2	2.2
Single yarn breaking strength CV %		293.2	288.0	381.5	261.5
Single yarn breaking strength CV %		12.0	13.2	8.6	10.6
U %		14.3	13.4	10.7	12.4
I P I Value Piece / 200m	Thin	—	16	0.3	4
	Thick	—	30	4	14
	Nep	—	19	6	12

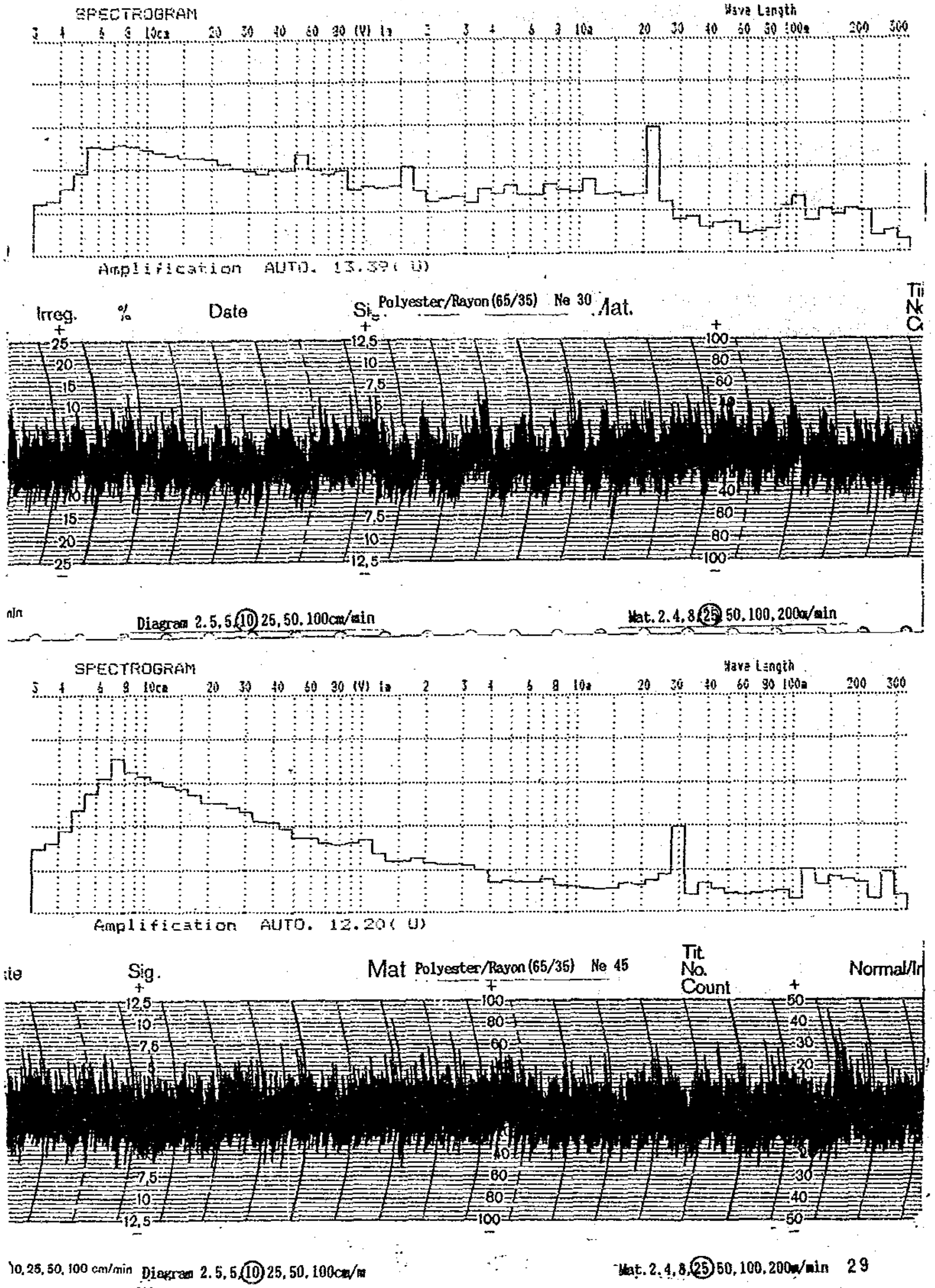


Figure 4-1 Uster Chart (for polyester/rayon blended yarn)

4-2 Production Machinery

4-2-1 Machinery and Equipment List

1) List of Production Machinery and Main Specifications

The main specifications of the existing production machinery and the number of machines and equipment are shown in Table 4-9.

2) Auxiliary Equipment and Laboratory Equipment List

Listed in Table 4-10 and Table 4-11 are the main auxiliary equipment and laboratory equipment currently in use. Equipment marked by an asterisk in the lists indicates machines and equipment that are obsolete and can no longer be used.

Table 4-9 Specifications of Main Production Machinery

Item No	Machine/Equipment	Quantity
S-1	Blow Room Machinery(PLATT)	
	1)Year of manufacture 1962	
	2)Lap feeding system to card	
	3)Line arrangement	
	a)Opening line for cotton	1 Line
	5 CL(Creeper lattice)	2 Sucutchers
	5 BHBO(Hopper bale breaker)	
	1 S C (Superior cleaner)	
	1 TVO (Twin opener)	
	1 H F (Hopper feeder)	
	2 ASC (Single beater opener)	
	2 H F (Hopper feeder)	
	2 SBL (Single beater scutcher & lap machine)	
	b)Opening line for man made fiber	1 Line
	4 CL (Creeper lattice)	2 Sucutchers
	4 BHBD(Hopper bale breaker)	
	1 H F (Hopper feeder)	
	2 ASC (Single beater opener)	
	2 H F (Hopper feeder)	
	2 SBL (Single beater scucher & lap machine)	
S-2	Revolving flat carding engine(PLATT)	102 sets
	1)Type of machine CM	
	2)Year of manufacture 1962	
	3)Lap feeding System	
	4)Number of flats 106	
	5)Fly comb system	
	6)Sliver can size 16"x36"H	
S-3	Revolving flat carding engine(MEIKIN)	1 set
	1)Type of machine CM	

Item No	Machine/Equipment	Quantity
	2)Year of manufacture 1962	
	3)Lap feeding system	
	4)Number of flats 106	
	5)Fly comb system	
	6)Sliver can size 16"x36"H	
S-4	Drawing Frame(HARA)	6 heads
	1)Type of machine D400MT	
	2)Year of manufacture 1982(4heads) 1983(2heads)	
	3)Number of passage 2	
	4)Number of feeding sliver per delivery 8	
	5)Number of deliveries per frame 2	
	6)Weighing system Top arm 4 over 4 roller	
	7)Delivery can size 20"x42"H	
S-5	Drawing Frame(TOYODA)	2 heads
	1)Type of machine DY-2C	
	2)Year of manufacture 1980	
	3)Number of passage 2	
	4)Number of feeding sliver per delivery 8	
	5)Number of deliveries per frame 2	
	6)Weighing system Top arm 4 over 4 roller	
	7)Delivery can size 20"x42"H	
S-6	Simplex Fly Frame(PLATT)	10 sets
	1)Type of machine simplex	
	2)Year of manufacture 1962	
	3)Number of spindle per machine 102	
	4)Lift 11"	
	5)Drafting system 4 over 4 apron draft sussen	
S-7	Simplex Fly Frame(TOYODA)	2 sets
	1)Type of machine FL-16	

Item No	Machine/Equipment	Quantity
	2)Year of manufacture 1989&1991	
	3)Number of spindles per machine 96	
	4)Lift 16"	
	5)Drafting system 4 over 4 apron draft SKF-1500	
S-8	Ring spinning frame(PLATT)	79 sets
	1)Type of machine PLATT	
	2)Year of manufacture 1962	
	3)Number of spindles per machine 372sps	
	4)Spindle gauge 75mm	
	5)Lift 10"	
	6)Drafting system 3roller apron top arm SKF pf-211	
	7)Over head travelling cleaner Pneumablo (LUWA)	
S-9	R T(Rotary,Traverse) Winder(MURATA)	6 sets
	1)Type of machine RT	
	2)Year of manufacture 1970(100Dx2) 1974(120Dx2) 1980(120Dx2)	
	3)Number of Drum per machine 100x2sets 120x4sets	
	4)Take-up package 6"traverse cone	
S-10	Doubler Winder(MURATA)	1 set
	1)Type of machine RT	
	2)Year of manufacture 1987	
	3)Number of drum per machine 120	
	4)Take-up package 6"Traverse x Parallel	
S-11	Ring Twisting machine(PLATT)	13 sets
	1)Type of machine Ring twister	
	2)Year of manufacture 1962	
	3)Number of spindle per machine 324sps	

Item No	Machine/Equipment	Quantity
	4)Diameter of ring 50mm	
	5)Lift 10"	
	6)Over head travelling cleanere with	
S-12	Cone Winder(KAMITSU)	4 sets
	1)Type of machine RT	
	2)Year of manufacture 1975	
	3)Number of drum per machine 120	
	4)Take-up package 6"Traverse cone	
S-13	Cone Winder(SAVIO)	1 set
	1)Type of machine RT(Auto)	
	2)Year of manufacture 1989	
	3)Number of drum per machine 56	
	4)Take-up package 6"Traverse x 9°15'cone	
S-14	Open end Spinning(CZECHO SLOVKIA)	6 sets
	1)Type of machine BD-200(Open end)	
	2)Year of manufacture 1975(5) 1982(1)	
	3)Number of drum per machine 200	
S-15	Roving Waste opener	1 set

Table 4-10 Auxiliary Equipment List

Item No	Equipment	Year of manufacture	Quantity	Manufacturer
A-1	Flat grinding machine	1963	1 set	Drons fields (England)
A-2	Roller assembling machine	1963	1 set	Ditto
A-3*	Rubber roller grinding machine	1963	1 set	Ditto
A-4	Rubber roller chemical treatment machine	1974	1 set	
A-5*	Spindle oiler		1 set	Nihon spindle (Japan)

Table 4-11 Laboratory Equipment List

Item No	Equipment	Year of manufacture	Quantity
L-1	Fibrograph	1974	1 set
L-2	Micronaire	1974	1 set
L-3	Pressley Tester	1974	1 set
L-4	Thread tension gauge	1974	1 set
L-5	Lap evenness Tester	1974	1 set
L-6	Staple diagram aparatus	1976	1 set
L-7	Gram balance	1975	1 set
L-8	Bear sorter	1974	1 set
L-9	Thermo meter	1974	1 set
L-10	Grain balance	1974	1 set
L-11*	Uster equipment		1 set
L-12	Wrap block	1962	1 set
L-13	Roving tester	1962	1 set
L-14	Yarn examiner / Inspector	1962	1 set
L-15	Lea tester	1962	1 set
L-16	Twist tester	1975	2 sets
L-17	Single yarn tester	1962	1 set
L-18	Wrap real	1962	1 set
L-19	Yarn balance	1962	1 set
L-20	Microscope pack	1962	1 set
L-21	Tacho Meter	1962	1 set
L-22	Strobo scope	1979	1 set
		1989	1 set
L-23	Digital balance	1989	1 set
L-24*	Conditioning oven	1974	1 set
L-25	Push pull tension gauge	1990	1 set

4-2-2 Layout of Production Machinery

The Cipadung Mill is a short-fiber spinning mill, located 13 km east of Bandung city and occupies a total area of 26 hectares with the building area of 213 meters from north to south and 70 meters from east to west.

There are 79 Ring Spinning Frames equipped with 29,388 spindles and six Open-end Spinning Machines (BD-200) with 1,200 drums installed within the Mill. The direction of flow of material is from the north to the south. The layout of the production machinery is shown in Figure 4-2.

a) Summary

Blow Room Machinery, Carding Machines, Drawing Frames, Roving Frames, Spinning Frames, and Winding Machines are arranged and installed in the order of material flow stemming from the north side to the south side of the building. However, under the present layout, the Roving Frames are scattered between Spinning Frames and Winding Machines, and slivers must be transported over a considerable distance. Also the distance to the Open-end Spinning Machines to which slivers must be transported is also a long.

In addition, the positions where the Draw Frames are installed are not to be balanced, and a problem exists in transporting slivers between machines. Space for storage of empty cans and slivers and carriages are sufficient.

A space on the east side of the building runs 10 meters in width by 213 meters in length. This is utilized as an office, a maintenance room, a roller shop, a testing room, a dinning room, etc. The distance between columns of this plant is 10 m, and 15 m × 5 = 60 m, a total 70 m from east to west, and 10.16 m and 20.32 m × 10 = 203.2 m, a total 213.36 m from north to south. Within the space of 10.16 m × 60 m, facilities related to air conditioning are installed.

b) Blow Room Process

Raw materials are fed from the west side of the Mill, and the lap is stored on the east wall side. There is sufficient stocking area available for opened raw cotton and lap.

c) Carding Process

There are 102 conventional Carding Machines and one Tandem Carding Engine modified by MEIKIN installed in a layout of 12 lines covering the entire ridge direction of the floor.

Adequate space between Machines and for passageways has been provided.

d) Drawing Process

The Drawing Frames for this process are Japanese made, but the positions where these Frames are installed are one-sided in the east area together with the Open-end Spinning Machines. The layout of the Drawing Frames including 2 sets of Toyota Frames (currently not operating) should be considered in relation to the position of Roving Frames.

e) Roving Process

The layout of this process is difficult to comprehend because the Roving Frames are located at places between both the Spinning Frames and Winding Machines and also at separated places in the pre-spinning process. This may be due to the repair made on the subsided floor. The distance that the cans and others must be transported is far and uneconomical.

f) Spinning Process

There are 79 Spinning Frames with 372 spindles per machine arranged in three rows running from the east to the west. The space between Frames is slightly narrow but passageways for carriages of roving yarn have been properly provided.

g) Open-end Spinning

Six Open-end Spinning Frames (BD-200) are installed parallel to the Spinning Frames. The raw material used is a blend of 25% comber noil with Indonesian cotton, but for open-end spinning yarn, the rate of end breakage is slightly high.

Since the Drawing Frames for the feed sliver is located at a considerable distance, the rate of coil disturbance of the slivers is also somewhat high.

h) Winding Process

The Winding Machines consist of ten machines of which RT Winders are the main Winding Machines including one for rewinding twisted yarn and one SAVIO (Italy) Autowinder with 56 drums. However, there is a problem in the layout of each Winding Machine which is causing interference in production flow.

i) Doubling Yarn Process

One Doubling Winder made by MURATA (with 120 drums) is installed on the northwest corner of the mill, but the space between the Doubling Winder and the wall is restricted, and the location of the installation is poor. Workability is quite unsatisfactory.

j) Twisting Process

There are 13 Ring Twisting Machines installed in parallel with the Spinning Frames on the west side of the mill. The space between machines is somewhat limited which is causing some workablility problems.

k) Roving Waste Opener

The Roving Waste Opener with its cotton collector is installed along the north wall of the Blow Room process.

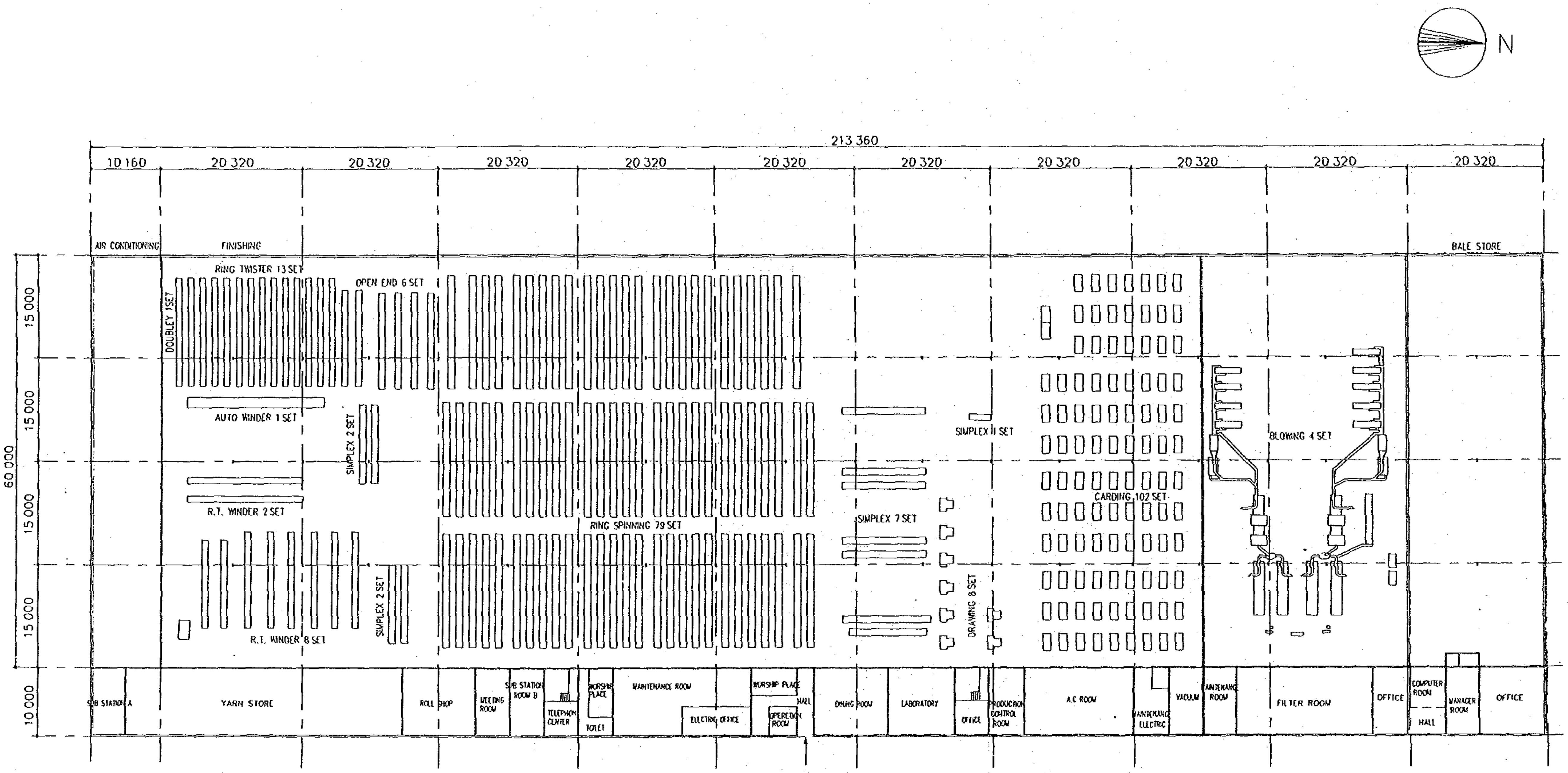


Figure 4-2 Layout of Machinery in the Cipadung Mill

4-2-3 Conditions of Machinery Maintenance and Usablility

Except for the Drawing Frames and the Open-end Spinning Frames (BD-200), almost all of the machines have been made in 1962 by PLATT of England.

As described in the analysis of the current situation of the Banjaran Second Mill regarding BD-200 Open-end Spinning Frames in Chapter 3, it is recommended to select machines in relatively good condition from mills under Sandang I group, and to revamp them as necessary, for the purpose of utilizing them in an independent Open-end Spinning Mill. Since the Cipadung Mill has been in operation for 26 years, the machinery is now in obsolete condition. The spinning process is a type of 50 mm ring and 10" lift, which are not suitable for short fiber spinning.

Because PLATT no longer exists as a company, obtaining supplies of spare parts from PLATT is nearly impossible. Under these circumstances, it seems to be very difficult to produce and to supply products of high quality being demanded by the market, even if the production machinery were to be modified and repaired.

Therefore, in the renovating plan, replacing most of the machinery with the exception of some types of machines and equipment is required.

a) Blow Room Process

There are one line, two Scutchers installed for cotton line, and one line, two Scutchers for man-made fiber. Lubrication and cleaning are performed in accordance with the established procedures, but many axes and other parts are worn and damaged.

When the quality aspect of the lap is viewed, problems in the functional aspect such as insufficiency in the opening and inadequate removal of leaves are prevalent.

The air compressor is installed on top of the lap machine which is inconvenient when maintenance is performed.

b) Carding Process

Both the cylinder cells and cylinder bends of the 102 Carding Machines have thin thickness of plate, and increasing the revolution of rollers under this condition, is impracticable.

At present the revolution is 170 rpm for the cylinder, and 9 to 10 rpm for the doffer. The cans used are 16" in diameter, 36" in height but apparently due to non-availability of parts, a very large number of the cans are damaged. What follows are undesirable effects such as the generation of fluff in the slivers and coil unhomogeneity. Moreover, a lot of neps and leaves are observed in the web.

In addition, there is only one Tandem Carding Machine modified by MEIKIN which is believed to have been used for testing of Open-end Spinning (currently not in operation).

c) Drawing Process

Drawing Frames that are installed consist of four heads of D 400MT and two heads of 250 MF, both made by HARA and two heads of DY-2C made by TOYOTA. These Frames can be continuously used from now on, and using these Frames for the first head while installing new Frames for the second head is recommended.

d) Roving Process

There are ten Roving Frames made by PLATT and two TOYODA's FL-16 Fly Frames (of which one Frame is scheduled to be obtained in the near future).

The two Toyota FL-16 Fly Frames are in good operable condition, but due to the obsolete and deteriorated PLATT's Frames, deflections in the draft rollers and in the flyers and excessive wear in the gears are causing adverse effects on the USTER %. Replacing the PLATT Frames must be implemented.

e) Spinning Process

There are 79 PLATT's Spinning Frames equipped with 372 spindles per Frame in the mill. These Spinning Frames use 10" lifts and 50 mm diameter rings, but the ring diameter is too large and the lift is too long which are causing frequent end breakage and lower spindle revolution. Quality and productivity have dropped as a consequence. The condition of the draft parts and tin rollers of these Spinning Frames are extremely worn out. Replacing these Frames with new Spinning Frames must be done.

f) Winding Process

The main Winders installed are RT types and in addition there is one SAVIO's (56 drums). Damaged drums of the RT Winders are observed in many places, and the electronic type slub catchers of RT Winders are of old types with parts made by other manufacturers. Consequently, it makes very difficult to maintain these Winders appropriately.

In almost all countries in the world, knotless yarn is prevailing recently and thus splicer knotters are being adopted. It is therefore recommended that the RT Winders be replaced by new Auto-winders with splicers.

g) Doubling Yarn Process

There is one Doubling Winder with 120 drum made by MURATA installed in the mill, and this Doubler Winder will be continuously used.

h) Twisting Process

There are 13 Ring Twisting Machines installed in the mill. Deterioration of the tin rollers, spindle parts, and other parts are at an advanced stage, and increasing the spindle revolution in the present condition is not feasible. In addition, gears, rollers and other parts are also observed worn or damaged, thus replacement of these Machines is recommended.

i) Open-end Spinning

There are six BD-200 Open-end Spinning Machines being operated. These Open-end Spinning Machines are installed between the Spinning Frames and Twisting Machines, but in this position the Open-end Spinning Machines would have adverse effects on both the Spinning Frames and Twisting Frames by generation of fly during sliver piecing and sliver can replacement. As mentioned previously, a separate Open-end Mill should be established.

4-3 Utility Equipment

4-3-1 List of Electrical and Utility Equipment and Main Specifications

The number of main Electrical Equipment and their specifications are shown in Table 4-12, and the number of main Utility Equipment and their specifications in Table 4-13.

Table 4-12 Electrical Equipment List
(Cipadung Existing Mill)

Item No.	Equipment/Specification	Quantity
E-1	Diesel Engine Generator Engine Out Put : 1,548HP Manufactuer : Mirrlees Bickerton and day AC Generator Capacity : 1,340KVA 1,070KW Phase : 3 Freqency : 50HZ Voltage : 3,300V Manufactured : 1962, A E I	4 sets
E-2	Intake Tie Transformer Capacity : 3,000KVA Voltage : 20KV/3KV (Primary Tap 21,000V, 20,500V, 20,000V, 19,500V, 19,000V) Connection : DYN 5 (Delta-Star) Percentage Impedance : 7.0% Manufactured : 1988, Unido	1 set
E-3	Transformer for Process & A/C Capacity : 750KVA Voltage : 3.3KV/380V Manufactured : 1962, A E I	6 sets
E-4	Transformer for Engine service Capacity : 30KVA Voltage : 3.3KV/380V	2 sets

Table 4-13 Utility Equipment List
(Cipadung Existing Mill)

Item No.	Equipment/Specification	Quantity
U-1	Refrigerator Capacity : 220 USRT Type : Centrifugal Turbo Chiller Refrigerant : R-11 Model. : 19C 6E Motor : 380V 50HZ 200KW Manufactured : 1962, Carrir	2 sets

Aux. Machine

Condenser Water Pump 2 sets

Chilled Water Pump 2 sets

Cooling Tower 2 sets

U-2	Air Conditioner for Spinning & Winding	2 sets
	Capacity : 254,850m^3/hr	
	Suppry Fan : 4,247.5m^3/min 76mmAq 90KW	
	Return Fan : 1,133m^3/min 22KW 2 sets	
	708m^3/min 11KW 2 sets	
	Spray Pump : 132 /min 23mAq 15KW 2sets	
	Chilled Water Return Pump : 314 /min 21mAg 45KW	
U-3	Air Conditioner for Pre-spinning Process	1 set
	Capacity : 95,160m^3/hr	
	Suppry Fan : 1,586m^3/min	
	Return Fan : 1,274m^3/min	
	Spray Pump : 100 /min 11KW	
U-4	Well	1 set
	Pump Capacity : 18m^3/hr 3.7KW	
	Depth : 100m	
	Casing Dia. : 200mm	
U-5	Well	1 set
	Pump Capacity : 24m^3/hr 5.5KW	
	Depth : 150m	
	Casing Dia. : 200mm	
U-6	Water treatment	1 lot
	1) Raw Water Reservoir 1 set	
	2) Strainer 1 lot	
	3) Filter 1 set	
	4) Softner 1 set	
	5) Chemical Tank 4 set	
	6) Raw Water Pump 2 set	
	7) Pump for Filter 1 set	
	8) Feed Pump 2 set	
U-7	Sprinkler & Hydrant	1 lot
	1) Eleuated Water Tank 1 set	
	2) Pump 1 set	

4-3-2 Electrical Equipment

(1) Initial Power Receiving Facilities

Figure 4-3 represents Single Wiring Diagram at the Cipadung Mill.

Power transformer station of State Electric Power Agency (PLN) and the 20 KV power receiving room as well as the 20 KV/3.3 KV transformer of the Cipadung Mill are all located adjacent to the power generating room, thus the distance of the distribution cables among these facilities are very short.

The 3000 KVA transformer located outside the building possesses ample allowance for the present work load conditions, and the 3.3 KV cable (150 mm*, 3-core X 3 cables) has sufficient capacity to meet future requirements. The main circuit breakers used for 20 KV initial power receiving and 3.3 KV are equipped with vacuum circuit breakers, and in view of their capacity as well as durable years, these vacuum breakers can still be utilized in the future.

The change over switch panels is not so old and these panels would be able to withstand continual use.

(2) Power Generation Equipment

a) Generators

The generators are very old and the predicted capacity to generate electricity continuously is estimated to be approximately 60%, at 600 KW. Most spare parts for engines are out of stock, and acquiring these spare parts is not easy. Because the model is out of date, about one year is required before parts can be received. At the present time the engines are being operated for only about two hours once a week to check operability. What is advised is to use the generators as a stand-by for possible power shortages in the future.

b) Generator Panels and Switch Boards

The following circuit breakers are being used for the generators.

- Oil circuit breakers for generators

Voltage	:3,300 volts
Rated current	:400 A
Breaking capacity	:75 MVA
Year of manufacture	:1962

- Feeder circuit breakers to transformers

Rated current	:160 A

Other specifications same as oil circuit breakers for generators above.

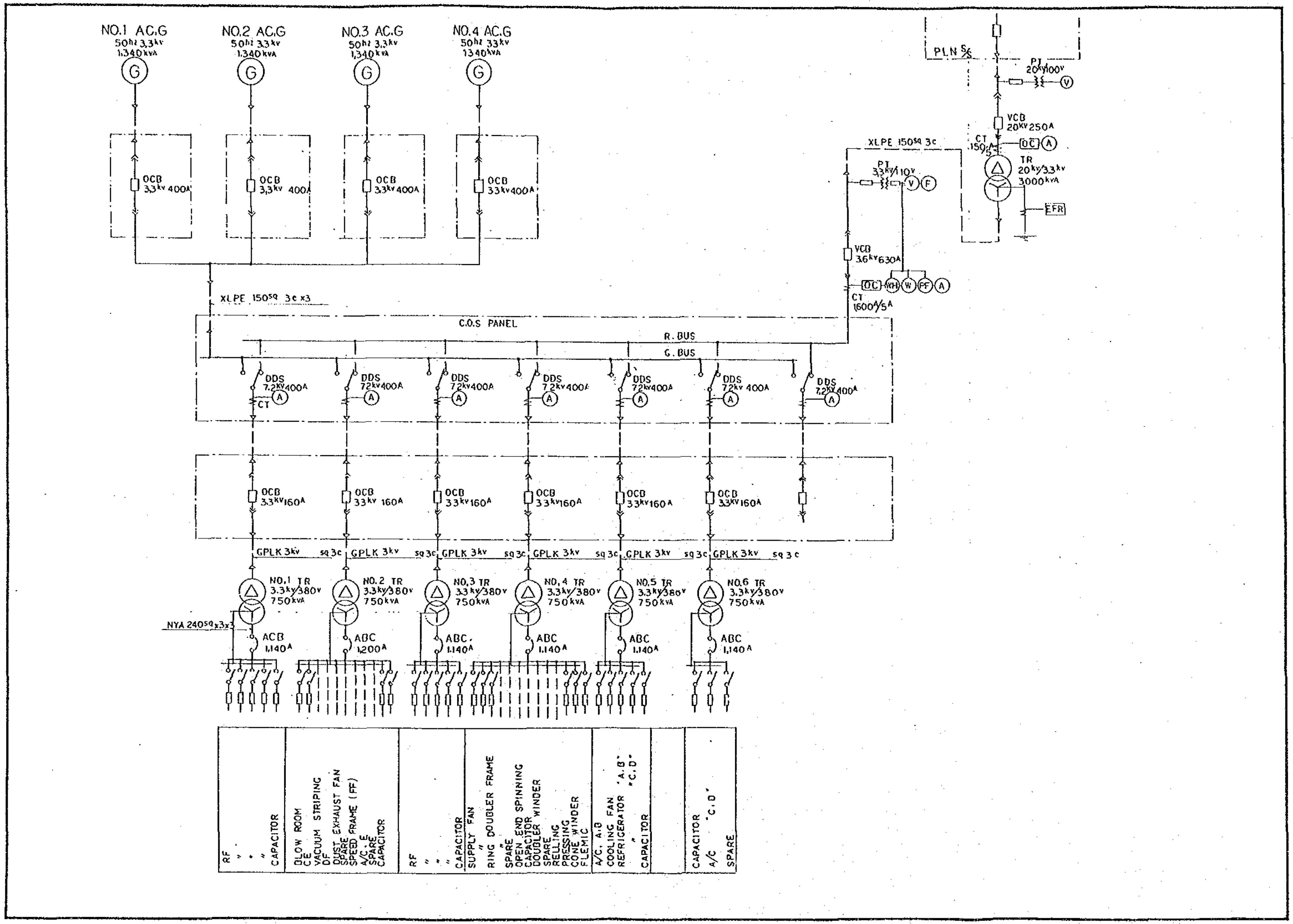


Figure 4-3 Single Wiring Diagram

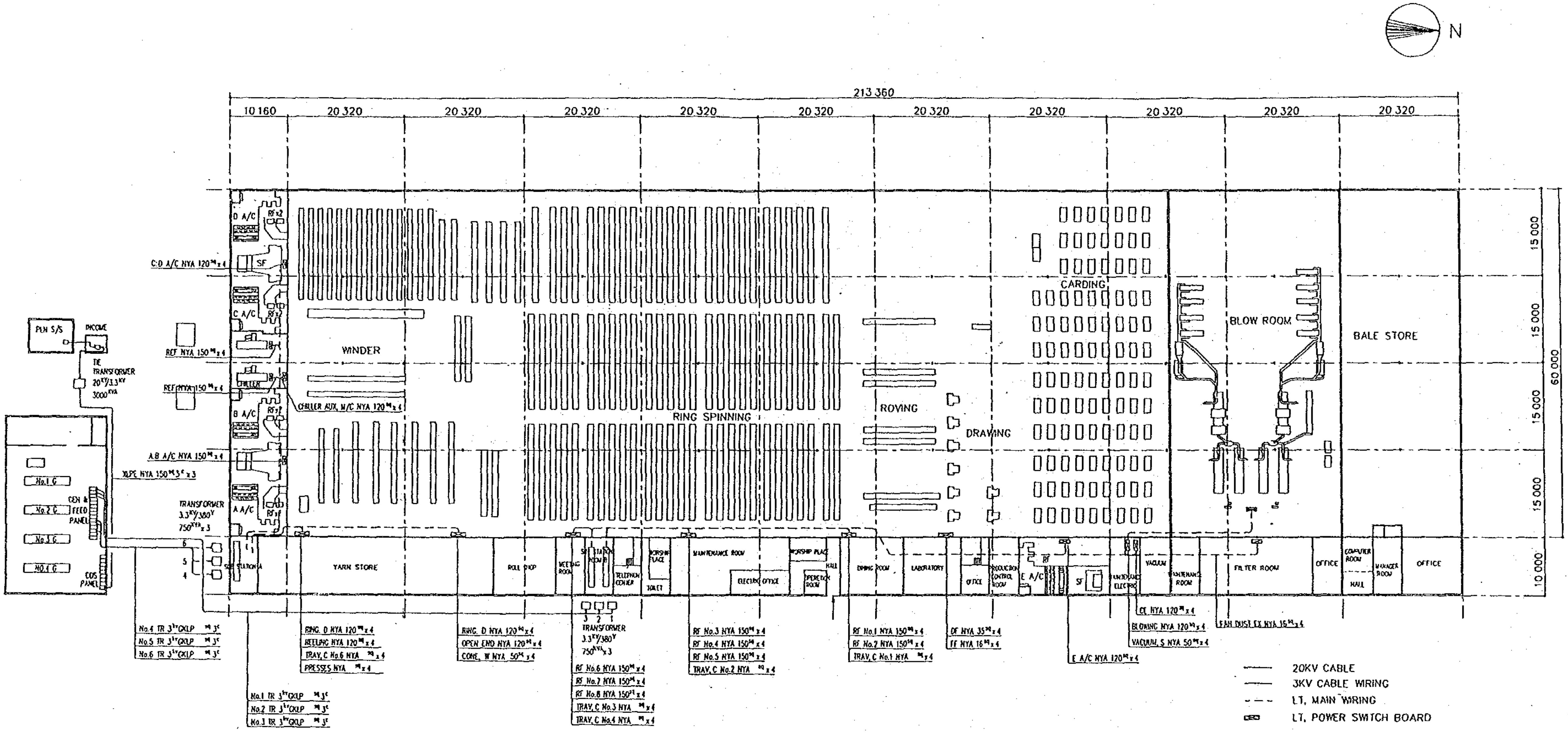


Figure 4-4 High Tension Cable and Main Low Tension Cable Wiring

As the same as generators, there would be no problem to use these circuit breakers as stand-by. The feeder and switchboards to each transformer have oil circuit breakers with breaking capacity of 75 MVA, which possess little allowance from the point of breaking capacity for initial power receiving, and therefore, checking and maintenance is vitally important.

(3) High Tension Distribution Line

All 3.3 KV feeder cables are PTA cables (belt paper insulated lead covered steel tape armored cables) which are difficult to move or repair. In case of future renovation which requires any wiring works, these cables must be replaced with new plastic ones.

(4) Transformer Equipment

a) Transformer

No major accidents or troubles with transformers have been encountered in the past although the transformers have been used under relatively easy load, and the extent of deterioration of the transformers is light. It is therefore considered that the existing transformers can be continuously used. However, as the period of operation under proper load (approximately 60 to 75 %) is expected to increase hereafter, precautions in the control of the insulation oil must be exercised.

b) Low Tension Switchboards (inside switch room)

These low tension switchboards are the original equipment installed when the Mill first started operation, and the wearing out of the switchboards has advanced on the whole in such parts as the coils, conductive parts, and mechanism elements, and continued use of these facilities is noticeable. Replacement of a new equipment will be required when renovation project is implement.

(5) Electrical Equipment inside the Mill

a) Low Tension Power Wiring

Both the low tension cables and panel boards are obsolete and unsound, and using these cables and panel boards further is impracticable.

It is not desirable to directly lay the NYA main wiring (PVC insulated electric wires) in underground ducts, and instead, the use of NYY (PVC insulated sheathing cables) hereafter is recommended.

In regards to the low tension panel boards, there are safety and space problems with the isolators and the enclosed fuses which are presently used, and it is recommended to mainly use NFB (no fuse breakers) in the future for safety and convenient operation.

The other power wiring would be capable to accommodating the current production machinery, but these wiring should be replaced at the time of renovation.

b) Lighting Facilities

Table 4-14 shows the record of luminous intensity. The present lighting facilities consist of fluorescent lamps of 40W X 2 lamps with globes which are directly fixed to the bottom side of the ceiling.

The space between fluorescent lamps and the number of lamps are almost equal for all processes. Lighting intensity at the pre-spinning process is slightly inadequate; at the spinning process poor; and at the winding process not sufficient. The number of lamps provided in the floor area, namely, the number of watts per unit area, is 15.3 to 15.5 w/m^2, which is higher than the standards of general spinning mills where the watts per unit area is 10 to 12 w/m^2. However, the lighting fixtures are provided with globes which lowers lighting intensity and causes poor lighting efficiency as mentioned above.

Table 4-14 Record of Luminous Intensity : Cipadung Mill

Name of Process		Place Measured	Number of Point Measured	Luminous Intensity Lux			Room Space m²	Installed No. of Lights FL40W x 2/set	Recommendable Luminous Intensity
				Ave.	Max	Min			LUX
BLOW ROOM		Scutcher	2	39	43	35	1,770	207 sets (20.7KW)	100
		Hopper	7	90.1	95	80			
C E		Front H = 0.75m	3	37	38	35	1,500	161 sets (16.1KW)	100
		Back H = 0.6m	3	35	35	35			
D F		Front H = 1.4m	3	55	60	50	720	92 sets (9.2KW)	100
		Creel H = 1.1m	2	78	85	72			
R O V		Canse Top H = 1.4m	5	74.8	87	70	1,050	115 sets (11.5KW)	120
		Front H = 1.4m	5	48.4	100	47			
		〃 H = 1.1m	5	51.6	70	42			
R F	m/c	Roving Top H = 1.7m	1 3	87.3	100	65	3,420	529 sets (52.9KW)	150
		Around Snail Wire H = 1.0m	1 3	46.4	55	35			
	m/c	Roving Top H = 1.7m	1 2	66.7	85	45			
		Around Snail Wire H = 1.0m	1 3	36.5	50	25			
W D		Mach Coner H = 1.3m	1 0	91.0	10.5	80	2,400	368 sets (36.8KW)	120
		Cone Winder H = 1.5m	1 4	107.1	14.5	85			
		H = 1.0m	1 5	68.7	100	45			

4-3-3 Water Supply and Fire Fighting Equipment

(1) Water Supply

a) Water Intake

Service water for the Cipadung Mill is supplied from two deep wells located within the mill compound (refer to Figure 4-5). The two wells are capable of supplying sufficient volume of water for the Mill.

b) Raw Water Treatment

Raw water pumped up from the deep wells is coagulated, sedimentated and filtered in the water treatment plant and then used as air conditioning water and chilled water (refer to Figure 4-6).

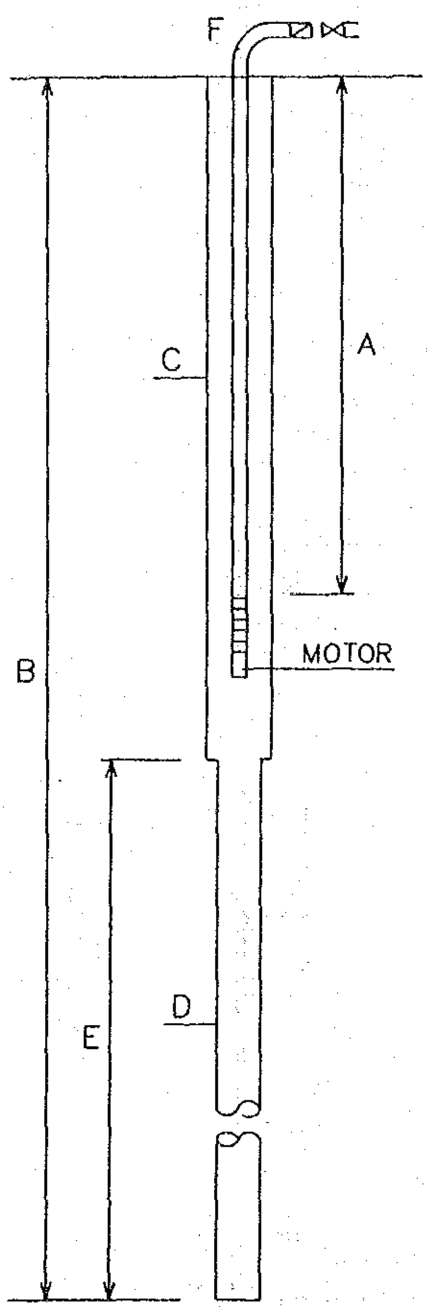
There is no problem regarding the volume of water or the quality of the treated water (refer to Table 4-16). The daily consumption of water according to recent record was 372m³ per day.

Table 4-15 Quality and Standard of Treated Water

ITEM	Standard Value		Cipadung
	Chiller	Condenser	
pH (25℃)	6.0 - 8.0	6.5 - 8.0	7.4
Electric conductivity(25℃)($\mu \Omega^{-1}$/cm)	< 200	< 800	–
Chlorine ion Cl^-(ppm)	< 50	< 200	12.0
Sulfuric acid ion So_4^{2-} (ppm)	< 50	< 200	13.0
Total ion Fe (ppm)	< 0.3	< 1.0	Nil
M Alkali Degree $CaCO_3$(ppm)	< 50	< 100	–
Total Hardnesss $CaCO_3$(ppm)	< 50	< 200	9.95
Suulfur ion S^{2-} (ppm)	Not to be detected		Nil
Ammonium ion NH_4^+ (ppm)	< 0.2	< 1.0	Nil
Silica SiO_2 (ppm)	< 30	< 50	45

(2) Fire Fighting Facilities

The mill is equipped with sprinkler system and hydrants located inside and outside the building as fire fighting facilities. The sprinkler system is a wet type with constant pressure being applied from an elevated water tank. In case of fire, the jetting function of the sprinkler heads will automatically start the pump. For the hydrant, the pump must be started manually, and water pressure to be increased through valve handling.



	WEST	SOUTH
CAPA CITY	18 m³/m	24 m³/m
A	36 m	42 m
B	100 "	150 "
C	8 " D	8 " D
D	4 " D	4 " D
E	60 m	60 m
F	2½ "	2½ "
MOTOR OUTPUT	3.7 kw	5.5 kw
AMP'	15 /8.8	/12.5
VOLT	220/380	220/380
TYPE	6E 33/2	1214 C/5.5/2
PUMP STEP	4 Step	6 Step
MAKER	KSB	RITZ
M.F DATE	1985	1987

Figure 4-5 Details of Well Pumps

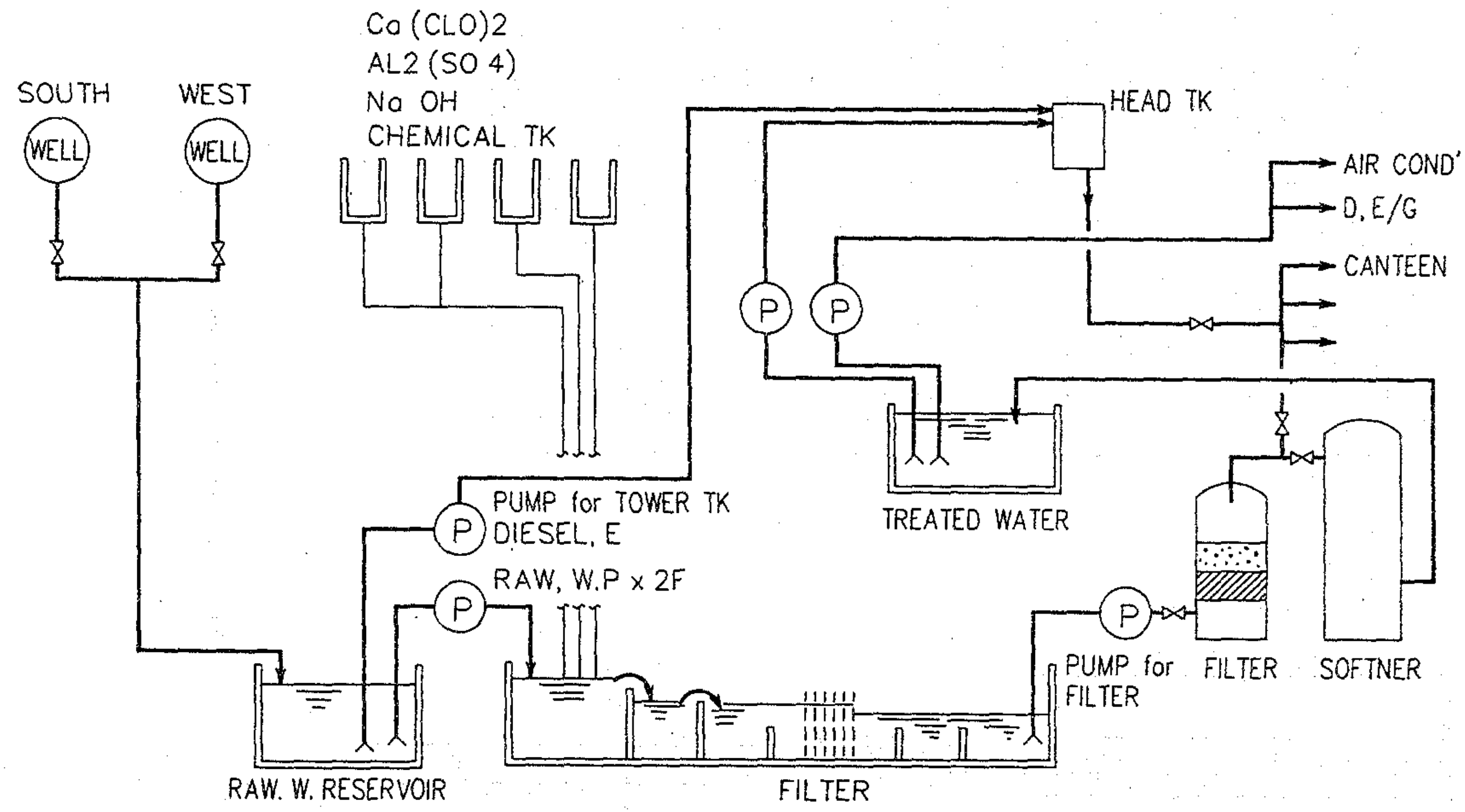


Figure 4-6 Water Treatment System

4-3-4 Utility Equipment

(1) Summary

As part of mechanical equipment, there are the chilled water generating equipment and the air conditioning equipment. The chilled water generating equipment consists of an open type centrifugal turbo refrigerators and two sets of auxiliary machines for supplying chilled water to the air conditioning equipment. The air conditioning equipment consists of five sets of horizontal type air conditioners (including three supply fans) which supply air to each production process. The present temperature and humidity conditions at each process are shown in Table 4-16.

Table 4-16 Temperature and Humidity Conditions at Each Process

Air conditioner	Process	Room Condition	
		Temperature	RH
A	Spinning (East side)	32° C	54%
B	Finishing	30	63
C	Spinning (West side)	32	53
D	Finishing	30	62
E	Carding	33	52
	Drawing	33	52
	Roving	32.5	52

Air flow of return air is routed through underground ducts back to the respective air conditioners where the air enters the air washer chamber after passing through a simple structured dust collector net.

The dust collecting unit is equipped with a steel net of approximately 30 mesh, but the caught dust must be manually removed.

The return air passes through suction grille provided on the floor, but as the suction grille becomes plugged, the air volume decreases, causing the air inside the Mill to become unbalanced. At the time the survey was performed, the rate of operation was approximately 70%, but when the operation returns to 100%, the room temperature will considerably increase.

(2) Refrigerator

Currently the chilled water generating equipment (Refrigerator) operates under normal conditions.

The refrigerators are old type turbo, so-called open type, and the motors, gear boxes, etc. are not integrated with the turbo compressors. This type of refrigerators is not so popular now.

Although obtaining replacement parts of the refrigerators is difficult, continuing the present operation seems to be fine.

However, replacement of refrigerators with the latest model turbo refrigerators must be considered in the near future for improving efficiency and for procuring replacement parts easily.

The deterioration of cooling tower is at an advanced stage and corrosion is noticeable on the metal parts. Repairs on such parts must be performed when an opportunity is available.

(3) Air Conditioning Equipment

The air flow of air conditioning system for the Cipadung Mill is shown in Figure 4-7. Figure 4-8 and Figure 4-9 represent layout of supply air ducts and return air ducts respectively.

a) Air Conditioners and Fans

The air washer chamber is made of concrete and there is no noticeable damage to any of the chamber and the air washers that could cause functional problems. Thus these air washers can still be used in the future.

The spray stands and the eliminators are quite worn down, and clogging of the eliminators in particular is impeding the air flow. The eliminators and spray stands must be periodically cleaned to maintain cooling efficiency and to prevent droppage of air flow volume.

The supply fans are of limit load type, and regardless of the years elapsed after installation, there seems to be no such problem as corrosion with the supply fans.

b) Supply Duct

The distribution of air duct and air conditioner is shown in Figures 4-8.

The ceiling of the building is flat with asbestors cement boards finishing, and insulation work with rock wool was done.

The main supply ducts for the pre-spinning process is hung from the ceiling frame. The main ducts for A, B, C, and D air conditioners are installed above the ceiling of the air conditioning room.

Each branch duct is hung from the steel truss and firmly fixed. There is only limited corrosion and damage to the ducts, and further use of the ducts presents no problem. However, there are damages in places in the dew-proof and heat insulation materials which should be repaired.

c) Return Air

The distribution of return air duct is shown in Figure 4-9.

The return air to each air conditioner and the exhaust of suction air of Spinning Frames are routed back through the underground ducts. The steel net at the suction grille, mentioned previously, is very effective to prevent waste and flies from invading into the underground ducts, and in the event of fire breaking out around the machinery, this net is also effective as a fire deterrent. However, clogging of the steel net at the suction grille will reduce the volume of air passage as much as 40%. In this case, it would result in increase of internal air pressure. This is the reason to have substantial volume of air flowing out from the inside of the room to the outside at the exits or openings of the building. When the outside enthalpy is higher than the inside during the daytime, this is a considerable loss of energy.

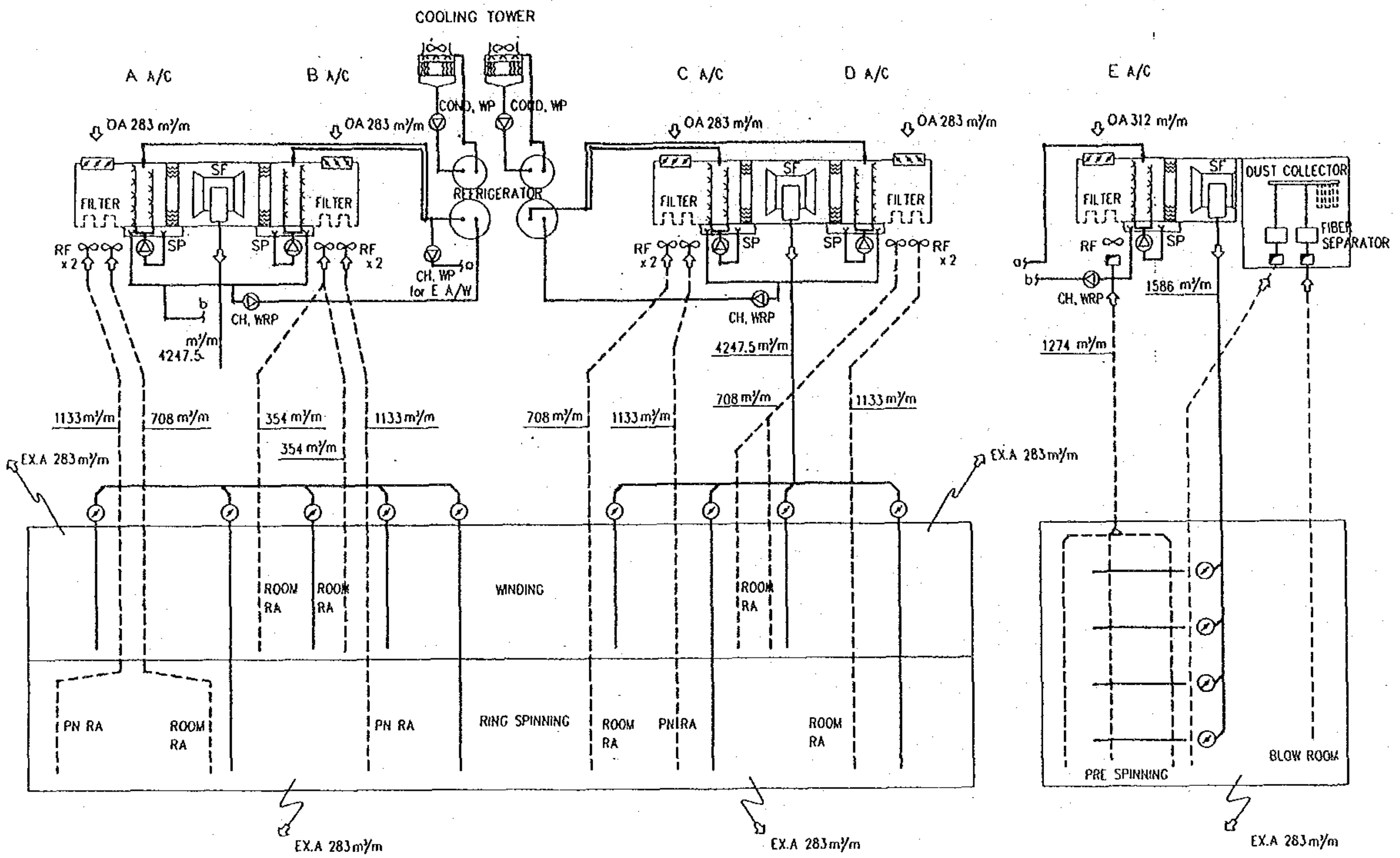
As a result of above, it will be necessary to remove the steel net on the suction grille in order to insure steady air flow. When removing the steel net on the suction grille, it will be absolutely necessary to make sure that all foreign matters other than naturally generated flies are prevented from being drawn into the suction grille.

d) Dust Collecting Equipment

Waste of fiber from the blow room process and the carding process are routed through a special underground ducts to the filter room. Presently, the filter is functioning properly. Waste of fiber contained in the return air and pneumatic suction air of the Spinning Frames is collected by the approximately 30 mesh steel screen filter fixed at the air conditioner. There is no feasible means at present to remove the waste adhering to the filter other than doing it manually. Automatic filters are of course preferable, but adopting automatic filters is difficult, due to limited space.

(4) Piping Equipment

The piping system in the Mill includes piping for water supply and water return connecting between the water chilling equipment and each air conditioner as well as for general water purposes. Problems do not exist currently regarding to the volume of requived water and the condition of use in the piping system.



A/C	Air Conditioning
SF	Supply Fan
RF	Return Air Fan
SP	Spray Pump
CH. W RP	Chilled Water Return Pump
OA	Out Door Air
EX A	Exhaust Air
PNRA	Pneumo Return Air
DC	Dust Collector
CT	Cooling Tower
CH. WP	Chilled Water Pump
CH. WFP	Chilled Water Feed Pump

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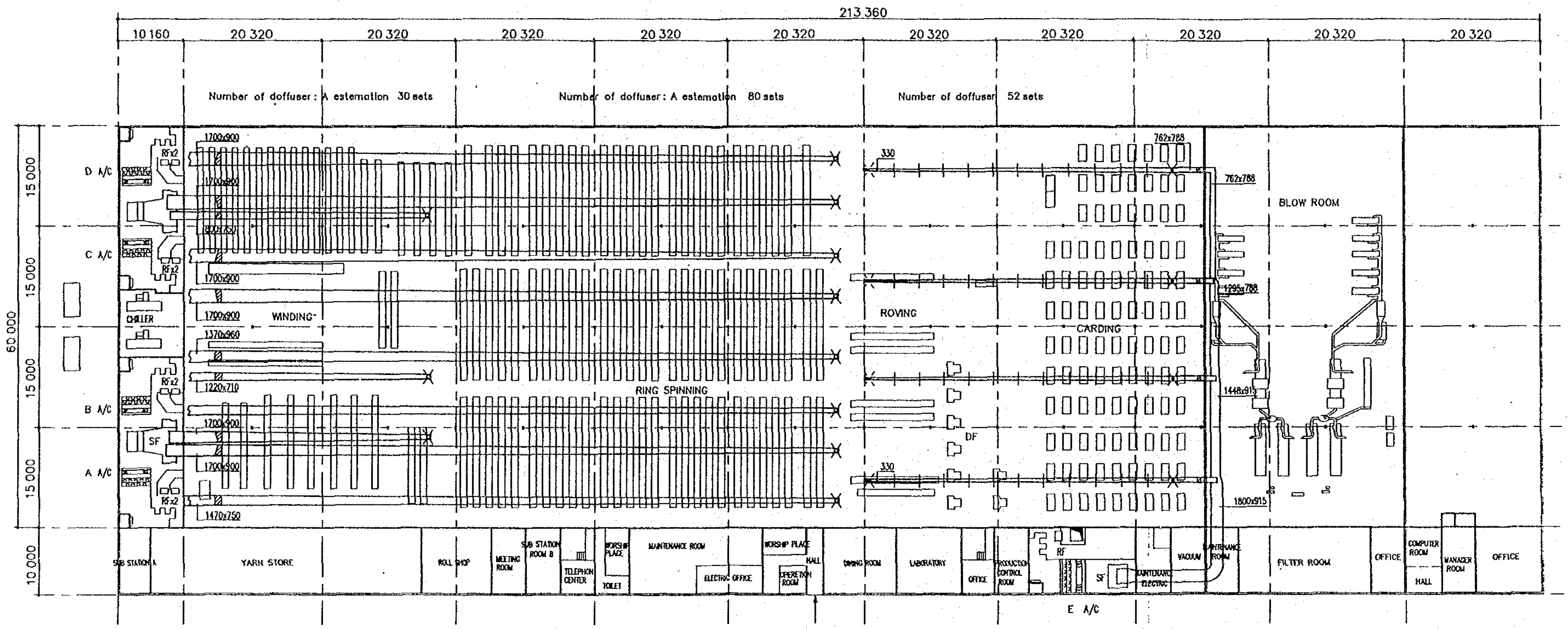
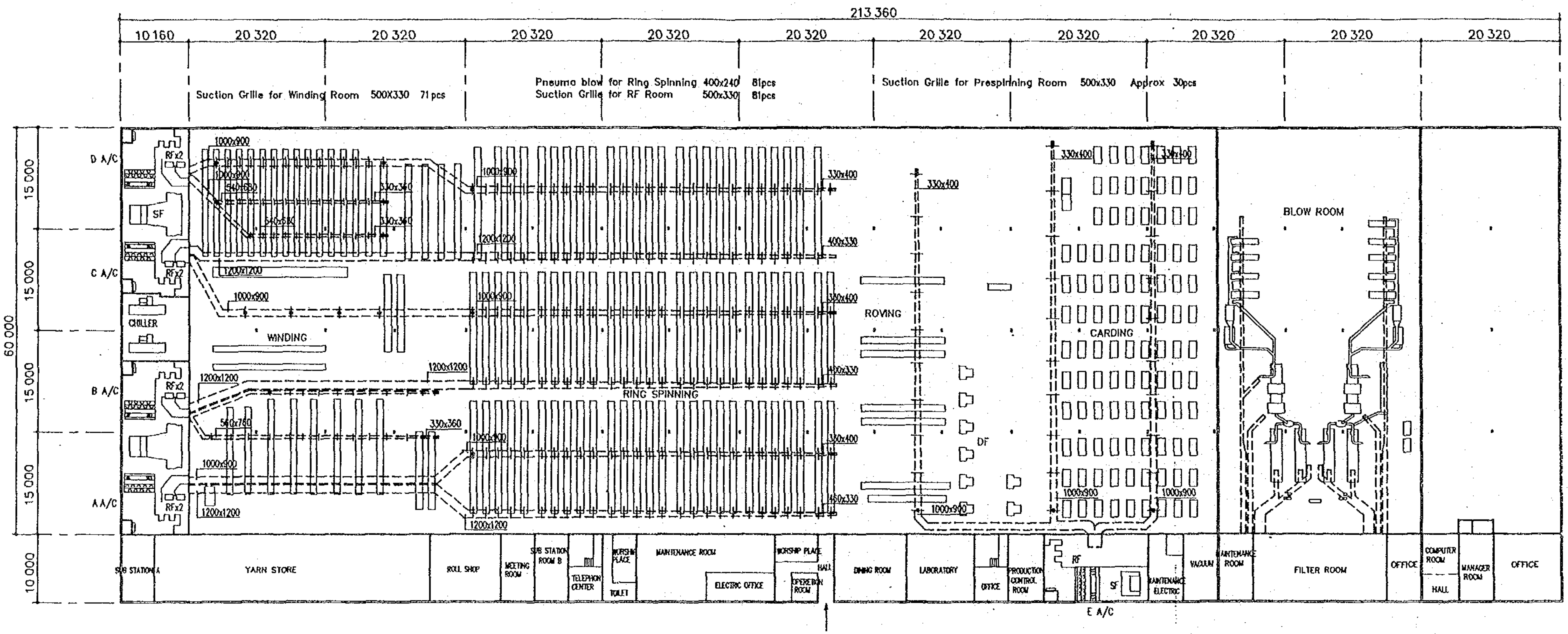
REVISIONS

Figure 4-7 Schematic Drawing for Air-Conditioning System of the Cipadung Mill



Notic Ring Spinning & Winding Room Ducting and Diffuser Location is a estemation

Figure 4-8 Supply Air Ducting



Notice 1 : Prespinning Room Return Air duct size is a estomation

2 : Number of Prespinning Room Return Air Suction Grille is a estamation

Figure 4-9 Return Air Ducting

4-4 Site and Building

4-4-1 Site

The Cipadung Mill is located 13 km east of the city of Bandung and occupies a part between the Sukarno-Hata highway on the south side and Ujunbrun Street on the north side. The east area adjacent to the site is a residential district, and the west area is occupied by a textile plant and farm lands.

The site covers an area of 260,153m² which is about the same area as Bandung Mill. For a spinning mill with 30,000 spindles, this site occupies very spacious area. The west half side of the compound is still vacant and currently utilized as a soccer ground and a banana plantation. A part of the plot facing the Sukarno-Hata highway has been opened to the general public as a fishing pond, a swimming pool, and badminton courts, thus these areas are effectively used.

4-4-2 Building Area

The Cipadung Mill has a total building area of 25,355m² consisting of the following buildings:

- Production mill	12,000	m²	(47%)
- Warehouses	4,600	"	(18%)
- Office and company housing	5,080	"	(20%)
- Electrical and power facilities	3,675	"	(15%)
Total	25,355	"	(100%)

The ratio of the building area to the site area (percentage of building coverage) is 9.7%, which is considered very low. The plants, company housing, warehouses, and other buildings in the premise are spaciously laid out and significant area is unoccupied.

4-4-3 Deterioration and Maintenance of Buildings and Structures

Approximately 30 years have elapsed since the construction of the Cipadung Mill, and deterioration and corrosion of the buildings and structures are apparent in many places. The site is located on a weak stratum, and the initial plans for the construction of the foundation was inadequate. This lead to the foundation and the floor sinking, and this has become a major obstacle for smooth production. Considerable investment is being made by Sandang I to improve the foundation by employing a special patented foundation to strengthen the area between the drawing process and the winding process (this area was filled up during the initial construction stage) from 1986. At present 80% of the work has been completed.

The outer walls of the mill building, particularly the walls of the west side and the north side, are damaged to a considerable extent, and improving and repairing the walls during the forthcoming renovation together with the partition walls and fittings in the mill whuch are also deteriorated are necessary. However, due to the high quality aluminum corrugated roofing sheets and correctly tightened bolts, the condition of the roofs is so sound even though 25 years have elapsed since construction. The roofs are undoubtedly usable. The steel plates used for the valley gutters are sufficiently thick. Therefore, valley gutters will not require any reconstruction or replacement, but periodic rust-proof painting, inspecting and cleaning are essential to extend their life and to prevent rain water leakage.

There is a substantial shortage in the number of toilets in view of the number of employees, and installing a new toilet in the west side air-conditioning room when it's remodelling is performed, on top of the reconstruction for existing toilets, is proposed. The outline of structures and finish schedule of the buildings of the Cipadung Mill is shown in Table 4-17.

Table 4-17 Building Structures and Finish Schedule of the Cipadung Mill

Types of building	Roofs	Walls	Ceilings	Floors
Production Mill (Steel construction)	Corrugulated Aluminum sheets	Brick with mortar coating	Steel frame with Asbestos Cement Ceiling with rock wool insulation	Terrazzo floor, and tile covering with one part mortar floor
Auxiliary Buildings - warehouses (Steel construction)	Corrugulated Aluminum sheets - slate	Ditto	Nil	Mortar
Company housings - (brick or RC construction)	Tile roofing	Ditto	Asbestos Cement boards	Terrazzo

Maintenance of the buildings and structures are not directly related to production, and frequently looked upon with less importance, but degradation of the working environment by rain water leaks, corrosion, and dirtiness of building elements would have adverse effects upon production and the shortening life of the buildings and structures. Thus repair and maintenance on the buildings and structures must be given the utmost attention.

4-5 Personnel and Training

4-5-1 Personnel

(1) Summary

Although an ideal employment arrangement would be to be able to increase or decrease the number of employees to match the production volume, it is frequently inevitable to keep excess number of personnel who have been employed during the time business was prosperous. When establishing employment plans, what must be considered is the outlook of the market situation in order to avoid having an excess of employees. From the transition of the production volume and average yarn count from 1986 to 1990 as shown in Table 4-18, there was a considerable number of excess personnel in 1990. With a rough calculation of the number of workers per bale of the production department using the control index adopted in Japan, the present number of 12 workers per bale is excessive even taking into consideration the obsolete production machinery. (The appropriate number of workers is considered to be 7 workers per bale with the present facilities).

The ratio of the number of workers for auxiliary and administration departments to that for production is 24.9% which is high in comparison to the Banjaran Mill. The number of personnel involved in labor and welfare fields is noticeably high. Labor control is implemented through determining the work load variations among workers and targeted level of wark load. As a result, products can be cost competitive, and the mill can be export-oriented.

Table 4-18 Transition of Production Volume and Average Yarn Count

Unit: Bales

	Production volume boles	Average yarn count	OE production ratio
1986	10,547 bale	Ne 34.7	23.6 %
1987	12,864	33.7	23.5
1988	12,670	35.9	21.9
1989	14,738	31.2	26.4
1990	12,875	31.3	25.2

(2) Organization

Figure 4-10 and Table 4-19 show the organization structure and personnel distribution respectively. Matters to be noted concerning the organization are as below.

a) The Scope of responsibilities between planning/administration department and the production department (the line) is not clearly defined. Production is mutually influenced by machinery, personnel, education and training, etc. Therefore, the line should have total responsibility and perform accordingly.

b) The mill manager presently exercises overall control over six department managers. However, in order for instructions and orders to be thoroughly communicated, it is desirable to reduce to three, i. e. the production, engineering, and administration, or to have engineering included in the production department and then have only the production department and the administration department. By having such an organization, the number of coordination among department managers will decrease, and in effect, this will contribute to strengthening and collaborating the relationship between production and sales, resulting in smooth operation of the mill.

c) When the organization is divided into many smaller sectors, the instructing and ordering system will become more diversified that the cases, where the true intent of the person issuing the instruction will not be passed down and thoroughly be understood, will increase.

d) Such education and training as one worker would be capable of performing two or three different types of work should be carried out. When the workers become capable of performing several different types of work, this will enable mutual assistance among sectors as well as provide help to sections. Labor distribution would then be evened out.

e) While the organization itself is as determined by the Sandang Ⅰ, as regards the polyester/rayon blended yarn, the numbers of the staffs for sales within the administration department are quite a lot, perhaps owing to many small orders received for the yarn.

Likewise, the proportion of employees belonging to the production department is 24.9%, which is 6% more than that of the Banjaran Mill. The appropriateness of personnel assingment depends on the actual conditions at each mill, and therefore it is not necessarily a good idea to reduce the size of the staff to the specified optimal numder.

Nevertheless, the situation described above does appear to deserve some consideration for improvement.

(3) Personnel

Comments regarding current personnel allocation are noted below.

a) It is desirable to have the number of maintenance personnel to be at least 10% of the production workers. In the case where the machinery are obsolete and deteriorated, the number of maintenance personnel should be kept even more.

b) In Table 4-20 showing the worker allocation, the percentage of the ring spinning operators is 37.9% but would be better at about 32%. Consequently, maintenance for the roller parts is now becoming insufficient. Namely, end breakage is frequently observed due to eccentric position of the bottom apron. As a measure to cope with this situation, the number of machines per operator has been decreased, to maintain actual equivalent productivity.

However, what should be done is to perform a special maintenance on the roller parts so that condition of machines are normalized.

c) Also from Figure 4-12, 33.8% of the workers have more than 20 years of employment period. The existence of a significant gap between such workers and the younger group may become a major problem in the future. It is really important to balance the age structure of personnel.

d) As apparent from Figure 4-12 showing distribution of workers by processes and number of years of employment, more than 50% of the maintenance workers keep on working for less than five years which are resulting in poor maintenance conditions of machinery. Elevating the standards of maintenance is essential but a special maintenance should be performed on the Spinning Frames with priority, to recover performance of the Frames.

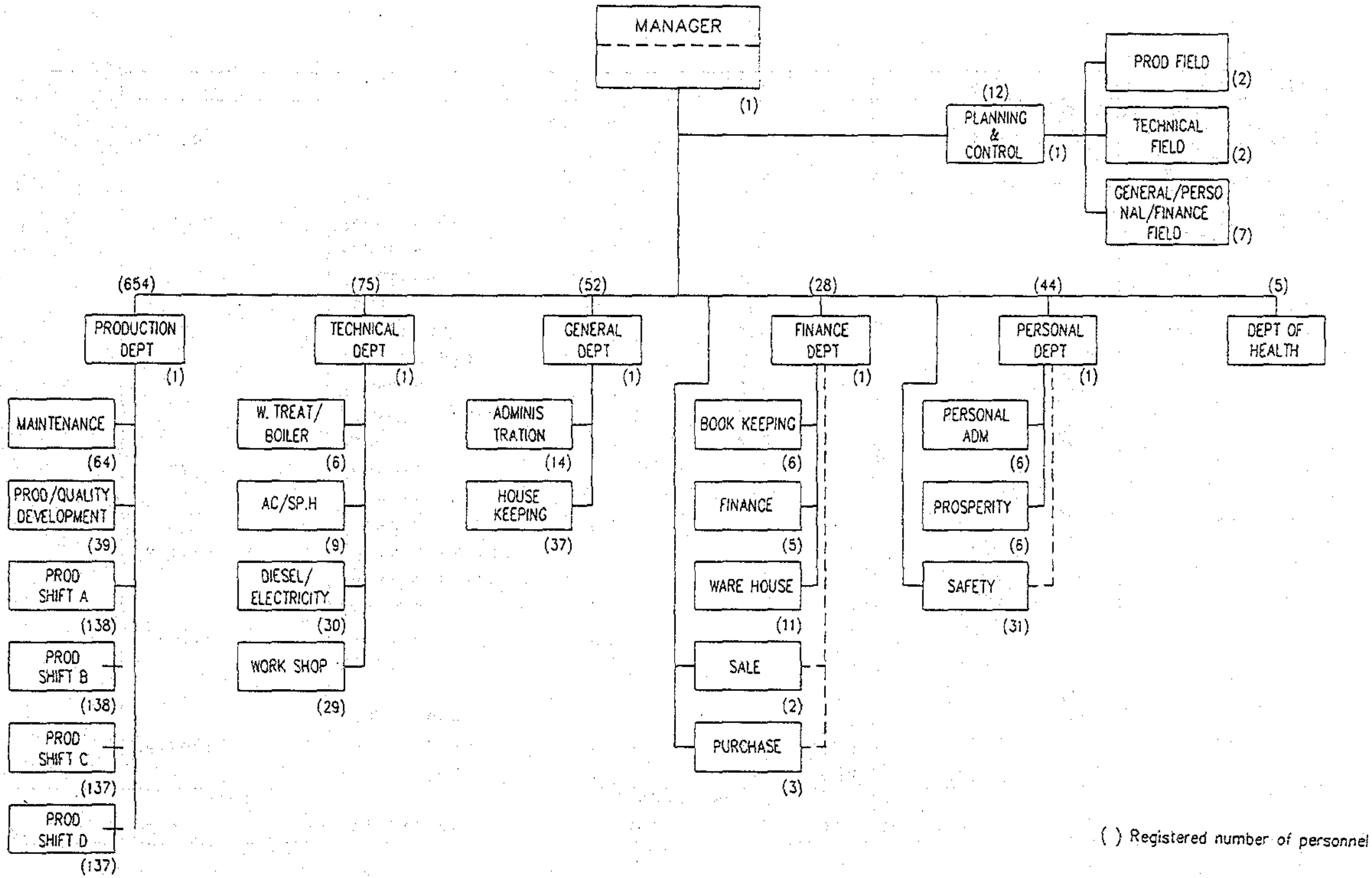


Figure 4-10 Organization of the Cipadung Mill

Table 4-19 Organization and Personnel Allocation of the Cipadung Mill

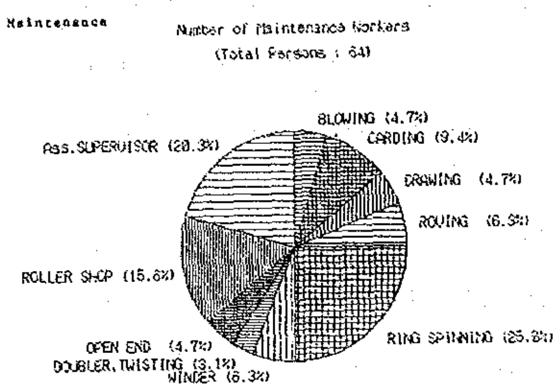
Mill Manager	Dept chief		Supervisor		Ass. Supervisor	Foreman	Operator	%	Total	%
1			Production	3	12	28	507	86.1		
	Production	1	Maintenance	1	4	8	51	8.6	654	75.1
			Laboratory	1	4	3	31	5.3		
							(589)	(100)		
			Electric	1	3	9	17			
	Utility	1	Utility	1	1	5	8		75	8.6
			Workshop	1	2	6	18			
			Administration			1	1			
	General	1	Administration	1	3	1	9			
			House Keeping	1	2	1	33		52	6.0
			Production	1	1					
	Planning	1	Technical	1	1				12	1.4
			General	1	2					
			Administration		1		3			
			Finance	1	2		2			
			Book Keeping	1	2		3			
	Financial	1	Ware house	1	2	2	6		28	3.2
			Sale	1			1			
			Purdiase	1	1		1			
			Personal	1	2		3			
	Personal	1	Prosperity	1	1		4		44	5.1
			Safety	1	2	4	24			
	Health	1			1		3		5	0.6
									(Mill Manager) 1	
1		7		21	49	68	725		871	100

Table 4-20 Personnel Allocation in Production Department

CIPADUNG

Process	Ass.Supervisor Forewan	Operator		Maintenance	Total
Blowing	5	27		3	35
Carding	6	30		6	42
Drawing	5	20	27.2%	3	28
Simplex	10	48		4	62
Ring Spinning	10	171	37.9%	16	197
Double Winder		11		1	12
Cone Winder	9	112	34.4%	4	125
Twister		32		1	33
Open end	5	56		3	64
Roller Shop	2			10	12
Total	52	507	100%	51	610
	8.5%	83.1%		8.4%	

(1) Maintenance Dep.



(2) Production Dep.

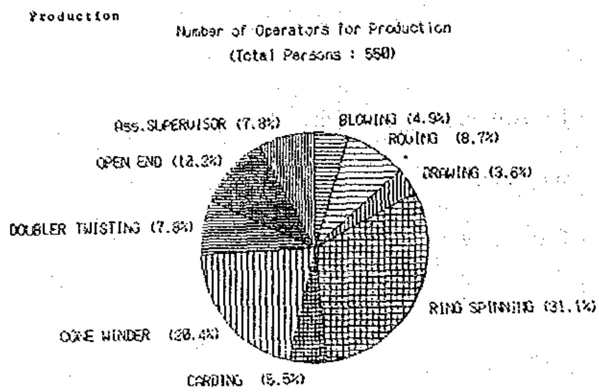
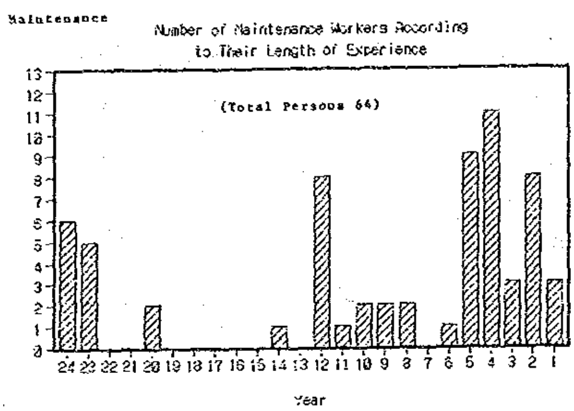


Figure 4-11 Number of Personnel by Process

(1) Maintenance Dep.



(2) Production Dep.

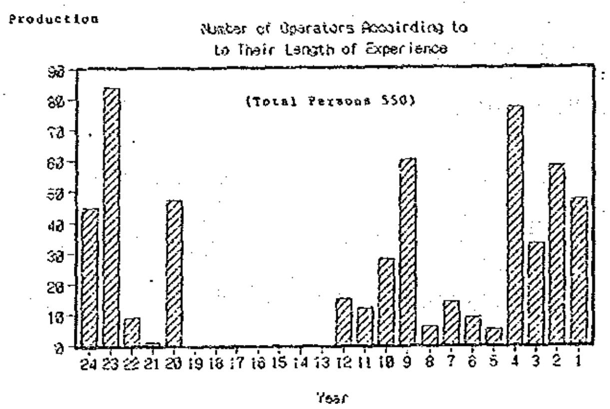


Figure 4-12 Number of Personnel by Years of Service

4-5-2 Education and Training

Refer to 3-5-2 of Chapter 3.

4-6 Manufacturing Cost and Sales

4-6-1 Cost

Table 4-21 shows the actual manufacturing cost of the Cipadung Mill in 1990.

Table 4-21 Actual Manufacturing Cost in 1990

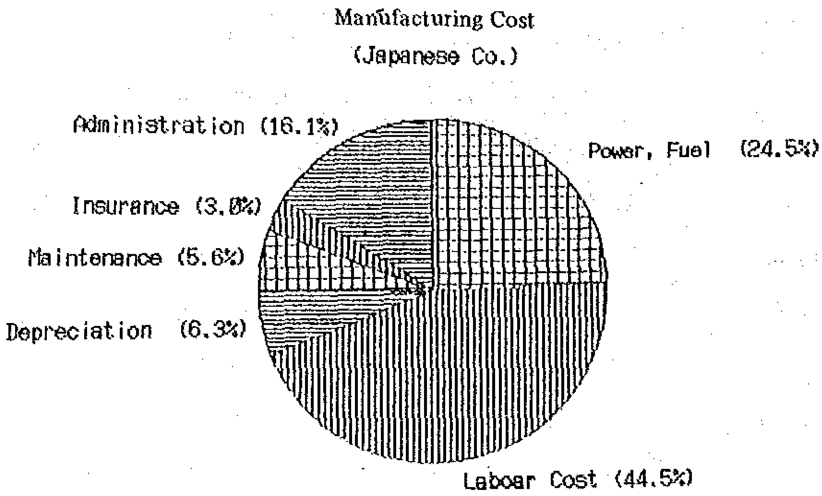
Unit : Th Rp

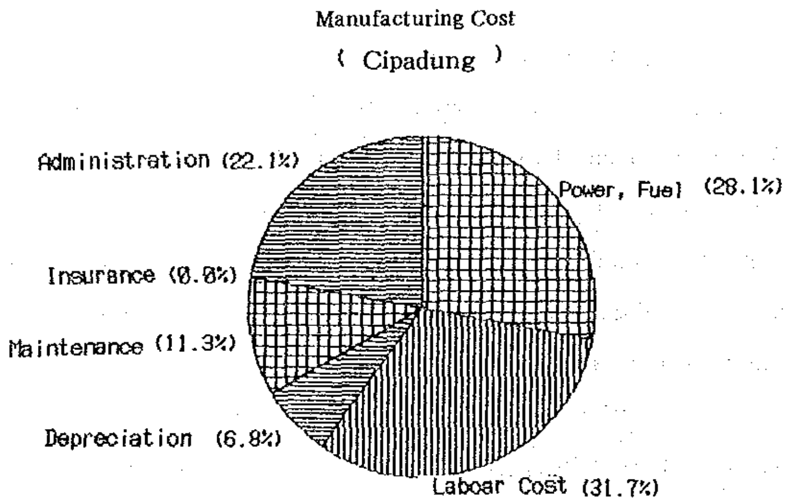
Item	Banjaran-1	%	%	Cipadung	%	%
Raw material	7,525,741	67.4		9,501,056	71.1	
Power, Fuel	715,644		19.6	1,086,547		28.1
Laboar Cost	1,933,424		53.0	1,227,198		31.7
Depreciation	165,357		4.5	261,287		6.8
Maintenance	499,747		13.7	436,895		11.3
Insurance	4,346		0.1	1,456		
Administration	327,610		9.1	853,120		22.1
Total	3,646,128	33.6		3,866,503	28.9	
Manufacturing Cost	11,171,869			13,367,559		

Points which demand considerations regarding the Cipadung Mill:

1) The administration cost is rather high compared with that of the Banjaran Mill, and this is due to inappropriate the scale for the production machinery. If the same quantity of office work as that of the Banjaran Mill is dealt with, there must be reserved power, thus, staff members should be trained so as to be able to deal with two or more kinds of office work. In addition, persons should not be assigned according to types of work. When workers in a certain section are too busy to finish their jobs, the jobs should be shifted to other section in order to make the amount of work equal. Only when the number of persons is insufficient in spite of such a shift, the increase of persons should be discussed.
2) Considerations are required on the fact that the maintenance cost is lower although the level of machinery and functions is poor than that of the Banjaran First Mill. The maintenance cost should be needed double of that in 1990 in consideration of the basic maintenance cost and the cost for recovering functions.
3) According to details of the manutacturing cost in Figure 4-13, the distribution by items differs between a Japanese major company and the Cipadung Mill on account of the difference of the factory scale and state of automated equipments. Furthermore, since categories into which items are classified differ, the actual condition should be understood in addition to the comparison of the percentage.

Figure 4-13 Comparison of Processing Cost





The administration cost of Japan (16%) includes the labor cost, the depreciation cost, maintenance cost, and insurance fee of the administration and auxiliary departmets. In other words, the administrotion cost of the Cipadung, which does not include these expenses for auxiliary department and which accounts for 22.6% should be further reduced.

4-6-2 Sales and Profits

Figure 4-14 shows the transition of production, sales and profits of the Cipadung Mill.

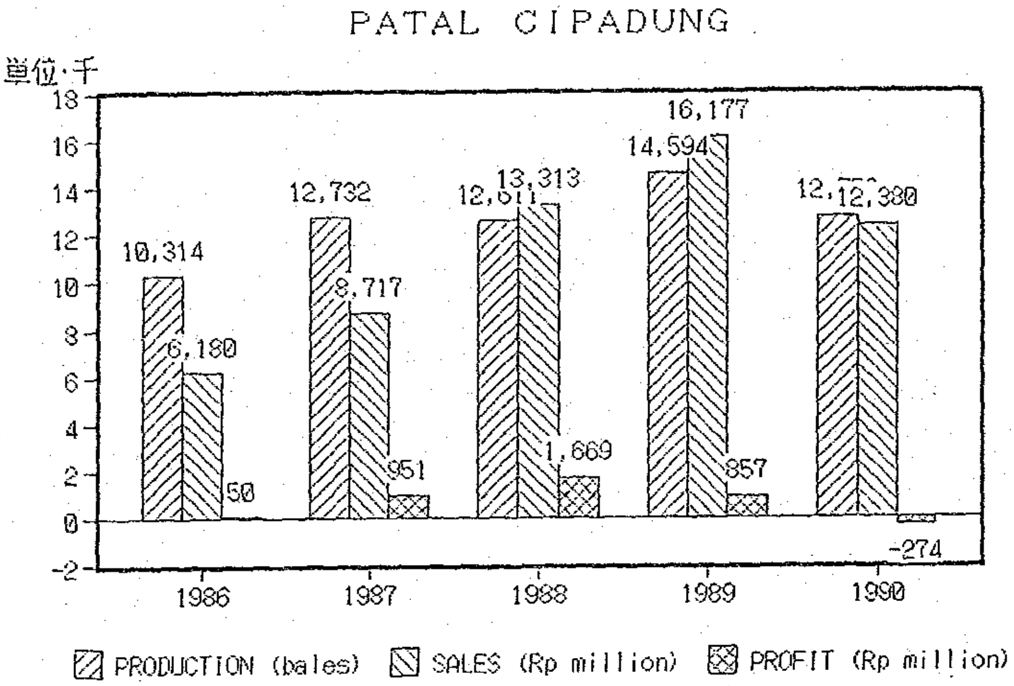


Figure 4-14 Transition of Production, Sales and Profit

The Cipadung Mill, of which equipment are very old and sales is decreasing, is being operated in the red. Urgent measures are required. This is because there are too many workers in the Mill and the management section for its production volume, as previously indicated.

CHPATER 5 THE MARKET

Tables and Figures

CHAPTER 5 THE MARKET

5-1 Projected Demands For Textiles

Indonesia's overall exports in 1990 marked an increase of 15.9% over the previous year, at a total of $25,675 million:$11,071 million (43%) for gas and petroleum, and $14,604 million (57%) for non-oil natural gas. While there was a significant rise in the total amount of exported gas and petroleum owing to the Gulf Crisis and the resultant surge in the oil price, the overall growth of exports of non-oil products slowed down because of the poor showing in primary products and processed goods. Of the industrial products which account for 80% of non-oil natural gas exports, textiles again made a good showing in 1990, recording an increase of 43.6% over the previous year at $2,917 million, and moving up to the first place, past the exports of plywood. The textiles continue to be in good demand both domestically and abroad, due to such reasons as the devaluation of rupiah in 1986, introduction of the drawback system, series of policies for export promotion and deregulation, and the weakening of competitiveness of NIES, particularly that of South Korea and Taiwan, because of the revaluation of their currencies and increase in labor cost, both of which had caused higher costs of their products and the resultant decrease in their demands. As the demands for the NIES products fell, Indonesia started to receive a growing number of inquiries from abroad. Likewise, coupled with the increase in foreign investments in the textile industry, many of the textile manufacturing plants were newly constructed or expanded, permitting wider product lines and higher productivity and quality, and enhancing exports as a result. The growing Indonesian textile industry was not seriously affected by the breakout of the Gulf War or by the slowdown of the US economy. For example, 6 million yards of polyester filament every month exported to the Middle East, was redistributed to Europe (3 million yards) and Hong Kong (1.5 million yards), and the rest to the domestic market, after the break out of the War.

The present project is for spun yarns, and the major product contributing to the above-mentioned boom of the textile industry are the filament fabrics. Because the boom of installation of spinning frames had not been matched by those of weaving and knitting machines, there happend to be temporary oversupply of yarns, and this caused the stagnation of the yarn market prices which started in the second half of 1990. The prices have begun to pick up, however, since around the second quarter of 1991. The yarns and fabrics exported during the period between January and November of 1990 amounted to $708 million, showing an increase of 52% over the previous year.

As the polyester filament fabrics are also included in this figure, the exact amount of exports of yarns alone is unknown. Nevertheless, the business has been favorable for some of manufacturers exclusively producing yarns and some of the manufacturers have successfully entered into contract with Germany for combed yarn. In fact the export is an effective measure to decrease an overstock of yarns, and that is why many manufacturers are eager to enhance exportation of their yarns.

The domestic demand for yarns, is expected to continue steady in the coming years and its growth largely depends on the amount of domestic textile consumption. Presented in the following section is an analysis of the relationship between the changes of textile consumption and domestic demand within Indonesia.

5-1-1 Domestic Consumption

Because the domestic consumption is still very limited in Indonesia like in other developing countries, the market for the Indonesian textiles has been mainly expanded abroad in accordance with the above-mentioned export promotion policy adopted by the government. The recent characteristics of Indonesian textile sales are its export orientation.

5-1-2 Domestic Market

According to the statistics of FAO (Food and Agriculture Organization), the worldwide consumption of textiles is as shown in Table 5-1. In 1986, for example, 3,540 thousand tons of textiles were consumed worldwide, which amounts to 7.3kg/yr per capita, increasing by 15.7% (at an annual rate of 2.5%) during 6 years between 1980 and 1986. Because of the increase in world population in the same period. per capita growth remained at 0.7% per year.

Table 5-1 World Textile Consumption

	1970	1975	1980	1985	1986
Consumption (1,000 ton)					
Cotton	11,862	13,032	14,284	15,627	16,960
Share (%)	(52.5)	(50.6)	(46.7)	(46.7)	(47.9)
Wool	1,666	1,551	1,770	1,904	1,926
Flax	753	745	709	758	777
Cellulosic fiber	3,456	3,033	3,332	3,016	2,978
Synthetic fiber	4,842	7,400	10,478	12,176	12,764
Share (%)	(21.4)	(28.7)	(34.3)	(36.4)	(36.1)
Total	22,579	25,761	30,593	33,481	35,405
Natural fiber	14,281	15,328	16,763	18,287	19,663
Share (%)	(63.2)	(59.5)	(54.8)	(54.6)	(55.5)
Man-made fiber	8,298	10,433	13,830	15,172	15,742
Population (1 million)	3,617	4,038	4,402	4,797	4,875
Consumption per Capita (kg)					
Cotton	3.3	3.2	3.2	3.3	3.5
Wool	0.5	0.4	0.4	0.4	0.4
Flax	0.2	0.2	0.2	0.2	0.2
Cellulosic fiber	1.0	0.8	0.8	0.6	0.6
Synthetic fiber	1.2	1.8	2.4	2.5	2.6
Total	6.2	6.4	7.0	7.0	7.3
Natural fiber	3.9	3.8	3.8	3.9	4.1
Man-made fiber	2.3	2.6	3.2	3.1	3.2

Source : Spinning Monthly Report, Apr. 1990

In 1989, the production of the major textiles(i.e. synthetic fiber, cotton, wool, and silk) totaled 3,832 thousand tons and when the estimated amount of ramie production of the same year is added to this figure, the total is approximately 3,900 thousand tons. Assuming that the amount produced is equal to the amount consumed world population is 5.2 billion, the consumption per capita in 1989 amounts to 7.5 kg/yr, indicating same increase rate as shown so far.

The textile consumption in Indonesia alone is as indicated below according to the same FAO statistics. Evidently, the figures are far below the world average.

Table 5-2 Textile Consumption Per Capita

	1984	1985	1986
Cotton	0.6	0.7	0.7
Cellulosic fiber	0.3	0.3	0.3
Synthetic fiber	0.9	0.9	1.0
Total	1.8	1.9	1.9

In 1986 for example, the annual per capita consumption of textiles in the industrialized countries was 10 to 25kg, while that of the developing countries was below 10kg. For the purpose of comparison, in the Asian NIES, such as, Hong Kong, South Korea, and Singapore, the amounts of per capita textile consumption for the same year were on the same level as those of the industrialized countries at 12.0kg, 14.3kg, and 29.1kg, respectively.

Table 5-3 Textlie Consumption by Countries

unit : kg

	1984	1985	1986
Indonesia	1.8	1.9	1.9
Malaysia	8.4	6.9	6.3
Singapore	18.3	21.6	29.1
Thailand	2.9	2.8	2.8
Philippines	1.3	1.4	1.6
India	2.2	2.3	2.4
Pakistan	2.4	2.1	1.8
Japan	17.8	17.8	17.7
U.S.A.	23.5	22.6	25.6

These figures indicate that there are great difference among the countries depending on the environmental condition, historical tradition, and the standard of living of each. Table 5-4 shows the present and expected changes in population distribution within Indonesia.

Table 5-4 Population Distribution in Indonesia

	Area (km2)	%	Population (mill.) 1988	1990	%	1993	Average Growth Rate
Java	132,187	7	105.8	109.4	61	114.1	1.5%
Others	1,787,256	93	69.8	69.9	39	78.8	2.4%
Total	1,919,443	100	175.6	179.3	100	192.9	1.9%

Source BPS & Repelita V

Despite the government's plan to decentralize the population, the results of the 1990 census continue to show a significant concentration on the island of Java. On this land whose area accounts for only 7% of the country's entire landscape, live 61% of its population. It is therefore natural that Java be the major domestic market and that most of the fiber industry be concentrated on this island. The total population of Indonesia is expected to grow at a rate of 1.9%/yr.

According to the projections made by the Ministry of Industry, textile consumption per capita in Indonesia is expected to increase to 1.98kg during the first year of the Fifth Five Year Plan, and to 2.22 kg by its final year, at an annual growth rate of 3%. According to a list formulated (Table 5-5) on the basis of import-export statistics and the amounts of production, however, it is estimated that calculated per capita consumption has already reached over 3 kg in 1989.

This implies that a structural change that is taking place within Indonesia, spurred by the recent economic development of the country. As the domestic consumption of textiles is expected to increase in the coming years, the annual rate of growth will be certainly greater than 3% projected by the government. In terms of total quantity of consumption, an annual growth of 5% can be anticipated by population growth and increase of consumption per capita.

Table 5-5 Textile Supply and Demand in Indonesia

unit 1,000ton

		1986	1987	1988	1989
Import	Fiber & Raw Mat.	232.1	281.9	247.8	351.5
	Yarns & Fabrics	68.8	65.0	74.7	141.3
	Garment	0.8	0.9	1.1	2.8
	sub total	301.7	347.8	323.5	495.7
Domestic Production	Cotton	8.0	4.2	2.5	2.5
	Polyester SF	78.0	80.9	99.6	100.0
	Polyester Fil.	70.4	82.2	104.4	120.0
	Nylon Fil.	11.8	12.0	12.0	14.0
	Rayon SF	46.1	51.4	59.0	59.0
	sub total	214.3	230.7	277.5	295.5
Supply Total		516.0	578.5	601.0	791.2
Export	Fiber & Raw Mat.	3.4	3.6	15.5	12.3
	Yarns & Fabrics	71.9	107.8	135.2	147.6
	Garment	56.5	53.6	64.0	88.9
	sub total	131.8	165.0	214.7	248.8
Domestic Consumption		384.2	413.5	386.3	542.4
Consumption Per capita(kg)		2.29	2.43	2.22	3.09
Population (mill)		168	170	174	175.6
Export Share in Supply %		25.5	28.5	35.7	31.4

5-1-3 Overseas Market

Foreign markets account for as much as approximately 30% of sales of the Indonesian textile industry. The growth in textile exports in recent years promoted by the government policy, is remarkable, recording an annual growth rate of over 40%. The composition of exported products remains unchanged with garments which have high value-added accounting for over 50%, and fabrics, approximately 30%. Lately, there has been little growth in the exports of yarns.

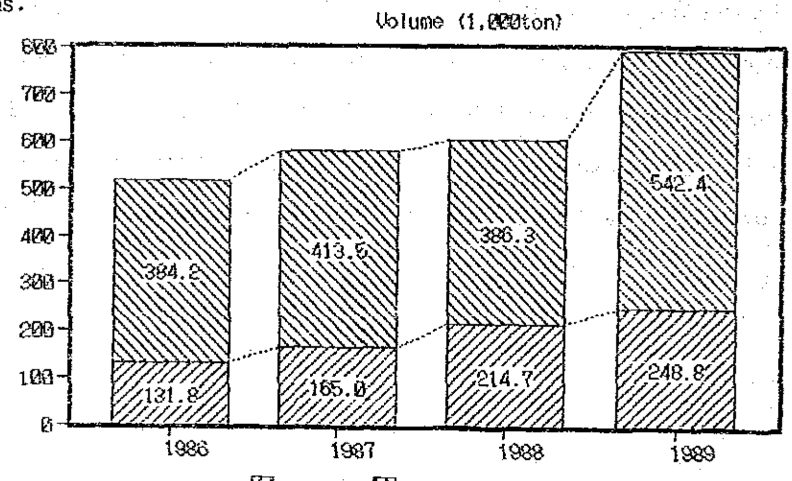


Figure 5-1 Textile Export and Domestic Demand

Source: P. T. Industri Sandang I

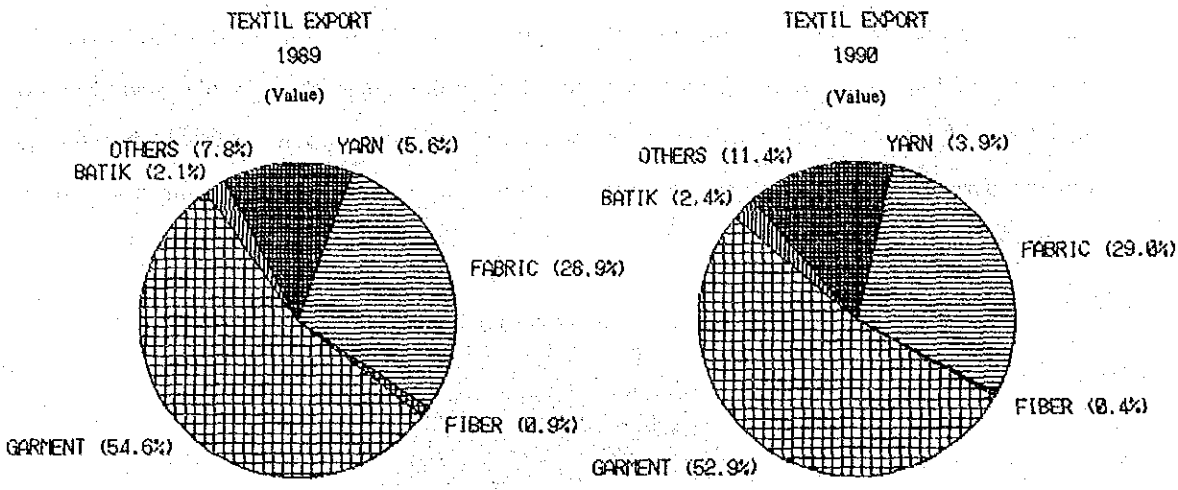


Figure 5-2 Composition of Textile Export

As shown in TABLE 5-6, among the overseas markets, the U.S. is by far the largest followed by EC. As for the secondary products, which occupies almost half of total export, its 51.4% was exported to the U.S. in 1988, and 48.7%, in 1989. Diversification of export destination will be necessary in the future under such circumstances, by increasing the amount exported to Japan, for instance. satisfying Japan's severe quality requirements.

Table 5-6 Value of Textile Exports by Destinations (1989)

Country of Destination	Value (000 US$)	Distribution (%)
USA	640,893.00	31.57
CANADA	50,215.00	2.47
LATIN AMERICA	11,602.00	0.57
EC	539,469.00	26.57
OTHER EUROPE	44,449.00	2.19
ASEAN	288,517.00	14.21
OTHER ASIA	214,677.00	10.57
AFRICA	8,958.00	0.44
MIDLE EAST	176,244.00	8.68
AUSTRALIA	48,920.00	2.41
OCEANIA	6,336.00	0.31
Total	2,030,280.00	100.00

Source: Biro Pusat Statistik

While the exportation of yarns which is the focus of the present project is small in terms of value, as mentioned above and shown in Fig. 5-2, when measured in terms of weight, the yarns accounted for approximately 16% in 1988, and 14% in 1989, of the total exports. Indicated in Fig. 5-3 are the percent weights of different types of yarns obtained through analyses performed according to the export statistics. As for the spun yarns which compose the majority of exports, cotton, polyester, cotton mix, rayon, and other yarns are more or less evenly distributed.

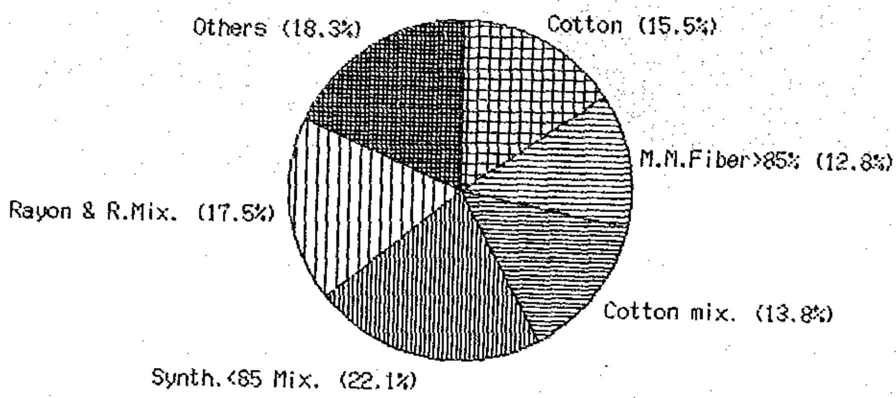


Figure 5-3 Export of Yarn (1988)

5-2 Supply

5-2-1 Production

Table 5-7 shown the recent changes in the amounts of production of the Indonesian textile industry. Indicated in Figs. 5-4, 5-5 and 5-6 are the figures obtained by integrating the projections made by the Ministry of Industry. Further increase in the demands for yarns can be expected, because the actual values of the period up to 1990 exceeded the projections made by the Ministry prior to the execution of the Fifth Five Year Plan, and the growths have been particularly remarkable for those products made of yarns, such as, fabrics and knits.

The investments in spinning equipment which reached their peak in 1989 have slowed down because of the difficulty of financing due to high interest rates and credit squeeze that took place in line with the tight money policy adopted by the Indonesian government. In addition, the cutdown of power supply to newly constructed plants has further discouraged the investments, forcing cancellation of some of the small-scale garment production projects. The new facilities for spinning and fiber-making as up-stream for which the license has already been acquired are nevertheless expected to be constructed. To 3.8 million spindles (those for acryl spinning excluded) available as of the end of 1990, 1.3 million are expected to be added by the end of 1991, and the total is certain to be about 5 million.

Table 5-7 Textile Pnoduction in Indonesia

RAW MATERIAL (1,000ton/year)

	'80	'84	'85	'86	'87	'88	'89
Polyester Filament	31.3	70.1	70.1	70.4	82.2	104.4	120.0
Polyester Fiber	53.8	73.1	72.6	78.0	80.9	99.6	100.0
Nylon Filament	10.1	11.0	10.2	11.8	12.0	12.0	14.0
Rayon Fiber	0.0	36.6	40.7	46.1	51.4	59.0	59.0
TOTAL	95.2	190.8	193.6	206.3	226.5	275.0	293.0
Cotton	13.0	16.5	10.5	8.0	4.2	2.5	2.5

SPUN YARN (1,000ton/year)

	'80	'84	'85	'86	'87	'88	'89
Cotton	84.3	113.8	124.3	143.8	156.4	156.8	163.8
Polyester/Cotton		74.9	81.8	94.6	102.9	103.1	111.9
Polyester/Rayon	95.4	50.9	55.6	64.3	69.9	70.1	76.1
Polyester 100%		3.0	3.3	3.8	4.1	4.1	7.8
Acryl	13.3	18.0	19.6	22.7	24.7	24.8	26.2
Rayon	28.9	38.9	42.5	49.2	53.5	53.6	54.9
TOTAL	221.9	299.5	327.1	378.4	411.5	412.5	440.7

FABRIC & GARMENT (100Mill m)

	'80	'84	'85	'86	'87	'88	'89
Cotton Fabric	5.5	8.0	8.1	8.7	8.7	10.3	10.7
Polyester S.F.	6.7	9.6	9.8	10.0	11.1	12.4	13.4
Polyester Filament	0.9	2.0	2.0	2.0	2.4	3.0	3.5
TOTAL	13.1	19.6	19.9	20.7	22.2	25.7	27.6
Garment (Mill Dz)		25.7	26.0	29.5	33.5	39.0	48.9

Source: JTN, March, 1991

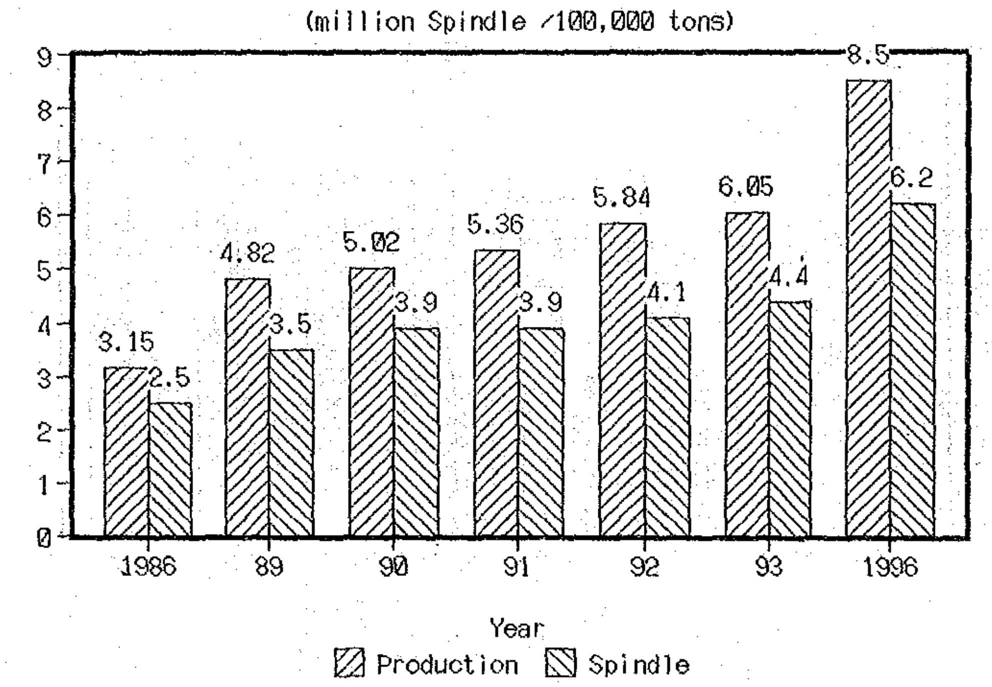


Figure 5-4 Spinning Equipment and Production Volume

Source: P. T. Industri Sandang I

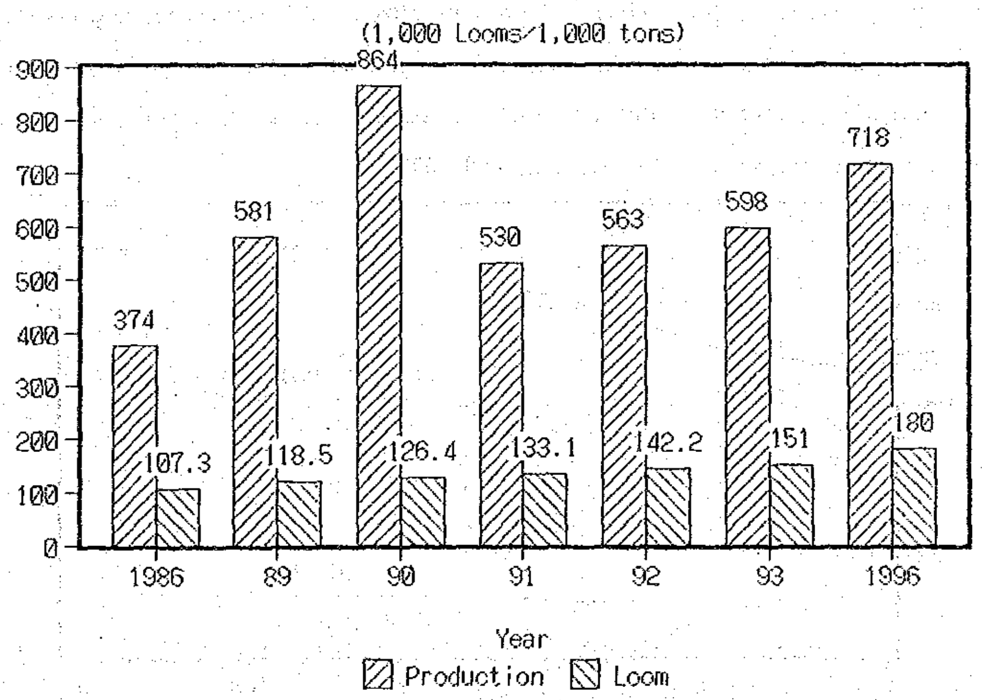


Figure 5-5 Weaving Equipment and Production Volume

Source: P. T. Industri Sandang I

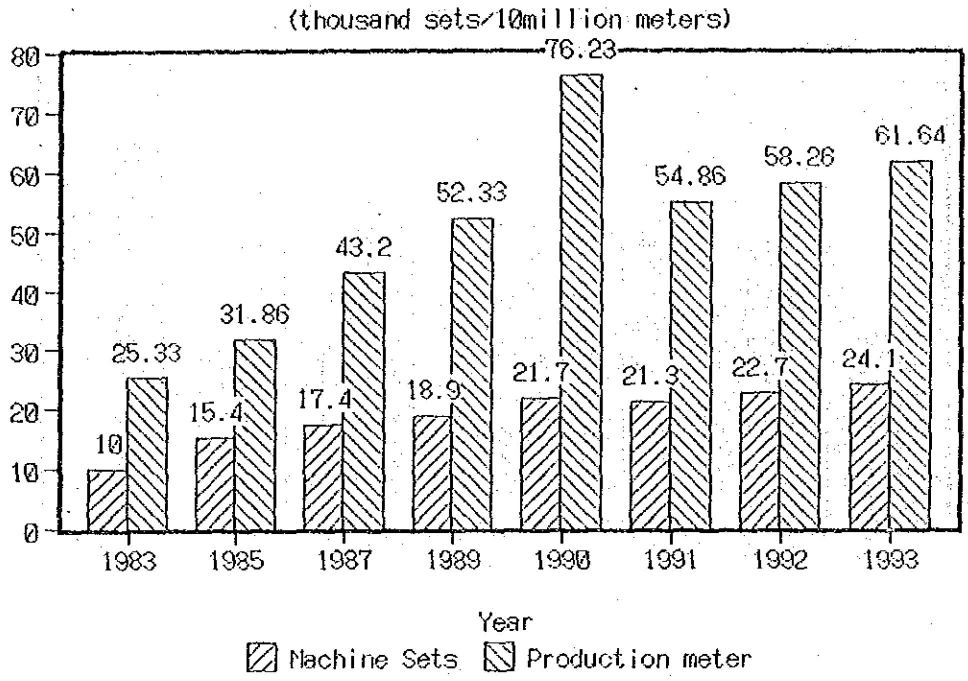


Figure 5-6 Knitting Equipment and Production Volume

Source: P. T. Industri Sandang I

As for the spun yarns which are the focus of the present project, the amounts of production of different kinds of yarns, such as, cotton, polyester-cotton, polyester-rayon, and rayon, have been fairly stable and the share of each kind remains almost unchanged. The cotton yarn accounts for slightly more than 1/3 of the total production, polyester- cotton, 1/4, and polyester-rayon and rayon yarns together account for approximately 30%.

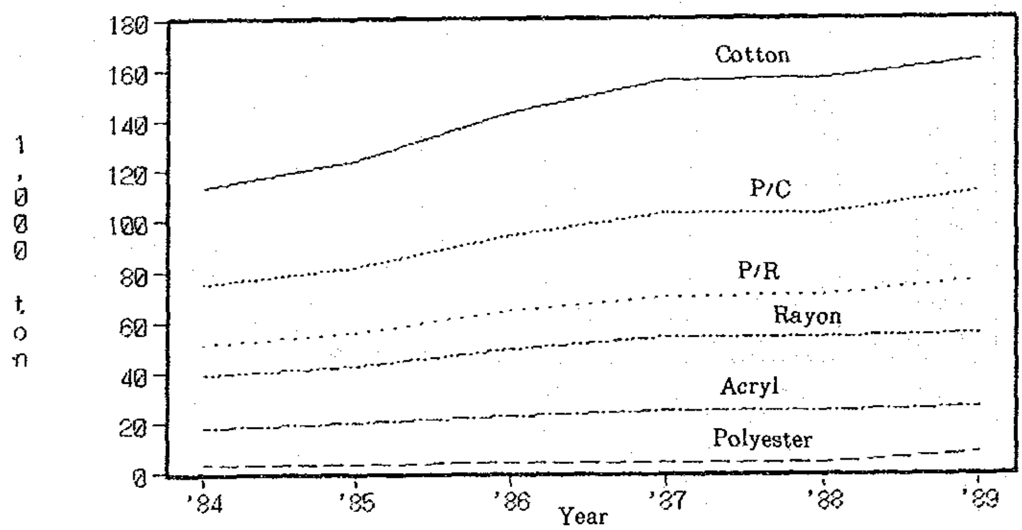


Figure 5-7 Growth of Spun Yarn Production

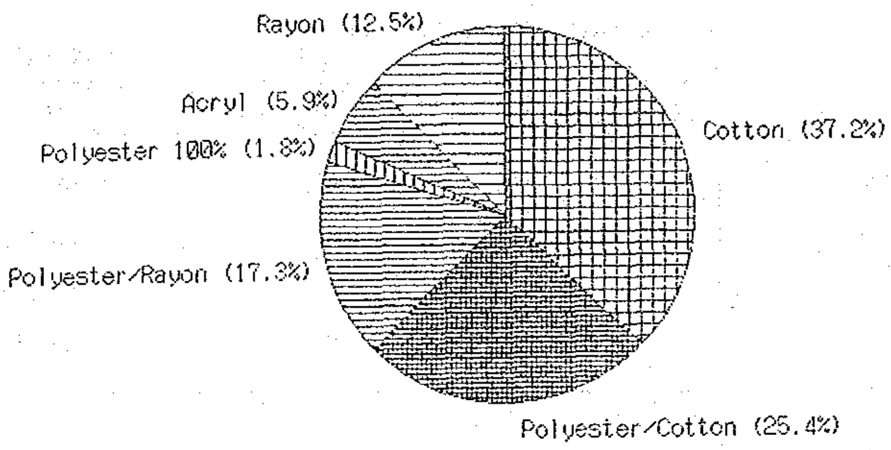


Figure 5-8 Production of Spun Yarn in 1989

5-2-2 Imports

As shown in Table 5-5, raw materials account for an overwhelming proportion among those products related to textile production imported to Indonesia. The value of the imported raw materials accounts for about 50% of the total, and 70%, when yarns are added. Out of the imported raw material, the cotton is the most at nearly 40% of the total.

5-3 Supply and Demand Analyses

The recent condition of supplies and demands for textiles in Indonesia is as indicated in Table 5-5 above. The Indonesian textile industry is capable of satisfying the domestic demand while also greatly contributing to the earning of foreign currencies through exports in accordance with the government policy. Considering the targets set by the Fifth Five Year Plan as well as the projections made by the Ministry of Industry, it is certain that the textile industry of Indonesia will continue to grow significantly in the coming years.

Table 5-8 Textile Production Forecast

(×1000ton)

	End of Pelita IV	End of Pelita V	lucrease
Fiber (Cut&Fil.)	293	493	+ 68 %
Yarn	468	751	+ 60 %
Fabric	461	728	+ 58 %
Garments	236	486	+106 %

Table 5-9 Textile Export Forecast

(US$ 1,000)

	End of Pelita IV	End of Pelita V	Increase
Fiber	16,461.7	15,600	− 5 %
Yarn	109,241.5	109,200	0
Fabric	433,421.2	1,089,900	+151 %
Garments	560,643.6	2,144,700	+283 %

As mentioned earlier, the production has already exceeded the target set by the Five Year Plan. The consumption and exports are also expected grow to a considerable extent in the coming years as shown in Table 5-9.

As for production, fiber, yarn, and fabric are projected to grow evenly in good balance as is indicated in Table 5-8. As for consumption, however, since the proportion of exports is to become even greater, it will increasingly necessary for the Indonesian textile industry to shift its emphasis from yarns to those products with higher value-added, such as, fabrics and secondary products, by taking advantage of the country's low labor cost. Lower cost of labor is an important source of competitiveness for the Indonesian textile industry. Such a shift in emphasis is particularly important because the overseas demand for products with high value added is expected to increase. Domestic consumption will also grow with the improvement in the country's standard of living, and that should give rise to demands for new products such as the fashion-related items, for instance.

Given these expectations, in making the future plans for the spun yarns of the present project, one must realize the importance of producing those which are internationally competitive.

Quick delivery or low price, per se, cannot be a competitive edge in the international as well as domestic market, unless the quality of yarn itself is improved. Reportedly, even under the present unfavorable market condition, the high-quality yarns for the newly-introduced knitting and air jet machines are already short in supply.

Outlined below are projected supply and demand for yarn in the next 10 years.

5-3-1 Analysis of Supply and Demand

(1) Projected production

As for man-made fiber and filaments, for which domestic production is being promoted, the projected production capacities of the near future computed on the basis of the number and scale of applications for plant expansion and of information provided by the industry sources are as follows:

(See Chapter 6)

	* **		
Nylon filament	(41 + 5) ton/day	16,100 ton/yr	
Polyester filament	(424 + 218)	224,700	
Polyester fiber	(330 + 335)	232,750	* present production
Rayon	(195 + 25)	77,000	** projected production
	total	550,550	

The projected production of the above fibers and filaments in the year 2000, computed on the basis of applications for facility expansion is other estimates, is as follows:

Nylon filament levels off	17,500
Polyester filament additionally increases	300,300
Polyester fiber (industry sources)	278,000
	(See Chapter 6)
Rayon fiber (if the facilities are expanded)	
	150,000
total	745,500ton/yr

Of the above, the fibers are used as materials for spun yarns, while the filaments are put in the weaving machine as yarn.

The estimated amount of filament yarn production in the year 2000 is 317,500 tons.

As for cotton, which is mostly imported, it is expected that there will be a natural increase in production owing to the projected worldwide expansion of the cotton-growing land. On the other hand, according to the industry sources, the number of spindles in operating conditions and the amounts of materials consumed for 1989 and 1990 are as follows:

	Number of spindles in operation	Amount of production
1989	300 million	485 thousand tons
1990	350	567

(1,620 tons/10 thousand spindles)

Material consumption (in thousand tons)

Cotton	Rayon	Acryl	Polyester
268	69	30	118
315	80	30	142
56%	14%	5%	24%

According to the projections made by the Ministry of Indus-try, given the expected expansion in the spinning facilities by the year 2000, it is presumed that there will be 580 million spindles producing 751 thousand tons of yarn in 1994, and 620 million spindles (all not necessarily in operating conditions) producing 850 thousand tons in 1996.

Such projections, however, appear slightly too optimistic considering the growth to date. Since nearly 100 million of the spindles currently available are deteriorated due to their extended operation of over 15 years they are bound to be either temporarily kept out of use or put totally out of operation someday in the near future. As this partly offsets the expected expansion of the facilities, the number of spindles in operating conditions by 2000 should be somewhere between 500 and 600 million, in which case, the projected production of spun yarn would be:

550 million spindles x 1,620 tons = 891 thousand tons

The expected total production of filament and spun yarn combined for the year 2000 then would be:

318 thousand tons tons +891 thousand tons +1,209 thousand tons

(2) Projected imports

Presented below are the annual amounts of yarn for weaving use imported from 1983 to 1987.

1983	1984	1985	1986	1987 (unit: ton)
12,845	13,220	14,186	25,923	24,183

Source: Capricorn Indonesia Consultant Inc.

The amount for 1988 is estimated to be around 19,000 tons.

While the yarn imports up to 1987 increased at an annual rate of 5 to 10%, in proportion to the growth in demand, it seems that the import had been stable at around 20 thoudand tons in the late 80s: an amount which should be suffi cient to cover the estimated rise in the demand for weaving yarn caused by the increased availability of various facilities, such as, those for spinning, weaving, and for polyester and rayon fiber production. Consequently, assuming that the imports of weaving yarn grow at an annual rate of 5%, the total amoount in the year 2000 is supposed to be:

20,000 tons × (1.05) = 32,600 tons

5-3-2 Future Demands

(1) Domestic demand

Assuming the growth rate of 5% per year as in the case above, the expected annual demand for 1989 is 542.7 thousand tons, and that for 2000 is 884 thousand tons. The figure was obtained by multiplying the amount in 1989 by (1.05)

(2) Exports

The annual amounts of exports from 1987 to 1990 are as fol-lows:

	1987	1988	1989	1990
	165	215	249	312 thousand tons
Percentage increase over previous year	+ 25.2%	+ 30.1%	+ 15.7%	+ 25.5%

The exports increased by 137% from 1986 to 1990, which is equivalent to 24% per year. Although the exports will still be promoted by the government policy in the coming years, it is unlikely that they will continue to grow at such a high pace. If the annual growth rate set reasonably low at 10%, then the amount of exports in 2000 will be:

312 thousand tons × (1.1) = 809 thousand tons

(3) Total demand

From the above estimates, the total demand in 2000 will be:

809 + 884 = 1,692 thousand tons

5-3-3 Balance of Supply and Demand

By the calculations presented above, it is certain that the demand will exceed supply. However, if the growth rate of weaver and knitter, for which the spun yarn is used, is assumed to be 6% annually based on Fig 5-5 and 5-6 and if this rate is adopted in calculating the expected amounts for the future, the figure for 2000 will be:

(the amount in 1990)

567 thousand tons × (1.06) = 1,015.4 thousand tons

According to this calculation, the amount obtained is sufficiently greater than the estimated production and imports of the spun yarn for the same year. Judging from the above macro-economic projection of the balance between supply and demand, it is expected that the Banjaran and Cipadung Mills will enjoy stable market shares. Moreover, with the improvement in product quality achieved through rehabilitation, both mills should be able to secure even greater shares.

The renovation of the deteriorated facilities and equipment at both Banjaran and Cipadung mills is indispensable for improving the productivity and product quality, as well as for expansion of employment opportunities. The renovation is also necessary for the purpose of reinforcing the exports as stated by the government policy and for disseminating the technologies to the other mills.

5-4 Merchandising and Pricing

5-4-1 Product Plans

The present conditions of the market for the Indonesian textiles can be summarized as follows:

- Exports are making a good showing, among others polyester filaments and its fabrics is competitive due to the scarcity in the market. The demand is particulary great after the the War in the Persian Gulf region which is its major customer.

- Exports of thin fabrics, garments, miscellaneous goods, and knits to industrialized countries (US and EC) are expected to grow even more in the coming years, resulting in greater domestic sales of the materials for producing such items.

- While the demand for cotton products will continue to show a steady growth owing to the lasting popularity of casual outfit, because of the high price of raw cotton so far, the sales of cotton yarn have been recently stagnated with the situation having been most serious in 1990.

The general price of yarns has started to recover since the second quarter of 1991. As mentioned earlier, high quality yarns for air jets are presently short in supply.

- The oversupply of polyester fiber yarns persists worldwide.
Because of this and severe competition by Taiwan and South Korea, Indonesian polyester fiber yarns are being sold below cost sometimes in the international market. Though the domestic price of the yarns has been also stagnated, they are in steady demand within the country and they can be sold in large quantities.

- The sales of rayon yarn will remain steady due to the limited procurement of raw materials. (New entrances to the market have slightly increased which is a negative factor.)
Generally speaking, as long as a spinning factory produces internationally competitive high quality yarns suitable for garments, fabrics, and knits for exports and maintains the costs at reasonable levels through rationalization of its facilities, it should be able to make sufficient profit. As the descriptions listed above refer only to the current market conditions, good selling products today may become unpopular tomorrow, depending on the condition of the international economy.

Such being the case, it is imperative to plan the product mix carefully on a long-term basis without persisting in the expected results of the immediate future. Installation of equipment capable of accommodating any changes in the production plans is a great advantage for any mills. However, even with such equipment, it is impossible to produce filament yarn at these two mills.

Under such restrictions, the product mix at the Banjaran and Cipadung plants are recommended as follows:

1) High grade, fine count combed yarn which are profitable and popular worldwide for a long time.

2) P/C yarn for polyester fiber fabrics which are durable, fashionable, and easy to care. (stable domestic supply of the materials is another advantage of producing the P/C yarns.)

3) Rayon blended yarn which is practical and has the scarcity value.

The production of Ne. 45 P/C yarn, which is to be the central product under 2) above, shall be concentrated at the Banjaran II in order to cut down the cost and enable quick response to price changes. Likewise, the Cipadung Mill should be designated to specialize in man-made fiber yarn.

The product mix at the Banjaran I should be concentrated on the high quality cotton combed yarn as well as polyester blended yarn of any blending ratio and any yarn counts to meet diversified users' needs.

5-4-2 Pricing

Indicated below are the changes in prices of polyester-cotton blended yarn Ne.45 and combed yarn Ne.40 (CM40), both of which are representative spun yarns, within the Indonesian market (in average annual price per bale).

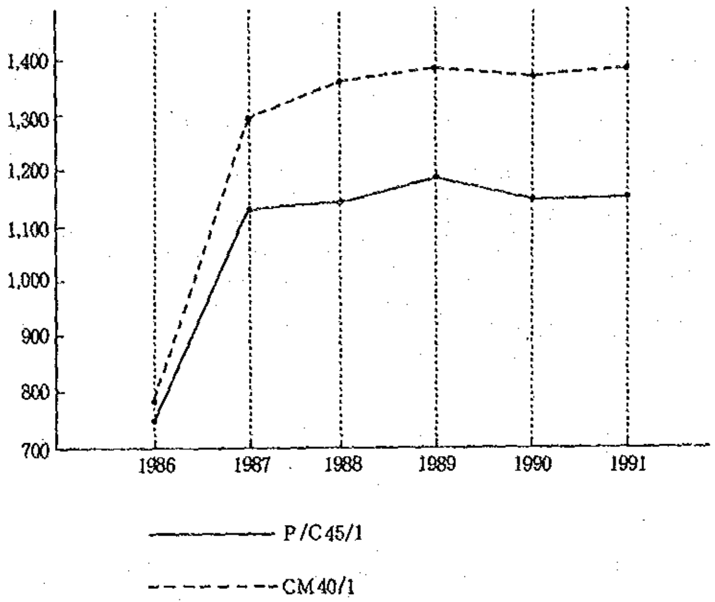
	P/C 45/1	CM 40/1	P/R 30/1
1986	Rp740, 000	Rp774, 000	Rp850, 000
1987	1, 130, 000	1, 293, 000	950, 000
1988	1, 143, 000	1, 360, 000	1, 000, 000
1989	1, 184, 000	1, 382, 000	1, 170, 000
1990	1, 144, 000	1, 371, 000	1, 100, 000
1991	1, 148, 000	1, 381, 000	1, 100, 000

While the prices of both cotton and cotton blended yarns had been on the rise up to 1989 (at an annual rate of 1 to 3%), they have started declining between 1990 and the first half of 1991.

In Japan, on the other hand, the market price of cotton yarn, which had been gradually falling since around 1984, began to pick up in 1986 and 1987. Although the price was stagnated for a while after that, it has continued to rise again since 1989. While it is misleading to compare the Indonesian and Japanese markets by the same criteria due to the different structures and business practices of the two countries, the fluctuation of market prices nevertheless is undoubtedly common to both. Meanwhile, the market price of cotton in New York which has been rising since 1985 is expected to stabilize at a modest level because of the worldwide increase in the cotton farm-ing land. The low cost of cotton should then positively affect the profitability of cotton yarn.

These changes in the market prices are plotted on the graph below.

Indicated in Figure 5-9 are the market prices of cotton yarn in Japan and that of cotton in New York.



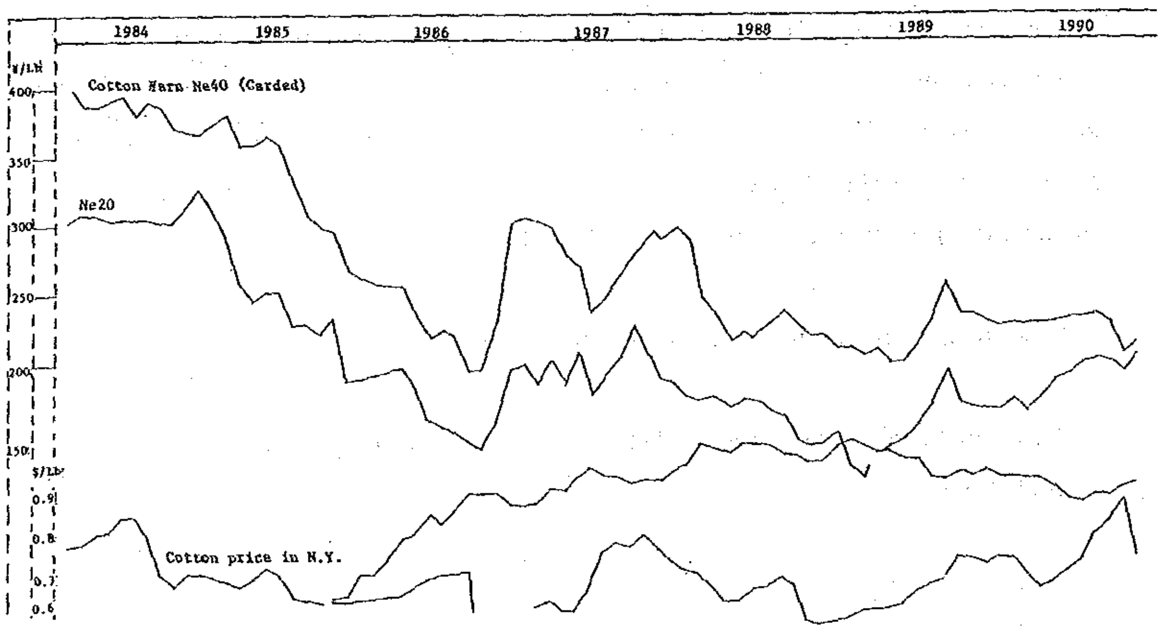


Figure 5-9 Transition of Yarn and Cotton Price

The selling price of major brands of yarns, according to the local survey conducted in February 1991, were as follows:

unit: Rupiah

CM 32	1,450,000
CM 40	1,550,000
CM 50	1,950,000 (Exportation)
P/C 45	1,230,000
P/C 30	1,050,000

When a follow-up survey was conducted in August 1991, the price of combed yarn was found to be on the rise. The price of CM40, for instance, was over 160 million rupiah per bale. (The prices surveyed were those indicated by the manufacturers of top technological standards within Indonesia which have recently either newly-installed or renewed their facilities.)

5-4-3 Product Mix

The table below is a summary of the final product mix and estimated sales price of the products.

CM 32	Rp 1,500,000/bale	C/P 40	1,300,000
CM 40	1,700,000	C/P 40/2	1,500,000
CM 50	2,000,000	P/R 20	1,050,000
P/C 20	1,050,000	P/R 30	1,150,000
P/C 40	1,150,000	P/R 40	1,250,000
P/C 45	1,250,000	P/R 45	1,300,000
P/C 40/2	1,350,000	P/R 40/2	1,400,000
C/P 20	1,150,000		

The above product mix should be revised as needed to make it match the market trends. In terms of sales strategy, yarns with high value-added (e.g. combed yarns) should be sold as a raw fabrics with higher value to be used by the garment industry.

Both foreign and domestic investments to hopeful garment manufacturers, whose exports of garments to the U.S. and Europe are expected rise, are rapidly increasing, and the demand for fabrics is certain to rise as a result. The domestic high quality fabrics produced with high technological standards should be able to replace those which are currently being imported. While many of the polyester or rayon-containing blended yarns have been conventionally sold to manufacturers of fabrics for domestic use, it is necessary to devise ways to switch the target to materials for gray and printed fabrics for exports.

CHAPTER 6 ANALYSIS OF RAW MATERIAL

Tables and Figures

CHAPTER 6 ANALYSIS OF RAW MATERIAL

6-1 Raw Material for Textile Industry

Fibers that are used as raw material for textile industry can be generally classified into the following large categories:

- Natural fiber
  - Vegitable fiber : Cotton, hemp, etc.
  - Animal fiber: Silk, wool. etc.
- Man-made fiber
  - Inorganic fiber: Metal and glass fiber
  - Regenerated fiber: Rayon
  - Synthetic fiber: Nylon, acrylic, polyester, etc.
  - Semi-synthetic fiber: Acetate

Among the fibers listed above, the main raw materials especially for fiber spinning are cotton, polyester fiber, and rayon fiber.

6-1-1 Raw Material Production in the World

(1) Cotton

The cotton yield in the world has been increasing since 1980/1981, and production in 1991/1994 is estimated more than 19,000,000 tons.

The countries such as China, U.S.A., India, Pakistan, Turkey, Greece are where production of cotton has been increasing while those countries like U.S.S.R., Egypt, and Sudan,have shown a tendency of decreasing the productions.

Consequently, it is assumed that cotton for Ne40 blended yarn produced in countries such as China, U.S.A., U.S.S.R., will be available in abundance and cotton for fine count yarn as represented by Egyptian cotton be getting in short. The main cotton producing countries and the recent cotton production in these respective countries are shown in the following table.

Table 6-1 World Cotton Production

(1000 ton)

Area / Country		1975/76	1980/81	1985/86	1987/88	1988/89	1989/90	1990/91
Asia Oceania	China	2,320	2,706	4,147	4,246	4,149	3,925	4,504
	India	1,160	1,362	1,955	1,543	1,802	2,125	1,938
	Pakistan	514	714	1,216	1,468	1,425	1,445	1,548
	Turkey	480	500	518	537	650	596	679
	Syria	158	118	161	96	114	136	151
	Iran	139	57	106	106	120	123	144
	Australia	25	99	258	281	292	315	313
	Israel	49	78	99	59	63	46	44
	Total(include others)	4,949	5,791	8,572	8,431	8,720	8,822	9,440
North/ Central America	America	1,808	2,422	2,924	3,214	3,355	2,663	3,303
	Mexico	197	353	220	223	308	167	247
	Guatemala	102	126	48	48	42	40	40
	Nicaragua	109	75	50	35	26	26	26
	Total(Include others)	2,283	3,032	3,271	3,538	3,750	2,911	3,634
South America	Brazil	390	594	793	864	701	762	757
	Argentina	140	84	120	282	195	270	249
	Colombia	121	115	113	134	121	105	119
	Peru	57	105	99	95	101	94	99
	Paraguay	38	105	107	204	218	270	232
	Total(include others)	795	1,030	1,278	1,612	1,383	1,560	1,508
Western Europe	Greece	130	117	163	174	235	250	275
	Spain	43	61	72	81	110	68	88
	Total(include others)	176	179	235	254	345	318	364
Soviet Union East Europe	Soviet Union	2,528	2,661	2,782	2,467	2,766	2,660	2,508
	Bulgaria	11	12	5	4	4	4	4
	Total(include others)	2,546	2,678	2,792	2,476	2,775	2,669	2,517
Africa	Egypt	382	529	435	352	311	284	332
	Sudan	108	97	142	136	142	132	134
	South Africa	19	57	47	76	78	66	78
	Tanzania	42	43	33	86	63	38	67
	Ivory Coast	26	56	82	114	128	119	125
	Zimbabwe	47	62	89	116	92	104	109
	Mali	39	40	67	75	97	105	93
	Total(Include others)	974	1,135	1,235	1,359	1,392	1,302	1,435
World Total		11,723	13,844	17,383	17,670	18,366	17,582	18,898

Source : ICAC (International Cotton Advisory Committee) "Cotton : World Statistics"

Note : 1. Every year starts from August 1st.
2. Provisional values in 89/90.
3. Estimated values in 90/91.

(2) Polyester Staple Fiber

The production of polyester staple fiber in the world which was 87,000 tons in 1960 has grown in 20 years by 55 times: 4,799,000 tons in 1989. The annual production of polyester fiber by countries is headed by U.S.A., and nine as major production countries with Indonesia at the bottom produced 74% of the total world production in the year of 1989.

Except U.S.A., the Asian countries, China, whose rate of production has been rapidly increasing, Taiwan, South Korea, Japan, India, and Indonesia, produce 2,083,600 tons per year and share a major part in the world polyester fiber production.

Production will keep on increasing in these Asian countries in the future along with diversification of products such as bright and finer deniers, besides semi-dull.

Production of polyester fiber and filam ant in recent years and the major producing countries are shown in the following table.

Table 6-2 World Polyester Production

(1000 ton)

Country	Polyster							
	1985		1987		1988		1989	
	f	s	f	s	f	s	f	s
Austria	---	18.1	---	15.7	---	16.7	---	17.4
Benelux	21.1	34.7	22.1	27.1	26.0	28.6	28.4	35.0
Ireland	12.0	21.1	12.0	36.3	13.0	38.0	16.7	45.1
France	37.6	36.0	37.0	37.0	35.8	38.0	34.1	38.0
West Germany	180.2	139.2	186.4	141.1	186.0	163.2	171.7	193.0
Greece	5.7	---	6.6	---	6.8	---	7.0	---
Italy/Malta	55.0	65.6	51.9	68.4	57.3	68.5	54.6	77.1
Portugal	---	27.6	---	28.8	---	25.0	---	26.8
Spain	41.0	70.3	38.0	67.1	38.4	70.2	38.3	70.2
Switzerland	29.9	20.2	25.9	16.7	29.3	20.3	29.5	15.9
Turkey	33.9	61.5	42.9	67.8	42.9	70.2	60.0	77.3
England	38.2	5.0	28.8	5.0	41.0	---	47.1	---
Bulgaria	16.0	21.0	19.6	25.7	20.0	25.7	20.3	26.0
Czechoslavakia	16.9	44.6	19.6	44.6	18.0	46.0	12.7	50.3
East Germany	29.1	35.0	28.7	45.0	28.5	47.0	25.4	48.6
Poland	32.6	27.0	29.8	14.9	30.0	25.7	28.5	24.3
Rumania	30.8	90.5	31.0	98.0	30.9	98.3	31.1	98.4
Soviet Union	69.6	167.3	107.2	198.6	128.9	198.2	135.7	200.6
Yugoslavia	19.7	26.8	21.0	46.1	21.2	42.0	21.1	43.6
Albania	0.4	---	0.5	---	0.5	---	0.5	---
America	599.0	917.0	535.0	1,071.0	556.9	1,112.0	548.4	1,082.0
Argentina	6.2	4.6	9.7	11.6	12.0	9.4	10.0	10.0
Brazil	56.0	64.3	64.6	78.3	60.2	81.1	69.5	80.5
Canada	21.0	46.0	20.0	45.0	22.0	46.0	9.0	43.8
Chile	1.0	2.0	1.9	2.7	2.1	2.8	2.2	3.0
Colombia	20.6	9.9	21.7	10.8	18.1	12.9	20.9	12.5
Ecuador	4.9	---	5.6	---	4.3	---	6.5	---
Mexico	85.4	75.1	76.1	90.4	83.3	90.1	76.0	94.0
Peru	6.6	11.0	6.6	10.9	6.4	10.2	7.7	10.9
Uruguay	1.3	3.7	1.2	3.4	1.3	3.6	1.3	3.9
Venezuela	8.7	6.0	12.9	21.9	14.8	20.9	15.9	21.4
Costarica	3.5	---	4.2	---	4.3	---	---	---
Japan	329.3	323.2	323.0	283.0	329.0	293.0	367.0	308.0
Australia/Newzealand	3.3	1.0	3.0	1.1	3.1	1.2	1.9	1.2
China	55.0	443.0	120.0	496.0	307.0	530.0	300.0	600.0
Taiwan	371.6	380.6	542.5	534.4	540.5	559.0	595.4	595.8
Egypt	1.8	27.1	2.9	31.1	4.2	33.2	5.4	37.4
India	68.0	39.7	100.4	80.7	135.7	99.4	143.0	112.2
Indonesia	72.9	58.9	94.7	80.9	95.2	86.6	110.0	105.0
Iran	6.0	14.0	5.0	16.3	4.9	16.0	4.9	16.0
Israel	4.8	---	2.1	---	---	---	---	---
Korea	274.6	234.3	329.5	304.8	412.0	337.3	455.5	365.3
Malaysia	---	38.8	---	38.9	---	40.0	---	45.0
Pakistan	17.4	23.0	25.1	25.4	15.5	32.3	15.0	26.0
Philippine	11.0	14.2	14.5	12.7	15.0	15.0	16.3	17.0
South Africa	35.0	31.8	31.0	35.3	36.7	35.2	37.3	35.9
Thai-land	22.1	55.0	33.3	67.2	37.0	74.4	40.0	80.0
Nigeria	2.5	3.0	4.0	3.1	4.5	3.1	4.5	3.2
Kenya	1.1	1.0	2.0	1.1	2.0	1.1	1.9	1.1
Tanzania	2.0	---	3.0	---	3.0	---	3.0	---
World total	2,763.0	3,739.7	3,104.5	4,341.9	3,485.5	4,567.4	3,631.2	4,798.7

Source : "Fiber Organon"

The production capacity of polyester fiber in Indonesia was 330 tons a day (116,000 tons a year) in 1990. It is estimated that the production will increase to approximately 485 tons a day (175,000 tons a year) by the end of 1991.

(3) Rayon Fiber

The annual production of rayon fiber in the world during a period of 20 years from 1970 to 1990 has shown very little change, i.e.between 1,800,000 tons to 2,000,000 tons, per year. The main countries producing rayon fiber are concentrated in the region of Asian and Eastern Europe; production in these regions now accounts for 70% of the total world production.

The production of rayon fiber is not expected to substantially increase in the future due to limited pulp resources. The following table lists the main rayon fiber producing countries and their respective production volumes.

Table 6-3 World Rayon Staple Production

(1000 ton)

Area		Area / Country	1970	1975	1980	1985	1987	1988	1989
Asia		Japan	356.1	255.6	278.0	283.3	201.1	190.8	174.0
		Korea	---	---	15.0	---	---	---	---
		Taiwan	22.9	46.5	75.3	119.5	117.2	123.2	145.0
		China	22.2	61.0	95.0	130.0	132.0	120.0	130.0
		Indonesia	---	---	---	40.7	52.0	59.0	60.0
		Thai-land	---	---	16.4	19.0	21.4	24.0	41.2
		India	63.4	66.8	74.6	95.0	116.8	121.5	125.0
		Bangladesh	---	---	---	1.0	1.3	1.0	1.0
		Iraq	5.0	5.5	5.5	5.5	5.5	5.5	5.6
		Total (Include others)	469.6	435.4	559.8	694.0	647.3	645.0	681.8
Western Europe	EC	West Germany	134.7	43.0	46.0	55.0	---	---	---
		England	158.7	125.5	109.0	60.2	---	---	---
		Italy	92.1	46.3	27.5	---	---	---	---
		France	77.9	55.3	49.6	15.0	---	---	---
		Benelux	25.8	10.7	22.0	---	---	---	---
		Spain	34.6	35.8	40.1	30.0	---	---	---
		Total (Include others)	524.2	317.7	294.9	160.2	---	---	---
	Others	Austria	67.6	74.0	100.6	109.0	---	---	---
		Finland	36.6	29.4	47.2	60.0	---	---	---
		Norway	27.0	18.4	28.4	---	---	---	---
		Sweden	29.9	18.5	34.9	33.0	---	---	---
		Turkey	1.0	3.7	5.0	7.0	---	---	---
		Total	162.1	144.0	216.1	209.0	---	---	---
	Total		686.3	461.7	511.0	369.2	329.0	349.1	342.8
North America		America	275.4	168.2	201.1	160.2	187.9	181.3	164.6
		Canada	17.9	13.0	30.0	26.9	28.5	33.2	33.5
		Mexico	10.8	11.8	11.0	---	---	---	---
		Total	307.1	196.7	245.9	187.1	216.4	214.5	198.1
South America		Brazil	14.6	18.5	25.3	26.5	33.9	36.6	40.2
		Chile	2.0	2.2	3.0	3.8	4.0	4.1	4.2
		Total(Include others)	23.7	29.6	29.8	38.2	49.2	51.3	52.0
USSR East Europe		Soviet Union (U.S.S.R)	234.3	309.0	345.0	340.0	345.0	337.2	338.9
		East Germany	130.2	135.6	132.0	132.4	120.7	118.8	131.9
		Czechoslovakia	47.6	49.6	34.9	39.6	36.8	39.4	29.1
		Poland	52.9	67.4	61.0	50.6	54.0	54.0	44.2
		Yugoslavia	23.2	49.9	58.0	55.0	50.0	54.0	56.2
		Rumania	34.3	48.9	54.0	53.0	57.0	66.5	61.6
		Bulgaria	---	19.0	33.0	37.6	---	---	---
		Hungary	3.9	8.8	9.0	5.5	4.1	4.2	4.3
		Total	526.4	688.2	726.9	713.7	667.6	674.1	666.2
Africa		Egypt	4.9	3.3	4.0	4.7	4.8	5.0	5.2
World total			2,018.0	1,814.9	2,077.4	2,006.9	1,914.3	1,939.0	1,946.1

Source : "Fiber Organon"
Note : In the column "EC", the total figures of the present 12 countries were quoted back from 1970.