During the same period, the production of polyester/cotton blended yarn also decreased from 100% to 50.8% of the total.

b) While the plant is designed for exclusively producing polyester/cotton (65/35) Ne 45 yarn, the actual results so far indicate a growing tendency to produce coarser yarns (ave. Ne 40.9). Since the yarns produced in lower counts (coarser yarns) are those with high cotton mixing ratios (i.e. C/P 65/35 Ne 40 and C/P 55/45 Ne 30) and the 100% cotton combed yarn Ne 40, the processes prior to the combing process are all being operated in full capacity.
While they are sometimes set beyond capacity, efforts must be exerted to win the market recognition with fine yarns by modifying the product mix for instance.

(3) Production Plan and Actual Results for November, 1990.
The spun yarn market condition deteriorated from the latter half of 1990, and Banjaran Mill was forced to partially reduce production. Consequently, a difference between the production capacity and the actual production volume is arising. A recent example of this situation is shown in Table 3-6 regarding the production plan and the actual production record for the month of November 1990.

Table 3-6 Production Plan and Actual Record for November, 1990

Mill	Product Type	Production bale/30 days	
		Plan	Actual
First	Cotton carded yarn Ne 20	0	64
	Ne 40	691	755
	Polyester/cotton Ne 20 blended yarn (35/65)	99	68
	Total	790	887
Second	Cotton carded yarn Ne 40	0	123
	Cotton combed yarn Ne 40	400	425
	Polyester/cotton Ne 40 blended yarn (65/35)	201	213
	Polyester/cotton Ne 40 blended yarn (35/65)	201	141
	Total	802	902
	Grand total	1,592	1,789

a) Calculation tables based on the operation conditions of each equipment from the production record in Table 3-6 for spun yarn at the First and Second Mills are shown in Tables 3-7 and 3-8 respectively. From these calculation tables, the following points are observed:

The operation rate (number of operated spindles/number of equipped spindles) at the First Mill was 94.6 %, and it allocates sufficient machinery for all processes other than ring spinning. In this case, an effort should be made to improve the quality of products by reducing efficiency or rotation speed.

The operation rate of the Second Mill was low at 75.6 %. Cotton carded Ne40 should be produced in order to optimize the machines at this Mill, as its machines are in a better condition than those of the First Mill. High quality yarn could be produced by transferring carding slivers from the First Mill, if supply and demand are not stable in the pre-spinning process at the Second Mill.

b) Some problems exist in processing control, because excess or shortage of efficiency is observed in both Mills under an environment that requires the production adjustment. The problems are caused due to lack of overall responsibility of the Mill such as retarded measures to rebuild the balance between the supply and demand of ring spinning and prespinning processes and delayed action to fill the gap between the plan and the actual results. Production control sheets for each machine should be fully used to keep a targeted daily production amount.

Table 3-7 Calculation Table for Spinning Plan of Banjaran First Mill

BANJARAN 1

Cotton, Cotton/Polyester

	Item / Process	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	for Polyester				12.5			0.5	9.0	7.5	960	50	351.56	7.5	83	1	2188.48	117.81	0.1	1
-2	for cotton (A)				12.0			2.0	9.0	7.5	960	50	337.50	7.5	83	1	2100.94	3600.45	1.7	2
-3	for cotton (R)				12.0			2.0	9.0	7.5	960	50	337.50	7.5	83	1	2100.94	3600.45	1.7	2
-4	for cotton (C)				12.5			2.0	9.0	7.5	960	50	351.56	7.5	83	1	2188.48	269.41	0.1	1
2	Carding Machine	oz/yard			Grain/6yds			Reusable 0.5	rpm	yds	φ	mmH								
-1	for Polyester	12.5	1	100.57	323			1.0	9.0	21.2	305	914	13.08	7.5	90	1	88.30	116.63	1.3	2
-2	for cotton (A)	12.0	1	98.18	308			4.0	9.0	21.2	305	914	12.47	7.5	85	1	79.52	3456.43	43.5	44
-3	for cotton (R)	12.0	1	98.18	308			4.0	9.0	21.2	305	914	12.47	7.5	85	1	79.52	304.19	3.8	4
-4	for cotton (C)	12.5	1	97.52	323			4.0	9.0	21.2	305	914	13.08	7.5	85	1	83.39	258.63	3.1	3
3	Pre-Drawing Frame	Grain/6yds			Grain/6yds				yds	m	φ	mmH								
-1	for Polyester of Blend	323	8	8.00	323			0.3	62.3	57	305	914	28.75	7.5	75	4	646.81	116.28	0.2	1
4	Pre-Combing of Cotton	Grain/6yds			Grain/yard				yds	m	W	φ								
-1	Sliver Lap Machine	323	18	1.38	700			0.3	62.3	57	232	630	373.80	7.5	75	1	2102.63	257.85	0.1	1
-2	Ribbon Lap Machine	700	6	6.00	700			0.3	56.9	52	300	630	341.40	7.5	75	1	1920.38	257.08	0.1	1
5	Comber	Grain/yard			Grain/6yds			Reusable 1.0	nip	mm	φ	mmH								
-1	for cotton	700	4	47.60	300			15.0	160.0	5	406	1067	17.85	7.5	85	2	227.56	215.95	0.9	1
6	1st Drawing Frame	Grain/6yds			Grain/6yds				yds	m	φ	mmH								
-1	COtton/Polyester Yarn	323	2	6.15	300			0.3	62.3	57	305	914	26.70	7.5	75	4	600.75	331.23	0.6	1
-2	(C)	300	4																	
-3	Cotton Carded Yarn (A)	308	6	6.00	308			0.3	62.3	57	305	914	27.41	7.5	75	4	616.77	3446.06	5.6	6
-4	Cotton Carded Yarn (R)	308	6	6.00	308			0.3	62.3	57	305	914	27.41	7.5	75	4	616.77	303.28	0.5	1
7	2nd Drawing Frame	Grain/6yds			Grain/6yds				yds	m	φ	mmH								
-1	COtton/Polyester Yarn	308	6	6.16	300			0.3	62.3	57	305	914	26.70	7.5	75	4	600.75	330.24	0.5	1
-2	Cotton Carded Yarn (A)	308	6	6.00	308			0.3	62.3	57	305	914	27.41	7.5	75	4	616.77	3435.72	5.6	6
-3	Cotton Carded Yarn (R)	308	6	6.00	308			0.3	62.3	57	305	914	27.41	7.5	75	4	616.77	302.37	0.5	1
8	Simplex Fly Frame	Grain/6yds			Grain/30yds				rpm		φ	mmL								
-1	COtton/Polyester Yarn	300	1	7.50	200	0.89	1.63	0.5	600		114	254	0.5843	7.5	75	108	354.95	328.59	0.9	1
-2	Cotton Carded Yarn (A)	308	1	9.06	170	1.09	1.30	0.5	500		114	254	0.5189	7.5	75	108	315.25	3418.55	10.8	11
-3	Cotton Carded Yarn (R)	308	1	7.70	200	1.15	1.39	0.5	500		114	254	0.5710	7.5	75	108	346.87	300.86	0.9	1
9	Ring Spinning Frame	Grain/30yds			Ne				rpm		mmR	mmL								
-1	COtton/Polyester Yarn	200	1	16.00	20	3.80	16.99	1.0	9000		42	165	0.0526	8.0	93	416	162.65	325.30	2.0	2
-2	Cotton Carded Yarn (A)	170	1	27.20	40	4.27	27.00	1.2	9000		42	165	0.0165	8.0	93	416	51.17	3377.52	66.0	66
-3	Cotton Carded Yarn (R)	200	1	16.00	20	4.17	18.65	1.5	9000		42	165	0.0479	8.0	93	416	148.17	296.35	2.0	2
10	Steam Setter								Batch/hour		Lbs/Batch									
-1	COtton/Polyester Yarn								1.0		660		660.00	7.5	90	1	4455.00	325.30	0.1	1
11	Auto Winder	Ne			Ne				yds	m	mm	Angle								
-1	COtton/Polyester Yarn	20	1		20			0.5	656	600	152	5.57	2.3429	7.5	60.0	60	632.57	323.67	0.5	1
-2	Cotton Carded Yarn (A)	40	1		40			0.5	656	600	152	5.57	1.1714	7.5	60.0	60	316.29	3360.64	10.6	11
-3	Cotton Carded Yarn (R)	20	1		20			0.5	656	600	152	5.57	2.3429	7.5	60.0	60	632.57	294.86	0.5	1

Table 3-8 Calculation Table for Spinning Plan of Banjaran Second Mill

BANJARAN 2
Cotton. Cotton/Polyester. Polyester/Cotton

		1	2	3	4	5	6	7	8		9		10	11	12	13	14	15	16	17
	Process / Item	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	for Polyester				14.0			0.5	11.0	9.1	960	50	477.75	7.5	83	1	2973.99	888.61	0.3	1
-2	for cotton (A)				12.5			2.0	11.0	9.1	960	50	426.56	7.5	83	1	2655.35	2037.56	0.8	1
-3	for cotton (C)				12.5			2.0	11.0	9.1	960	50	426.56	7.5	83	1	2655.35	3404.64	1.3	2
								Reusable												
2	Carding Machine	oz/yard			Grain/6yds			0.5	rpm	yds	φ	mmH								
-1	for Polyester	14.0	1	98.33	370			1.0	26.0	45.4	508	1067	43.29	7.5	90	1	292.21	879.73	3.0	3
-2	for cotton (B)	12.5	1	98.44	320			4.0	23.0	34.9	508	1067	33.12	7.5	90	1	223.56	1956.05	8.7	9
-3	for cotton (C)	12.5	1	98.44	320			4.0	23.0	34.9	508	1067	33.12	7.5	90	1	223.56	3268.46	14.6	15
3	Pre-Drawing Frame	Grain/6yds			Grain/6yds				yds	m	φ	mmH								
-1	Polyester of Blend (A)	370	8	7.59	390			0.3	246.1	225	508	1067	137.11	7.5	83	4	3414.11	649.04	0.2	1
-2	Polyester of Blend (B)	370	7	8.25	314			0.3	246.1	225	508	1067	110.39	7.5	83	4	2748.80	228.05	0.1	1
4	Pre-Combing of Cotton	Grain/6yds			Grain/yard				yds	m	W	φ								
-1	Sliver Lap Machine	320	18	1.37	700			0.3	62.3	57	232	630	373.80	7.5	80	1	2242.80	3258.65	1.5	2
-2	Ribbon Lap Machine	700	6	6.00	700			0.3	56.9	52	300	630	341.40	7.5	80	1	2048.40	3248.88	1.6	2
								Reusable												
5	Comber	Grain/yard			Grain/6yds			1.0	nip	mm	φ	mmH								
-1	for cotton	700	4	40.80	350			15.0	180.0	5	508	1067	20.08	7.5	85	2	256.00	2729.06	10.7	11
6	1st Drawing Frame	Grain/6yds			Grain/6yds				yds	m	φ	mmH								
-1	Polyester/Cotton Yarn	390	5	8.22	365			0.3	246.1	225	508	1067	128.32	7.5	83	4	3195.26	995.52	0.3	1
-2	(C)	350	3																	
-3	COtton/Polyester Yarn	314	3	8.04	335			0.3	246.1	225	508	1067	117.78	7.5	83	4	2932.63	649.62	0.2	1
-4	(C)	350	5																	
-5	Cotton Combed Yarn (A)	350	8	8.00	350			0.3	246.1	225	508	1067	123.05	7.5	83	4	3063.95	1950.19	0.6	1
-6	Cotton Carded Yarn (B)	320	8	8.26	310			0.3	246.1	225	508	1067	108.99	7.5	83	4	2713.78	568.72	0.2	1
7	2nd Drawing Frame	Grain/6yds			Grain/6yds				yds	m	φ	mmH								
-1	Polyester/Cotton Yarn	365	8	8.34	350			0.3	246.1	225	508	1067	123.05	7.5	83	4	3063.95	992.54	0.3	1
-2	COtton/Polyester Yarn	335	8	8.12	330			0.3	246.1	225	508	1067	116.02	7.5	83	4	2888.86	647.67	0.2	1
-3	Cotton Combed Yarn (A)	350	8	8.00	350			0.3	246.1	225	508	1067	123.05	7.5	83	4	3063.95	1944.34	0.6	1
-4	Cotton Carded Yarn (B)	310	8	8.00	310			0.3	246.1	225	508	1067	108.99	7.5	83	4	2713.78	567.01	0.2	1
8	Simplex Fly Frame	Grain/6yds			Grai/30yds				rpm		φ	mmL								
-1	Polyester/Cotton Yarn	350	1	8.03	218	0.73	0.78	0.5	900		152	406	2.0040	7.5	80	108	1298.62	987.58	0.8	1
-2	COtton/Polyester Yarn	330	1	7.57	218	0.88	0.94	0.5	900		152	406	1.6565	7.5	80	108	1073.43	644.43	0.6	1
-3	Cotton Combed Yarn (A)	350	1	8.03	218	1.12	1.20	0.5	900		152	406	1.2976	7.5	80	108	840.86	1934.61	2.3	3
-4	Cotton Carded Yarn (B)	310	1	7.11	218	1.21	1.30	0.5	900		152	406	1.1978	7.5	80	108	776.18	564.18	0.7	1
9	Ring Spinning Frame	Grai/30yds			Ne				rpm		mmR	mmL								
-1	Polyester/Cotton Yarn	218	1	34.88	40	3.65	23.09	1.0	11800		44	203	0.0253	8.0	93	432	81.47	977.70	12.0	12
-2	COtton/Polyester Yarn	218	1	34.88	40	3.73	23.59	1.0	11800		44	203	0.0248	8.0	93	432	79.75	637.98	8.0	8
-3	Cotton Combed Yarn (A)	218	1	34.88	40	4.05	25.59	1.2	11800		44	203	0.0229	8.0	93	432	73.52	1911.40	26.0	26
-4	Cotton Carded Yarn (B)	218	1	34.88	40	4.27	27.00	1.2	11800		44	203	0.0217	8.0	93	432	69.68	557.41	8.0	8
10	Steam Setter								Batch/hour		Lbs/Batch									
-1	Polyester/Cotton Yarn																			
-2	COtton/Polyester Yarn								1.0		660		660.00	7.5	90	1	4455.00	1615.68	0.4	1
11	Auto Winder	Ne			Ne				yds	m	mm	Angle								
-1	Polyester/Cotton Yarn	40	1		40			0.5	875	800	152	5.57	1.5625	7.5	85	60	597.66	972.81	1.6	2
-2	COtton/Polyester Yarn	40	1		40			0.5	875	800	152	5.57	1.5625	7.5	85	60	597.66	634.79	1.1	2
-3	Cotton Combed Yarn (A)	40	1		40			0.5	875	800	152	5.57	1.5625	7.5	85	60	597.66	1901.84	3.2	4
-4	Cotton Carded Yarn (B)	40	1		40			0.5	875	800	152	5.57	1.5625	7.5	85	60	597.66	554.62	0.9	1

3-1-3 Methods of Quality Control

Standard control items and testing methods for a whole spinning mills in PT Sandang I are listed in Table 3-9, and the Banjaran First and Second Mills also follow this standadized procedure. However, items for which nothing can be done even with poor testing results (i.e. U% of carding sliver) and items for which will not be changed once being set (i.e. rotation of drawing and roving), are mixed each other. Although there are control sheets for each item, it is difficult to read the control limits and target values at a single glance. A new "easy-to-see" control method should be enforced in order to understand long term change, transitions and trends. also, a system should be established in order to correspond to more advanced and complicated needs in the future.

Table 3-10 shows the results of an examination performed by the Japan Spinners' Inspecting Foundation for yarn quality on a full cop, which is currently being spun at the Banjaran Mills.

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

Table 3-11 shows the standard characteristic values in Japan for different kinds of yarn, and achieving these values are indispensable

Figure 3-1 shows the USTER charts and diagram of the spectrograms of cottons Ne 20 and Ne 30. The spectrogram of cotton Ne 30 has cyclic spots indicating requirements for adjustment. Figure 3-2 shows the USTER charts and diagram of spectrogram of polyester/cotton Ne 40 and polyester/cotton Ne 45. The spectrogram for both Ne 40 and Ne 45 also have cyclic spots indicating also requirements for adjustment.

The evaluations of the results of the yarn testing are as follows:

- Although yarn count deviation per single yarn for cotton Ne 30 is considerably high to the minus side, the strength of a single yarn is low and the strength variation ratio is also high. This corresponds to the fact that the IPI values of the thin yarn (2.8 times the Japanese Standard Characteristic Value) and the thick yarn (1.7 times) are very poor, which clearly reflects the fluctuation of the USTER chart and the periodical irregularity of the spectrogram. As a countermeasare, a front roller part of the first drawing needs to be adjusted.
- Ne 20 cotton has low U% and high IPI values for thick yarn (2.1 x Japanese Standard Characteristic Value), which affect its ratio of twist variation. In order to improve these

values, the setting condition of the pre-spinning process have to be reviewed to maintain parallel position.

- Polyester/cotton blended yarn (65/35) Ne 45 has a very small coefficient of count variation. Stabilizing the lap weight, reducing the fluctuation at longer intervals, and decreasing the periodic irregularity of the spectrogram by adjusting the shake at the front bottom roller of the drawing frame are measures to be taken.

What is important is to minimize the periodical irregularity which is commonly observed in the results of the above 3 yarn tests. Because the spectrometer became so obsolete that it is no longer employed and the quality is being evaluated by the value of U% alone as a result, the frequency periodical irregularity is often left overlooked. It is regrettable that no testing method to substitute for the spectrometer method was not introduced when it was decided to stop using the equipment. Assessment of the size of oscillation and the waviness on USTER Chart, combined with evaluation of the unevenness, nep, and fluff of the yarn by visually inspecting the seriplane (blackboard), should sufficiently serve the purpose.

Table 3-9 Standard Quality Control Items at Sandang I.

Process	Type	QC Testing Items	Frequency				Remarks
			Shift	Day	Week	Occassion	
Bale store	Raw cotton	Grade, S.L., Micro., Pressley		1			
		Staple diagram				At change	
Blowing	Lap	Each lap weight	1				All laps
		OZ/yard & CV%			1		One grade
		Lap imperfection rate	1				All laps
		Staple diagram				At change	
	Waste	Waste %				At change	
Carding	Sliver	Sliver weight & CV%			1		
		Sliver U%				Once/month	
		Staple diagram				At change	
		Sliver nep & leaves		1			
	Waste	Waste %				At change	Once/two months
		Waste(Flat)				At change	Once/two months
Lap former	Lap	Lap weight & CV %			2		
Combing	Sliver	Sliver weight & CV %		1			
		Sliver U %			2		
		Staple diagram				At change	
	Waste	Waste %				At change	
Drawing	Sliver	Sliver weight & CV %	4				Once/H, 4 yards
		Sliver U %		1			Two grades
		Silver breakage by reason			1		
		No. of rotation				Once/month	

Process	Type	QC Testing Items	Frequency				Remarks
			Shift	Day	Week	Occassion	
Roving	Roving	Roving weight & CV%			1		20 yards Two grades
		Roving U%			1		20 yards Two grades
		Roving breakage by reason			1		20 yards Two grades
		No. of rotation				Once/month	
Ring spinning	Yarn	Yarn weight & CV%			1		120 yards
		Lea breaking strength & CV%			1		
		Lea elogation & CV%			1		
		Single yarn strength & CV%			1		
		No. of twisting			1		
		U%		1			
		IPI		1			
		Instantaneous yarn cutting			2		
		Yarn breakage (1000sps/H)			2		
		Outlook inspection			1		
		Idle spindle			2		
		No. of rotation				Once/month	
Finish-ing	Yarn	Yarn breakage (10,000m)			1		
		Cone weight & CV%	1				Random sampling
		Defective winding	1				All cheese

Table 3-10 Yarn Test Record

(N=3)

Test Items		Mill	Banjaran 1st Mill		Banjaran 2nd Mill	
		Kind	Cotton carded yarn		Polyester/cotton blended yarn	
		Yarn	Ne 20	Ne 30	Ne 40	Ne 45
a. Count						
Actual (Ne)			20.12	29.16	40.90	45.32
Deviation (%)			+0.6	-2.8	+2.3	+0.7
CV%			0.9	1.6	2.5	2.6
b. Breaking Strength; single						
Average (gf)			491.7	196.6	322.5	255.4
CV%			9.7	12.5	16.6	11.1
Elongation (%)			6.3	5.6	9.6	9.0
c. Breaking Strength; Lea						
Average (Kgf)			52.3	30.5	36.5	30.3
CV%			7.1	3.4	3.8	5.9
Elongation (%)			5.2	4.5	5.3	7.2
d. Twist						
Average (tpi)			18.2	22.3	20.6	22.6
CV%			7.1	5.2	5.0	7.0
e. U%			14.5	18.4	14.1	13.3
f. IPI Values (Piece/200m)		Thin	3	39	4	6
		Thick	44	108	9	15
		Nep	70	85	17	39

Table 3-11 Average Yarn Quality in Japan (1990)

		Cotton carded Yarn		Cotton combed Yarn		P/C blended Yarn
		Ne 20	Ne 30	Ne 30	Ne 40	Ne 45
Deviation of yarn count (%)		±1.0	±1.0	±1.0	±1.0	±1.0
Yarn count CV % (%)		1.7	1.9	1.6	1.7	1.8
Single yarn breaking strength CV %		423	263	307	219	272
Average breaking strength for minimum 6 data (gf)		360	219	243	184	222
Single yarn breaking strength CV %		8.9	10.0	8.0	9.4	10.9
U %		13.0	14.9	11.6	12.6	13.0
I P I Value Piece / 200m	Thin	4	14	1	5	10
	Thick	21	63	4	13	19
	Nep	31	93	5	16	20

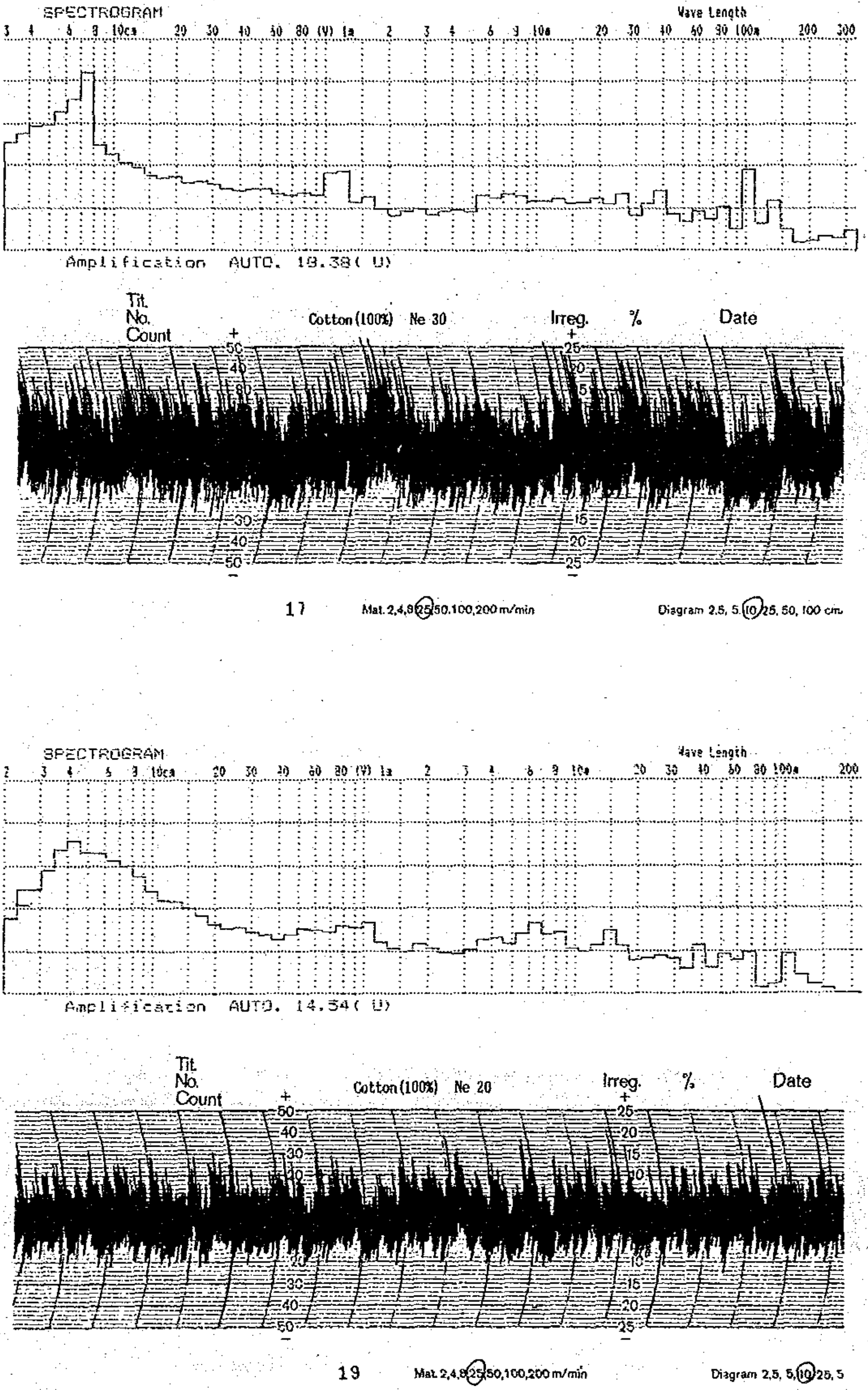


Figure 3-1 USTER Chart (for cotton yarn).

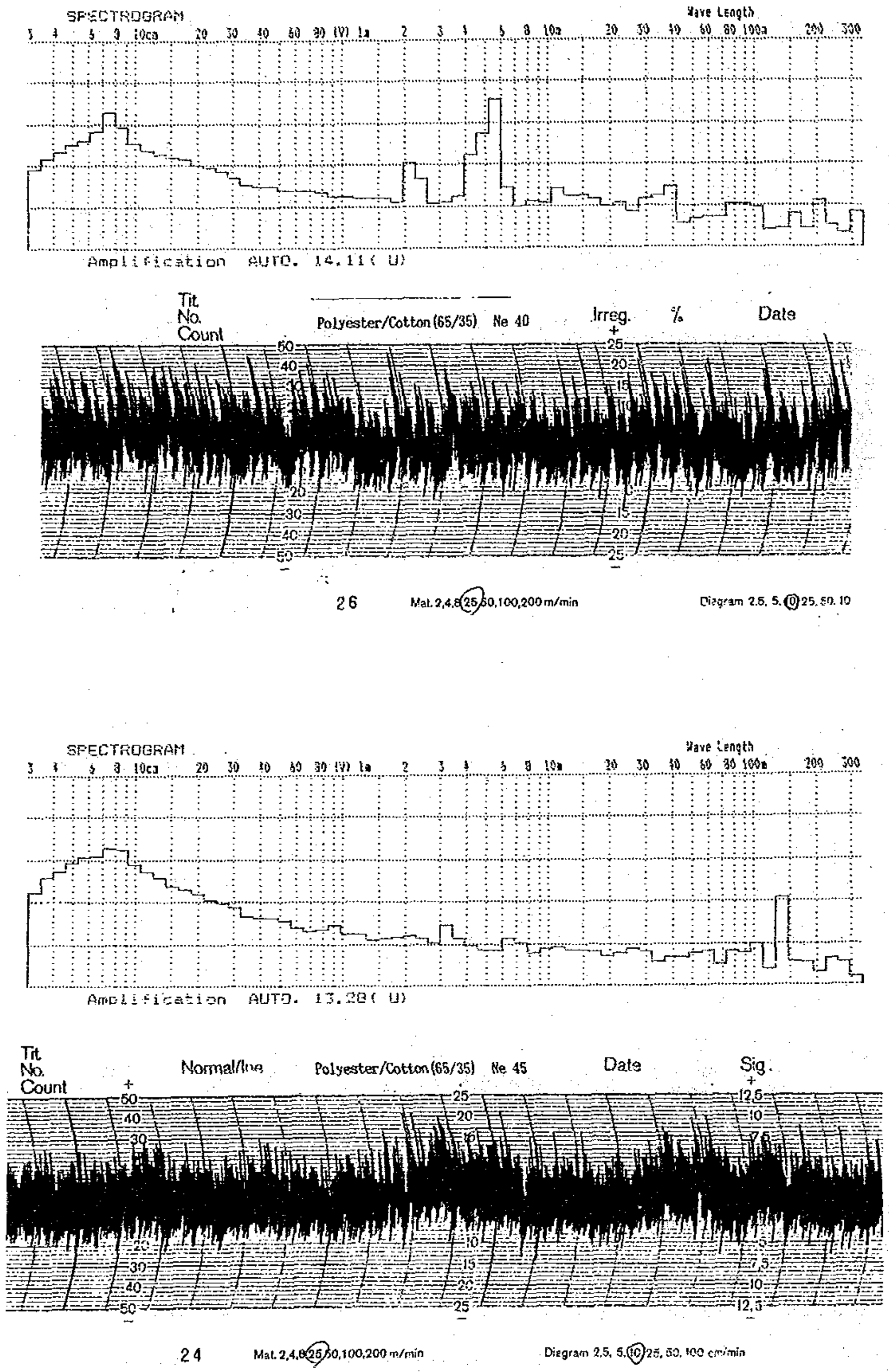


Figure 3-2 USTER Chart (for polyester/cotton blended yarn)

3-2 Production Machinery

3-2-1 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 3-12.

(2) Auxiliary Equipment and Laboratory Equipment List

Listed in Table 3-13 and 3-14 are the main auxiliary equipment and laboratory equipment currently in use.

Table 3-12-(1) Specifications of Main Production Machinery: First Mill

Item No	Machine/Equipment	Quantity
S-1-1	Blow room machinery(P.R.China)	
	1)Year of manufacture 1964	
	2)Lap feeding system to Card	
	3)Line arrangement	
	a)Opening line for cotton	1 line
	5 BHF(Hopper bale breaker)	3 scutchers
	1 WHF(Waste feeder)	
	1 conveyor belt	
	1 V O(Vertical opener)	
	2 Fan condenser with opener	
	3 Over flow reserve box	
	3 Double beater opener with lap machine	
	b)Opening line for man made fiber	1 line
	5 BHF(Hopper bale breaker)	2 scutchers
	1 WHF(Waste feeder)	
	1 conveyor belt	
	1 V O(Vertical opener - Bye pass)	
	2 Fan condenser with opener	
	2 over flow reserve box	
	2 Double beater opener with Lap machine	
S-1-2	Revolving flat carding engine(P.R.China)	113 sets
	1)Type of machine CE	
	2)Year of manufacture 1965	
	3)Lap feeding system	
	4)Fly comb system	
	5)Silver can size ϕ12"x36"H	
S-1-3	Drawing frame(Pre lap forming)(OM)	1 set
	1)Type of machine Vertical Drafter	
	2)Year of manufacture 1968	
	3)Number of feeding sliver per delivery 8	
	4)Number of deliveries per frame 2	
	5)Draft system Vertical	

Item No	Machine/Equipment	Quantity
	6)Delivery can size 16"x42"H	
S-1-4	Drawing frame(Pre lap forming)(TOYODA)	2 sets
	1)Type of machine DK-9	
	2)Year of manufacture 1971	
	3)Number of feeding sliver per delivery 8	
	4)Number of deliveries per frame 2	
	5)Draft system 5 over 4 roller	
	6)Delivery can size 16"x42"H	
S-1-5	Lap former(OM)	1 set
	1)Type of machine CMB-127	
	2)Year of manufacture 1968	
	3)Number of feeding sliver per frame 20	
	4)Feeding can size 16"x42"H	
	5)Taking up size of lap 400mm x 270mm	
S-1-6	Lap former(TOYODA)	2 sets
	1)Type of machine 3K 3A	
	2)Year of manufacture 1970,1971	
	3)Number of feeding sliver per frame 20	
	4)Feeding can size 16"x42"H	
	5)Taking up size of lap 400mmx270mm	
S-1-7	Combing machine(OM Whitin)	4 sets
	1)Type of machine Whitin	
	2)Year of manufacture 1968	
	3)Number of combing head per frame 8	
	4)Number of deliveries per frame 2	
	5)Delivery can size 16"x42"H	
	6)Comb cylinder Needle	
	7)Drafting system 2 over 2	
S-1-8	Combing machine(TOYODA)	3 sets

Item No	Machine/Equipment	Quantity
	1)Type of machine CM-8	
	2)Year of manufacture 1970	
	3)Number of combing head per frame 8	
	4)Number of deliveries per frame 2	
	5)Delivery can size ϕ16"x42"H	
	6)Comb cylinder Needle	
	7)Draft system 2 over 2	
S-1-9	Drawing frame(P.R.China)	40 heads
	1)Type of machine DF	
	2)Year of manufacture 1964	
	3)Number of feeding sliver per delivery 6	
	4)Number of deliveries per frame 4	
	5)Draft system 4 over 4 dead weight	
	6)Delivery can size ϕ12"x36"H	
S-1-10	Drawing frame(HOWA)	
	1)Type of machine FLEMIC	
	2)Year of manufacture 1970	
	3)Number of feeding sliver per delivery 21~24	
	4)Number of deliveries per frame 2	
	5)Draft system 3 over 4	
	6)Delivery can size ϕ16"x42"H	
S-1-11	Simplex fly frame(OM)	17 sets
	1)Type of machine FLD-108	
	2)Year of manufacture 1967-1968	
	3)Number of spindles per machine 62	
	4)Lift 9"	
	5)Draft system 4 over 4	
S-1-12	Ring spinning frame(P.R.China)	74 sets
	1)Type of machine 3 line short apron	
	2)Year of manufacture 1964	

Item No	Machine/Equipment	Quantity
	3)Number of spindles per frame 416	
	4)Spindle gauge 70	
	5)Lift 7"	
	6)Draft system 3 over 3 apron	
	7)Over head travelling cleaner LUWA	
S-1-13	Winding machine(P.R.China)	13 sets
	1)Type of machine RT	
	2)Year of manufacture 1964	
	3)Number of drum per machine 100	
	4)Take up Package 6"Traverse cone	
S-1-14	Winding machine(Murata)	1 set
	1)Type of machine R.T	
	2)Year of manufacture 1982	
	3)Number of drum per machine 120	
	4)Take up package 6"Traverse cone	
S-1-15	Doubler winder(P.R.China)	5 sets
	1)Type of machine R.T	
	2)Year of manufacture 1964	
	3)Number of drum per machine 100	
	4)Take up package 6"Traverse cone	
S-1-16	Ring twisting machine(P.R.China)	22 sets
	1)Type of machine Ring twister	
	2)Year of manufacture 1964	
	3)Number of spindle per machine 380	
	4)Diameter of Ring 50mm	
	5)Lift 8"	
S-1-17	Ring twisting machine(OM)	8 sets
	1)Type of machine Ring twister OM-SD	
	2)Year of manufacture 1962	

Item No	Machine/Equipment	Quantity
	3)Number of spindle per machine 400 4)Diameter of ring 50mm 5)Lift 8"	
S-1-18	Double winder(MURATA) for coarse count yarn	1 set
S-1-19	Ring twister(KYORITU)	1 set
S-1-20	Reeling machine	4 sets
S-1-21	Bunding press	3 sets
S-1-22	Baling press	1 set
S-1-23	Roving waste opener	1 set
S-1-24	Spindle tape loom	10 sets

Table 3-12-(2) Specifications of Main Production Machinery: Second Mill

Item No	Machine/Equipment	Quantity
S-2-1	Blow room machinery(OHARA)	
	1)Year of manufacture 1974	
	2)Lap feeding system to card	
	3)Line arrangement	
	a)Opening line for cotton	1 line
	4 MBK(Blending feeder)	2 scutchers
	1 V C(Belt conveyor)	
	1 M Z(Magnetic trap)	
	1 K D_2(Fan condenser)	
	1 S F(Filter)	
	1 H R_6(Step cleaner)	
	1 V O_1(Porcupine opener)	
	1 K D_1(Fan)	
	1 S F(Filter)	
	2 V O_2(Porcupine opener)	
	2 K D_1(Fan condenser)	
	2 S F(Filter)	
	2 K S_1(Hopper feeder)	
	2 S W(Scutcher with lap scale)	
	b)Opening line for man made fiber	1 line
	1 C L(Clipper lattice)	1 scutcher
	1 MBK(Blending feeder)	
	1 V O(Porcupine opener)	
	1 K D(Fan condenser)	
	1 K S(Hopper feeder)	
	1 S W(Scutcher with lap scale)	
S-2-2	Revolving flat carding engine(TOYODA)	24 sets
	1)Type of machine CK-7	
	2)Year of manufacture 1974	
	3)Lap feeding system	
	4)Roller doffing system	
	5)Sliver can size φ20"x42"H	

Item No	Machine/Equipment	Quantity
S-2-3	Revolving flat carding engine(P.R.China) 1)Type of machine CE 2)Year of manufacture 1965 3)Lap feeding system 4)Fly comb system 5)Sliver can size ϕ12"x36"H	4 sets
S-2-4	Revolving flat carding engine(MEIKIN) 1)Type of machine CE 2)Year of manufacture 1981 3)Lap feedinrg system 4)Fly feeding system 5)Silver can size ϕ20"x42"H	1 set
S-2-5	Drawing frame(Pre lap forming)(HARA) 1)Type of machine CHERRY D-1200 2)Year of manufacture 1974 3)Number of feeding slivers per delivery 8 4)Number of deliveries per frame 2 5)Draft System 4 over 4 presserbar 6)Delivery can size ϕ20"x42"H	5 sets
S-2-6	Drawing frame(Pre lap forming)(TOYODA) 1)Type of machine DY-2C 2)Year of manufacture 1980 3)Number of feeding slivers per delivery 8 4)Number of deliveries per frame 2 5)Draft system 5 over 4 roller 6)Delivery can size ϕ20"x42"H	1 set
S-2-7	Lap former(TOYODA) 1)Type of machine SK-4A 2)Year of manufacture 1974 3)Number of feeding slivers per frame 42~45	2 sets

Item No	Machine/Equipment	Quantity
	4)Feeding can size ϕ20"x42"H	
	5)Taking up size of lap 400mm x 270mm	
S-2-8	Combing machine(TOYODA)	11 sets
	1)Type of machine CM-8	
	2)Year of manufacture 1974	
	3)Number of combing head per frame 8	
	4)Number of deliveries per frame 2	
	5)Delivery can size ϕ20"x42"H	
	6)Comb cylinder Needle	
	7)Drafting system 2 over 2	
S-2-9	Drawing frame(HARA)	6 heads
	1)Type of machine CHERRY D-800F	
	2)Year of manufacture 1974	
	3)Number of feeding slivers per delivery 8	
	4)Number of deliveries per frame 4	
	5)Number of passage 2	
	6)Draft system 4 over 4 presser bar	
S-2-10	Simplex fly frame(TOYODA)	8 sets
	1)Type of machine FL-16	
	2)Year of manufacture 1974	
	3)Number of spindles per machine 96	
	4)Lift 16"	
	5)Draft system Sussen 4 over 4 apron draft	
S-2-11	Ring spinning frame(TOYODA)	78 sets
	1)Type of machine RY	
	2)Year of manufacture 1978, 1980, 1981	
	3)Number of spindles per frame 432	
	4)Spindle gauge 75mm	
	5)Lift 8"	
	6)Draft system 3 over 3 apron	

Item No	Machine/Equipment	Quantity
	7)Over head travelling cleaner LUWA	
S-2-12	Winding machine(MURATA)	9 sets
	1)Type of machine MACH splicer	
	2)Year of manufacture 1988, 1989, 1990	
	3)Number of drum per machine 60	
	4)Take-up package 6"Traverse cone	
S-2-13	Winding machine(MURATA)	22 sets
	1)Type of machine GILBOS	
	2)Year of manufacture 1974	
	3)Number of drum per machine 16	
	4)Take-up package 6"Traverse cone	
S-2-14	Steam setter(ASHIDA)	2 sets
	1)Type of machine AV-1 AV-2	
	2)Year of manufacture AV2 1974	
	AV1 1977	

Table 3-13-(1) Auxiliary Equipment List : First Mill

Item No	Equipment	Year of manufacture	Quantiity	Manufacturer
A-1-1*	Flat grinding machine	1964	3 sets	P.R.China
A-1-2	Flat clipping machine	1964	1 set	Ditto
A-1-3	Taker-in munting machine	1964	1 set	Ditto
A-1-4*	Spindle oiler	1964	1 set	Nihon spindle
A-1-5*	Rubber assembling machine	1964	1 set	P.R.China
A-1-6*	Rubber roller grinding machine	1964	1 set	
A-1-7	Rubber roller treatment machine	1974	1 set	

Table 3-13-(2) Auxiliary Equipment List : Second Mill

Item No	Equipment	Year of manufacture	Quantity	Manufacturer
A-2-1*	Flat grinding machine	1964	1 set	P.R.Chaina
A-2-2	Flat grinding machine	1974	1 set	Yamatokoei
A-2-3	Taker-in munting machine	1974	1 set	Ditto
A-2-4	Rubber assembling machine	1974	1 set	Ditto
A-2-5*	Rubber roller grinding machine	1974	1 set	Ditto
A-2-6	Rubber roller chemical Treatment machine	1974	1 set	
A-2-7*	Spindle oiler	1974	1 set	Nihon spindle

Table 3-14-(1) Laboratory Equipment List : First Mill

Item	Equipment	Quantity	Manufactur
L-1-1	Wrap block	1 set	
L-1-2	Wrap reel	1 set	
L-1-3	Lea strength	1 set	
L-1-4	Balance	1 set	Shimazu
L-1-5	Twist tester	1 set	
L-1-6	Web test plate	2 sets	
L-1-7	Micronaire	2 sets	Keisoki
L-1-8	Compresser	1 set	Bebbicon
L-1-9	Baer softer	1 set	Zweiglo(Swiss)
L-1-10	Presslay strength	1 set	Tex Test(Swiss)
L-1-11	Torsion balance	1 set	Shimazu
L-1-12	Thermomerter(Wet & Dry)	1 set	Zeal(England)
L-1-13	Fiber strength	1 set	
L-1-14*	Storobo master	1 set	
L-1-15	Thormogragh/Fibrogragh	1 set	
L-1-16	Balance(350kg etc)	2 sets	
L-1-17	Cotton Fibro Softor	1 set	

Table 3-14-(2) Laboratory Equipment List : Second Mill

Item No	Equipment	Quantity	Manufacturer
L-2-1	Lap irregularity tester	1 set	Sacolowell
L-2-2	Wrap block	1 set	Shimazu
L-2-3	Conditioning oven	1 set	Ditto
L-2-4	Balance	1 set	Ditto
L-2-5*	Tacho meter	1 set	TECLOK
L-2-6	Hand tacho meter	1 set	Taquet(Swiss)
L-2-7	Grain balance	1 set	Metler(Swiss)
L-2-8	T.P.I single tester	1 set	
L-2-9	Lea strength	1 set	
L-2-10	Wrap leale	1 set	Shimazu
L-2-11	Single strength	1 set	
L-2-12	Uster(Keisoki) integrator recorder	1 set	Keisoki
L-2-13*	Uster Indicator Integrator Recorder Spectorgraph	1 set	Zellweger
L-2-14	Yean appearence	1 set	
L-2-15	Balance	1 set	Avery (England)
L-2-16	Balance	1 set	
L-2-17	Strobo scope	1 set	Sugahara
L-2-18	Thermometer(Wet & Dry)	1 set	
L-2-19	Hardness tester	1 set	Shimazu
L-2-20	Quadrant balance	1 set	Ditto
L-2-21	Tension gauge	1 set	Teclok

3-2-2 Arrangement of Production Machinery

The Banjaran Mills are located 20 km south of Bandung and occupy a total area of 25 hectares. The First Mill spans 170 meters from north to south and 87 meters from east to west, and the Second Mill, spanning 190 meters from north to south and 70 meters from east to west, is located to the south of the First Mill on the other side of a warehouse. The Mills are equipped with mainly 64,480 spindles for shorter fiber spinning. Production machinery are allocated in both the First and Second Mills, as shown in Figures 3-3 and 3-4 respectively.

(1) Layout of Production Machinery at the First Mill

a) Summary

A Blow Room is located in the south part of the building, and raw materials are processed to the north through Carding Machines, Combing Machines, Drawing Frames, Roving Frames, Spinning Frames and finally Winding and Twisting Machines installed in another room.

The whole processing flow is good, but there are some disturbing factors such as transportation and setup of cans and semi-products piled up around the Combing Machine and the two FLEMIC Drawing Frames which were introduced in 1970. There is an air-conditioning room, a maintenance room, a canteen and an office in the east and west side of the building in 5 meter width. Ten looms for spindle tape are also located and operated at this corner of the building.

In the Reeling Machine room, there are a MURATA Doubling Machine and a KYORITSU Twisting Machine for coarse yarn which are not in use. Columns are placed at intervals of 7.8 m in the northsouth direction, and of intervals of 5m, 8m, 12m × 5, 8m and 5m in the east-west direction.

b) Blow Room Process

This process flows from west to east, with a sufficient space for opening raw cotton and storing carriers.

c) Carding Process

One hundred and twelve Carding Machines are equipped at the smallest machine intervals. Cans used are small (ϕ12" × 36"H), and they have been extensively damaged due to the long term of their usage, which affects the quality of products such as sliver fluff and coil irregularity. Twelve machines, numbered 101 to 112, are placed at the far end of the west side, causing inconvenience for carrying laps and slivers.

d) Drawing Process

Nine sets of machines for four-delivery and two-passage are installed in parallel. Slivers are six-feed, cans are ϕ12" × 36"H, and the roller part is a dead weight.

e) Drawing Process for Lap Former

Two TOYODA DK-9 machines with ϕ16" × 42"H cans, eight sliver feeds and two deliveries are placed at the west and east sides of the Combers. There is also a VERTA drafter (two-delivery) which is not being used.

f) Lap Former

There are two TOYODA 3K3A machines with doubling of 20-sliver, and one OM's CMB-127 which is not being used.

g) Combing Process

There are three TOYODA and four OM's WHITIN machines.

h) Polyester/cotton Blending Process

There are two HOWA FLEMIC machines being used for final drawing, but transportation of cans and laps are not smooth around this area due to improper installation positions and intervals between the machines.

i) Roving Process

Seventeen frames of OM's FLD-108 with 9" lift are placed in the vertical direction to the Drawing Frames. Although space for spare cans and intervals between the frames seem to be a little narrow, they do not disturb the operation.

j) Spinning Process

Seventy four frames of 416 spindles with 7" lift (wooden bobbins are for weft) and ϕ42mm ring are placed in two rows running from the east to the west. Each row has 37 frames placed from the north to the south. There is no problem with frame intervals or passages. However, productivity is very low which has been attributed to the old machinery, retarded introduction of bearings, and the poor quality of products due to the Skewer-type of roving yarn.

k) Winding Process

There are thirteen RT Winding Machines and five Doubling Machines in the same direction as the spinning processing facilities, separated by a wall. Across an aisle in the same direction, there are 30 Twisting Machines, and three Winding Machines including one MURATA's. Eight MURATA Twisting Machines and one MURATA

Winding Machine are also installed across an aisle in the north side, though they are not operated now.

The layout of the east corner where general office and a manager's office are located disturbs the transport of products from the MURATA winding machine.

l) Other equipment

There is a Reeling Machine, a Handling Machine and a KYORITSU's coarse yarn Twisting Machine, which is not operated due to a lack of some spare parts. Ten spindle tape looms which are in operation are located in the south-west corner.

(2) Layout of Production Machinery at the Second Mill

a) Summary

The Blow Room Machinery is placed in the north part of the mill, and products flow from the north to the south, finally transported to the shipping exit located in the south-east corner. One set of Blow Room Machinery with one line and two scutchers and another set of Blow Room machinery with one line and one scutcher for man-made fiber are installed from the north side through an opening room in parallel with the east-west direction. Separated by a wall, 24 CK-7 Carding Machines and two rehabilitated MEIKIN Carding Machines are installed in the east corner. On the west side of these Carding Machines, there is a drawing processing unit (used as a grain adjuster for man-made fiber and a Sliver Lap Machine used as a Lap Former for cotton), and in the west side of this drawing processing unit combing and drawing processing units are placed. The layout of the machinery here causes a slow flow of products. On the west side of the Combing and Drawing Frames, eight Roving Frames are equipped in the east-west direction. In the three rows, 78 Spinning Frames are placed vertical to the Roving Frames, and the space between each frame and aisles for carriers seem to be sufficient.

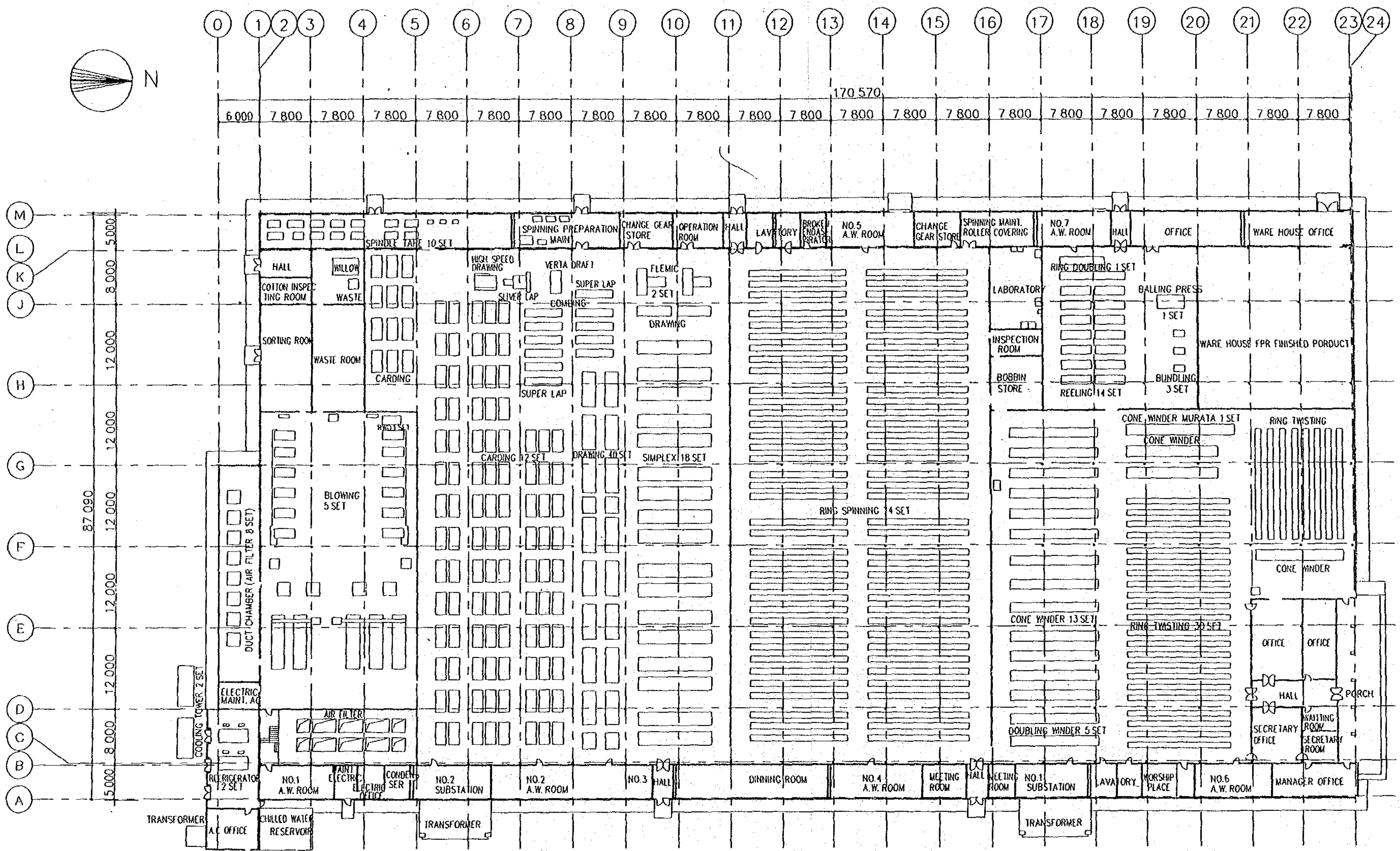


Figure 3-3 Layout of Production Machinery : Banjaran First Mill

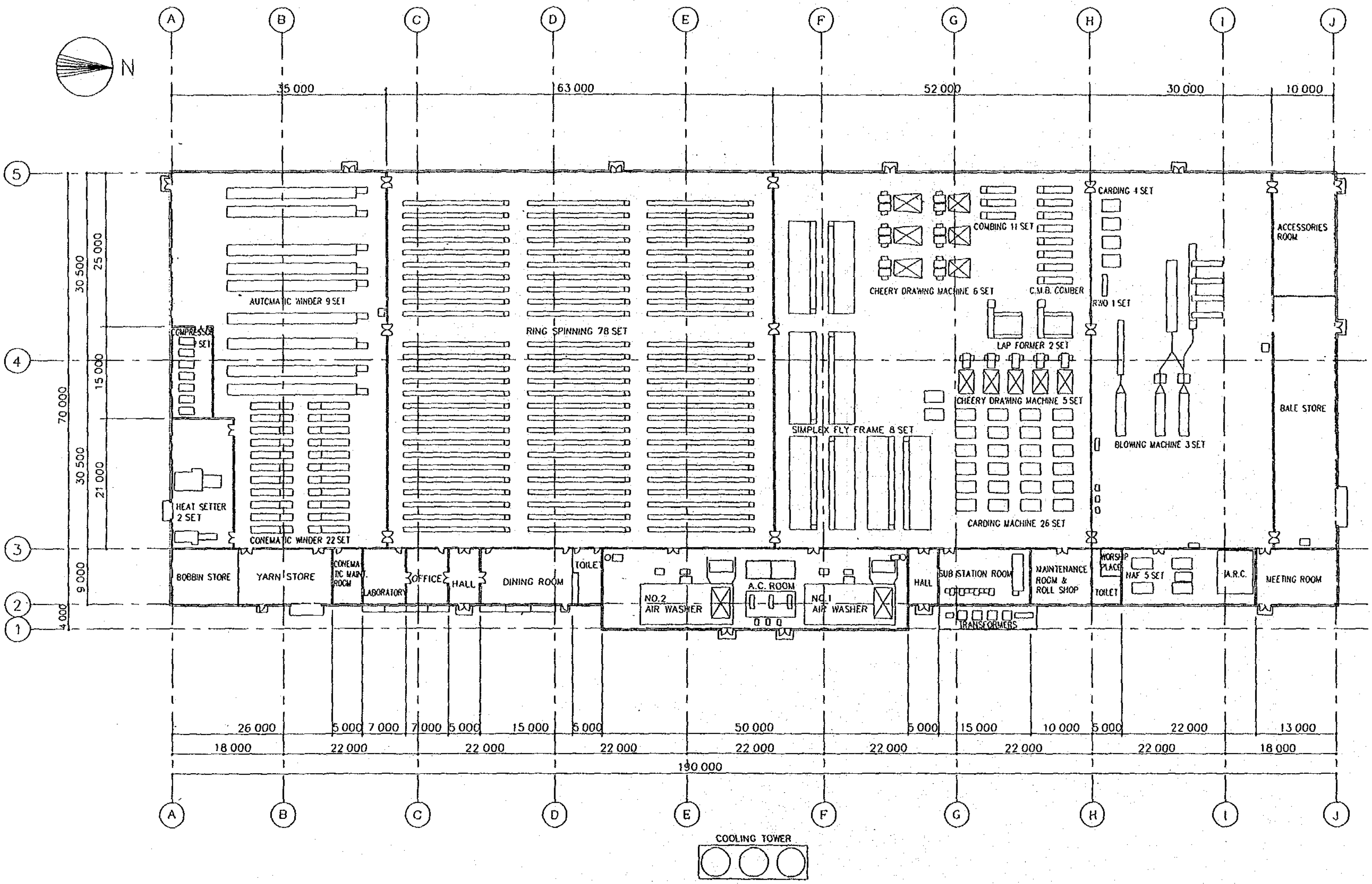


Figure 3-4 Layout of Production Machinery : Banjaran Second Mill

At the south end of the mill, nine MURATA Mach-Corner Autowinders (60 drums) and 22 MURATA Gilbos Autowinders are stationed, but all the Gilbos winders are not in operation now. In a part of this corner, two Steam Setters are being operated. This mill is equipped with machines made in Japan in 1974, most of which are in a good shape to use. Columns are built at intervals of 9m and 30.5m × 2 from the east to the west and 18m, 22m × 7 and 18m from the south to the north. Auxiliary rooms such as an office, a laboratory, an canteen, a meeting room, a lavatory and a utility room are allocated in nine-meter span at the east side of the Mill.

b) Blow Room Process

This process stemming from the west to the east has sufficient space for the stock of opened raw cotton and laps, and for carriers. However, there is no such arrangement as a net curtain for preventing mixture of cotton and polyester fiber.

c) Carding Process

Twenty four TOYODA CK-7 Machines (roller doffing) are being operated. There are some problems in the quality and maintenance of this model, though it can be used for Open-End Spinning.

d) Drawing Process (for Grain Adjuster and Lap Former)

There are five CHERRY D1200 frames which are equipped with two-delivery, and eight-sliver doubling, and one TOYODA DY-2C frame which is rarely used. The distance between Carding Machines and Lap Formers is slightly narrow, which disturbs the transportation of sliver cans.

e) Lap Former

There are two TOYODA SK-4A Lap Formers. Quite a few lap licking are observed at the combing process. It is noted that the process of connecting Drawing Machines and Lap Formers has a licking problem.

f) Combing Process

There are eleven TOYODA CM-8 (two deliveries) Machines equipped, but their condition of maintenance seems to be poor. Spacing between the machines is good enough for transportation and storage of the sliver cans.

g) Drawing Process

There are six Cherry D-800F Frames (four deliveries) with two-pass and eight-sliver doubling. The maintenance of their roller parts is poor. Spare parts control must also be carried out.

h) Roving Process

There are eight TOYODA F-6 Roving Frames equipped. There is sufficient space for aisles provided between the Frames. Roller parts, flyers, flyer bearings and gears are very much worn out. Spare parts of the top arm made of SUSSEN are no longer available.

i) Spinning Process

Seventy eight TOYODA RY (8" lift and φ44mm) Ring Frames are equipped and divided into three rows in the north-south direction. Eight of them were made in 1980/81 and are still in good condition. However, the rest of them have problems with the rings, which have exceeded their durable life. This, along with poor conditions of spindle and draft parts, has been affecting the yarn quality and the end break adversely. Main spare parts must be ordered immediately. Aisles and spacing between the frames are large enough, and blow cleaning equipment is installed appropriately.

j) Winding Process

There are nine MURATA Mach-Corner Autowinders (60 drums), and twenty-two Gilbos Autowinders which are not being operated. The Mach-Corner winders are placed in the same direction as the Spinning Frames, but the different interval between the winders are disturbing the working efficiency. Although these winders are quite new, no yarn length measuring devices are equipped, thus too many workers are assigned to control the yarn length.

k) Steam Setting Process

Two ASHIDA Steam Setters (different capacities) are equipped. Yarns transported from the Banjaran First Mill and Cipadung Mill raise the issue of the transportation costs.

3-2-3 Conditions of Machinery Maintenance and Usability

(1) Purpose and Importance of Maintenance

Implementation schedule sheets for regular maintenance and guidelines for each operation are prepared for both the First and Second Mills. However, problems such as the overall deterioration of machines due to long term usage, spare parts that are difficult to find and poor maintenance techniques, are degrading the quality of products. It is necessary to recognize the importance and the purpose of maintenance once more.

The purpose of maintenance is to keep machines and equipment in perfect condition, and the following three points summarize what the perfect conditions of machines and equipment are.

- To provide high quality of goods produced by machines and equipment.
- To achieve maximum performance of machines and equipment.
- To maintain maximum durable life of machines and equipment.

The maintenance procedures must satisfy these purposes. In other words, it is a matter of course that machines and equipment are going to be worn out as the time elapses. However, appropriate and timely cleaning, overhauling, fixing, oiling, checking functions, ordering parts and controlling costs for repair will provide longer duration of life as well as high operating ability. This is a purpose of maintenance.

Maintenance is a daily activity to keep the facilities in good condition in order to produce the maximum profit from investment. Maintenance and operation are two wheels of a vehicle, and missing one of them cannot achieve smooth operation of the Mill. With more complexities in machinery and equipment, the importance of maintenance techniques is increasing in the production process.

Therefore, the following items must be checked:

- Conducting maintenance according to standard procedures;
- Using standard parts;
- Making perfect products under normal conditions of operation after maintenance;
- Planning maintenance from a long-term view point and following it;
- Utilizing repair costs according to plans which were made based on inspection of functions and standards of machinery.
- Improving the individual skill level of technicians.

(2) Conditions and Usability of Production Machinery and Equipment at the First Mill

Most of the machines were made in China in 1964 and '1965. The machinery, including accessories, is in obsolete condition, and obtaining spare parts is nearly impossible. All of the machines are old models, and it is even no use to repair or fix them. In order to produce quality goods, all the machines must be replaced by new ones.

a) Blow Room Process

Blowing machines have been made in TEISHU, CHINA and are not in good condition, especially around the axes of each machine, which are almost worn out without bearings. Many parts such as strikers for beaters and pins for Kirschner beaters, are very much worn down, and net-type cage rollers for each condenser are also quite damaged. The lap machine weight method is a dead weight lever method that can not deal with larger laps and may cause much variation in weight. It is difficult to increase the rotation speed of lap rollers, and increase in productivity is not possible.

b) Carding Process

The Carding Machines have been made in CHINTAO, CHINA,
and changing cylinder pedestals, doffer pedestals, etc. over to bearings has not implemented. Base wire rolling of both cylinders and doffers are not precise, which makes the cylinders unbalanced and the needle touch flat. As a result, the webs are in a poor condition, and productivity is low. The size of the cans (ϕ12" × 36"H) is small.

c) Drawing Process

Drawing Frames have been made in SHEN YANG, CHINA.
Drafts use the four-line roller, dead weight method. Slivers are six, one head, four deliveries and two passes. The size of the cans is ϕ12" × 36"H. Sliver U% is not favorable due to the dead weight method. Productivity is low because bearings have hardly been employed.

d) Drawing Process for Lap Former

Two TOYODA DK-9 Drawing Frames (made in 1971) are equipped. Sliver feeds are eight (seven are in use) and two deliveries, and size of the cans is ϕ16" × 42"H. This model is rarely used in Japan, and spare parts cannot be obtained. One Verta drafter (two deliveries) manufactured by OSAKA MACHINERY is not in operation. (This model is also not produced any more.)

e) Lap Former

There are two TOYODA DA-3K3A Lap Formers, manufactured in 1970 and 1971 respectively, operated with ϕ16" × 42"H cans and 20-sliver feeds at the delivery speed of 57 m/min. This model is not produced any more and spare parts are not available. Lap licking occurs quite often. One 1968 OSAKA MACHINERY CMB-U127 is installed but not being operated.

f) Combing Process

Three 1970 TOYODA CM-8 Combing Machines (two deliveries) and four OSAKA MACHINERY's WHITIN (two deliveries) Combing Machines are in operation. They are both supplied by eight laps. Lap licking happens quite often, and fleeces are not in good condition. Three TOYODA CM-8 Combing Machines are installed and eleven Frames of the same model are in the Second Mill. The ones in this mill should be moved to the Second Mill after replacing and repairing main parts in order to improve efficiency. Although two MARZOLI Machines are present, they are not operated.

g) Polyester/cotton Blending Process

Two Frames of 1970 FLEMIC (two deliveries) from HOWA are equipped. They are operated with sliver of 16 supplies × 3 creels, and a total of 48 doubling. Chinese-made Drawing Machines (sliver of 6 supplies, 4 deliveries) is used in the following process, but quality products cannot be expected due to the draft parts and dead weight.

h) Roving Process

Seventeen frames of 1967/68 OSAKA MACHINERY (OM) FLD-108 are equipped. The cans size is ϕ12" × 36"H, and 9" lift wooden bobbin is used. The clearer is made of wooden board and roller axes have not been converted to bearings. The method of setting a skewer in a wooden bobbin is rarely used now, and spare parts including flyer parts are almost impossible to obtain.

i) Spinning Process

Spinning Frames were made in SHANGHAI, CHINA in 1964 and equipped with 416 spindles. Creels with skewers and roller parts have not been changed to bearings. Tin rollers are very much worn out and shake often. 7" lift, ϕ42mm rings and wooden bobbins are used. SUSSEN 68-30K14 is used for the top cradle, but yarn quality is very poor. LUWA pneumatic blows are equipped, but some frames are operated without pneumatic blows. Spindles rotate at a speed of 9,000 rpm. Productivity is low, and these frames need to be replaced with new equipment as soon as possible.

j) Winding Process

There are ten 1964 RT Winding Machines made in TIENTSIN, CHINA, and three Winding Machines of the same model and one 1982 MURATA RT are used for twisting. Five of them are equipped with electroric slab catchers (USTER, or PEYER for Murata), and others use a mechanical method. Yarn is wound at an average speed of 600 m/min. All the machines except for MURATA RTs should be replaced with Autowinders.

k) Twisting Process

There are five RT Doublers made in TIENTSIN, CHINA in 1964, twenty two 1964 Chinese Ring Twisting Machines with 380 spindles and eight 1962 Osaka Machinery (OM) ring Twisting Machines with 400 spindles, but none of the OM machines are in operation. Bobbins used are 7" lifts (wooden) and 8" Lifts (plastic-made), and rings are ϕ50mm. The condition of the twin rollers is good but no high-speed operation is expected due to poor conditions around spindles.

l) Others

A KYORITSU Twisting Machine with 100 spindles for coarse yarn and a MURATA RT Doubler are in the finishing room. There is also a Reeling Machine and a Handling Machine left in the same room, but they need to be reamoved when new machines come in. Ten spindle tape looms that are placed and operated in the south-west corner should be left where they are.

(3) Condition of Production Machinery and Equipment at the Second Mill

Most of the production machinery at the Second Mill was manufactured in Japan in 1974, and has been used for 16 years since then. It is possible to keep operating this equipment by renewing spare parts and to improve the quality and production efficiency. However, the Lap Machines in the blowing process, CK-7 Carding Machines and Lap Formers are worn down, and their quality of products is poor, thus these are to be replaced. When replacing, some of the Carding Machines can be re-used for open end spinning. It would be a good idea to choose those Carding Machines that are in relatively good condition and to build a separate mill for open end spinning.

a) Blow Room Process

There are a set of one line, two scutchers lap delivery type machines for cotton and another set of one line, one scutcher lap delivery type machines for man-made fiber. The Lap Machines with lap weight adjustment are an early SW model, and the bodies of the Lap Machines and direct current motors for piano motion are very much worn out.

By replacing the main parts of hoppers and beaters in the process before Lap Machines, these machines can still be used and only the three scutchers need to be renewed.

b) Carding Process

There are twenty four TOYODA CK-7-C Machines, two rehabilitated MEIKIN Machines, and four Chinese-made Machines installed in the blowroom, but the question is all the TOYODA CK-7-C model Machines. In this model, the ratio of the cylinder and doffer diameters is 40" to 20", which is different from the standard 50" to 27". Experience has shown that the 40"/20" type is inferior to the 50"/27" type in geueral in respect of quality of the card web and poor parallelism due especially to the smaller doffing ratio. In terms of maintenance, this type of Machines also has an disadvantage in cleaning cotton stuck in the fixed flat bars and adjusting the gauge of sheets.

This 40"/20" model is no longer in production, and spare parts are rarely available, so this will be a good opportunity to renew the machines. The rehabilitated MEIKIN Machines and the China-made Machines should be disposed of.

The centralized dust collector should be reviewed in order to optimize its use.

c) Pre-drawing Process

There are five heads of 1974 HARA CHERRY D-1200 and one head of 1980 TOYODA DY-2C for lap former and polyester-fiber grain adjustment. These Machines need to have main parts such as draft parts and gears replaced, and to have shaking of rollers and the appropriate gauges adjusted, which should allow the further operation of these Machines, and provide better quality and productivity.

d) Lap Former

Two TOYODA SK-4A manufactured in 1974 are equipped. In the present condition, lap licking happens quite often and the Machines themselves are obsolete and difficult to repair. They should be replaced by new ones.

e) Combing process

Eleven TOYODA CM-8 Machines are equipped. They are causing lots of lap licking and poor fleece evenness now. In order to use them again, the cylinder half lap should be changed to the uni-comb style, and main parts such as top combs, detaching rollers and every gear should be adjusted and/or rehabilitated. The centralized dust collector is not used due to its duct being cut in the middle.

f) Drawing Process

Six heads of HARA CHERRY D-800F four deliveries are equipped and divided into two passes and three rows. Once main draft parts, gears and bearings are replaced by new ones, and shaking of the rollers and their gauge are properly adjusted, these Machines can be used for further operation.

g) Roving Process

There are eight TOYODA FL-16 Frames manufactured in 1974. The draft part of this model is equipped with top arms made by SUSSEN who has now stopped producing top arms, so parts are rarely available. There are some problems in the load of back top rollers, damaged flyers, worn down top and bottom flyer bearings and worn-out bobbin gears, which cause inadequate U% and lower efficiency due to breaking of roving yarn. Solving these problems as well as the proper adjustment for draft parts and vibration of bottom rollers will allow further operation of these machines.

h) Spinning Process

A total of 78 TOYODA Spinning Frames (33,696 spindles), of which seventy were manufactured in 1974 and eight in 1980/81, with LUWA blow cleaner, are equipped. The quality of yarn produced shows a poor USTER U%, and productivity is not favorable. In order to increase the productivity, adjusting the parts around spindles, replacing rings which have exceeded their usable life and selecting proper travelers must be done immediately. To improve U% of the yarn, draft parts and bottom rollers must be adjusted.

i) Winding Process

There are nine MURATA Mach Corners and twenty-two MURATA Gilbos Machines. None of the latter are operated now, and they are rarely seen in Japan any more due to difficulty in maintenance. Also, this model is not in production any more, thus spare parts are not available. These Machines should be replaced by alternative Mach Corners which have similar productivity. The splicers equipped now were manufactured in 1988, '89 and '90, and can continue to be used without a hitch.

j) Steam Setting Process

There is one ASHIDA 1974 AV-2 model and two ASHIDA 1977 AV-1 model Steam Setters which can stand further use. However, they also process yarns produced at the First mill and the Cipadung Mill which requires their layout to be reviewed.

(4) Auxiliary Equipment and Laboratory Equipment

The lists of auxiliary equipment and laboratory equipment are shown in Table 3-13 and 3-14 respectively with asterisks indicating the ones which cannot be used.

3-3 Utility Equipment

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

Main electrical equipment and their specifications are shown in Table 3-15 and main utility equipment and their specifications in Table 3-16.

Table 3-15 Electrical Equipment List

Item No.	Equipment/Specification	Quantity
E-0-1	Diesel Engine Generator Engine Out Put : 1,150HP Number of Cylinder : 6 Manufactuer : Nigata Engineering AC Generator Capacity : 937.5KVA 750KW Phase : 3 Freqency : 50HZ Voltage : 6,300V Manufactuer : Meidensha Electric Mfg	3 sets
	(B-I Existing Mill)	
E-1-1	Transformer for process (Substation) Capacity : 750KVA Voltage : 6.3KV/380V Manufactured : 1965 in P.R.China	4 sets
E-1-2	Transformer for Chiller Capacity : 750KVA Voltage : 6.3KV/3.3KV Manufactured : 1965 in P.R.China	1 set
E-1-3	Transformer (Generator room) Capacity : 180KVA Voltage : 6.3KV/380V 6.3kv/220V	2 sets
E-1-4	Transformer for water treatment Capacity : 100KVA & 30KVA Voltage : 6.6KV/220V	2 sets
E-1-5	Transformer for intake water equipment Capacity : 100KVA Voltage : 6.6KV/220V	1 set

(B-II Existing Mill)

E-2-1 Transformer for Air conditioner — 2 sets
Capacity : 1,500KVA
Voltage : 6KV/3KV
Manufactured : 1972, Meidensha

E-2-2 Transformer for Process — 2 sets
Capacity : 750KVA
Voltage : 6KV/400V
Manufactured : 1972, Meidensha

E-2-3 Transformer for Process & Stand by — 2 sets
Capacity : 1,000KVA
Voltage : 6KV/400V
Manufactured : 1972, Meidensha

E-2-4 Transformer for lighting — 1 set
Capacity : 150KVA
Voltage : 6KV/220・127V
Manufactured : 1972, Meidensha

Table 3-16 Utility Equipment List

(B-I Existing Mill)

U-1-1 Refrigerator — 2 sets
Capacity : 250 USRT
Type : Centrifugal Harmetic type Turbo Chiller
Refrigerant : R-11
Model : HS-14
Motor : 3,000V 50HZ 220KW
Manufactured : 1968, Hitachi co.
Aux. Machine
Condenser Water Pump : 2 sets
Chilled Water Pump : 2 sets
Cooling Tower : 2 sets

U-1-2 Air Conditioner for Blow room — 1 set
Capacity : 41,500m³/hr
Suppry Fan : 692m³/min mmAq 11KW
Return Fan : 10KW
Spray Pump : 5.5KW
Chilled Water Return Pump : 3.5KW

Item No.	Equipment/Specification	Quantity
U-1-3	Air Conditioner for Pre-spinning & Winding	4 sets
	Capacity : 51,700m³/hr	
	Suppry Fan : 862m³/min mmAq 15KW	
	Return Fan : 14KW	
	Spray Pump : 10KW	
	Chilled Water Return Pump	
	: 3.7KW & 2.2KW	
U-1-4	Air Conditioner for Ring Spinning	2 sets
	Capacity : 125,000m³/hr	
	Suppry Fan : 2,083m³/min 30KW	
	Return Fan : 20KW	
	Spray Pump : 10KW 2 sets	
	Chilled Water Return Pump	
	: 7.5KW & 11KW	
	(B-I / B-II Existing Mill)	
U-3-1	Intake Raw Water Equipment	1 lot
	-1) Intake Pump : Vertical Type 3 sets	
	-2) Strainer 1 set	
	-3) Transfer Pump 3 sets	
U-3-2	Water Treatment Equipment	1 lot
	-1) Raw Water Basin : Volume 100m³ 1 set	
	-2) Precipitator : Capacity 250m³ 1 set	
	Type : Carbon steel structure	
	Dimension : Top φ14.8m, Bottom φ9.6m x 4.3mH	
	Detention Time : 123min	
	Surface Rate : Average 1.88m/hr	
	-3) Chemical Feed for Accelearating Precipitator	
	Alum Dissolving Tank 2 sets	
	Caustic Soda Dissolving Tank 2 sets	
	Chemical Feed Pump 3 sets	
	-4) Automatic Valveless Gravity Filter 2 sets	
	-5) Filtrated Water Basin 1 set	
	-6) Softener 1 set	
	-7) Sofened Water Tank 1 set	
	-8) Chrolinator	
	Chmical Dissolving Tank 1 set	
	Measuring Tank and Feed Pump	
	for Pre-Chrolination 1 set	
	Measuring Tank and Feed Pump	
	for Post-Chrolination 1 set	

Item No.	Equipment/Specification		Quantity
	-9) Feed Pump	2 sets	
	-10) Pumps		
	Raw Water Pump	3 sets	
	Softner Pump	2 sets	
	Miscellaneous Water Pump	1 set	
	Driking Water Pump	1 set	
	Baby Compressor	1 set	
U-6	Sprinkler & Hydrant		1 lot
	1) Pump 3 sets		
	Capacity : 105m^3/min		
	Head : 69.5m		
	Motor : 50HZ 380V 40KW		
	2) Elevated Water Tank 2 sets		
	For Sprinkler Height:30m Volume:20m^3		
	For Hydrant Height:20m Volume:20m^3		
	(B-II Existing Mill)		
U-2-1	Refrigerator		3 sets
	Capacity : 250 USRT		
	Type : Centrifugal Hermetic Type Turbo Chiller		
	Refrigerant : R-11		
	Model : HS-13AR		
	Motor : 3,000V 50HZ 220KW		
	Manufactured : 1974, Hitachi Co.		
	Aux. Machine		
	Condenser Water Pump : 3 sets		
	Chilled Water Pump : 3 sets		
	Cooling Tower : 3 sets		
U-2-2	Air Conditioner for Process		2 sets
	Capacity : 5,000m^3/hr		
	Supply Fan : 5,000m^3/m 50mmAq 110KW		
	Return Fan : 4,500m^3/m 30mmAq 30KW		
	Spray Pump : 5,500 /m 20m 30KW		
	Return Air Filter : Auto Screen type Surface Area 27.4m^2		
U-2-3	Direct Humidifier for Process		1 lot
	Four Nozzle type Atomizer 132 sets		
	Roots Blower 27m^3/min 30KW		
	〃 10m^3/min 11KW		

Item No.	Equipment/Specification	Quantity
U-2-4	Steam Boiler	1 set
	Boiler	
	Capacity : 2,500KG/hr	
	Heating Surface Area : 48.5m²	
	Pressure : 10kg/cm²	
	Kind of Fuel : IDO	
	Model : IHI KURE Boiler KMH 4	
	Manufactured : May 1974, IHI KURE Manufactory	
	Accessories	
	Softner	
	Fuel Tank : 50ton	
	Soft Water Tank : 10ton	

3-3-2 Electrical Equipment at Banjaran Mills

Single wiring diagram of the Banjaran Mills is shown in Figure 3- 5.

(1) Initial Power Receiving Facilities

Initial power from PLN is first transformed at the exclusive substation (20KV/6KV, 10,000 KVA), being shared by Banjaran Mills and the neighboring mill (KTSM), and is received into a panel room in the power station through a 240mm², 3-core cable. The maximum capacity of this cable is 3,520 KVA which will not allow the contracted load of 4,000 KVA, though there are no problems with the present load. This receiving cable is also connected directly to a receiving mother line. This makes it very inconvenient and dangerous to inspect and maintain the receiving cable and switchboards of the power station. This means that it is not possible to turn the power off or on from the cable at Banjaran Mills, and instead it has to be done by means of the circuit breaker at PLN. If there was an operation mistake at PLN during inspection and maintenance of a switchboard at the power station, the power would be charged up at once. Also, when inspection of a cable such as insulation measurement is being done, each terminal must be inconveniently separated from the receiving mother line before inspection.

(2) Power Generation Equipment

There are three power generators left at present, of which No. 4 and No. 6 are capable of operation, and the possible continuous operation output is approx.60 % of their capacities. Currently, one of the two is operated alternately between 6:00 pm and 10:00 pm to assist PLN with its power shortage. However, there are several maintenance problems. In particular, acquiring parts is very difficult. Since the model is out of date, some parts are difficult to obtain from the manufacturers or sometimes require a special order. Also, in some cases, it takes one year to receive those parts. Many spare parts must be kept in stock, but to do so is difficult at present. Due to the above reasons, it is not possible to operate these generators continuously. They should be kept as a standby for when the power needed is more than the contracted amount from PLN. Replacing generators may also be taken into account, as there is no problems with the building or its foundations. The crane installed is electric and capable of lifting ten tons.

Both the generator panels and the switchboards, which are the main apparatus of the switchboard equipment, are MEIDEN'S Oil Circuit Breakers (OCB) using the minimum amount of oil with the following specitication.

Rated voltage: 7.2 KV

Rated current: 600 A

Rated breaking capacity: 150 MVA

Year produced: 1969

Both switchboards and OCB are in good conditions and allows for continuous usage in the future. However, inspections of the OCB structure and movement tests for the over current relays need to be done periodically. The 6 KV BN cable (butylene rubber isolated chloroprene sheathed cable) which is connected between the generator and the generator panel has a problem with its durability (it is periodically changed over in Japan). The one used here need to be replaced as earlier oppotunity as possible.

(3) High Tension Distribution Line

As shown in Figure 3-6 the high tension distribution cable, which runs from the switchboard at the power station to the transformer at the First Mill's electrical room, is a GPLK paper insulated, flat steel wire armored cable) with 6 KV, 35 ㎟, 3-core cores, and is laid underground. The material used for this cable is of a very old type, and recently such cables have come to be replaced with plastic ones. Also, each terminal of this cable is processed by stuffing insulation compound into the cable head, which is very difficult to implement. Therefore, this cable needs to be replaced by a plastic one during renovation.

The 6 KV feeder line, which runs from the switchboard at the power station to the 6 KV main panel at the Second Mill's electric room, is a CV cable, 240 ㎟, 3-core, and is laid underground. The type, size and installation method of this cable can handle the anticipated future load amount. However, the main point of inspection and maintenance of the high tension cable is the terminals, and a special care is needed against the moisture invasion which is caused by rain or outside air.

3-3-3 Electrical Equipment at the Banjaran First Mill

(1) Transformer Equipment

a) Transformer

The transformer currently installed was made in China (Shanghai, 1965). It is not too much worn down because there has not been a serious trouble with it and it hasn't been used for heavy loads, so it can be used for further operation. However, it is not easy to estimate how much efficiency this transformer has.

b) Low Tension Switchboard

The low tension switchboard currently installed is an open style vertical board, with parts such as the fuses loaded at the rear of each breaker board, the current transformer, gauges and distribution lines being quite worn down. Until renovation is to be realized, inspection should be carried out every day in order to avoid any accidents.

The low tension condenser equipment is in the same condition as the low tension switchboard, and need to be replaced.

(2) Electrical Facilities inside the Mill

a) Low Tension Power Wiring

The low tension power wiring which runs from the electrical room into the air-washer room through the Mill is a paper insulated flat steel wire armored cable and very old, and its terminal parts are very much particularly worn out.

The power panel board and lighting panel board are also worn down and decaying, and using them is impracticable.

b) Lighting Facilities

The roof of the First Mill is a saw-tooth type roof without a ceiling. Fluorescent lights are fixed and wired onto special iron frames. The amount installed is 8.43 watts/m^2 at the main production area. (Note that it is calculated with 50 W input for 40 W fluorescent light.) Although the intensity of the fluorescent lights cannot be measured during the daytime due to sunlight coming in, it is estimated to be 70 lux on average at the operation site from the number, style and installation method of the lights. Stabilizers inside the fluorescent light are much decayed, and already 30 % of them have been replaced due to their burning and blowing. There will be a need for replacements from time to time in the future.

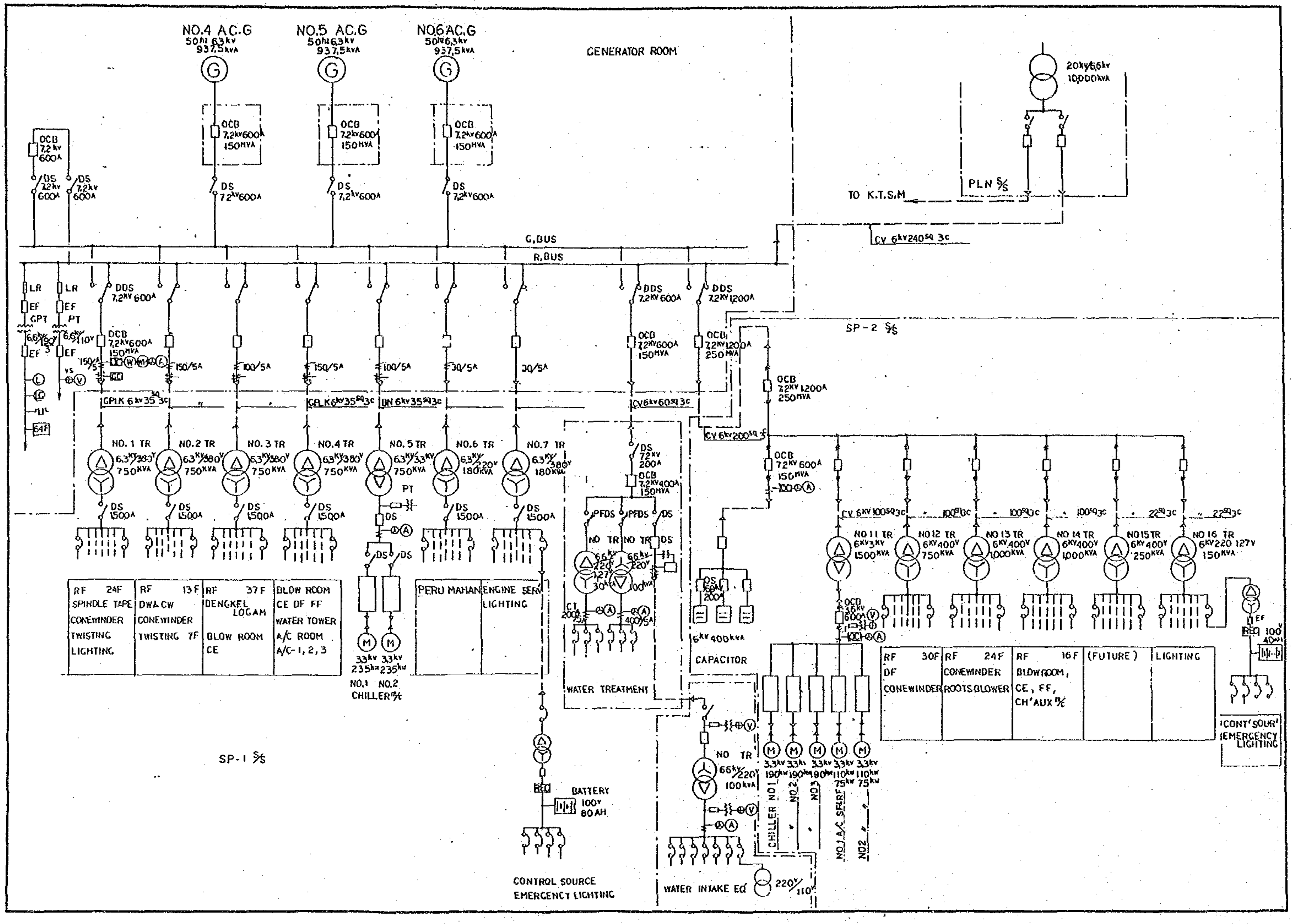


Figure 3-5 Single Wiring Diagraw

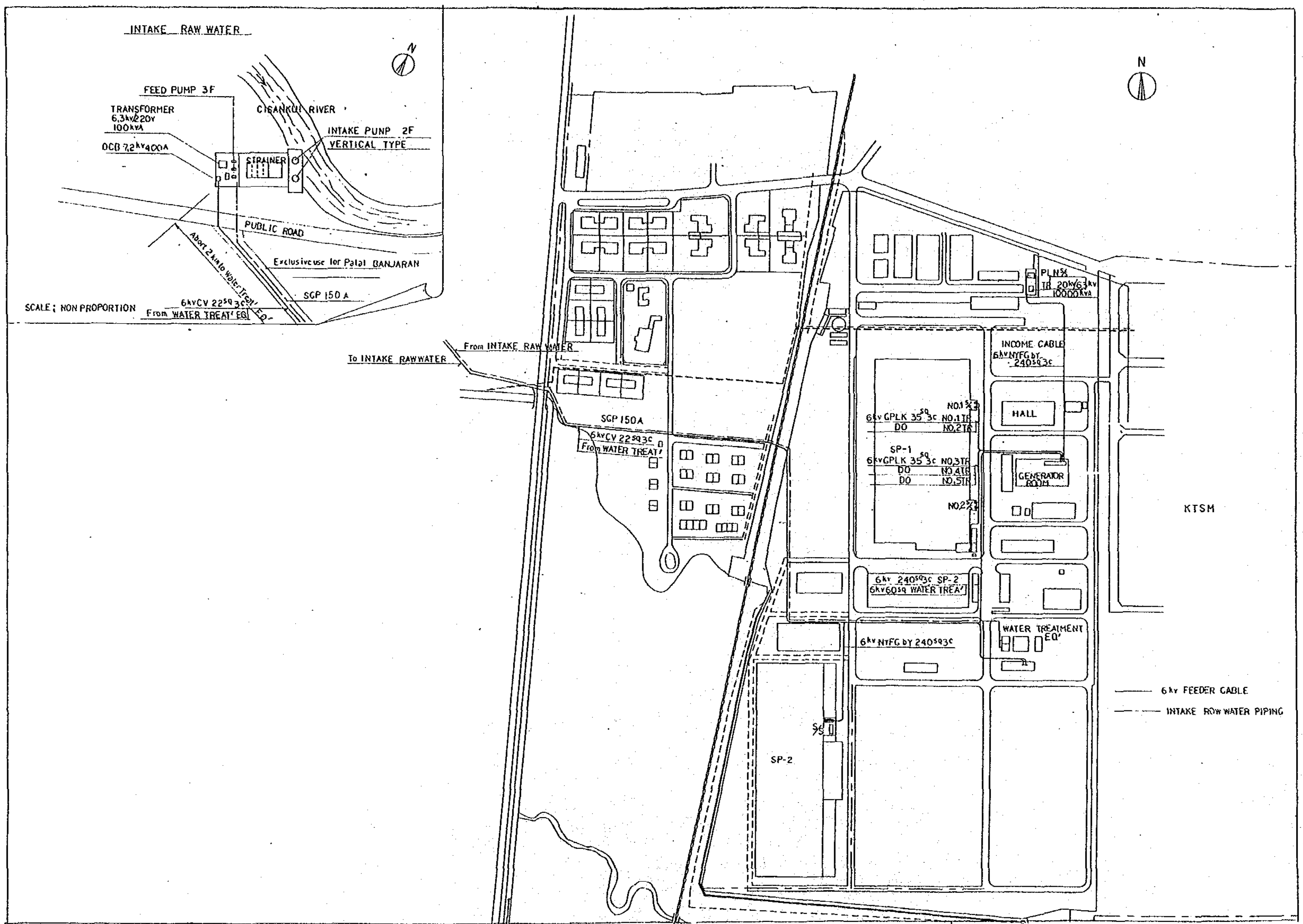


Figure 3-6 6KV High Tension Cable Diagram and Raw Water Intake Piping Diagram

3-3-4 Electrical Equipment at the Banjaran Second Mill

1) Transformer Equipment

a) Transformer

Each piece of equipment at the transformer room such as panels, cables and trance is within its load capacity. A watthour meter should be equipped with each transformer pannel for proper power control. The OCB of the high tension transformer panel is a type of small amount of oil (7.2 KV, 600 A and 150 MVA). There has not been a big accident since it was installed, which allows continued use of this equipment with regular inspection.

The transformer is installed outside the building along with each of the trancsformer panels, and it can continuousiy used since there has not been any problems including control of the insulation oil.

b) Low Tension Switchboard

Basically, there is no problem with the existing equipment. However, what requires attention is balancing the transformer's load at the time of load variation, and selecting the adequate breaker for wiring.

(2) Electric Equipment inside the Mill

a) Low Tension Power Wiring and Power Distribution

Figure 3-7 shows the low tension power wiring. The cables currently in use are CV cables or chlorinated vinyl cables which will endure further use.

b) Lighting Facilities

The fluorescent lights are 40 W with one tube output in all processes. Table 3-14 shows the results of illumination measurement and the wattage per unit area. Illumination is a little less in the processes of blowing, carding, drawing, lap forming and combing. However, appropriate measures such as daily cleaning of bulbs and replacement of burned out bulbs will avoid many problems. The illumination in the roving, spinning and wiring processes is completely insufficient. Particularly in the spinning process, the working place near the snail wire is very dark due to creels. More strictly controlled maintenance for illumination at the spinning process than that at the pre-spinning process is needed.

c) Plug Socket Wiring

Voltage for plug socket supplied presently is 127 V, which is neither the Indonesian standard nor the Japanese standard, and the observation is that it must be very inconvenient to use. The reason why 127 V is used is probably because the voltage with respect to the ground was set below 150 V in the Japanese standard. However, Indonesian voltage is 220 V with respect to the ground, so this situation must be reconsidered.

During renovation, 220 V plug sockets should be installed and 127 V circuits should be discontinued as soon as arrangement of the new loads has been completed.

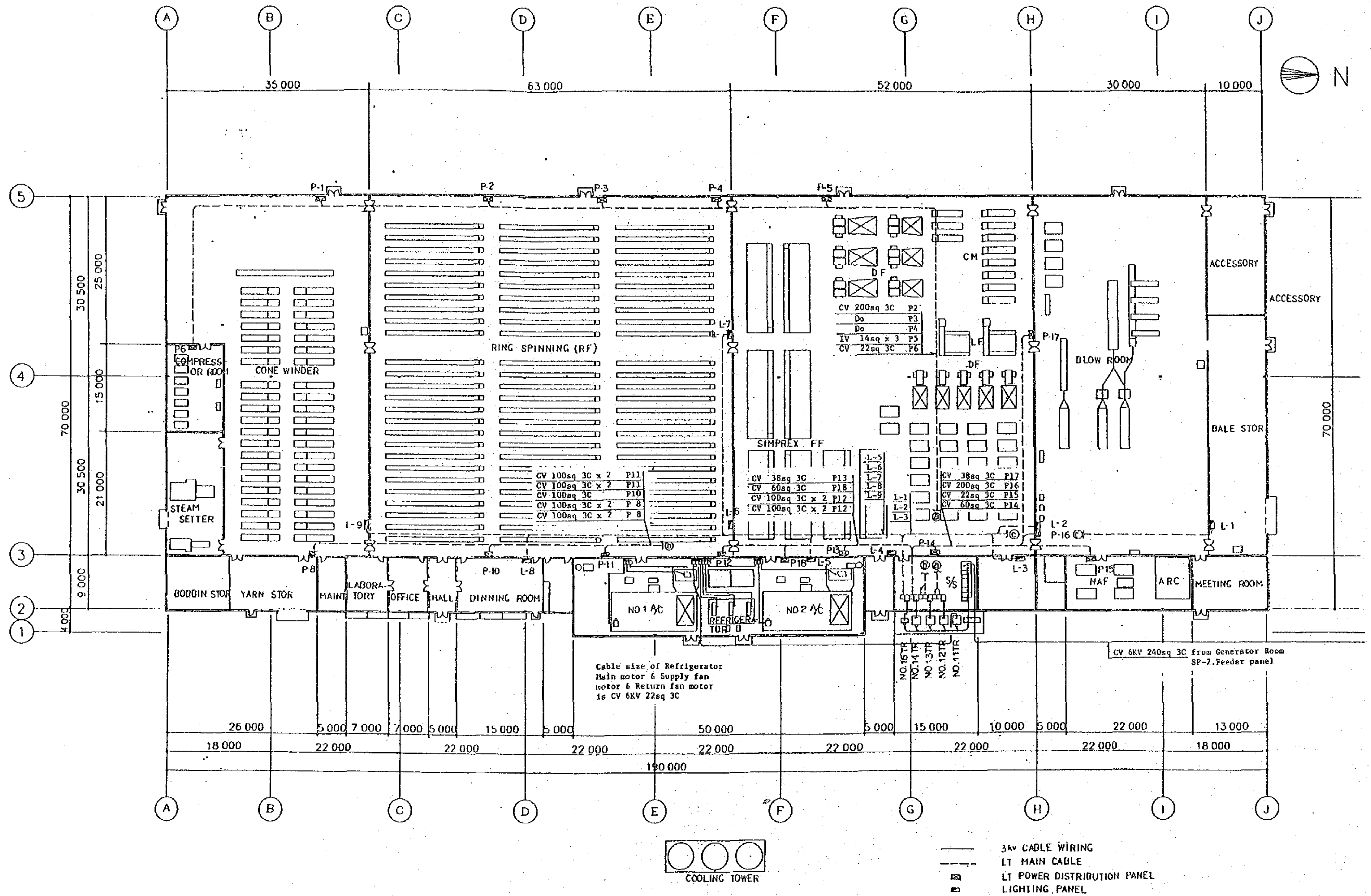


Figure 3-7 Main Low Tension Cable Wiring

Table 3-17 Luminous Intensity : Banjaran Second 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	3	80	90	70	1,830	220 sets (11.0KW)	100
		Frame Top of Scutcher	2	77	80	70			
		Hopper	4	103.8	110	110			
		Frame top of Feeder	4	66.3	70	60			
C E		Front H=0.75m	4	75	85	65	3,172	380 sets (19.0KW)	100
		Creel H=0.6m	5	72	80	60			
D F		Front H=1.4m	2	95	100	90			100
		Creel H=1.1m	1	80	80	80			
L F		Frame top H=1.2m	2	95	100	90			100
		Laping H=1.0m	3	88.3	95	85			
C M		Sliver Plate H=0.85m	5	87	100	70			100
R O V		Conse Top H=1.4m	5	81	90	70			120
		Front H=1.2m	8	93.1	120	75			
		H=1.0m	8	68.1	80	40			
R F	No. 40	Roving Top H=1.9m	1 2	139	190	90	3,843	672 sets (33.6KW)	150
		Around Snail Wire H=1.0m	1 2	71.3	85	60			
	No. 76	Roving Top H=1.9m	1 2	137	180	70			
		Around Snail Wire H=1.0m	1 2	75	100	50			
W D	No. 3	Mach Comer Front H=1.3m	1 4	51	60	45	1,775	212 Sets (10.6KW)	120
	No. 4	Mach Comer Front H=1.3m	1 5	68	85	45			

3-3-5 Water Supply

(1) Water Intake

Water is supplied from an intake chamber along the Cisankui River through a strainer to the Banjaran Mills by a 2km long water supply pipe.

(2) Raw Water Treatment

As shown in Figure 3-8, chlorination, and coagulant injection are done at the water processing facility inside the Mills. After going through the process of sedimentation and filtration, water for industrial use is sent to required places. Drinking water must go through the chlorine disinfection process once more and is sent by a pump. The treatment capacity is 250m³/h, and the amount used was about 500m³/day when measured during this investigation.

(3) Water Quality

The quality of the treated water and the standard values for chilled and air conditioning water are listed in Table 3-18.

Table 3-18 Quality and Standard of Treated Water.

ITEM	Standard Value		Banjaran
	Chiller	Condenser	
pH (25℃)	6.0 - 8.0	6.5 - 8.0	6.93
Electric conductivity(25℃)($\mu\ \Omega^{-1}$/cm)	< 200	< 800	-
Chlorine ion Cl^- (ppm)	< 50	< 200	13.88
Sulfuric acid ion So_4^{2-} (ppm)	< 50	< 200	25
Total ion Fe (ppm)	< 0.3	< 1.0	0.1
M Alkali Degree $CaCO_3$(ppm)	< 50	< 100	-
Total Hardnesss $CaCO_3$(ppm)	< 50	< 200	-
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	-

Among items for water quality measurement, measurement such as the electric conductivity and total hardness were not available. However, looking at the overall results, there should be no problems with further usage of this water including the chilled water which requires strict conditions.

Drinking water is further disinfected by chlorine after treated with industrial water use. The results of analysis done for drinking water are shown in Table 3-19. There is no item listed for colon bacillus testing, but there is no problem with it in consideration of the proper operation of the chlorine disinfection treatment at the present Mill.

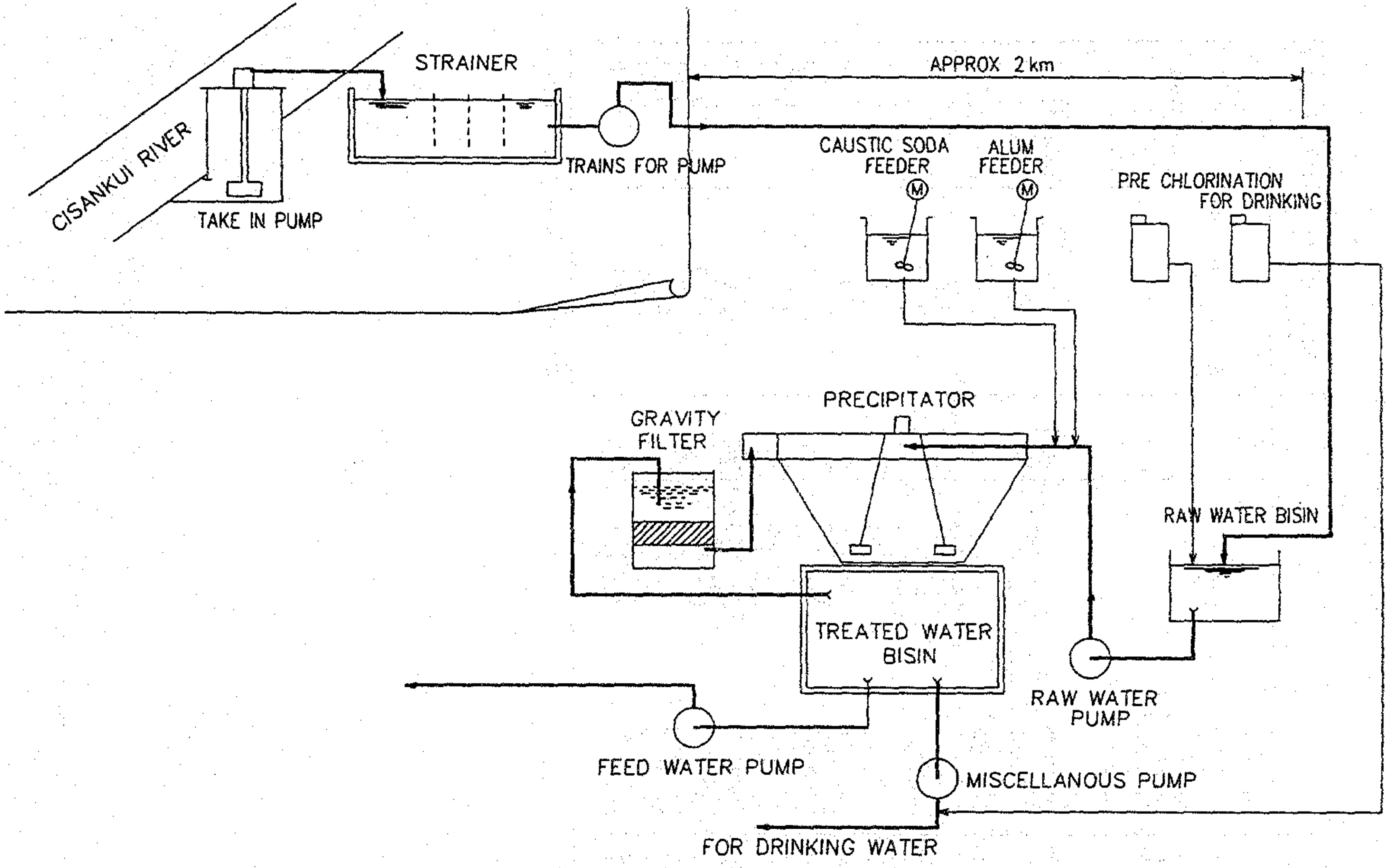


Figure 3-8 Water Treatment System for Banjaran Mill.

Table 3-19 Analysis Results of Drinking Water.

NO	ELEMENT		UNIT	DRINK WATER ESSENTIAL LIMIT	TEST RESULT
I	PHYSICAL				
1	Air/Water Temperature		°C	Air Temperature	-
2	Colour		Unit	50	3
3	Smell		-	-	nothing
4	Taste		-	-	-
5	Muddiness		Unit	25	4
II	CHEMISTRY				
6	pH		-	6.5 - 9.2	6.93
7	Solid matter		mg/l	1500	142.69
8	Organic matter	(as $KMnO_4$)	mg/l	10	8.39
9	Carbondioxide	(as CO_2)	mg/l	0,0	-
10	Betel-lime		°D	5 - 10	5.49
11	Calsium	(as Ca)	mg/l	200	20.06
12	Magnesium	(as Mg)	mg/l	150	7.31
13	Iron	(as Fe)	mg/l	1,0	0.10
14	Mangan	(as Mn)	mg/l	0.5	0.15
15	Copper	(as Cu)	mg/l	1.5	0.00
16	Zink	(as Zn)	mg/l	15	0.00
17	Cloride	(as Cl)	mg/l	600	13.89
18	Sulfate	(as SO_4)	mg/l	400	25.00
19	Sulfide	(as H_2S)	mg/l	0,0	0.00
20	Fluoride	(as F)	mg/l	1,0 - 2,0	0.80
21	Ammonia	(as NH_4)	mg/l	0,0	0.00
22	Nitrate	(as No_3)	mg/l	20,0	4.20
23	Nitrite	(as NO_2)	mg/l	0,0	0.01
24	Phenolic	(as Phenol)	mg/l	0,002	0.00
25	Arsen	(as As)	mg/l	0.05	0.00
26	Plumbum	(as Pb)	mg/l	0,10	0.00
27	Selenium	(as Se)	mg/l	0,01	0.00
28	Chromium	(as Cr)	mg/l	0,05	0.00
29	Cyanide	(as Cn)	mg/l	0,05	0.00
30	Cadmium	(as Cd)	mg/l	0,01	0.00
31	Quicksilver	(as Hg)	mg/l	0,001	0.00

Bandung, August 14, 1990

Source : Sandang I

3-3-6 Fire Fighting Facilities

The following are the fire extinguishing equipment at the Banjaran Mills:

- Sprinkler equipment
- Hydrant equipment
- Fire extinguishers

(1) Sprinkler Equipment

Both the first and the second Mills use sprinkler systems that are pressurized by an overhead tank (GL+30m). The three pressure pumps of 150 m3/hr at the time of operation are installed.

(2) Hydrant Equipment

Both Mills are equipped with outside and inside hydrants, and the overhead tanks (GL+20m for hydrant) are giving pressure constantly. The hydrant pump has sufficient capacity, but valves around pumps and check valves installed are not sufficient. The fact that water might run backwards when the valves are operated improperly must be considered.

Occasional repair of this equipment is recommended. Other than these points, there are not many problems as a whole with the fire fighting facilities.

3-3-7 Utility Equipment at the Banjaran First Mill

(1) Outline

There are chilled water generating equipment, air-conditioning and fire extinguishing equipment as mechanical equipment. Two sets of Hermetic model turbo refrigerators and auxiliary machines are equipped for supplying chilled weter to the air-conditioning equipment.

There are seven sets of horizontal type air conditioners which supply air to various process as shown in Figures 3-9 and 3-10. The return air is sent by a return fan through net filters at the inlet which are placed on walls for each conditioner. Although the filter net is a plastic net of approx. 30 mesh, the fly stuck on the net is taken manually, so sometimes the amount of wind coming out decreases due to insufficient cleaning. The operation ratio of the production machinery was low at about 60% during the this investigation took place, so the temperature and humidity at the Mill's normal operation condition was not able to be measured. However, it is estimated that it would be very hot once actual operation starts. The temperature and humidity at the time of the investigation are shown in Table 3-20.

Table 3-20 Temperature and Humidity at Each Process (B-I Mill)

Air washer	Process unit	Room condition	
		Temperature	R H
No. 1	Blowing	30.5° C	62%
No. 2	Carding	31.5	57
No. 3	Drawing	31.0	58
	Roving	31.5	57
No. 4	Spinning (East side)	33.0	52
No. 5	Spinning (West side)	32.0	54
No. 6	Finishing (East side)	28.5	72
No. 7	Finishing (West side)	29.0	70

(2) Refrigerator

Currently the chilled water generating equipment (refrigerators) works under good conditions, and their rated performances are recorded in the operation logbook. There is no problem with the function of the cooling tower, though the metal part is partially rusted, which to be re-painted immediately. Sufficient chilled water is supplied by the two sets of 250 USRT for present production capacity. However, the refrigerators at the First and Second Mills must be replaced sooner or later due to the difficulty of acquiring parts, the possibility of breakdown and the refrigeration efficiency.

a) Parts Supply

	First Mill Type HS-14		Second Mill HS-13AR	
	Production	Delivery	Production	Delivery
Large parts:impeller gears, metal etc.	Possible at the present condition.	More than 6 months	Possible	More than 6 months
Extraction pump	Impossible, but usable with other models which are modified.	More than 6 months	Possible	More than 6 months
Other small parts	Possible	More than 3 months	Possible	More than 3 months
Apparatus. censors, etc	Possible	More than 3 months	Possible	More than 3 months
High tension electric parts	Must be change for each panel.	More than 6 months	Change for each panel	More than 6 months
No. of years passed after the stop of Manufacturing	22 years		17 years	

Note: The delivery time listed above applies to domestic orders. The time required for transportation and processing should be taken into consideration for over seas orders.

b) Measure for Breakdown

When HS-14 model is used for a long time, the aluminum part of the impeller sometimes becomes damaged by corrosion. Regular inspections (overall) will find this problem through a color check and the replacement schedule can be prepared if there is a problem.

The tubes which cannot be judged easily should be inspected once every five years. Especially, the thickness and the cracks in tubes should be inspected by means of the magnetic inspection device. The number of days required for inspection is estimated to be four days per machine.

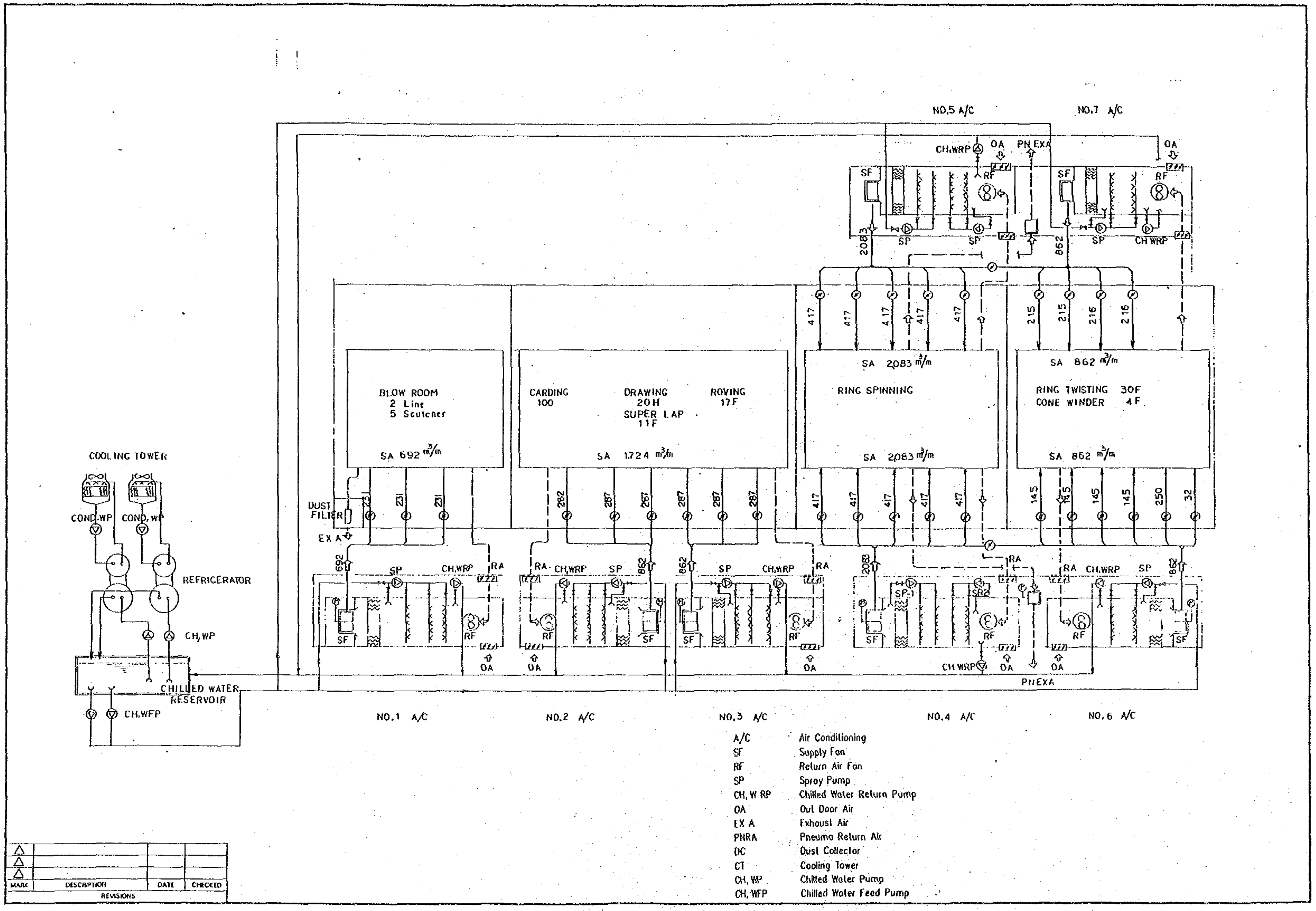


Figure 3-9 Scheme of Air-conditionning (B-I Mill)

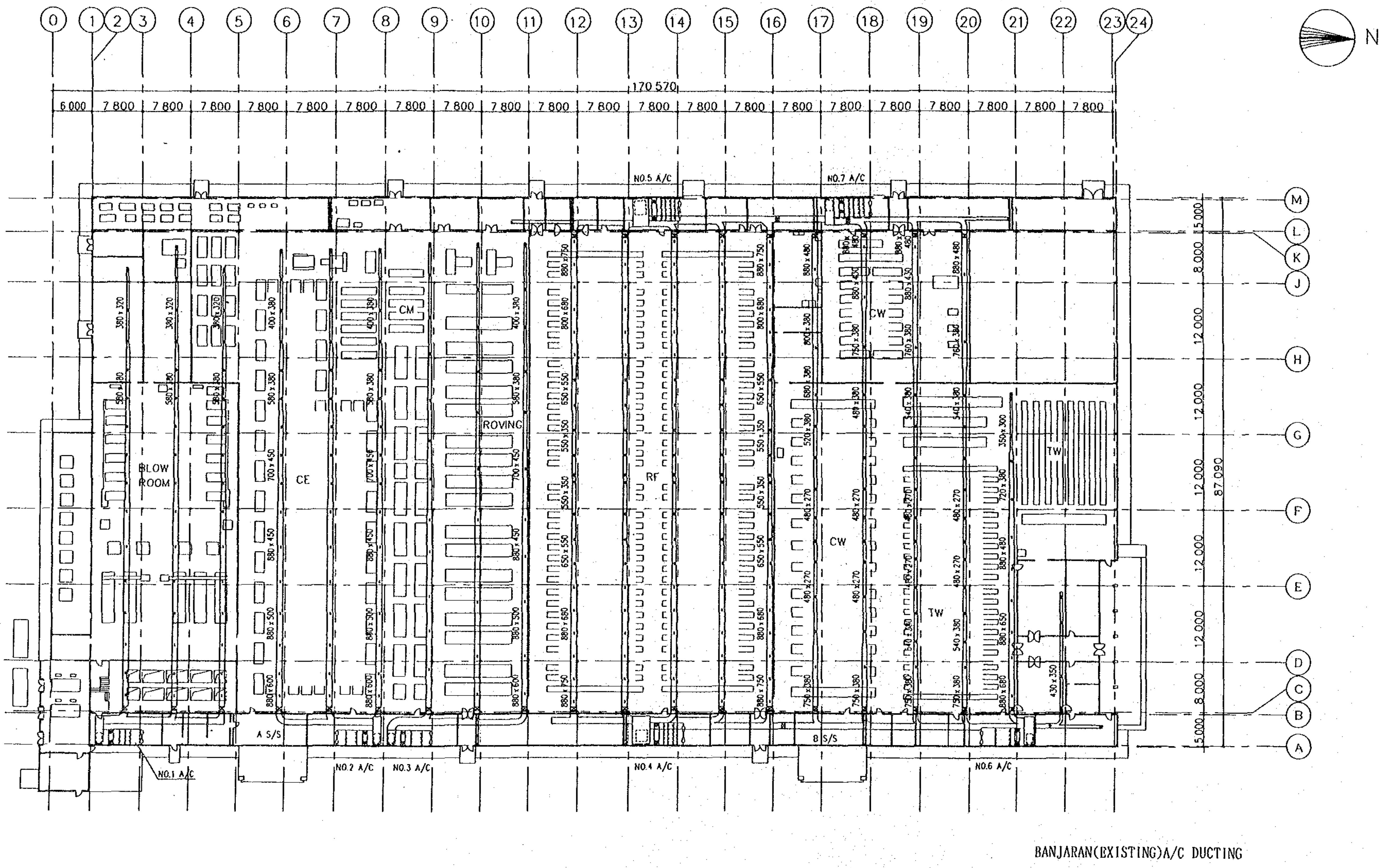


Figure 3-10 Supply Air Ducting (B-I Mill)

c) Comparison of Efficiency with New Models

	Capacity	Motor Output	Ratio with HS-14 being 100
New Model equivalent model	250 USRT	160 KW	73
HS-13AR	"	190 KW	86
HS-14	"	220 KW	100

Assuming annual operation as 350 days per year, twenty hours per day and 90 % load, the difference between the electricity usage of the HS-14 model refrigerator and the new model amounts to 400,000 KWH.

(3) Air-Conditioning Equipment

a) Air-Conditioners and Fans

The air washer chamber is made of concrete with partial cracks. However, there is no noticeable damage that could disturb further operation. Fans and spray stands are obsolete, and it will be difficult to continue using them in the long run. Also, there is a lack of safety equipment such as safety covers or belts for the V belt drive of the fan. A safety cover must be provided immediately.

b) Supply Duct

The main duct is located in the ceiling of the service area and it is dewproof insulated. The steel part of the main duct is very much corroded, and further use in the future seems to be difficult, though it can be operated by paying careful attention for the time being. Branch ducts are hung from the valley part of the sawtooth roof, and are not dewproof insulated. There is almost no problem with corrosion of their steel parts.

c) Return Air

Return air comes back to the air washer through the galleries installed on the walls. Currently plastic net filters with about 30 meshes are equipped onto these galleries. Fly stuck on the filter net is shaken off and collected by workers. The amount of resistance lost after the cleaning is estimated to be 2 to 3 mmAq. On the other hand, before cleaning the filter, the resistance lost becomes up to 7 to 10 mmAq, and the amount of air flow varies to a great degree. One of the reasons for this problems is that the area of the filter was decreased when the original design was changed from the zigzagged model to the present flat net model. The pneumatic blow return air for the Spinning Frames is sent into the underground duct first and sent outside by the exhaust fan.

Cotton dust in the blow room is forwarded into the dust collector inside the blow room.

3-3-8 Utility Equipment at the Banjaran Second Mill

(1) Outline

As for the power installation at the Banjaran Second Mill, these include refrigerator, air washing, piping, air compressing and boiling facilities. The refrigerators are installed in the same place of the air washers.

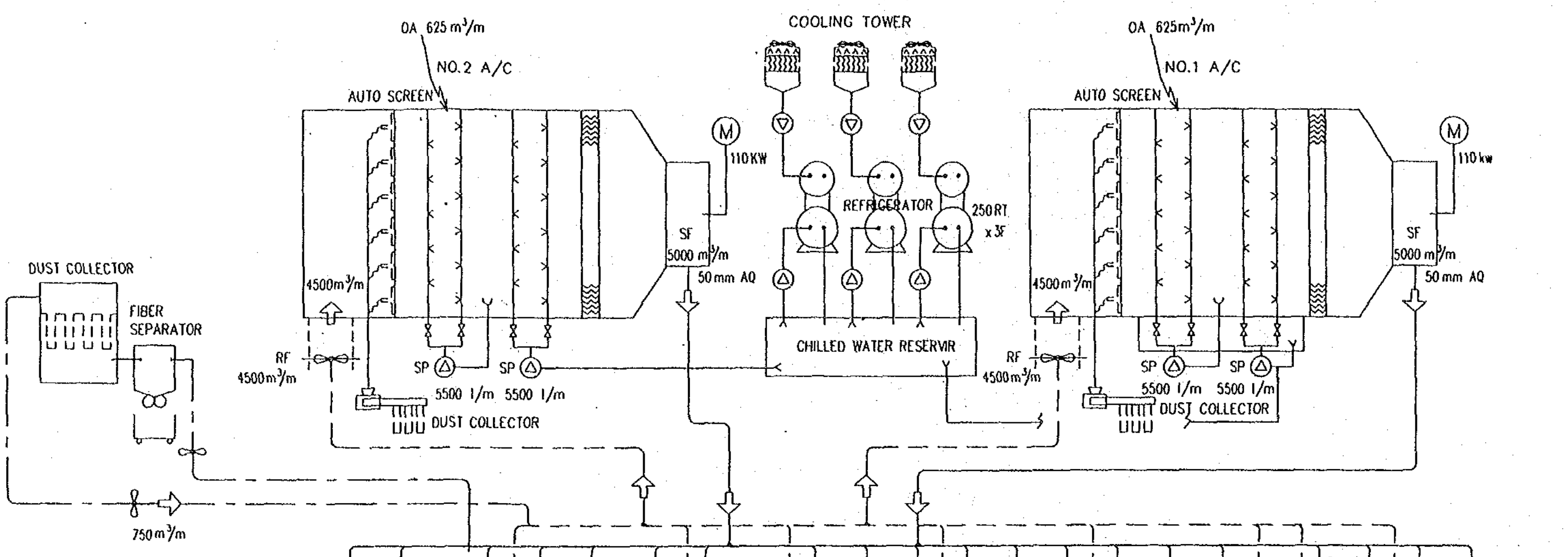
There are three sets of hermetic-type turbo machines as the refigerators, and they are supplying chilled water to the air washers. Two sets of horizontal air washers are supplying air to the respective processes as shown in Figures 3-11,3-12 and 3-13 Air adjustment for the production machinery cannot be done by these air washing facility alone, so that the water is sprayed directly by atomizers for humidity adjustment of the blow room process to roving process as well as of winding process.
The ceiling inside the Mill is flat, and glasswool is installed on the top side of the ceiling as an insulator.

Between the ceiling and the roof is a space about 1.5 m to 2.0 m large, and sufficient ventilation is provided by surrounding canopies. A supply air duct with dewproof insulation is insulation is inside the ceiling.

Air is returned by underground ducts in each processing unit into the air washing room. Dust in the returned air is taken out by an automatic screen type dust collector, and the air is mixed with the outside air and forwarded into the air washer.
The temperature and the humidity inside each process is listed in Table 3-21 on conditions that the operation rate of the production machinery was 70 - 80%.

Table 3-21 Temperature and Hnmidity as Each Process (B-II Mill)

Air washer	Process unit	Room condition		Atomizer
		Temperature	R H	
No. 1	Blowing	27.5° C	65%	Misting
	Carding	30.0	58	
	Combing preparation	30.0	77	Misting
	Combing	31.0	70	Misting
	Drawing	30.5	68	Misting
	Roving	31.5	65	Misting
No. 2	Spinning	35.0	44	
	Finishing	29.0	60	

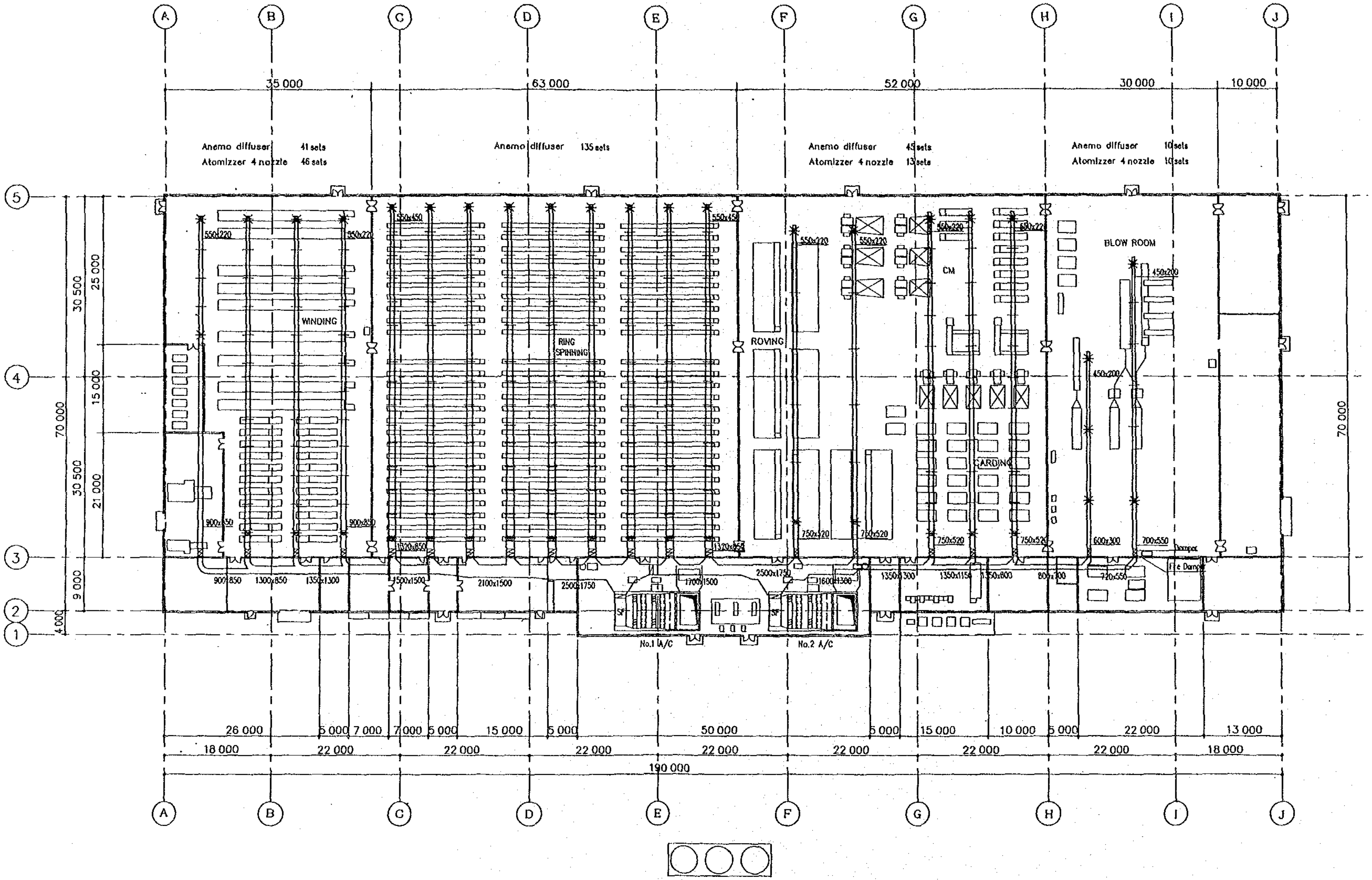


m³/m	100 200	1080 400 400 400	400 200 200	1025 750 750 750 1675 750 750 750 1675 750 750 750 1675	800 450 270 450 450 250
AIR BALANCE	SA 300 m³/m EX, A 300	SA 1200 m³/m RA 330 m³/m TO. DUCT. C, CE WAST, CM NOIL } 750 EX, A (LEAK) 120	SA 400 m³/m PNRA 200 m³/m RA 200 m³/m	SA 6750 m³/m PNRA 1950 m³/m RA 4500 m³/m EX, A (LEAK) 300 m³/m	SA 1600 m³/m RA 1070 m³/m EX, A (AW) 480 m³/m EX, A (LEAK) 50 m³/m
DIRECT HUMIDY FIER NUMBER OF ATOMIZER NOZZLE x SET	NOZZLE SET 400 x 10	NOZZLE SET 400 x 10	NOZZLE SET 400 x 3		NOZZLE SET 4 x 46
ROOM CONDITION	DB RH 27.5° C x 65%	DB RH 30° C x 65-77%	DB RH 31.5° C x 65%	DB RH 35° C x 44%	DB RH 29° C x 60%
NUMBER OF PRODUCTION MACHINE	BLOW ROOM 2 LINE 3 SCUTHER	CE 26F PRE DF 5F SL M/C 2F CM 11F DF 6F	ROV 8F	RING SPINNING 78F	AW 9F

EX, A 300 m³/m　EX, A 120 m³/m　EX, A 300 m³/m　EXHAUST AIR FOR AW 480 m³/m　EX, A 50 m³/m

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	Pneuma Return Air
CT	Cooling Tower
CH, WP	Chilled Water Pump
CH, WFP	Chilled Water Feed Pump

Figure 3-11 Scheme of Air-conditionning (B-II Mill)



Notice : Layout of Atomizer is Omitted

Figure 3-12 Supply Air Ducting (B-II Mill)

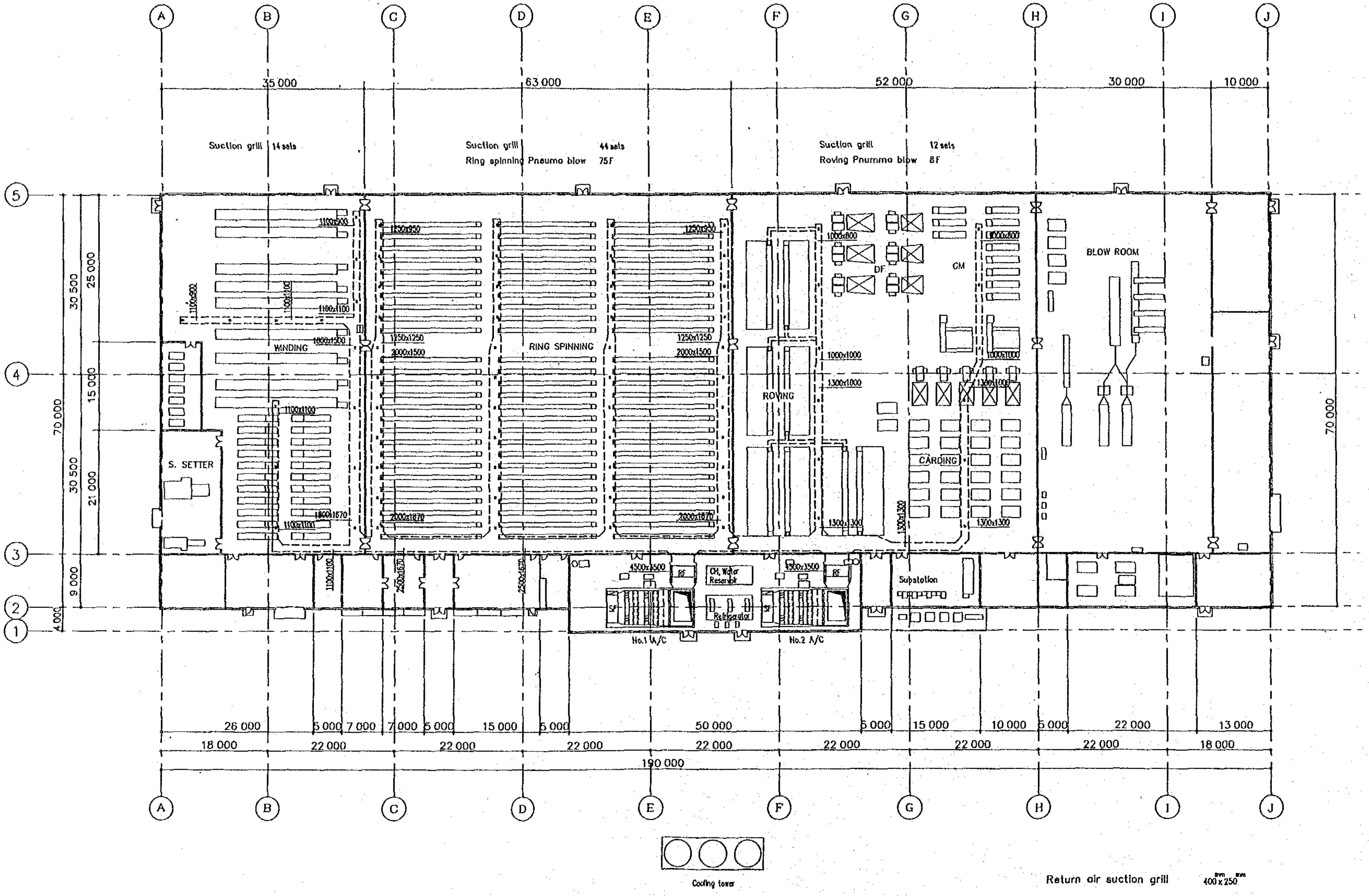


Figure 3-13 Return Air Ducting (B-II Mill)

There is a air compressor facility for Winders installed, and both water cooling and air cooling systems for the compressor are operating well. However, these are not oil-free type and the separators and filters need to be checked when the Winder models are changed over in the future.

The boilers installed are for Steam Setters, and watersoftning equipment is also installed. Their operating condition is good.

(2) Refrigerator

The condition of the chilled water generating equipment is fairly good and is operated at the rated performance.

There is no damage to the machinery,in particular no worn out parts, and it is capable of further use. As for the accessories, there is no problem with the pumping and piping parts, but the metal parts of the cooling tower are very rusted. The corrosion of the ladder for inspection purposes is particularly dangerous, and it needs to be fixed immediately.

The refrigerators are 17 years old, and it will be necessary to check parts needed in five years. There are no parts currently in stock. As for the ordering ability of the spare parts and the comparison between existing models and new ones of refrigerators can be referred to 3.3.7 above.

(3) Air-Conditioning Equipment

a) Air-Conditioning and Fans

The air washer chamber is made of steel plate, and there are some parts that are rusty and sometimes there is a leakage of water from joints. On spray stand and eliminators, there are many scales adhered, though they are functioning so far. The water leakage from the chamber must be repaired by sealing materials after drying it very well when the operation of the Mill is stopped. Equipment with many scales, such as the spray stand and the eliminator, must be cleaned inside thoroughly at least once a year.

The supply fan is a limit load type. The rust-proof paint on the rotor is peeled, and it is rusted all over. However, due to the sufficient thickness of its steel plate, there will be no problem once appropriate repairs are carried out. As for the casing of the fan, its suction part is corroded, and patching repairs are needed.

b) Supply Duct

There are no problems with the duct mechanism. However, the inside of the duct is very dirty because of the trouble with the automatic screen, which will be described later, and dust is falling out from the supply outlets. The inside must be cleaned thoroughly when there is a chance.

c) Return Air

Return air from inside the Mill and also pneumatic return air from the roving and spinning machines are sent back to the automatic screen of the air washer through the underground duct. The return air from inside the rooms goes into the underground duct from the floor through the suction grille, and there is a steel net attached to the suction grille. The amount of the returned air is reduced due to the fly and waste stuck on the steel net. (Refer to Figure 3-14.)

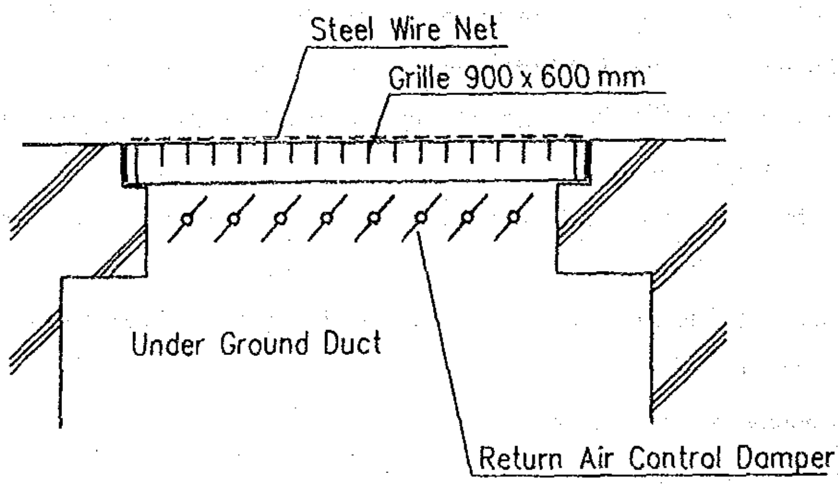


Figure 3-14 Return Air Suction Grille.

Originally, the fly on the floor was sent through the spaces in the grille to the underground duct and collected at the automatic screen, but the steel net was installed due to the bad condition of the automatic screen and also to prevent the duct from becoming dirty. The fly and the dust stuck on the steel net severely reduce the amount of the return air. The automatic screen must be fixed at once, and the steel net on the suction grille must be taken away for stable return air flow. Also in the production department, it is important that the instruction for preventing the fly and dust from invading into the return duct, except for the natural flow of the fly, are followed. There is another problem with the return air. That is the plate which separates the entrance and exit sides of the No.2 return fan has been removed. The reason for this could not be assumed, but it should be replaced in order to increase the amount of air so that dust does not pile up inside the return duct.

d) Dust Collector

Return air from the blowing and the carding processes is sent to the NAF model dust collecting room. After passing through a filter, it is sent back to the air washer with return air from other processes and then finally into the automatic screen type dust collector. (Refer to Figure 3-15.) Since Six suction nozzles are all removed from the automatic screen attached to the No.2 air washer, cleaning of the filter is done by workers. Therefore, insufficient air is sent to the air washers because complete clearning is not possible by workers. The automatic screen should be repaired at once to recover its normal function.

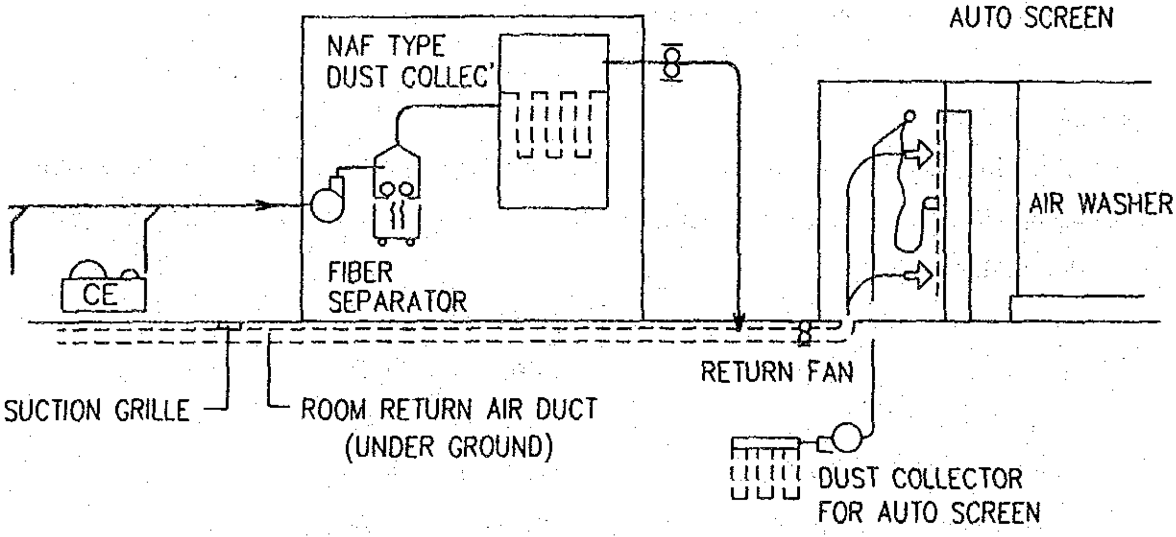


Figure 3-15 Dust Collecting System

(4) Piping Equipment

There are chilled water and cooling water pipes around the refrigerators and general piping. There is no leakage nor damage, thus no problems.

(5) Air Compressing Equipment

There is air compressor equipment for Autowinders, and there are no problems with its installation or operation.

(6) Boiler Equipment

Steam from the boiler is used for heatsetting cheese and is sent to the two Steam Setters. Boiler capacity and pressure are sufficient, and there are no problems with this equipment.

3-4 Site and Building

3-4-1 Site

Banjaran Mill is located between Jalan Banjaran and K.T.S.M. (Kompleks Pabrik PT K.T.S.M.) in the Pameungpeuk district outside of the city of Bandung, and it is only 20 km away from downtown Bandung. However, traffic between the city and the mill is heavy, and it takes too much time to access by cars.

The total area of the site is 253,372 m2, which is very large compared with other Spinning mill with 60,000 spindles. Therefore, each building is arranged comfortably, and there is even about 40,000 m² area left as open space for future expansion. There are many other factories and housings around this site, and Jalan Banjaran becomes very busy with heavy traffic during commuting hours.

3-4-2 Building Area

Banjaran Mill consists of two mills, the First Mill and the Second Mill. The total area including the offices and company houses is about 46,000 m². The following is the breakdown of the buiding areas:

- Production mill	First:	14,782 m² (32 %)
	Second:	13,630 m² (30 %)
- Warehouses:		5,178 m² (11 %)
- Offices and company housing:		4,339 m² (9 %)
- Electronics, power, etc .:		8,143 m² (18 %)
	Total:	46,072 m² (100 %)

The ratio of the building area to the area of the site is very small, and the buildings are arranged with much space between each other.

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

The Banjaran First Mill is a spinning mill with a saw-tooth roof style built by a Chinese company from 1965 to 1967, and many parts of the buildings are becoming old and corroded. Deterioration of asbestos cement roofing and corrosion of valley gutter are especially noticeable and are causing leakage when it rains. Also, many parts, such as damaged walls, peeled off mortar, deteriorated floor and doors, must be repaired and fixed. However, main parts of the building such as the foundations and structural frames seem to be having sufficient bearing power, although some parts are getting deteriorated. Therefore, most of the building parts except for the main structure need repairs during the next planned renovation. Especially, the whole floor and the whole roof should be repaired.

The Banjaran Second Mill was built by a Japanese company from 1971 to 1973. It is a plant with no windows and uses the parallel truss style, so it must have been an epochmaking spinning mill then. About 20 years have passed since construction, but the maintenance condition of the building is fairly good, and it is regarded as a modern plant even now.

Therefore, as for the building at the Second Mill, there is not much need for repairs except for floor construction for production machinery being renewed during the renovation. A description of the building structure at the Banjaran mill is given in Table 3-22.

Table 3-22 Description of the Building Structure at the Banjaran Mill.

	Roofing	Wall	Ceiling	Floor
1st Mill (steel structure)	Corrugulated middle slates	Brick with mortar	Plain slate with wooden base	Tile flooring
2nd Mill (steel structure)	Colored iron sheets	Ditto	Sandwich insulation method	Terrazzo floor paint
Auxiliary buildings & warehouses (steel structure)	G. I. sheets, slate	Ditto	-	Mortar
Company houses (brick or Reinforced Concrete)	Tile roofing	Ditto	Plain slate board	Terrazzo

Maintenance of the buildings is not directly related to production, and is often not taken seriously. However, a deterioration in the working environment such as a leaking roof, corrosion and dirt lowers productivity, and insufficient maintenance affects durability of the building members, so that much consideration is needed. Therefore, a system of periodical inspection and repair should be established.

3-5 Personnel and Training

3-5-1 Personnel

(1) Summary

If the number of staff could be changed as amount of production is changed, arrangement of staff would be ideal, but realistically personnel matter must be dealt with, having nothing to do with production variations. Looking at Table 3-23, which shows the production amount and the average yarn count from 1986 to 1990, it can be estimated that there was excess personnel in 1990. The number of personnel per bale in the production department, which is a management index used in Japan, was calculated to be 12.6 persons/bale at the Banjaran First Mill, even though the machinery is becoming old. At the Banjaran Second Mill, which is automated, this number was still large at 4.4 persons/bale. Considering the present equipment at the First and the Second Mills, appropriate numbers should be 8 persons/bale and 4.0 persons/bale respectively.

Too many personnel not only causes difficulty in labor control, but also increases the burden in welfare programs. Therefore, ideas such as higher operation efficiency and longer operation hours should be fully incorporated in prosperous times in order to increase the productivity, and the easy idea of increasing the productivity by increasing the number of personnel should not be considered. Production control for reaching goals should be planned thoroughly by accumulating daily employee education.

Table 3-23 Changes in Production and Average Yarn Count

	Banjaran 1 First Mill		Banjaran 2 Second Mill	
Item Year	Production Bale	Average yaru count	Production Bale	Average yaru count
1986	11,256	31.9	13,134	49.9
1987	11,372	33.9	13,035	44.6
1988	11,066	35.7	11,937	44.1
1989	12,199	34.6	13,881	42.9
1990	10,932	35.4	13,093	40.8

(2) Organization

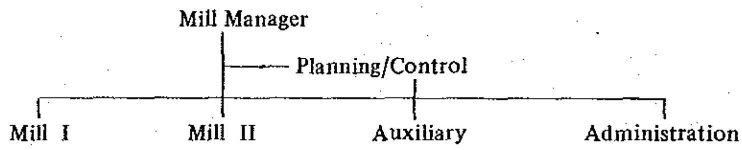
The organizational structure of the Banjaran Mills and its personnel allocation table are as shown in Figure 3-8 and Table 3-21 respectively. The followings are points to be noted :

a) The planning and control department is directly connected with the mill manager. It is the Sandang Headquarters that gives production instructions to the planning and control department, according to which the adequacy of operation supplies and the required number of workers for achieving the prescribed production goals are examined, only after which the production plans are finalized. In this respect, the role of production department becomes ambiguous. It is generally said that the machinery, staff, education, etc. must be closely linked to enable smooth progression of production.

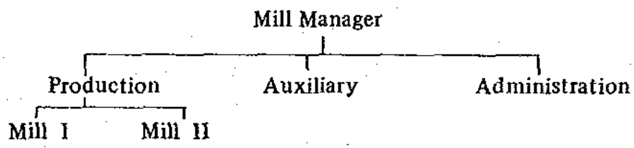
Moreover, everyone involved must be willing to follow the same policy in executing one's tasks. However, under the present organizational structure, the divisions in charge of planning the production and of controlling the progress of production are more liable to blame each other instead of maintaining a close, cooperative relationship.

Illustrated below are some of the suggested schemes for restructuring the organization.

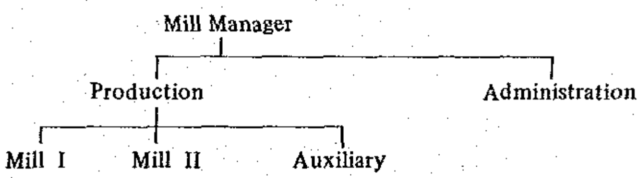
Present



Alternative Idea (1)



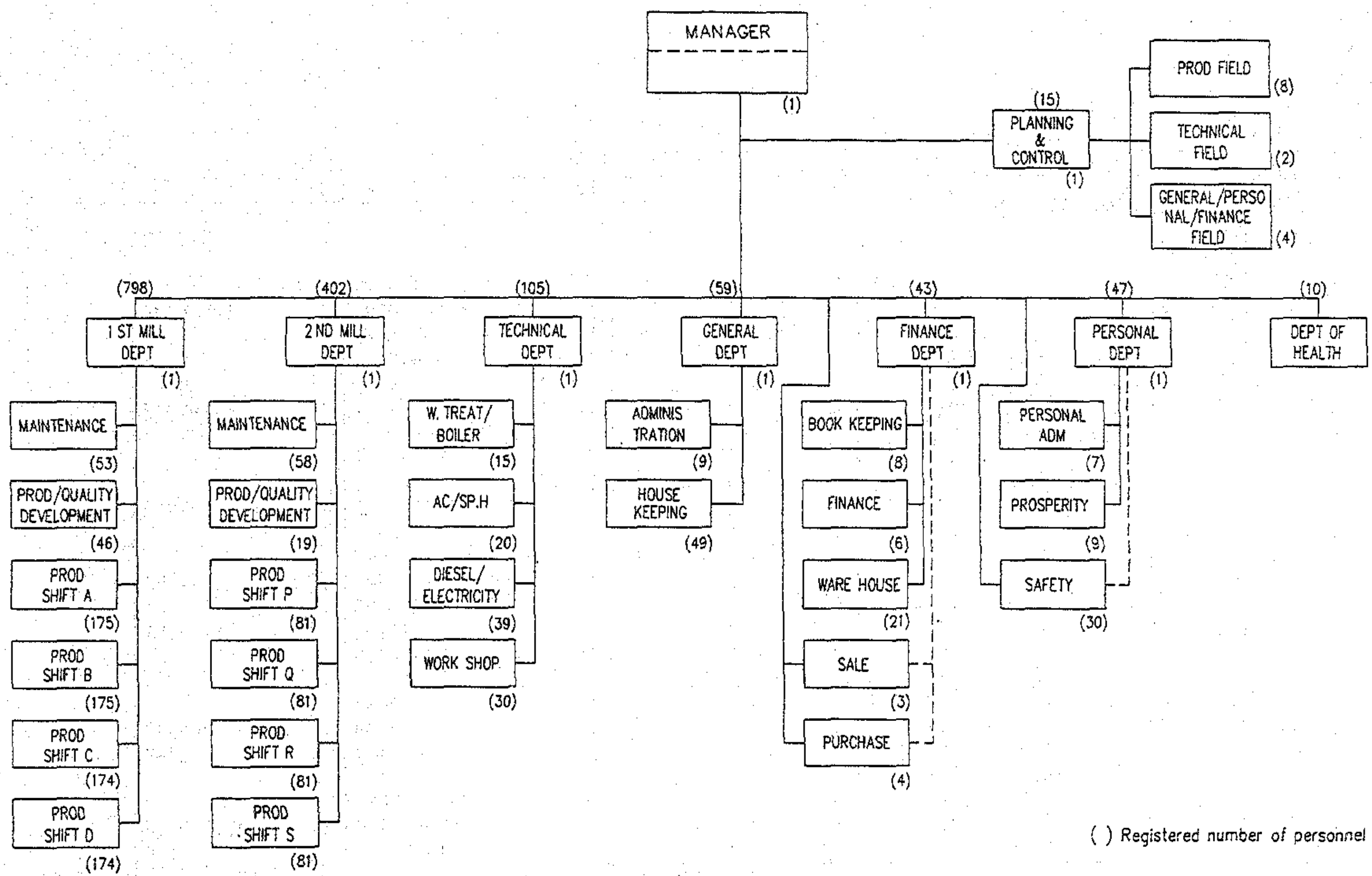
Alternative Idea (2)



b) The plant manager is now the head of the six departments. The departments should be separated into production, engineering and administration, or into production (including engineering) and administration, in order for instruction and orders to be understood more thoroughly. By doing this, the opportunity for opinion adjustment among the department heads will be decreased, cooperative relationship between production and sales will be stronger, and the administration of the mill will go more smoothly.

c) Generally as organization becomes more complicated, instructions and orders become too diverse, and the instruction's real intention cannot be understood thoroughly most of the time.

d) Workers should be educated in ways in which each person can do two or three different types of jobs. Then they will be capable of helping each other between departments and sections, and the operation density will be averaged out.



( ) Registered number of personnel

Figure 3-16 Organization Structure of Banjaran Mill.

Table 3-24 Organization and Personnel Distribution of Banjaran Mill.

Mill Manager	Dept chief		Supervisor		Ass. Supervisor	Foreman	Operator	%	Total	%	%
1	B-I		Production	4	12	28	654	89.4			
	Production	1	Maintenance	1	5	7	40	5.5	798	53.9	53.9
			Laboratory	0	4	5	37	5.1			
							(731)	(100)			
	B-II		Production	4	8	24	288	83.7			
	Production	1	Maintenance	1	4	8	45	13.1	402	27.2	27.2
			Laboratory	1	4	3	11	3.2			
							(344)	(100)			
			Electric	1	4	13	21				
	Utility	1	Utility	2	3	12	18		105	7.1	
			Workshop	1	3	5	21				
	General	1	Admiinistration	1	3	1	4				
			House Keeping	1	2	1	45		59	4.0	
			Production	2	1	1	4				
	Planning	1	Technical	1	1				15	1.0	
			General	1	3						
			Financial	1	2		3				
			Book Keeping	1	2		5				
	Financial	1	Ware house	1	2	3	14		43	2.9	18.9
			Sale	1	1		1				
			Parchase	1	1		2				
			Personal	1	2	1	3				
	Personal	1	Prosperity	1	2		6		47	3.2	
			Safety	1	1	4	24				
	Health	1			1		8		0	0.7	
								(Mill Manager)	1		
1		8		29	71	116	1255		1480	100	
		0.5%		2.0%	4.8%	7.8%	84.8%		100%		

(3) Personnel

a) As shown in Table 3-24, personnel outside of the production department at the Banjaran Mill is high at 18.9 % compared to other private companies in Indonesia, and this number should be lowered below 15 %. Even if the number of operation workers are increased, the production efficiency does not increase much. Therefore, some countermeasures for this problem must be taken. For instance, the instance of poor quality products such as yarn that is very easily cut can be decreased by strengthening maintenance to increase labor productivity.

b) Even though the machinery at the Banjaran First Mill is becoming very old, the number of maintenance personnel is less than that of the Second Mill. On the other hand, there are too many people at the production control and in the laboratories. While rationalizing the number of personnel as a whole, appropriate personnel arrangement for the mill's problems need to be considered.

c) In order to decrease the number of personnel per bale at the Banjaran Second Mill, personnel above the level of foreman should be decreased from the current 16.6 % to below 10 %. Also, education that allows the operators to act on their own judgment should be thoroughly practiced, and site management that the results of individual effort to be understood by everybody need to be carried out.

d) As can be understood from Table 3-25 regarding personnel arrangement for each process and Figure 3-17, there are too many workers in winding process at the Banjaran Second Mill, where Automatic Winders are the main machines. Even if the number includes the packing workers, the number of drums per worker should be increased to decrease the current 45.8% to below 35%.

e) Looking at Figure 3-18 which shows the distribution of personnel by process and by years served, one can see that the pattern is to hire only during prosperous periods. Even though the working positions are determined by the vocational aptitude test during hiring, training of workers to handle more than two types of jobs should be considered, and also interchange and rearrangement of the positions should be implemented.

f) For maintenance personnel, maintenance ability is not directly commensurate with the length of the years of service. Among all personnel, the ones who have a feel for maintenance should be allocated with priority. Sometimes the labor conditions for maintenance are disadvantageous (no allowance for late night work, late promotion) so it is not very popular, and this situation must be improved, otherwise there will be no hope for betterment of the maintenance ability.

Table 3-25 Worker Distribution by Process in the Production Sector

BANJARAN I

Process	Ass.Supervisor Foreman	Operator		Maintenance	Total
Blowing	5	17		1	23
Carding	6	26		7	39
Drawing	5	40	22.8%	3	48
Simplex	10	66		3	79
Ring Spinning	10	189	28.9%	14	213
Double Winder		12			12
Cone Winder	10	246	48.3%	6	262
Twister	4	58			62
Roller Shop	2			6	8
Total	52	654	100%	40	746
	7.0%	87.7%		5.3%	

BANJARAN II

Process	Ass.Supervisor Foreman	Operator		Maintenance	Total
Blowing	5	14		1	20
Carding	6	9		2	17
Drawing	5	23	21.5%	1	29
Simplex	10	16		1	27
Ring Spinning	10	94	32.6%	9	113
Cone Winder	6	132	45.8%	8	146
Draft Part				17	17
Clean Service	1			1	2
Roller Shop	1			5	6
Total	44	288	100%	45	377
	11.7%	76.4%		11.9%	

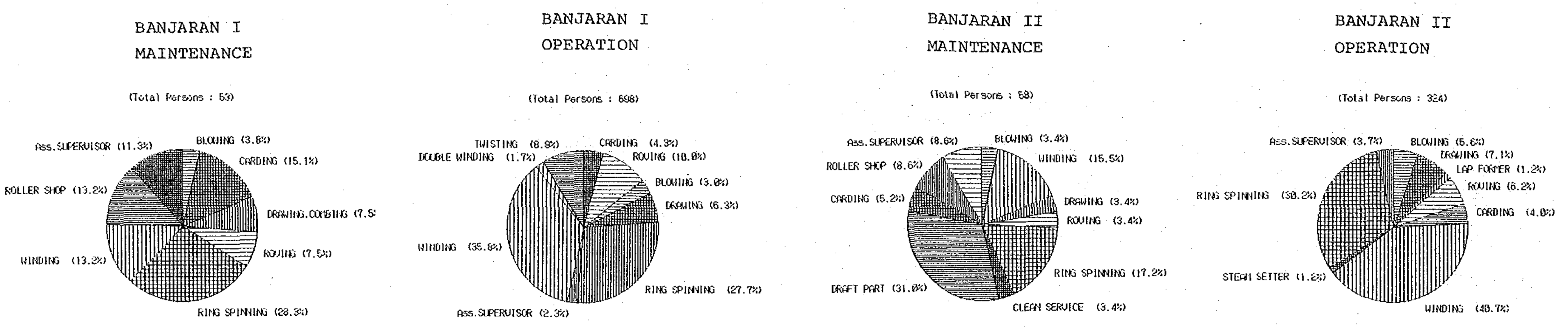


Figure 3-17 Number of Personnel by Process

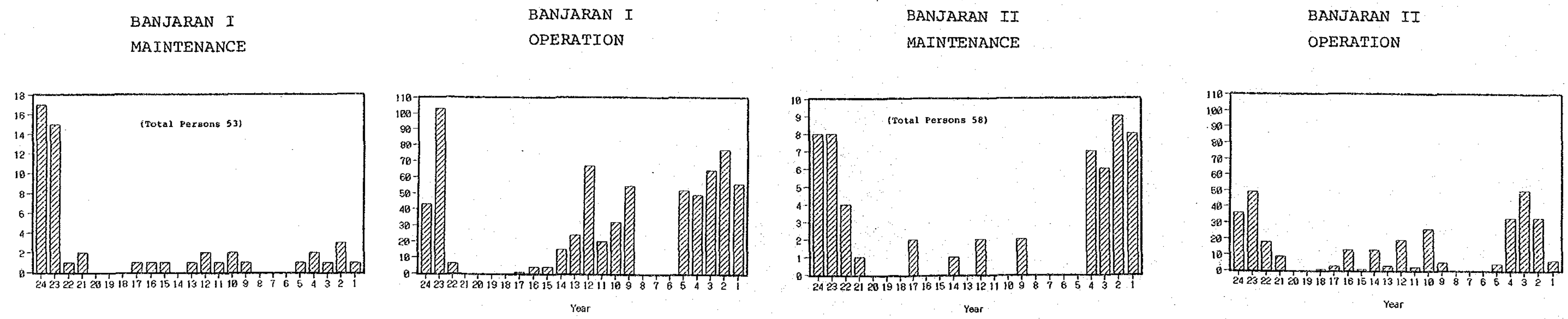


Figure. 3-18 Number of Personnel by Years of Service

3-5-2 Training

The results of investigations into current training practices are divided as follows.

a) Training for newcomers with no experience (general workers)

b) Training for newcomers with no experience who plan to be middle positions

c) Training for newcomers with experience (general workers)

d) Training for newcomers with experience who plan to be higher positions

This distinction is only a basic plan, and contents of the individual operation are determined in detail. However, standard actions which are basic repetitive actions such as lap piecing, sliver piecing and poor yarn piecing are not standardized. Therefore, there is a difference due to instructor's levels, and one could notice some faults in production and quality of the products that are obviously caused by the difference in individual levels. Standard movements during operation tend to be neglected because they are simple repetitive movements. However, the next process is the customer, and employees should be trained to understand that simple operations do affect the efficiency and the quality in the next process and should be able to carry out the standard movements at any time. Plans should be enforced to motivate the workers, such as posting an individual report table in the job site or recording the workers' movements on a video tape for them to check the way they work.

a) Training for newcomers with no experience (general workers)

Term : Basic education for one month

1st week	General briefing :Company regulations Company history Safety, hygiene Knowledge of fiber (material, fiber, machinery)
2nd week	General briefing on technology :Working system Special technique and theory of machinery Basic training of practical skill Operational practice of machinery
3rd week	Practical training :Operational practice Performance evaluation
4th week	Repetitive practical training Ditto

b) Training for newcomers with no experience who plan to be middle executives

Term : Six-month education

Term	Content
1-2 month	General briefing :Work regulations Basic knowledge of production Special skills and knowledge
3rd month	Practical training :Practical training Training of operational practice
4-5 month	Practical training :Repetitive operational practice Mastering special skills
6th month	Practical training :Repetitive operational practice Mastering special skills Performance evaluation :Leadership Cooperative attitude Sincerity

c) Training for newcomers with experience (general workers)

The term is not specifically fixed. (It depends on experience)

Content
General briefing :Basic knowledge of spinning, Work regulations Function assignment, Machinery Performance evaluation : Sincerity, Cooperative attitude Behavior, Skills

d) Training for newcomers with experience who plan to be higher executives

The term is not specifically fixed. (It depends on experience)

Contents
General briefing :Work regulations, Outline Improvement of capability, Special skills, Theory Performance evaluation :Sincerity, Cooperative attitude Leadership, Behavior

3-6 Manufacturing Cost and Sales

3-6-1 Cost

Table 3-26 shows the manufacturing cost of Banjaran Mill in 1990.

Table3-26 Actual Manufacturing Cost in 1990

Unit : Th Rp

Item	Banjaran-1	%	%	Banjaran-2	%	%
Raw material	7,525,741	67.4		10,473,657	77.5	
Power, Fuel	715,644		19.6	1,213,169		40.0
Laboar Cost	1,933,424		53.0	674,434		22.2
Depreciation	165,357		4.5	205,266		6.8
Maintenance	499,747		13.7	666,499		21.9
Insurance	4,346		0.1	1,930		0.1
Administration	327,610		9.1	272,600		9.0
Total	3,646,128	33.6		3,033,898	22.5	
Manufacturing Cost	11,171,869			13,507,555		

There are some problems in the combination and the order of the items in the manufacturing cost table of the Mill. Points which demand considerations:

1) Management of manufacturing cost

a) The cost of cotton for raw material which is decided at a discretion of the head office of Sandang I, and the overheads cost for the head office such as cost for sales and management should be separated from the other items which are decided at a discretion of the mill.

b) To clarify the responsibility for the manufacturing cost, each item of the manufacturing cost should be classified into three categories: production; auxiliaries; administration. It is also important to complete account slips and tables to make the manufacturing cost management easier.

c) In the items of the manufacturing cost, the packing material cost and electric and fuel charge should be classified into variable cost. The labor cost depending on a long and short term outlook on the Mill and production scale and an outlook on employment environment, and the maintenance cost depending on a level of machinery maintenance should be classified into the semi-fixed cost. Insurance fee, taxes, depreciation cost and rental fee which are necessary for business activities should be classified into the fixed cost. Appropriate ways to each category to manage the manufacturing cost are required.

Examples of Variable Cost Classification

Department	Item	Cost	Note
Production Department	Variable Cost	Packing & Material Cost	Up and down depending on production amounts.
	Semi-fixed Cost	Repair Expenses Labor Expenses	Based on the mill policy, an amount (repair), and holidays and personnel (labor) will be decided.
	Fixed Cost	Depreciation Expenses Tax, Insurance	The previous year's amount or a company size will be applied to fix.
Auxiliary and Administration Department	Semi-fixed Cost	Auxiliary Department Expenses Administration Department Expenses	Same as the production Department for those which relate to utilities. For those which are needed besides the costs for production & supplement departments.

d) It is difficult to know the advantage and disadvantage and to judge the properness of ways to manage the manufaturing cost from the cost of each item, total cost and the percentage of the cost of each item for the total because kinds of products and production volume change every year. Therefore, the manufacturing cost should be managed by the following way to make increase and decrease analysis of the cost and profit calculation easier and to clarify items which require ideas and efforts for improvement. First, a certain yarn count of a certain material should be selected for a standard. Then, the manufacturing cost of the selected standard yarn count per bale should be calculated. (See 7-9-6 for the calculation)

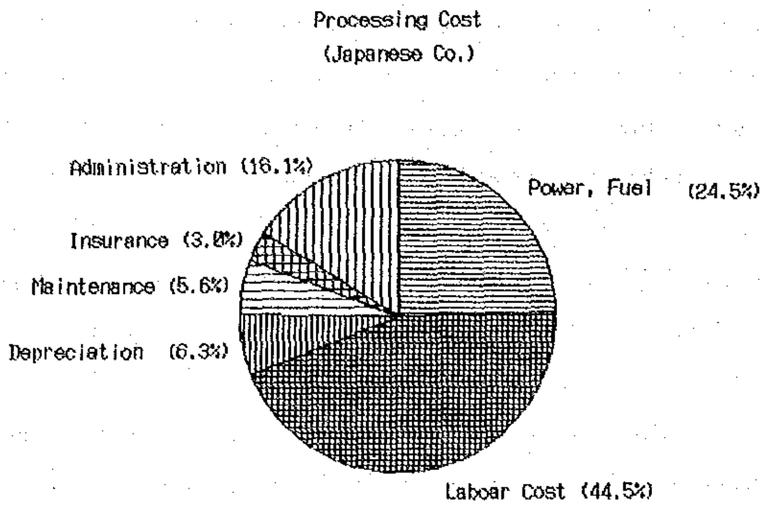
2) Reduction of manufacturing cost

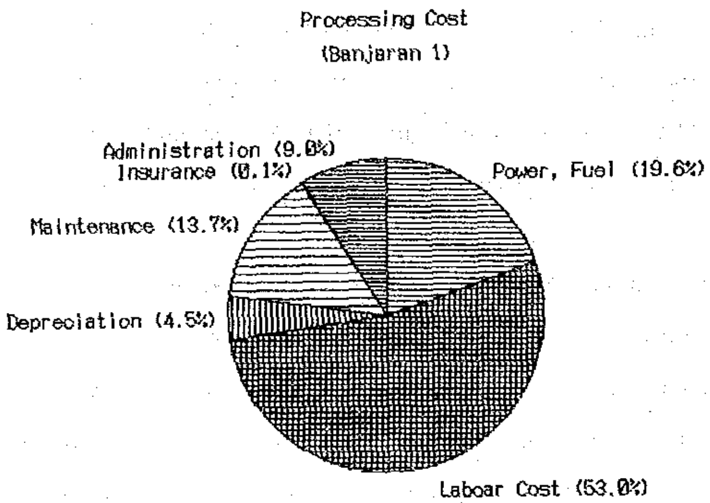
If the items of manufacturing cost are clearly and well classified as mentioned above, the reduction of the manufacturing cost will become easy.

a) As for the variable cost, variable cost per bale should be reduced. As for the semi-fixed cost, staff's ideas are required for reduction. For example, since the budget calculated from a long-term plan is often larger than actually necessary amount of money, the amount reduced by more than 10 % should be considered as a budget. As for the fixed cost, appropriate control of causes of expenditure will prevent it from increasing.

b) Though the maintenance cost is likely to be first cut down when the manutacturing cost has to be reduced, it is wrong. The replacement cycle of machines and equipment calculated from the durable years should be strictly observed to maintain their functions. If the maintenance cost was reduced to 50% of the previous year, it would take 2.5 years to recover the amount (when the recovering rate is 20%). However, durable years cannot be extended by as long as 2.5 years. Therefore, the maintenance cost should not be reduced below the maintenance basic amount, i. e. annual cost for metallic wires, needles, rings, top rollers, aprons and other things.

Figure 3-19 shows the proportion of processing cost items of Banjaran Mill and a certain Japanese major company for comparison.





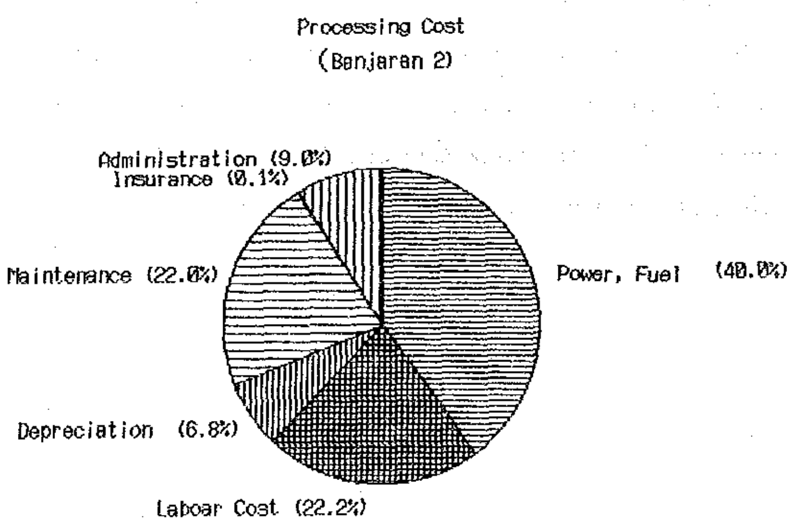


Figure 3-19 Comparison of Processing Cost

According to the manufacturing cost details in the figure, the percentage of each item considerably differs between the Banjaran First Mill and the Second Mill. This difference is caused by the machinery scale and state of automation of each mill. Since the Banjaran Second Mill has new machinery, electric and fuel charge and depreciation cost account for high percentage while the percentage of the labor cost is low because of high productivity. On the other hand, the Banjaran First Mill shows an exact reverse tendency because of its old machinery. Since each item of both Mills include the overheads cost, it cannot be simply compared with that of Japanese company which does not include the overheads cost. If the classification is made by the same categories, the management cost of both Mills will account for more than 15%, and the percentage of other items will decrease accordingly.

The ideal distribution rate of each item must be decided from the following viewpoint. The market price is calculated by adding profit to manufacturing cost (raw material cost plus processing cost). Therefore expenses required when the standard type of fiber is produced in the most economical spinning way by present machinery should be taken into consideration.

3-6-2 Sales and Profits

The change of the production volume, sales and profits of Banjaran Mill (bales) for past five years are shown in Figure 3-20 by using the data of the Sandang head office.

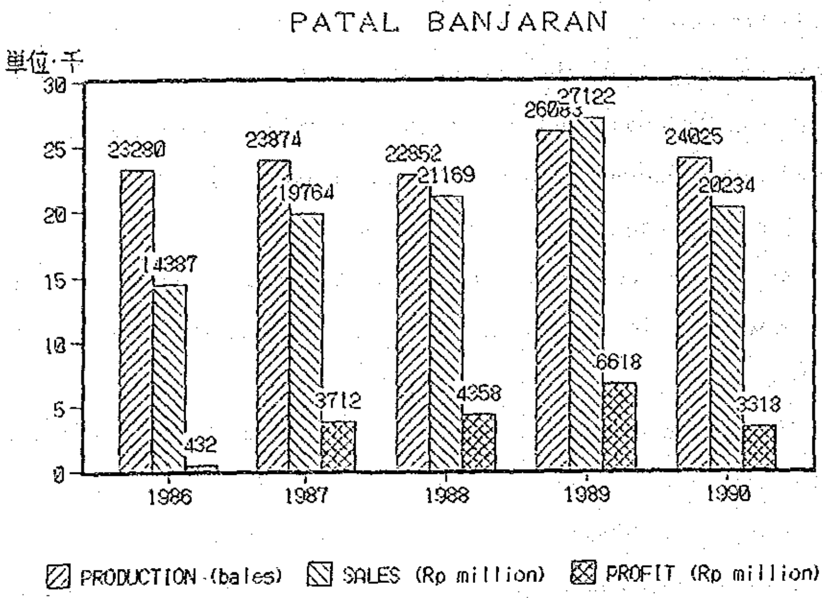


Figure 3-20 Transition of Production, Sales and Profit

As described in Chapter 2, Banjaran Mill is making a large profit these days and according to the comparison of the manufacturing cost, this is caused by good business condition of blended yarn of polyester/cotton produced in the new Second Mill. Figure 3-21 shows the change of the production volume in the Banjaran First Mill and Second Mill.

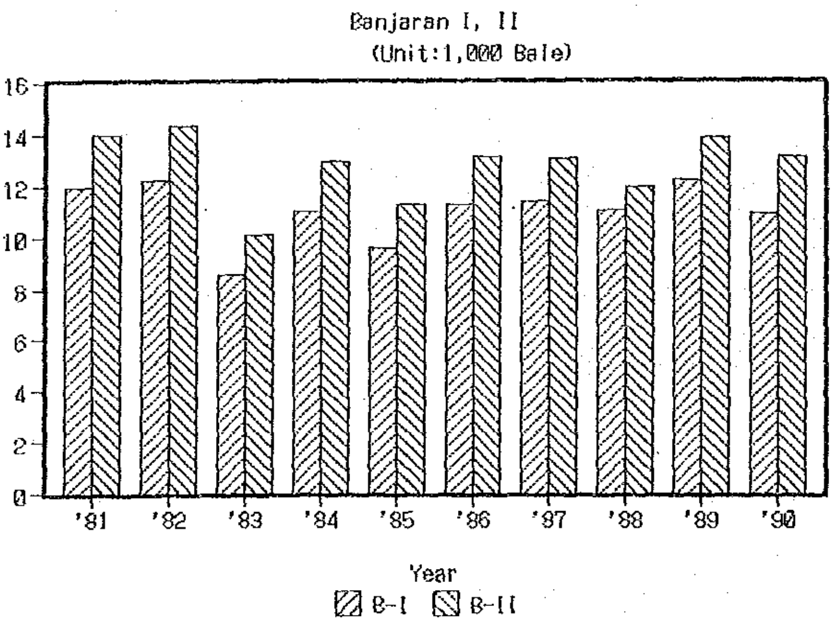


Figure 3-21 Comparison of Production, Volume