The supply capacity of Indonesia of rayon fiber was 58,000 tons a year in 1989, 70,000 tons a year in 1990, and expected to remain the same in 1990 and 1991 since production facilities are still limited.

6-1-2 Consumption of Raw Material in Indonesia

The number of spindles in actual operation in Indonesia was 3,500,000 in 1990, and it is estimated to increase to 3,800,000 in 1991.

The breakdown of products in 1990 are roughly estimated as below.

Type	Total Production	Domestic	Material Imported
Cotton	315,000t	33,000t	282,000t
Rayon Fiber	75,000t	75,000t	——
Acrylic Fiber	30,000t	——	30,000t
Polyester Fiber	142,000t	116,000t	26,000t
Total	562,000t	224,000t	338,000t

Indonesia will continue to rely overwhelmingly on cotton imports. However, under the government policy, there is no doubt that measures will be taken to increase the domestic production of polyester and rayon fibers. As to acrylic fiber, Indonesia totally depends on import for its demand at present time, but it is likely to be produced domestically in the future.

6-2 Cotton

6-2-1 Raw Cotton Market in Indonesia

In the Republic of Indonesia cotton is being transacted mainly as a "type contract", and grading is performed by an evaluation based on American cotton. The cotton used in Indonesia in 1990 was 330,000 tons in total of which 300,000 tons were imported cotton and 30,000 tons were domestic cotton.

The transition in the volume of imported cotton from 1983 to 1989 (for a period

of seven years) is shown in Table 6-4.

In Table 6-5, the countries from where cotton has been imported with volumes of import from the respective countries for 1989 is listed.

Table 6-4 Transition of Imported Cotton

1983-1989

Year	Volume (ton)	Value (US$'000)	% Change Volume	% Change Value
1983	115,256	175,162		
1984	125,256	214,428	8.7	22.4
1985	128,555	179,876	2.6	-16.1
1986	171,379	171,480	33.3	-4.7
1987	211,484	265,598	23.4	54.9
1988	195,183	301,107	-7.7	13.3
1989	262,264	373,761	34.3	24.1

Source: Biro Pusat Statistik

Table 6-5 Cotton Import by Countries (1989)

Country of origin	Volume (ton)	Value (US$'000)	Market Share % Volume	Market Share % Value
U.S.A.	81,741	127,111	31.2	34.0
PAKISTAN	45,627	55,770	17.4	14.9
AUSTRALIA	31,043	46,956	11.8	12.6
BRAZIL	30,200	43,562	11.5	11.7
PEOP.REP.OF CHINA	20,502	28,756	7.8	7.7
U.S.S.R.	16,062	17,264	6.1	4.6
MEXICO	11,426	15,918	4.4	4.3
IVORY COAST	6,651	10,191	2.5	2.7
TANZANIA	1,385	2,300	0.5	0.6
OTHER AFRICA	9,939	15,547	3.8	4.2
OTHER COUNTRIES	7,690	10,383	2.9	2.8
TOTAL	262,264	373,761	100.0	100.0

Source: Biro Pusat Statistik

60% of the imported cotton is from U.S., Pakistan, Australia, and Brazil, among them, American cotton occupies a large percentage.

Generally, American cotton fluctuates a little in terms of quality of cotton, thus it occupies an overwhelming share in the raw material market. Although there was considerable deterioration in the quality of cotton delivered from Australia last year (due to unusual rainfall), the grade of Australian cotton this year has improved and can be used as Ne40 combed yarn.

In order to enhance productivity as well as to upgrade quality of yarn, American cotton must be utilized as much as possible at a steady price throughout the year and blending it with raw cotton from other origins in consideration of cost for raw materials. The fiber length of Pakistan cotton is slightly shorter than normal while its micronaire value is slightly higher. It can be used for low count yarn.

6-2-2 Quality of Cotton

The main characteristics and bases for classification of cotton are grade, fiber length, and character.

(1) Grade

Grading is performed mainly by visual inspection and overall evaluation of tint, leaf inclusion, and preparation. Table 6-16 shows the relationship between grade and tint.

Table 6-6 Grades and Color Codes of American Cotton

Color codes	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Grades	Plus	White	Light spotted	Spotted	Tinged	Yellow stained	Light grey	Gray
(1) Strict good middling		(01)SGM						
(1) Good middling		(11)GM	(12)GM Lt Sp	(13)GM Sp	(41)GM Tg	(15)GM YS	(16)GM Lt Gray	(17)GM Gray
(2) Strict middling		(21)SM	(22)SM Lt Sp	(23)SM Sp	(24)SM Tg	(25)SM YS	(26)SM Lt Gray	(27)SM Gray
Middling plus	(30)M plus							
(3) Middling		(31)M	(32)Mid Lt Sp	(33)Mid Sp	(34)Mid Tg	(35)Mid YS	(36)Mid Lt Gray	(37)Mid Gray
Strict middling plus	(40)SLM plus							
(4) Strict low middling		(41)SLM	(42)SLM Lt Sp	(43)SLM Sp	(44)SLM Tg		(46)SLM Lt Gray	(47)SLM Gray
Low middling plus	(50)LM plus							
(5) Low middling		(51)LM	(52)LM Li Sp	(53)LM Sp	(54)LM Tg			
Strict good ordinary plus	(60)SGO plus							
(6) Strict good ordinary		(61)SGO						
Good ordinary	(70)GO plus							
(7) Good ordinary		(71)GO						
(8) Below grade		(81)BG Below GO	(82)BG Below LM Lt Sp	(83)BG Below LM Sp	(84)BG Below LM Tg	(85)BG Below Mid YS		(87)BG Below SLM Gray

(2) Fiber Length (staple length)

Both visual inspection and touching are done to classify fiber length, and a good portion of sample fiber is compared with the standard staple type.

The general relationship between the fiber length and yarn count that can be spun is shown in Table 6-7.

Table 6-7 Staple Length and Yarn Count To Be Spun

Staple Length	Carded Yarn		Combed Yarn	
	Warp	Weft	Warp	Weft
Up to 1	Up to 28	Up to 36	-	-
Up to 1 1/8	-	-	Up to 30	Up to 40
1 1/8 - 1 1/4	30 - 50	40 - 60	30 - 60	40 - 70
1 1/4 - 1 3/8	50 - 75	60 - 80	60 - 70	70 - 100
1 3/8 - 1 1/2	50 - 75	60 - 80	70 - 80	100 - 120
1 1/2 - 1 5/8	75 - 100	80 - 120	80 - 100	120 - 150
1 5/8 - 1 3/4	75 - 100	80 - 120	100 - 180	150 - 180
Over 1 3/4	-	-	150 - 100	150 - 300

(3) Character

Character refers to various factors that do not fall under either the above grade or fiber length; the main factors of character are as listed below.

a) Fineness by Micronnaire

Extremely fine	Less than 3.5
Fine	3.5 - 3.9
Average	4.0 - 4.4
Rough	4.5 - 5.0
Extremely rough	Over 5.0

b) Maturity (Causticare scale maturity index)

Very immature	Less than 72
Immature	72 - 75
Normal	76 - 79
Mature	80 - 83
Very mature	Over 83

c) Fiber Strength

〔0 Gauge〕

Evaluations	1000psi	g/tex
Very weak	Less than 70	Less than 34
Weak	70 - 76	34 - 37
Normal	77 - 83	38 - 41
Strong	84 - 90	42 - 45
Very strong	Over 90	Over 45

〔1/8 inch Gauge〕

Fiber Length (in.)	g/tex
Less than 15/16 in.	20
31/32 - 1 - 1/16 in.	22
1 - 3/32 - 1 - 1/4 in.	24
More than 1 - 9/32 in.	33

d) Uniformity and Variation Coefficient

Uniformity of fiber length M/UHM (Servo type)	Extremely uneven	Less than 74
	Uneven	74 - 76
	Normal	77 - 79
	Even	80 - 82
	Extremely even	Over 82
Uniformity of fiber length 50/25 (Digital type)	Extremely uneven	Less than 42
	Uneven	42 - 43
	Normal	44 - 45
	Even	46 - 47
	Extremely even	Over 47
Variation coefficient of Fiber length	Extremely small variation	Less than 26
	Small variation	26 - 29
	Normal	30 - 33
	Large variation	34 - 37
	Extremely large variation	Over 37

e) Suger Content, pH Value

Sugar content(%)	High	More than 0.3
	Normal	0.1 - 0.3
	Low	Less than 0.1

pH value	Very high	More than 10
	High	9 - 10
	Normal	7 - 8
	Low	5 - 6
	Very low	Less than 5

(4) Matters Requiring Attention in the Use of Cotton

Needless to say, selecting the cotton for the spinning mill is the most influential factor for the production of high quality yarn.

Exercising consistency to retain the cotton type, grade, and length throughout the year with minimum fluctuation is vital. The mill is required to perform inspection on delivered raw cotton, and to categorize the use of the cotton according to its grade, fiber length, and character.

Excellent equipment are recently available to test and inspect raw cotton, and it is recommed to utilize it as earlier as possible.

The spinning condition of production machinery will be required to match the quality of raw cotton, but there are cases where the raw cotton must satisfy the specifications of the production machinery.

In addition to the above, there are following matters that will require attention to be exercised in regards to quality.

a) Mixture of Foreign Matters

In the cotton bale, foreign matters including polypropylene hessian cloth, pieces of polyethylene wrapping sheet, waste colored yarn and waste strings being mixed have been frequently observed. At times some metal such as pieces of needles, nails, bolts, and nuts have been found mixed in the cotton.

Utmost care must be exercised to remove such foreign matters when feeding the raw cotton to blow room machinery so that fire and dyeing unevenness can be prevented.

b) Honeydew

In many cases, honeydew is usually brown, dark green or black small particles cluster and forms smudge spots on the fiber. Honeydew frequently causes fiber's entwisting to rollers as well as other troubles in the mill.

Honeydew consists of cockroach secretions with high viscosity. They become difficult to remove once pressed on. Thus easily be distinguished from other foreign matters.

If these secretions are detected in a raw cotton, it should be removed before the cottons used to avoid troubles in the spinning process as mentioned above.

Additionally, when the secretions have been detected in a lot, entire bales must be checked.

c) Immatured Cotton

When quite a few immatured cotton is contained,the produced yarn will be fairly irregular and considerably inferior in strength as well as frequently cause fiber entwisting to rollers.

By measuring the sugar content in cotton, the immatured cotton can be detected to some extent. It can be also detected comparing its micronaire with other cotton. When the micronaire is extremely fine, it can be judged that large amount of

immature cotton exists.

d) Color

It is necessary to pick out fibers with distinguishable colors such as yellow or red within the same lot. These fibers can be used seperately for small quantity mixing.

6-2-3 Cotton Prices

(1) Market Price of Cotton

Because cotton is a commodity item, the price of cotton fluctuates accordingly, but in general New York cotton market price is used as the cotton market price index. The cotton price varies significantly depending upon the world cotton harvest volume, the supply and demand of textile products, and consumer's taste for cotton products. The New York cotton market price has been increasing after dropping to a bottom price during the latter half of 1986 and has now reached a high price of over 90 cents in June and July of 1990 for the first time in 10 years.

However, the current high price of cotton may slowly drop since the Department of Agriculture of U.S.A. is drafting a policy to lower the American cotton price and cotton production in the world during 1991 and 1992 is estimated to increase.

Figure 6-1 shows the CIF European prices of cotton during the past 10 years. Index "A" is cotton for Ne30 to Ne40 yarn while index "B" for low count yarn. It is noted that there has been a cycle of price in every two years. As seen in the Figure, the average price of index "A" cotton is approximately 75 to 77 cents. Transition of the New York cotton market price (grade SLM fiber, length 1-1/16") for the recent period are as follows.

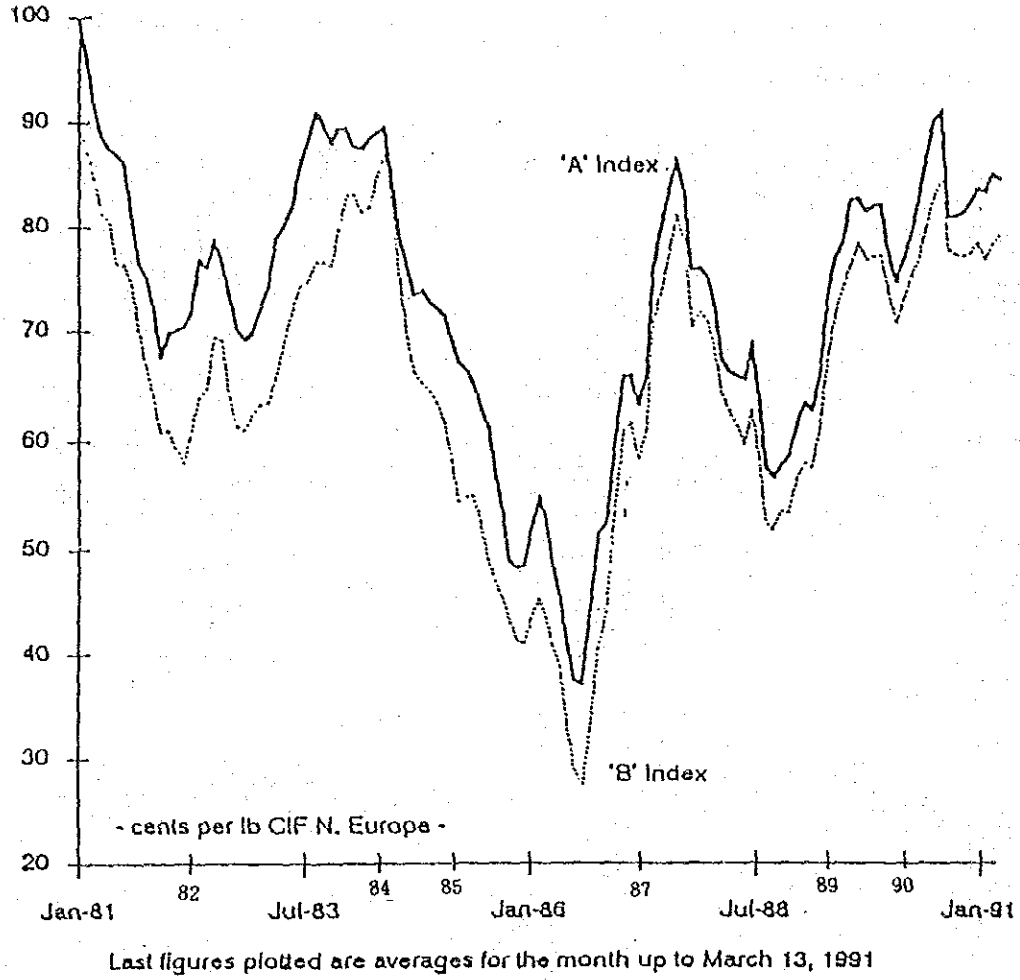


Figure 6-1 CIF North Europe Cotton Price

The current change of the New York Cotton Market (grade SLM staple length 1 1/16") is shown as follows.

	CONTRACTS EXPIRING MARCH:						CONTRACTS EXPIRING MAY:					
	1987	1988	1989	1990	1991	1992	1987	1988	1989	1990	1991	1992
	US Cents/Lb.						US Cents/Lb.					
JAN 90				66.43	64.73					67.45		
FEB 90				68.08	65.90					69.53		
MAR 90				69.91	65.90					71.26	66.47	
APR 90					66.70					74.00	67.05	
MAY 90					69.02					74.09	69.35	
JUN 90					73.12						73.30	
JUL 90					74.35						74.71	
AUG 90					72.31						73.00	
SEP 90					73.62	68.80					74.21	
OCT 90					73.91	68.14					74.33	
NOV 90					73.68	66.30					73.88	66.43
DEC 90					75.65	66.24					74.96	66.66
JAN 91					76.93	65.40					75.80	65.69
FEB 91					84.30	68.20					83.71	68.47

	CONTRACTS EXPIRING JULY:						CONTRACTS EXPIRING OCTOBER:					
	1987	1988	1989	1990	1991	1992	1987	1988	1989	1990	1991	1992
JAN 90				67.60						65.30		
FEB 90				69.78						66.57		
MAR 90				71.61	66.20					66.58		
APR 90				73.69	67.06					67.98		
MAY 90				76.92	69.30					71.09	64.83	
JUN 90				82.23	73.20					76.21	68.04	
JUL 90				90.38	74.50					77.68	69.85	
AUG 90					72.85					74.00	69.61	
SEP 90					74.26					73.86	69.85	
OCT 90					74.38					72.00	68.72	
NOV 90					73.98						67.72	
DEC 90					74.45						68.19	
JAN 91					74.94	65.89					67.67	
FEB 91					82.59	68.38					71.98	

	CONTRACTS EXPIRING DECEMBER:						CONTRACTS EXPIRING DECEMBER:					
	1986	1987	1988	1989	1990	1991	1986	1987	1988	1989	1990	1991
JAN 90					64.02							
FEB 90					65.31							
MAR 90					65.15							
APR 90					65.87							
MAY 90					68.18							
JUN 90					72.35	68.37						
JUL 90					73.62	67.93						
AUG 90					71.17	67.85						
SEP 90					72.44	67.62						
OCT 90					73.55	67.26						
NOV 90					74.28	65.50						
DEC 90					76.12	65.47						
JAN 91						64.43						
FEB 91						67.69						

(2) Purchasing Prices

Cotton, currently purchased by Sandang I is either imported directly or through trading companies.

The actual purchasing prices from June to September 1990 is shown below.

	Grade	Staple/length	Rp/kg	¢/Lp
Ne30/40	M	1"	2963	69
	M	1 1/32"	3089	72
	M	1 1/16"	3220	75
	M	1 3/32"	3293	77
	M	1 1/8"	3467	81
	SM	1 3/32"	3467	81
	SM	1 1/8"	3618	84

The estimated prices in 1993 which is the year when renovation project is expected to start are listed below.

Ne30/40	SM	1 1/8"	3568	83
	SM	1 3/32"	3439	80
	M	1 1/8"	3310	77
	M	1 3/32"	3181	74
	M	1 1/16"	3095	72
Ne50	Peru pima	1 9/16"	5159	120
	USA pima	1 7/16"	5588	130

Exchange Rate: US$ 1=1954 RP

6-3 Polyester and Rayon Fibers

6-3-1 Capacity of Man-made Fiber Production Facilities of Indonesia

Man-made fibers being produced for spinning in Indonesia are nylon, polyester and rayon fibers while Indonesia depends upon import for its demand for acrylic fiber.

In Table 6-8, production capacities of man-made fibers including filaments and their planned expansion are listed.

Table 6-8 Man-made Fiber Production Equipment in Indonesia

	NYLON		POLYESTER		RAYON	Total
	FY	SF	FY	SF	SF	
I.T.S	28		11+28	55		94 +28
INDACI	13+5					13 + 5
TIFICO			80+20	78		158 +20
KUMA FIBER				52		52
SOLO SYNTHETICS				55		55
YASINTA			100	+80		100 +80
TEXMACO			85			85
POLYSINDO EKA				30		30
SULINDAFIN			52	60+15		112 +15
VASTEX			24	(+60)		24 (+60)
BITRATEX				(+50)		(+50)
INDO RAMA			+80	+70		+150
PAN ASIA			72	(+60)		72 (+60)
INDO BARAT					120	120
SOUTH PACIFIC					75+25	75+25
SAMDANG USAHA			(+30)			(+30)
DAN LIRIS			(+60)			(+60)
Total Present	41		424	330	195	990
Total Projected	5		218	335	25	583
Total (Present+Projected)	46		642	665	220	1573

Forecast production of polyester fiber in the future is shown in table 6-9.

Table 6-9 Forecast Production of Polyester Staple Fibre in Indonesia

(Unit:ton/day)

	1990	1991	1992	1993	1994	1997	2000
TIFICO	78	78	78	78	78+α	78+α	78+α
ITS	55	55	55	55	55	55	55
KUMA FIBER	52	52	52	102	102	102	102
TRI REMPO	55	55	55	55	55	55	55
SKI/DANLIL	-					100	100
SULINDA	60	75	75	75	75	135	135
YASINTA	-	80	80	80	120	120	120
PAN ASIA	-	-	-	-	60	60	60
BITRATEX	-	-	-	-	-	-	50
POLYSINDO	30	30	30	30	30	30	30
INDORAMA	-	70	70	70	70	70	70
No. Company	6	8	8	8	9	10	11
Total Capacity	330	495	495	545	645	745	795
Capacity/Y 1,000ton	116	173	173	191	226	261	278

The current production capacity of polyester fiber of Indonesia is 116,000 tons a year and an additional 12,000 tons a year is supplemented by import. This total amount of 128,000 tons of polyester fiber is being delivered to spinning mills or to others.

The estimated production volume during the following 10 years is shown is Table 6-9,and is expected to exceed more than approximately double the current production by the year 2000. However, in view of power supply conditions, quality and price competition with the surrounding countiries, the achievement of the planned production seems not to be so easy.

In other words, unless development is undertaken to exploit new fields of applications, accomplishing the planned target can prove difficult.

6-3-2 Characteristics of Polyester Fiber

The mainstream of polyester fiber presently used for spinning is polyester fiber of 1.3 to 1.5 denier,38 mm cut and semi-dull. For 2-inch spinning, there is also polyester fiber of 1.4 to 2.0 denier with 51 mm cut.

In addition, there is a small quantity of polyester fiber of bright produced for sewing yarn. The general characteristics and the quality standards are as described below.

(1) General Characteristics

a) Strength

Polyester fiber is far stronger than acrylic fiber and is second after nylon in strength and possesses good durability. The strength of polyester fiber does not change in wet or dry condition.

b) Wear Resistance

The wear resistance of polyester fiber follows nylon and exhibits far superior in comparison to natural fibers or acrylic fiber.

c) Hygroscopic and Water Absorbing Properties

Moisture content of polyester fiber at 20℃ and 65% RH is 0.4%, and this fiber can be regarded as having no hygro scopic properties. Polyester fiber also has a low water absorbing property and quickly dries when it gets wet.

d) Anti-crease Property

Polyester fiber possesses an excellent crease recovery property that excels wool particularly in conditions such as dampness and high humidity.

e) Touch

Polyester fiber has a touch of elasticity and warmth, and its fabric provides a feeling of comfort.

f) Heat Resistance

Polyester fiber is among the best heat resisting fibers and its melting point is from 255 to 260#C.

g) Chemical Resistance

Polyester fiber has strong resistance to general chemicals and to acid.

h) Mildew, Vermin, and Bacteria Resistance

Polyester fiber is not affected by mildew, vermin, or bacteria.

i) Heat Setting Property

When once polyester has been set by heat, it does not deform. Therefore there is no shrinkage, no small crease, and no elongation, and pleats will remain set and stable. Polyester fabrics can be readily washed and will not deform and fall out of shape by washing.

j) Blending Property with Other Fibers

Polyester fiber has good blending property with all other fibers and by blending the characteristics of the counter fibers will be enhanced.

k) Electrical Property

Polyester fiber has a good electrical insulation property.

Polyester fiber that possesses the above characteristics is blended with cotton to produce yarn for twill and poplin.

(2) Quality Standard

The quality standards of polyester fiber are as follows.

Table 6-10 Quality Characteristics of Polyester Fiber

Denier	:1.3 - 1.5 D
Variation Ratio of Denier	:+- 5% +- 3%
Cut lengh	:3.8mm
Percentage of Deviation for Cut Length	:6.4 g/D +- 2%
Dry strength	:Over 6.4 g/D
Dry Elogation	:4.0 +- 3%
Number of Crimp/25mm	:1.4 +- 2.5%
Oiling%	:0.11 +- 0.05%
Melting Point	:255oc - 262oc
Moisture Content (at normal condition)	:0.4 %

6-3-3 Characteristics of Rayon Fiber

There are currently two companies in Indonesia that are engaged in the production of rayon fiber, namely, P.T. South Pacific Viscose and P.T. Indo Bharat Rayon, which totally produce approximately 70,000 tons a year.

On the other hand, Indonesia has imported approximately 6,600 tons of rayon fiber in 1989.

The products are regular and high tenacity types of bright, semi-dull, and dull, with denier from 1.2 to 2.5 and cut length from 32 mm to 76 mm. The characteristics of rayon fiber are shown in the following table.

Table 6-11 Standard quality of Rayon Staple Fiber

		Regular Type	High Tenacity Type
Dry Strength	g/denier	2.4 - 2.6	2.8 - 3.0
Wet Strength	g/denier	1.3 - 1.5	1.5 - 1.7
Dry Elogation	%	17 - 20	15 - 18
Wet Elogation	%	19 - 22	17 - 20
Oiling	%	0.2 ± 0.5	0.2 ± 0.5
Moisture Content	%	13	13
Net Weight/bale		200kg	200kg

6-3-4 Matters Requiring Attention in the Use of Polyester and Rayon Fibers

Technical troubles arising in spinning process are related to fiber characteristics as follows, and when a spinning plan is made, fibres to be used must be selected carefully.

(1) Denier and Fiber Length

Fiber length in millimeters is converted into inches and expressed as L.

- Example: 38 mm = 1.5"

  51 mm = 2.0"

- When L/denier is bigger than 1 and as it increases, card nep will increase as well.

- When L/denier is smaller than 1, yarn breakage and yarn unevenness increase.

(2) Number of Fibers Composing Yarn Count

- Number of fibers composing yarn count = 5315/(Ne yarn count × Single fiber denier) This should be more than 60 fibers at least and normally 90 fibers.

(3) Ratio of Presence of Long Fibers (which have fiber length more than 3 mm longer than stipulated)

When this ratio is high, no draft yarn will be generated, and the number of end breakage will increase particularly at roving and spinning.

(4) Tenacity

When tenacity of fiber which is related to the strength of spun yarn is high, yarn will become hard. For knit yarn where softness is required, the tenacity should be 6.0 to 6.4 g/denier.

(5) Oiling Agent

Static electricity has much to do with this agent. Its quality is judged from the static electricity measured over the card web. It is permissible, if less than 2 kv. Rayon fiber has a high moisture content, so care should be taken so that blending ratio may not vary.

6-3-5 Prices of Polyester and Rayon Fibers

Present purchase records of polyester and rayon fibers are shown in the table below.

Rp/kg

Type	I /90	II /90	III /90	IV/90	I /91
Polyester Fiber	3,250	2,700	2,650	2,700	2,750
Rayon Fiber Regular	4,400	4,400	4,400	4,400	4,400
Rayon Fiber High Tenacity		4,550	4,550	4,550	4,550

The prices of polyester and rayon fiber are influenced by domestic and international supply and demand as well as by consumers' taste. Price transition of raw materials for synthetic fibers which influence the price of fibers is shown below.

	1989	1990				1991			
	4-Q	1-Q	2-Q	3-Q	4-Q	1-Q	2-Q	3-Q	4-Q
U.S.A PX* (¢/lb)	28.5	25.5	23.0	21.5	27.5	24.5/22.0	20.5	19.75	
AMOCO PTA ($/T)	765	710	670	645	720	680/650	630	618	

*Paraxylene

EG (Ethylene-glycol)

	1989	1990				1991		
	4-Q	1-Q	2-Q	3-Q	4-Q	1-Q	2-Q	3-Q
USA Ethylene (¢/lb)		24.0	23.3	24.3	29.3	26.0	21.3	(19.0)
Far East EG ($/T)	650	410	400	410	500	650	550	470
EG Fluctuation/¥1,000/Kg Naphtha Fluctuation (¥/Kg)					+20	-8	-7	0

Pulp

US$/ton

Manufacturer	1988				1989				1990				1991	
	1~3	4~6	7~9	10~12	1~3	4~6	7~9	10~12	1~3	4~6	7~9	10~12	1~3	4~6
Alaska Pulp (Alapul T)	631.79	677.28	712.88	712.6	763.21	813.75	864.29	864.29	828.91	788.48	748.04	748.04	748.04	717.72
Saiccor (N BKP S)	655	695	730	730	780	810	810	810	810	850	650	650	600	540

There is a tend among the polyester fiber makers in Indonesia and surrounding countries to increase the production capacities. Prices of polyester fiber therefore are expected to maintain a weak pace.

As to rayon fiber, world production is gradually decreasing and due to the limited pulp resource,prices of rayon fiber are expected to continue at the same level as present. Based on the above considerations as well as domestic and international informations collected prices of polyester and rayon fiber for the purpose of financial analysis was set as follows.

- Polyester staple of 1.5 denier or 2.0 denier :2,200 Rp/kg
- Rayon staple of 1.5 denier or 2.0 denier :4,400 Rp/kg

6-4 Waste Processing

It is difficult to re-use waste of polyester, rayon, and their blended fibers. And their selling price is very low. Therefore, cotton waste is treated here.

6-4-1 Type of Waste and Process Method

The types of wastes that generate from each machine in the spinning process and the methods of processing such wastes are shown in the table below. To improve the yield of raw cotton and to reduce cost, it is necessary to re-use as much of the waste that is generated as possible.

Table 6 - 12 Waste and its Disposal

Machines to Generate Waste	Kinds of Waste	Disposal Method
Blow Room Machinery	Dropping Waste	Sale
	Sweeping Waste, Stain,Dust	Sale
Carding Engine	Flat Strip	Sale
	Dropping Waste	Sale
	Sweeping Waste & Dust	Sale
	Lap & Sliver Waste	Re-use
Drawing Frame	Sliver Waste	Re-use
	Sweeping Waste & Dust	Sale
Lap Former	Sliver Waste	Re-use
Comber	Lap & Slever Waste	Re-use
	Comber Noil	Sale
Roving Frame	Roving Waste	Re-use
	Sweeping Waste & Dust	Sale
Ring Spinning Frame	Pheumafil Waste	Re-use
	Sweeping Waste & Dust	Sale
Winder	Waste Yarn	Used for cleaning

The yarn waste generated at the winders must be reduced as much as possible. However, once generated, it can be used for wiping and cleaning the machines during maintenance.

6-4-2 Sales Price

There are firms that buy wastes, and the prices of wastes are shown in Table 6-13.

Table 6-13 Price of Waste

Distinction	Kind of Waste	Price Rp/kg
Dropped Waste	Under Blow Room Machinery	110
	Under Carding Frame	110
Flat Waste	Flat of Carding Frame	150
Comber Noil		2,200
Swept Waste		150

CHAPTER 7 BANJARAN MILL RENOVATION PLAN

Tables and Figures

CHAPTER 7 BANJARAN MILL RENOVATION PLAN

7-1 Production Plan and Raw Material

7-1-1 Production Plan

Sandang I formulated a renovation program as a corporate plan. The plan includes rehabilitation of Banjaran and Cipadung Mills accordingly. The present renovation scheme was prepared on the basis of the Plan of Sandang I, with additional considerations provided in the areas of technology and market conditions. Current situations and two schemes are compared below.

	Present	Plan by Sandung	Renovation Plan Draft
	Type		
	Cotton Carded Yarn	Cotton Carded Yarn	Cotton Combed Yarn
	P/C Yarn	Cotton (Open End)	P/C Yarn
	C/P Yarn	C/P Yarn	C/P Yarn
Banjaran	Average Yarn Count		
	Ne 30.3	Ne 28.4	Ne 34.7
No.1 Mill	Facility Capacity		
	30,784 spindles	41,584 spindles	33,600 spindles
		784 Rotors	(960×35 Frames)
	No.of Spindle Rotation		
	9,000 rpm	13,000 rpm	15,000 rpm
	Annual Production		
	12,200 bale	34,000 bale/Year	23,000 bale/Year
	(Year 1989)		
	Type		
	Cotton Combed Yarn	P/C Yarn	P/C Yarn
	P/C Yarn		
	C/P Yarn		
Banjaran	Average Yarn Count		
	Ne 40.5	Ne 45	Ne 45
No.2 Mill	Facility Capacity		
	33,696 spindles	38,016 spindles	33,696 spindles
	No.of Spindle Rotation		
	12,000 rpm	14,000 rpm	15,000 rpm
	Annual Production		
	13,880 bale	17,753 bale/Year	18,000 rpm
	(Year 1989)		

Remarks) P/C Yarn : Polyester / Cotton 65/35 blended Yarn

C/P Yarn : Polyester Cotton blended Yarn, but blend ratio Cotton ≧ Polyester

In response to the recent popularity of fine yarns, the machinery is capable to produce combed yarn of Ne 50 or more at the First Mill. Also possible at the First Mill shall be the spinning of knitting yarns which have been increasingly in demand, as well as that of polyester/cotton blended yarn. Because of product mix mainly composed of combed yarn, the productivity at the First Mill under the present plan shall be smaller than that of the Sandang I Plan.

The Second Mill, on the other hand, is specialized for production of polyester/cotton blended yarn, in an attempt to reduce the cost through stable production.

It will be necessary for both mills to produce yarn that would be recognized in the domestic market as a yarn with easy care as well as a yarn with little fluctuation of quality that would meet the standards for export. Production plan at full operation time is shown in Table 7-1. Annual operation conditions are set at operating 24 hours per day and 345 days per year (a total of 8,280 hours per year), and operation will be done four groups with three shifts. In Table 7-2, the monthly production plan for the first year after start-up is shown.

Table 7-1 Annual Production Plan

Unit: Bale/year

Mill	Product type		Production Volume
Mill No. 1	Cotton comber yarn	Ne 32	6,536
	〃	Ne 40	5,462
	〃	Ne 50	3,581
	Polyester/cotton 65/35 blended yarn	Ne 20	1,550
	〃 〃	Ne 40	1,090
	〃 〃	Ne 40/2	1,020
	〃 35/65 〃	Ne 20	1,600
	〃 〃	Ne 40	1,125
	〃 〃	Ne 40/2	1,052
	Sub-total		23,016
Mill No. 2	Polyester/cotton 65/35 blended yarn	Ne 45	18,824
	Total		41,840

Table 7-2 Production Schedule After One Year of Operation Start

Unit : Bale / M

Month	B-I Mill									B-II Mill	Total
	Cotton combed yarn Ne32	Cotton combed yarn Ne40	Cotton combed yarn Ne50	Polyester cotton 65/35 Ne20	Polyester cotton 65/35 Ne40	Polyester cotton 65/35 Ne40/2	Polyester cotton 35/65 Ne20	Polyester cotton 35/65 Ne40	Polyester cotton 35/65 Ne40/2	Polyester cotton 65/35 Ne45	
1	272.3	227.6								1568.7	2.068
2	544.7	445.2	149.2	129.2	90.8	42.5				1568.7	2.980
3	ditto	ditto	298.4	258.3	181.7	170				ditto	3.477
4	ditto	ditto	ditto	ditto	ditto	ditto				ditto	ditto
5	ditto	ditto	ditto	ditto	ditto	ditto				ditto	ditto
6	ditto	ditto	ditto	ditto	ditto	ditto				ditto	ditto
7	ditto	ditto	ditto	ditto	ditto	ditto				ditto	ditto
8	ditto	ditto	ditto				266.8	187.5	87.7	ditto	3.409
9	ditto	ditto	ditto				ditto	ditto	175.3	ditto	3.497
10	ditto	ditto	ditto				ditto	ditto	ditto	ditto	ditto
11	ditto	ditto	ditto				ditto	ditto	ditto	ditto	ditto
12	ditto	ditto	ditto				ditto	ditto	ditto	ditto	ditto
Total	6.264	5.235	3.133	1.421	999	893	1.334	938	789	18.824	39.830

7-1-2 Raw Material

(1) Selection of raw materials

The raw materials used at the Banjaran Mill are cotton and polyester fiber. Since the choice of materials directly affects the cost and quality of the spun yarn, the selections must be made with special care. Refer to Chapter 6 for the points to check in evaluating the raw materials. Discussed below are the points to bear in mind in selecting, purchasing, and using cotton, which is a natural fiber whose quality is largely determined by the place and climate at cultivated place.

Because the quality of cotton is greatly affected by the environmental conditions at a cultivated year, it is imperative to check each lot by a competent and experienced cotton classer. Classified cotton bales should be stored in order according to its type and grade. Bale storing should be planned carefully avoiding unnecessary move in the warehouse taking account of mixing condition and bale arrangement in front of the bale opener. The stability of the cotton mixing ratio throughout the year (i.e. in long term) is particularly important for the stable production and uniform quality of the yarns.

The method of procuring raw cotton must be reexamined and improved in order to cut down the cost and to ensure its stable supply in consistent quality. The current contract method through tendering in every 3 months does not seem to secure always cotton with stable quality. To supply products of stable quality throughout the year, it is necessary to reconsider purchasing and financing plans for procurement of cotton.

It is recommended to procure the American cotton stably all year round through the green card contract based on the grading provided by the US Department of Agriculture, and to procure other kinds of cotton for blending purpose under the tender basis at every 3 months checking the availability of funds, the price of cotton, and the quality of produced yarns.

Needless to say, cheap and good quality cotton should be purchased so long as the funds allow. It is preferable to maintain, as much as possible, the mixing ratio of main cotton such as SJV at 30% - 40% throughout the year. Maintaining the proportion of major cotton at 30% - 40% and supplementing for the remaining 60 - 70% various cotton to be blended, checking the cost and product quality, is the method most widely adopted.

Examples of cotton mixing ratio widely used are shown below.

(1) Ne 20 carded yarn

US Orl/Tex	SLM	1-1/32"	30%
US Memphis	SLM	1-1/16"	30%
Pakistan	SLM	1-1/32"	etc 40%

(2) Ne 30 carded yarn

US Memphis	MID	1-1/16"	30%
Australia	SLMplus	1-1/16"	40%
C, America	SLMplus	1-1/16"	30%

(3) Ne 30 combed yarn

US Memphis	MIDplus	1-3/32"	30%
Australia	SM	1-3/32"	40%
W.Africa	SM	1-3/32"	30%

(4) Ne 40 combed yarn

US SJV	SM	1-3/32"	10%	10%
US Memphis	MIDplus	1-3/32"	20%	20%
Australia	SM	1-3/32"	30%	20%
(Indonesia)	Sm	1-3/32"		20%
(China)	129		30%	20%
W. Africa	SM	1-3/32"	10%	10%

(5) Ne 50 combed yarn

Peru	Pima	1-9/16"
America (USA)	Pima	1-7/16"
Sudan		1-7/16"
Egypt Giza		1-7/16"

As indicated above, it is general to use the American cotton, whose quality seldom fluctuates, as a major cotton for the yarns of lower yarn counts than Ne 40. The Peruvian pima, American pima, and Sudan cotton are the possible choices of cotton for the yarns of higher counts than Ne 50.

The Sudan cotton, however, is not recommended to use by itself because of foreign matters and its property to cause roller entwisting. By contrast, both the Peruvian and American pima give better results when employed alone, and the yarn quality deteriorates a bit when blended each other.

For these reasons, it is preferable to employ the American cotton as the main cotton for the yarns of Ne 40 and lower count yarn as a way to stabilize the production. The purchased cotton should be used, in principle, on the first-in first-out basis so that the period of storage may not exceed 2 years.

(2) Consumption of raw material

Cotton and polyester fibers will be used as raw material, and in Table 7-3 the consumption volumes at full production stage are shown.

Table 7-3 Annual Consumption of Raw Material

Mill	Product type		Production (bale/year)	Aannual consumption Kg	
				Cotton	Polyester
B-I	Cotton combed yarn	Ne 32	6,536	1,540,085	—
		40	5,462	1,287,017	—
		50	3,581	843,795	—
	P/C 65/35 yarn	Ne 20	1,550	127,830	188,450
		40	1,090	89,893	132,523
		40/2	1,020	84,120	124,012
	P/C 35/65 yarn	Ne 20	1,600	245,056	104,747
		40	1,125	172,305	73,650
		40/2	1,052	161,125	68,871
	Sub-total		23,016	4,551,226	692,253
B-II	P/C 65/35	Ne 45	18,824	1,552,432	2,288,637
	Total		41,840		

Note : Yield of cotton combed yarn calculated at 0.77.
Polyester calculated at 0.97.

To use imported cotton mainly from U.S.A., and polyester fiber produced in Indonesia are planned. Cotton types corresponding to each product is shown in Table 7-4.

Table 7-4 Grade of Raw Materials Used by Product Types

Mill	Product type	Classification	Blended ratio(%)
Mill No. 1	Cotton comber yarn for Ne 20 & cotton comber yarn for Ne 40	SM 1 1/16" (26.99mm) SM 1 3/32" (27.78mm) Average 27.385	50 50
	Cotton comber yarn for Ne 50	SM 1 13/32 (35.8mm)	100
		SM 1 5/8 (41.4mm)	100
Mill No. 2	Polyester/cotton 65%/35% Ne 45	SM 1 1/16 (26.99mm) Polyester 1.3 denier X 38mm	35 65

(3) Raw material initially required

Required production plan of spinning frame will be

Cotton (comber): 26 frames × 960 spindles = 24,960

Polyester/cotton blend: 9 frames × 960 spindles = 8,640

The amount of raw cotton required for starting operation under the above conditions is shown in the following Table.

Table 7-5 Required Volume of Initial Raw Materials

	Cotton (combed) yarn	Polyester/cotton blended yarn
Yarn production volume/month	1,362 bales (247 tons)	660 bales (119.75 ton)
Required raw cotton volume	76,800 kg	Polyester only 19,420 kg

Note: In the above table, 76,800 kg listed as cotton (combed) includes cotton for polyester blended yarn. 19,420 kg is only polyester fiver.

The amount of raw material to be consumed during one year after start-up of operation is shown in Table 7-6.

Table 7-6 Planned Amount of Raw Material Consumption for One Year of Operation Start

Unit : Kg/M

Month	B-I Mill									B-I Total	B-II Mill
	Cotton combed yarn Ne32	Cotton combed yarn Ne40	Cotton combed yarn Ne50	Polyester cotton 65/35 Ne20	Polyester cotton 65/35 Ne40	Polyester cotton 65/35 Ne40/2	Polyester cotton 35/65 Ne20	Polyester cotton 35/65 Ne40	Polyester cotton 35/65 Ne40/2		Polyester cotton 65/35 Ne45
1	64.162	53.630								117.792	P 190.724 C 129.372
2	128.348	107.259	35.156	P 15.708 C 10.655	P 11.040 C 7.488	P 5.167 C 3.505				P 31.915 C 292.411	ditto
3	ditto	ditto	70.312	P 31.404 C 21.302	P 22.091 C 14.985	P 20.669 C 14.020				P 74.164 C 356.226	ditto
4	ditto	ditto	ditto	ditto	ditto	ditto				P 74.164 C 356.226	ditto
5	ditto	ditto	ditto	ditto	ditto	ditto				P 74.164 C 356.226	ditto
6	ditto	ditto	ditto	ditto	ditto	ditto				P 74.164 C 356.226	ditto
7	ditto	ditto	ditto	ditto	ditto	ditto				P 74.164 C 356.226	ditto
8	ditto	ditto	ditto				P 17.467 C 40.863	P 12.275 C 28.718	P 5.741 C 13.432	P 35.483 C 388.932	ditto
9	ditto	ditto	ditto				ditto	ditto	P 11.476 C 26.849	P 41.218 C 402.349	ditto
10	ditto	ditto	ditto				ditto	ditto	ditto	P 41.218 C 402.349	ditto
11	ditto	ditto	ditto				ditto	ditto	ditto	P 41.218 C 402.349	ditto
12	ditto	ditto	ditto				ditto	ditto	ditto	P 41.218 C 402.349	ditto
Total	1.475.994	1.233.529	738.233	P 172.766 C 117.191	P 121.459 C 82.388	P 108.572 C 73.647	P 87.332 C 204.316	P 61.408 C 143.664	P 51.653 C 120.843	P 603.190 C 4.189.805	P 2.288.637 C 1.552.432
									Grand Total (B-I + B-II)	P 2.891.827 C 5.742.237	

7-1-3 Quality

The quality of yarn to be produced after completion of the renovation project must gain high appraisal within the Republic of Indonesia as well as satisfy the international high quality standards.

In general, utilizing the data of USTER statistics is convenient to numerically express quality standards.

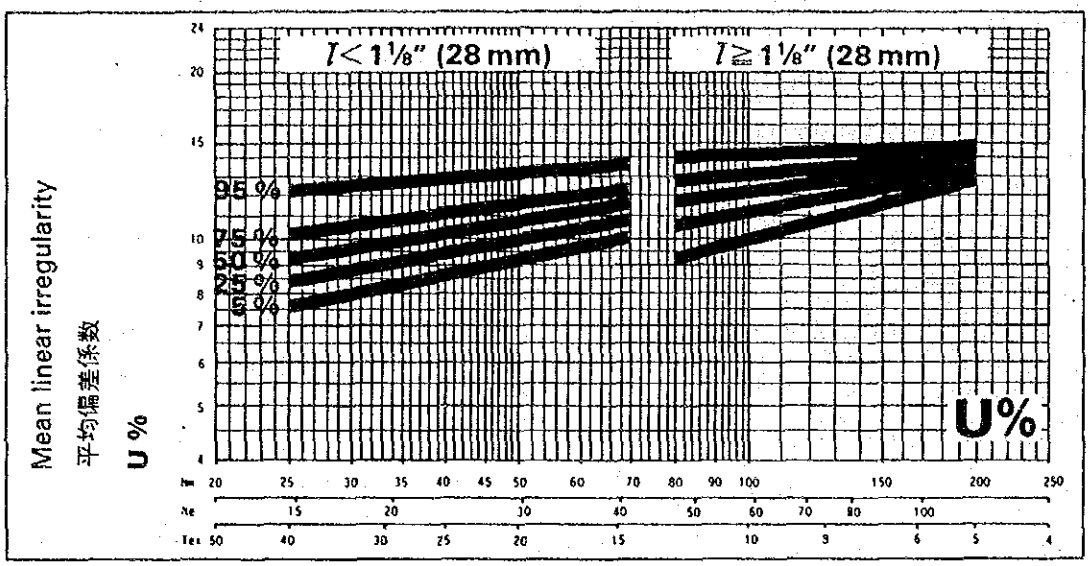
The targets regarding quality of the products after the renovation project are shown in Table 7-7. The detailed data is listed in Figures 7-1 to 7-6. In Table 7-8 the conditions for establishing the USTER statistics table are shown.

Table 7-7 Target Value of Yarn Quality

Mill	Type	Single Yarn Strength (g)	U%	Thin (Pieces / 1,000m)	Thick (Pieces / 1,000m)	Nep (Pieces / 1,000m)
Banjaran I	Cotton Combed Ne 30	298-339	11.0-10.2	17-5.5	95-48	150-85
	Cotton Combed Ne 40	226-251	11.5-10.6	25-10	160-95	160-120
	Cotton Combed Ne 50	209-231	11.8-10.8	22-10	77-42	130-70
	P/C Ne 20	606-677	10.0- 9.3	9.1-2.8	42-18	58-35
	P/C Ne 40	288-388	12.4-11.6	48-22	100-60	110-70
Banjaran II	P/C Ne 45	243-266	12.8-12.4	67-33	120-73	140-80
(Reference) Currently	P/C Ne 40	322.5	14.1	20	45	85
Measured Value	P/C Ne 45	255.4	13.3	30	75	195

The product mix at the Banjaran I will change significantly after the renovation. The Actual problems of the cotton carded yarn, such as weak single yarn strength, U%, and IPI value caused by the irregular frequencies of the Drawing Frames are solved after the renovation and the yarns produced will be able to satisfy the above standards.

The current problem at the Banjaran II is also caused by the irregularity of frequencies of the Drawing Frames, and its correction is the first priority in the renovation. The U% of Ne 45 shall be reduced from 12.8 to 12.4 or less. In addition, weight control shall be thoroughly executed, with the coefficient of count variation set at 2.6 brought down to 1.5 or less. Through these modifications, yarns of consistent quality, which seldom break when knitted or woven thus satisfying its consumers, can be produced.



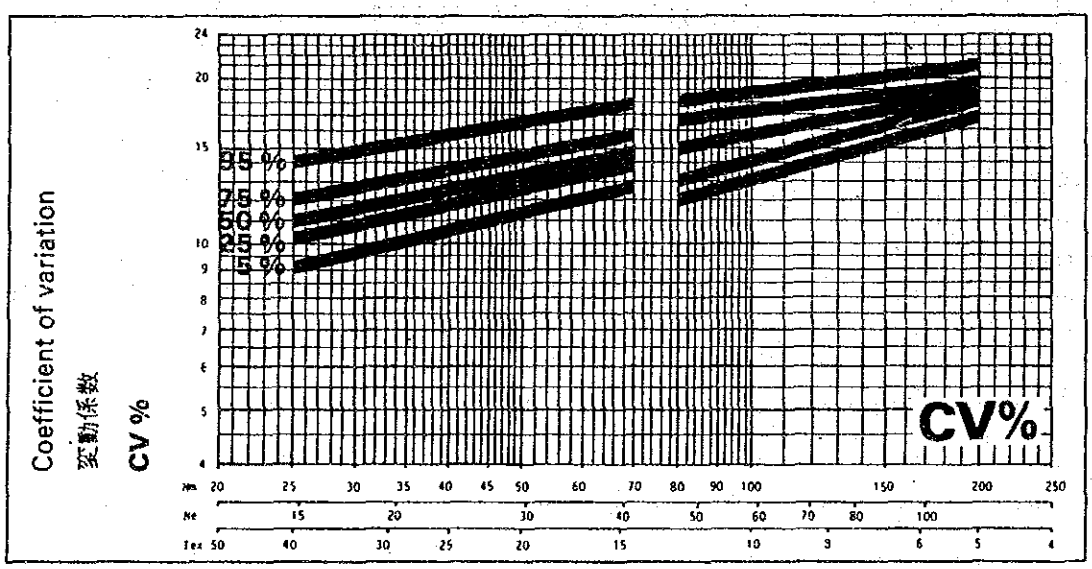


Figure 7-1 USTER Line (1) : Combed Yarn U% & CV%

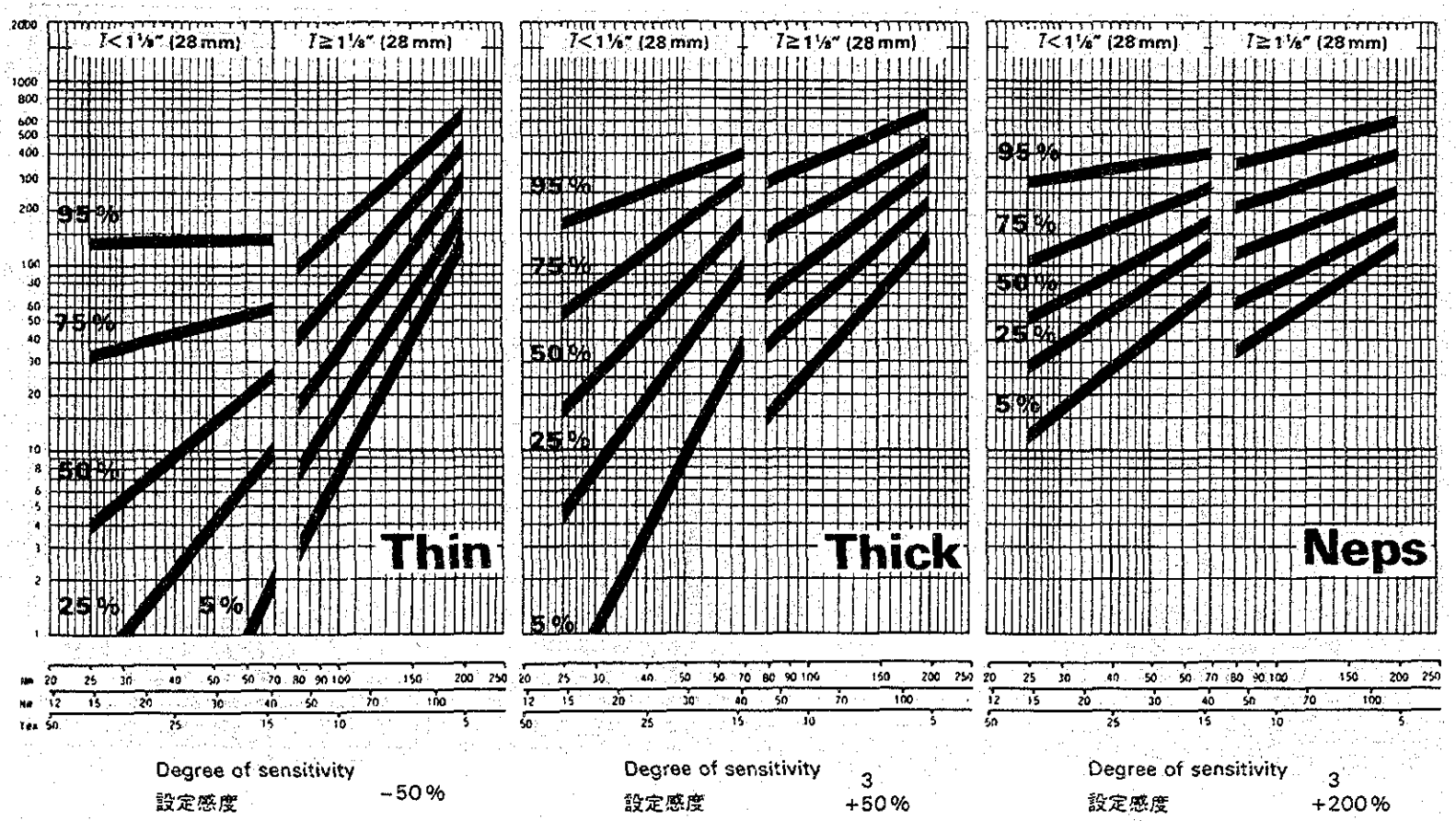


Figure 7-2 Uster Line (2): Combed Yarn IPI

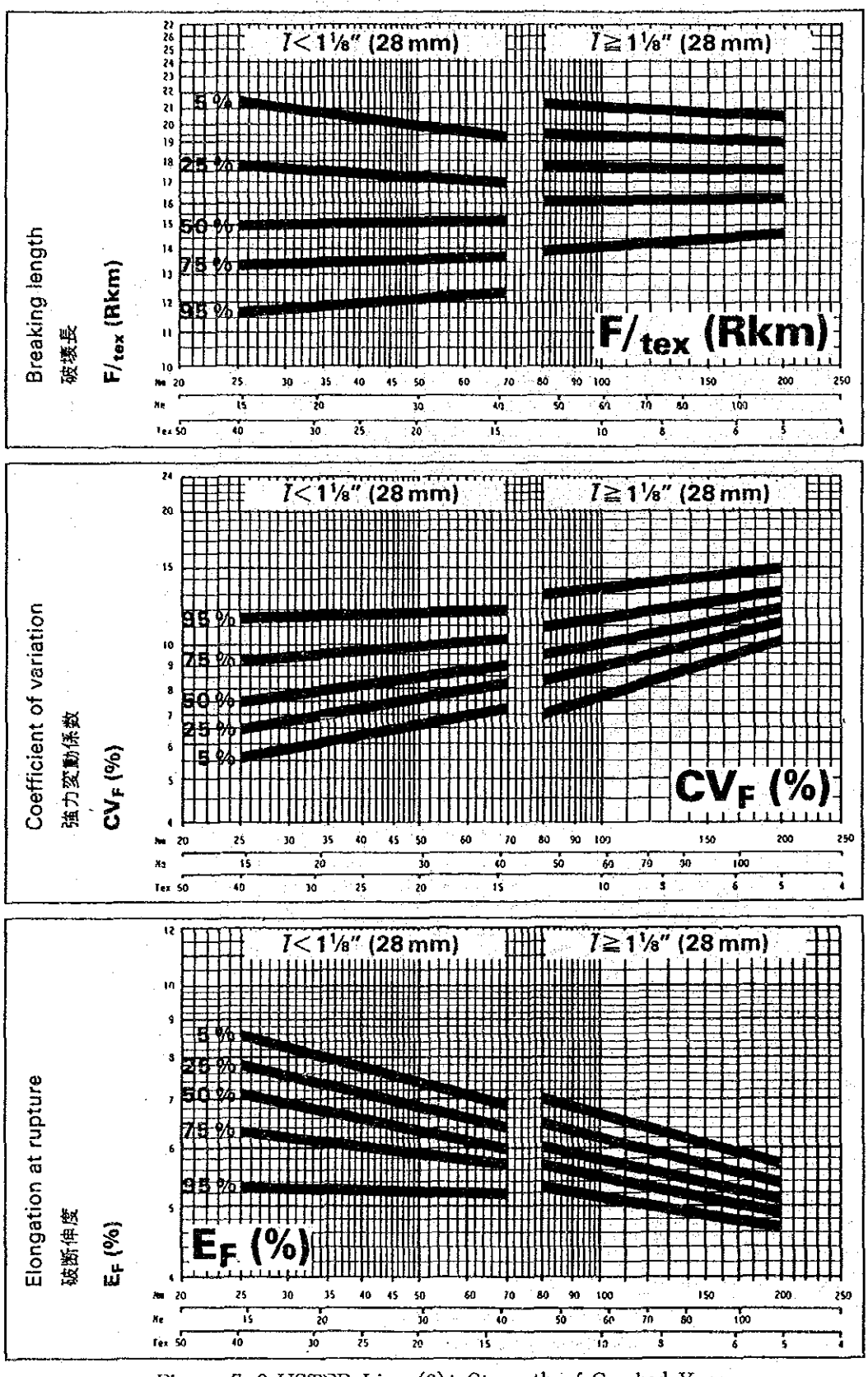
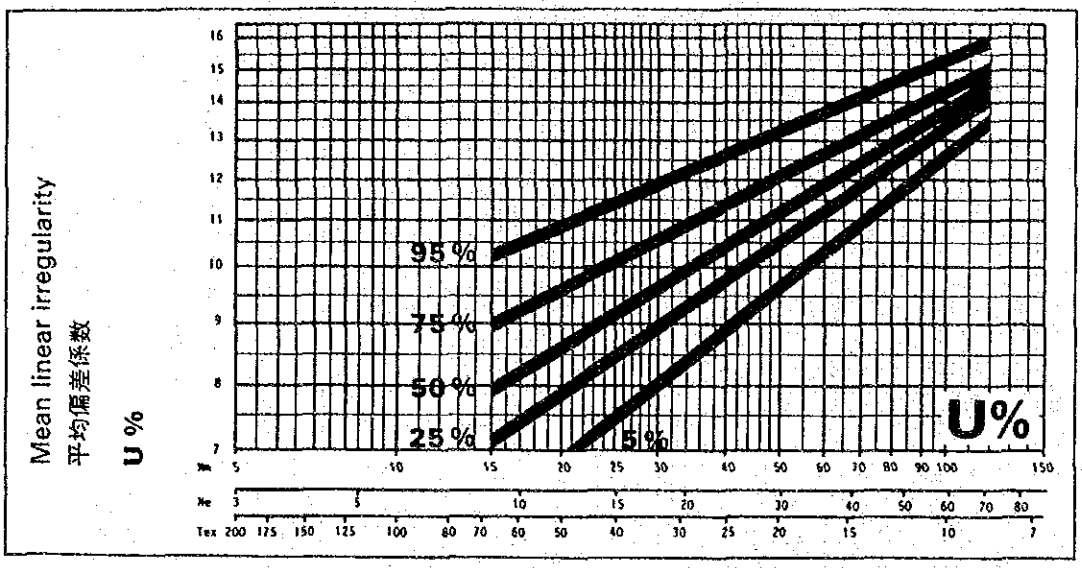


Figure 7-3 USTER Line (3): Strength of Combed Yarn



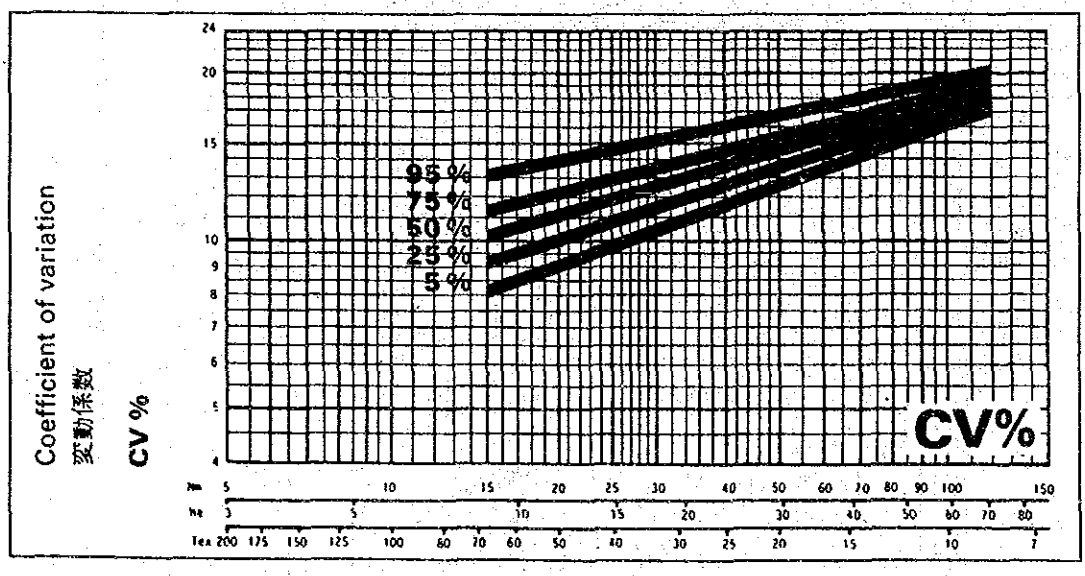


Figure 7-4 USTER Line (4): Blended Yarn U% & CV%

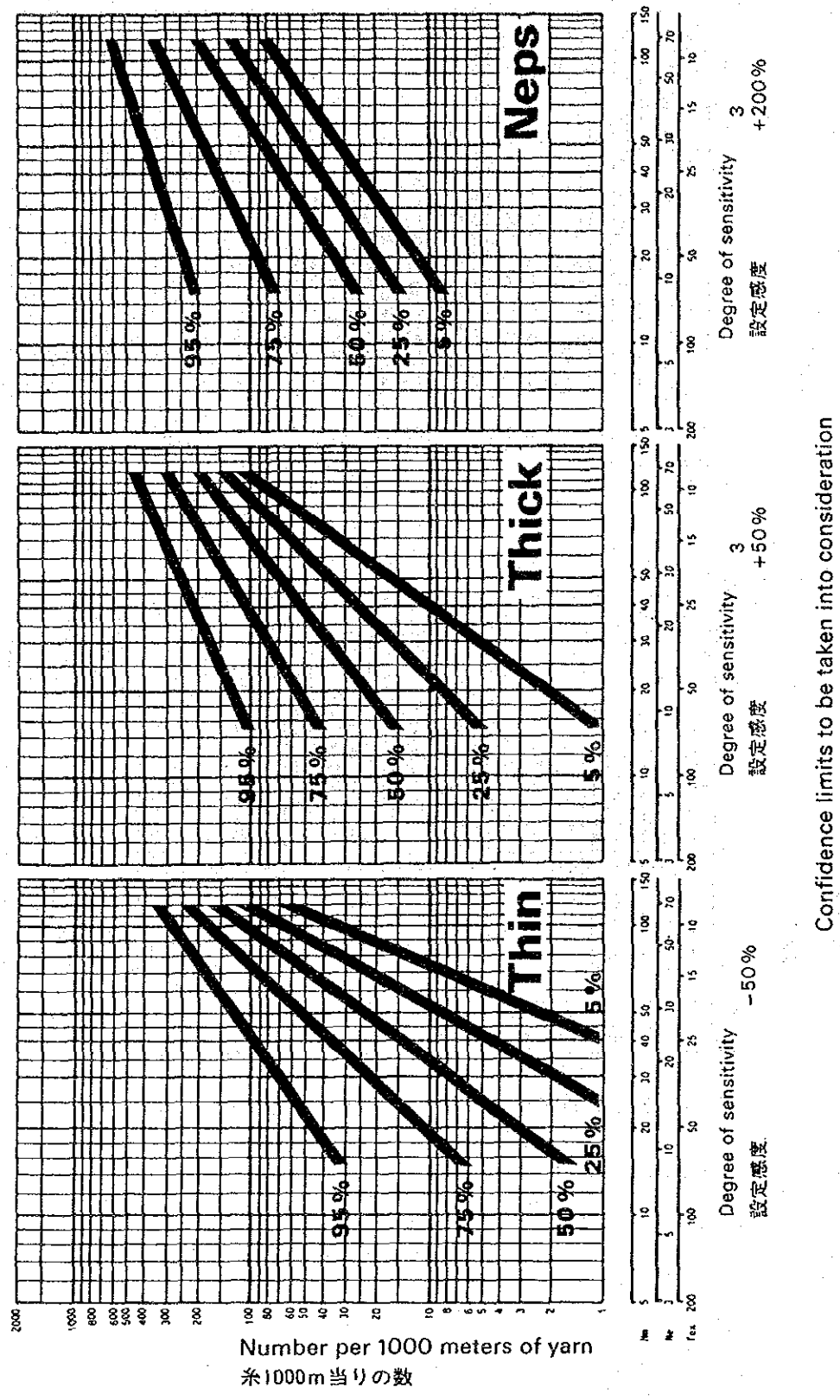


Figure 7-5 USTER Line (5): Blended Yarn IPI

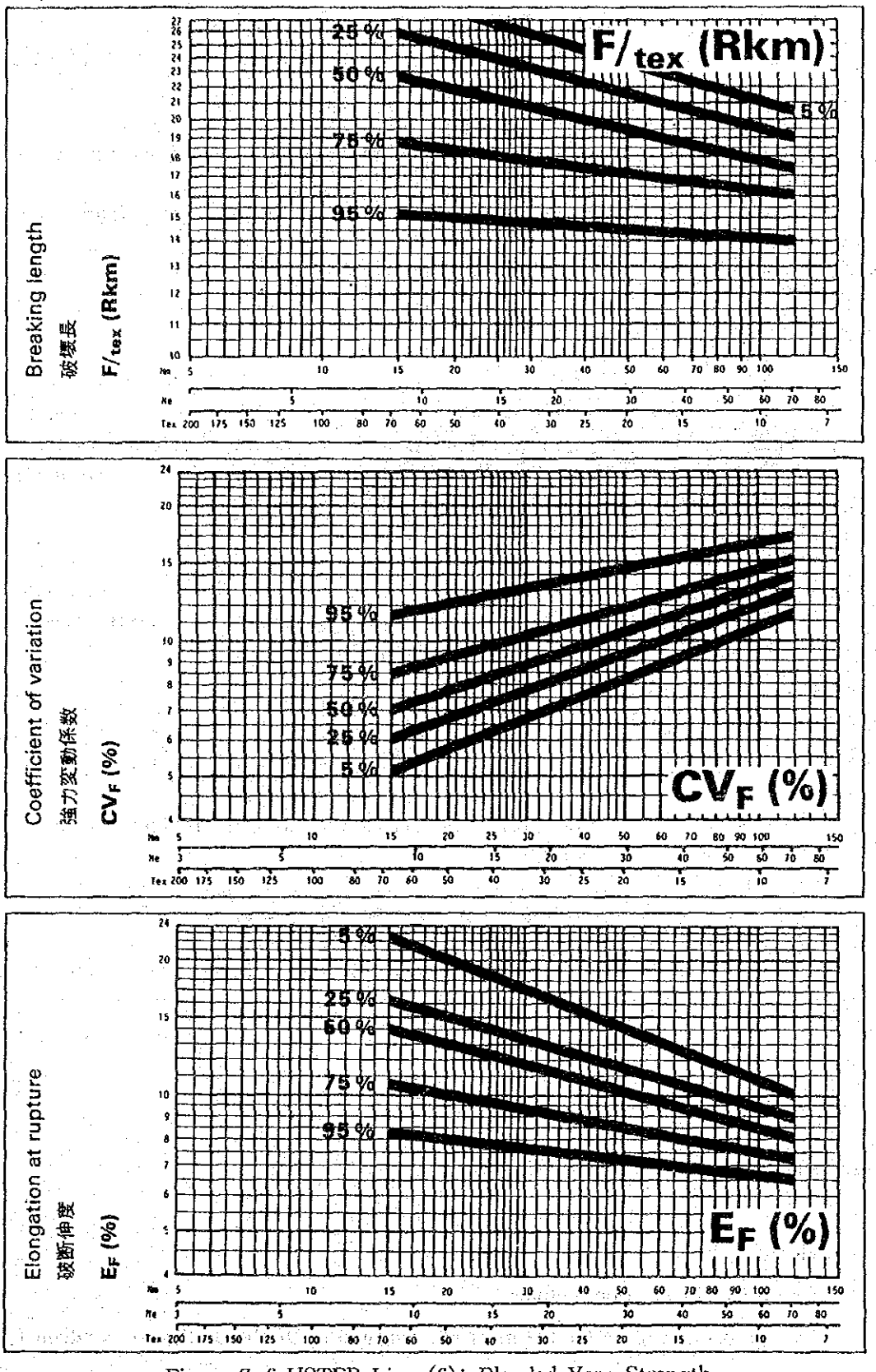


Figure 7-6 USTER Line (6): Blended Yarn Strength

Table 7-8 Setting Conditions of USTER Statistics Diagram

Property items	Note and established conditions
Yarn unevenness U % CV % Thin yarn Thick yarn Neps	Unevenness and imperfection would vary and are subject to the yarn count, raw material, type of fibers, frame condition, and gauge setting.
Breaking length High tenacity variation coefficient Breakage elongation	Experience values gained through tests performed on the USTER DYNAMAT automatic tensile tester (constant velocity load type) Test conditions Use as many packages as possible and repeat tests 100 to 400 times with USTER DYNAMAT tensile tester under the following conditions. Standard atmosheric conditions: Temperature 20° C ± 2° C Humidity 65 % ± 2 % Material to be tested must be fully refined before test. Average breaking time: 20 ± 3 sec Initial tensile force: 0.5 CN/tex (Corresponds to weight of 500 meter of yarn)

7-2 Production Control and Quality Control

7-2-1 Production Control

(1) Control of Production Volume

The production plans for the mills are prepared at the head office of Sandang I, and its control is performed by the mill based on daily actual production. The machine

operators are expected to do self-control to achieve the target production volume. The operators must be fully aware that the actual production of the machines that they run both affects the production volume of their group and the demand and supply balance of the entire mill. Therefore, the following matters must be taken into consideration.

a) To write down the target production in the production recording sheet of each machine. The chief must check its records every day to take appropriate actions.

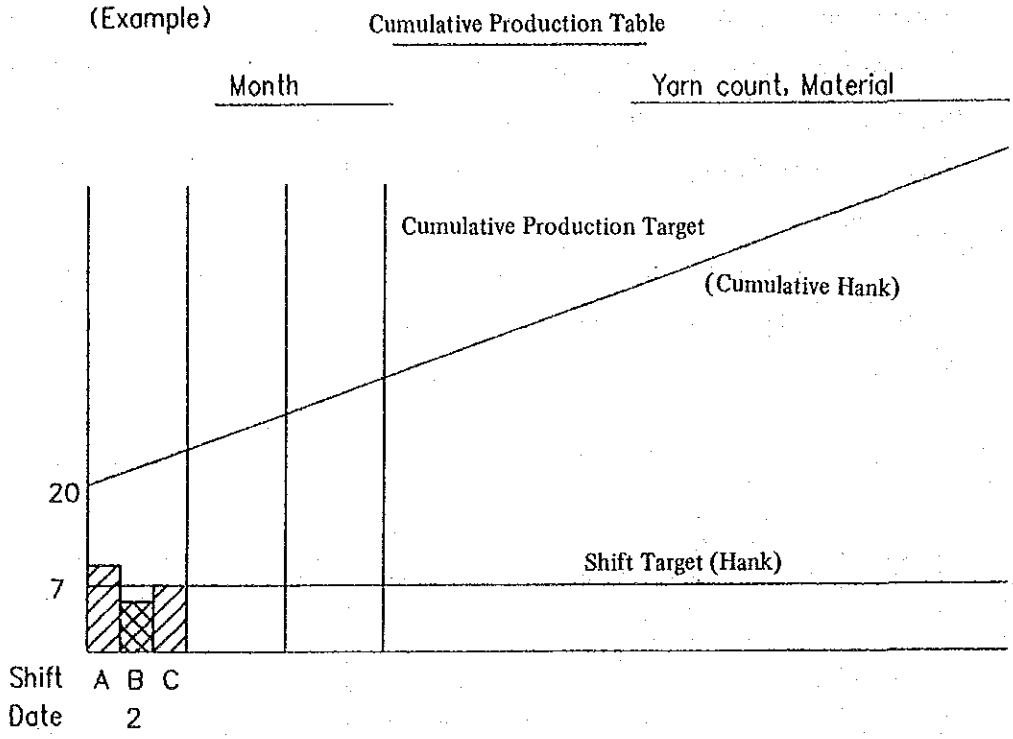
(Example)

Hank Table

Month _____ Shift Target _____ Machine No. _____

Shift	A			B			C		
Date	Hank	Remark	Sign						
1									
2									

The supervisor of each group at the job site will check the hank of the process and machines which became crucial point at that time before finishing his shift every day. If the hank is smaller than the target, the supervisor should check and try to remove its hindrance. If it is impossible to do so, he or she should pass the information to the supervisor of the subsequent group, who in turn devises measures to make up for the deficiency of production, such as operation even in the rest time, improvement of efficiency by reducing the number of machines in charge of operators, etc. In sum, what is most important is to achieve the target of production (the target number of hanks), and the supervisors of each shift A, B and C should be jointly responsible for fulfilling this requirement.



b) The cumulative production table should be posted at a suitable place where every one gets to see, such as, by the work assignment board or attendance control board, so that all the workers can learn at a glance, the condition of production achievements and the amounts produced by each shift. If certain shift alone fails to achieve its targets of production, proper measures should be taken by determining whether its cause lies in an operator or in the trouble generated at some particular process or machine. At times, it may be necessary to take drastic measures according to chief's instruction.

c) To thoroughly acquaint with the standard work volume (unit time and working method by each individual operation), and to educate and train machine operators.

(2) Control of Productivity

Control of productivity is as important as control of production achievement. The productivity of a mill, widely applied in Japan is expressed through calculat ing production volume per spindle(volume produced by one spindle per day which is converted into 20 English yarn count).

By examining above production volume per spindle, whether the operating condition is good or bad for the entire mill is judged and comparison of productivity is possible. This index will be also compared to with productivity of other mills as

well as with other companies. To grasp the productivity of the entire mill, it is recommended to utilize such conversion index as above mentioned. For reference, the Japanese conversion index table together with the calculation basis is shown in Table 7-9.

The factors that would influence the production volume per spindle include the rotating speed of the spindle, number of twists, operation time, operation rate, rate of end breakage and number of operators allocated.

When the rotating speed of the spindle increases and becomes too high, the yarn quality will degrade by increased end breakage, fluff, and unevenness and lowering tenacity. The number of twists is determined by the end use of the produced yarn. However, if reduction of the rate of end breakage or increase of tenacity is needed, the number of twists is better to increase slightly high.

The number of operators allocated at machines will be decided accordingly with the rate of end breakage. By allocating a larger number of operators, loss of productivity due to end breakage can be compensated. Such factors should be considered for the overall decision.

Table 7-9 Conversion Ratio Ne 20 Yarn Count

Yarn count	Conversion ratio	Yarn count	Conversion ratio	Yarn count	Conversion ratio	Yarn count	Conversion ratio	Yarn count	Conversion ratio
5	0.273	35	1.973	65	4.755	95	8.784	125	15.966
6	0.322	36	2.044	66	4.860	96	8.946	126	16.220
7	0.371	37	2.115	67	4.966	97	9.109	127	16.475
8	0.420	38	2.187	68	5.072	98	9.272	128	16.730
9	0.469	39	2.258	69	5.177	99	9.435	129	16.984
10	0.518	40	2.329	70	5.283	100	9.598	130	17.239
11	0.567	41	2.416	71	5.389	101	9.853	131	17.494
12	0.616	42	2.503	72	5.494	102	10.107	132	17.748
13	0.665	43	2.590	73	5.600	103	10.362	133	18.003
14	0.714	44	2.677	74	5.706	104	10.617	134	18.258
15	0.763	45	2.764	75	5.812	105	10.872	135	18.513
16	0.812	46	2.851	76	5.917	106	11.126	136	18.767
17	0.859	47	2.938	77	6.023	107	11.381	137	19.022
18	0.906	48	3.025	78	6.129	108	11.636	138	19.277
19	0.953	49	3.112	79	6.234	109	11.890	139	19.531
20	1.000	50	3.199	80	6.340	110	12.145	140	19.786
21	1.062	51	3.302	81	6.503	111	12.400	160	24.880
22	1.123	52	3.404	82	6.666	112	12.654	180	29.974
23	1.185	53	3.507	83	6.829	113	12.909	200	35.068
24	1.247	54	3.610	84	6.992	114	13.164		
25	1.300	55	3.713	85	7.155	115	13.419		
26	1.370	56	3.815	86	7.317	116	13.673		
27	1.432	57	3.918	87	7.480	117	13.928		
28	1.494	58	4.021	88	7.643	118	14.183		
29	1.555	59	4.123	89	7.806	119	14.437		
30	1.617	60	4.226	90	7.969	120	14.692		
31	1.688	61	4.332	91	8.132	121	14.947		
32	1.759	62	4.437	92	8.295	122	15.201		
33	1.831	63	4.543	93	8.458	123	15.456		
34	1.902	64	4.649	94	8.621	124	15.711		

Table 7-10 Basic Calculation Table for Puoductivity Conversion Factor

	Ne10	Ne16	Ne20	Ne30	Ne40	Ne50	Ne60	Ne80	Ne100	Ne120
Ring Spinning Cop										
Diameter of Ring (mm)	50	48	48	48	45	42	42	38	38	38
Type of Bobbin	JIS	JIS	JIS	JIS	JIS	JIS	JIS	JIS	JIS	JIS
Lift (mm)	190	190	190	190	190	180	180	180	180	180
Yarn Weight per Cop (lb)	0.231	0.209	0.209	0.209	0.174	0.130	0.130	0.116	0.116	0.116
(g)	104.8	94.8	94.8	94.8	78.9	59.0	59.0	52.6	52.6	52.6
Efficiency										
Doffing										
No. of Spindle per m/c	400	400	400	400	400	400	400	400	400	400
Doffing Method				Auto-doffer						
Doffing Frequency (/16hr)	8.6	6.0	4.9	3.0	2.5	2.5	1.9	1.4	0.9	0.6
Doffing Time (min)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Doffing Time (min /16hr)	38.7	27.0	22.1	13.5	11.3	11.3	8.6	6.3	4.1	2.7
Doffing Time Loss (%)	4.0	2.8	2.3	1.4	1.2	1.2	0.9	0.7	0.4	0.3
Loss % by Yarn Breakage	2.0	1.8	1.5	1.3	1.2	1.2	1.1	1.1	1.1	1.1
Twist Number										
Standard Twist per inch	13.40	16.40	18.20	21.00	24.00	26.00	27.70	30.50	33.80	39.50
Twist coefficient	4.24	4.10	4.17	3.83	3.79	3.68	3.58	3.41	3.38	3.61
Twist shrinkage (%)	3.9	3.4	3.1	2.8	2.5	1.9	1.7	1.6	1.5	1.6
Loss % by Twist	3.9	3.4	3.1	2.8	2.5	1.9	1.7	1.6	1.5	1.6
Other Loss (%)	1.1	1.1	1.1	1.1	1.1	1.7	2.1	2.1	2.1	2.1
Total Loss (%)	11.0	9.1	8.0	6.6	6.0	6.0	5.8	5.5	5.1	5.1
Actual Efficiency (%)	89.0	90.9	92.0	93.4	94.0	94.0	94.2	94.5	94.9	94.9
Productivity per spindle										
Spindle speed (rpm)	9,400	11,500	12,800	13,500	14,200	14,000	13,500	13,200	12,000	11,000
Calculated Productivity (lb)	2.227	1.391	1.116	0.680	0.470	0.342	0.258	0.172	0.113	0.074
(g)	1,010.2	631.0	506.2	308.4	213.2	155.1	117.0	78.0	51.3	33.6
Actual productivity (lb)	1.982	1.265	1.027	0.635	0.441	0.321	0.243	0.162	0.107	0.0699
(g)	899.0	573.8	465.8	288.0	200.0	145.6	110.2	73.5	48.5	31.7
Conversion Factor	0.518	0.812	1.000	1.617	2.329	3.199	4.226	6.340	9.598	14.692

7-2-2 Quality Control

As described in the analysis of the current condition in Chapter 3, the standard items to be controlled and the methods to test those items are specified and executed according to those specification.

However, the products presently produced are not necessarily satisfactory as for the quality and it is necessary to reexamine the possible causes leading to this phenomenon. The basic principle of quality control is to constantly manage the processes according to the given standards so as to maintain the deviation in the finished products within the predetermined range. For this purpose, the properties of quality must be measured to detect any abnormality of the processes. If a process is found abnormal, proper measures must be taken to restore its normal operation and stabilize the product quality. On the other hand, to upgrade the quality can be achieved by improving process conditions, equipment and raw material, etc..

(1) Method of Quality Control

Quality control is not simply measuring the values of quality, but to objectively determine where is any abnormality in the process based on the measured data.

It is always necessany to clear:

- By whom and according to what criteria are measured data judged ?
- By whom and by what procedure are detected abnormalities corrected ?

These procedures should be put into practice and for that purpose it is recommended to fortify the current quality control system. Matters to be implemented are recommended as below.

a) A person responsible for quality control should be clear in the organization chart, and he must be fully acquainted with the actual spinning processes as well as versed in spinning technology and quality control procedures, as an engineer.

b) When quality data can be expressed in control charts, this must be done whenever possible, and the charts should be used to judge abnormality statistically. For instance, change by time of second drawing slivers * and ring yarn grain * should be made graphic. Control charts will make it possible to read the changes of quality value with time elapse and by recording and preventing the causes of abnormality, recurrences of abnormality can be avoided.

c) The defects in the production process can be detected through checking of routine items of quality control, that is :

- The number of neps * per 100 square inches and generation ratio of wastes in BL, CE and CM make clear defects of raw cotton and blowing process.
- Generation quantity of pneuma waste and the number of ring yarn breakage testify the operation defects in the pre-spinning process.
- The number of yarn breakage in one winder cop shows the faults of the ring frame and foregoing processes.

Such information should be fed back to the preceding process to prevent reoccurrences of such defects in advance.

Control items for quality control (considered important for spun yarn) include yarn irregularity (U%), IPI (by USTER tester) *, variation of yarn count ratio (CV% of 120yds cut), tenacity ($\bar{x}$ and average of 6 at minimum), and residual defects (USTER CLASSIMAT defects).

Also yarn irregularity check using the yarn inspection board is a simple, convenient and effective mean to make an overall evaluation of the yarn. This method can be effectively utilized for checking the produced yarn on a daily basis, for making comparisons before and after the changes of machine conditions, and for evaluating yarns of other manufacturers.

Regarding yarn control items, the following recommendations are made.

d) As for the control index of yarn strength, the average value of single yarn tenacity and its variation (by CV% or avaraged 6-min) are more important in the post-spinning processes. The present control centered on lea tenacity (120 yds) should be changed to the control by single yarn tenacity.

e) Residual defect test at the winding process is not being periodically performed. This test is a very important control item and should be performed periodically. The main purpose of the CLASSIMAT unit is to examine the extent of defects that were removed after rewound on a winder equipped with an electronic yarn clearer. However, the automatic winder sometimes wrap the waste yarn, and its yarn clearer breakdowns, increasing residual defects unexpectedly. The periodical test with the CLASSIMAT is very effective to detect such defects at an earlier stage and to minimize damages.

f) Yarn breakage test on the Warper should be always carried out. Its data would provide an effective means to detect abnormality in the processes of the spinning sector at an early stage and to pinpoint where the defect lies in the process.

Therefore the tests should be performed on the total number each time.

* (Note) Example tables and charts are attached at the end of the document for reference.

Below is a matrix chart showing the items described above.

Count variation	B	A		C							
Single yarn strength						A		B	B	B	
User evaluation				B	B		A	A			
Process control	A	B	B	A	A				A	A	A
Items of evaluation / Items of control / Process (place of origination)	Grain of sliver from drawing machine	Coefficient of count variation	Drop waste ratio	Unevenness	IPI value	Single yarn strength	Residual defects	Yarn breakage at warping process	Volume of generated pneumatic waste	Number of end break in the cop	Neps within web
BLOWING	B	C	B								B
CARDING	A	B	B		A	B	B	C			A
COMBING	B	C	A		A	C	B	C			
DRAWING	B	A			B	C	C	C	C	B	
ROVING		C		B	B	B	C	B	B	B	
SPINNING		B		A	B	A	C	A	A	A	
WINDING							A	A			

The control items are shown by letters A, B and C in order of importance.

In conclusion, the important is to produce yarns that please the customers, which do not break in the process of weaving or knitting thus contributing to productivity, and which can make the woven or knitted fabrics made from them free from defects. It is needless to say that quality control is indispensable for such purpose.

Much information regarding yarn quality can be accessible, but it is dufficult to know what kind of control is made by each yarn manufacturer because such technology is a kind of know-how and do not see the light. Some quality control norms adopted in first rate spinning mills in South East Asia are introduced in Table 7-11 for reference.

Table 7-11 Norm of Quality Control

NO.1

[Combed 30Ne,40Ne,60Ne:Es/C 40Ne] 16 July 1990

PROCESS	ITEM	STANDARD VALUE	CONTROL LIMIT	CONTROL ITEM	PERIOD	SAMPLE SIZE	TESTING DEVICE or METHOD	PERSON in CHARGE
QC-1 RAW MATERIAL	1. Fineness (μg/in)	-----	(4.1--4.9)	☓	at change of raw cotton	5 bales/kind n= 5 / bale	Micronaire	Inspector
	2. Fiber Strength (lbs / sq.in.)	----	> 80000	☓	::	5 bales/kind n= 5 / bale	Pressley Tester	Inspector
	3. Fiber Length (inch)	----	> 1.03	☓	::	5 bales/kind n= 2 / bale	Digital Fibro 2.5 % SL	Inspector
	4. Moisture Regain	----	> 7.0 %	☓	::	5 bales/kind n= 2 / bale	Moisture Content Measuring Instrument	Inspector
	5. Grade	----	-----	----	all bales	n= 1 / bale	at sight	Forman /Leader
	6. Honeydew Content	----	-----	----	when necessary	n= 2 / bale	Honeydew Testing Device	Inspector
	7. Maturity	----	-----	----	::	n= 2 / bale	Causticaire Method	Inspector
QC-2 Blow Room Machinery	1. Lap Weight	standard weight	within (standard±1.6%)	X	all laps	n= 1 / Lap	Lap Scale	Operator
	2. Rate of Laps out of weight limit	-----	(C) < 5 % (Es) < 8 %	X	1 / shift	all laps /set/shift	Calculation	Leader /Forman
	3. CV % of Lap Weight/yard	----	< 2 %	☓	1 / month	n=2 laps/set	Lap Tester	Maintenance Leader
	4. Trisection Test of Lap	----	difference < 5 %	X	when necessary	n=2 laps/set	Standard Method	Maintenance Leader
	5. Waste Percentage	----	< standard×1.1	X	1 / year	n=1 / set	Standard Method	Maintenance Leader
QC-3 Card	1. Sliver Weight / 6 yds	standard weight	within (standard±5%)	☓	1 / week	n=2/machine (M)	Wrap Block & Balance or Auto-Sorter	Inspector
	2. U %	----	< 3.8 %	X	1 / month	n=1 / M	Uster Tester	Inspector
	3. Neps (including leaf & trash)	----	< 7 pcs /36sq.in.	X	1 / day	n=2 / M	6×6 in. Board	Maintenance Leader
	4. Waste Percentage	----	< standard×1.1	X	1 / year	n=1 / M	Standard Method	Maintenance Leader

[Combed 30Ne,40Ne,60Ne:Es/C 40Ne]

PROCESS	ITEM	STANDARD VALUE	CONTROL LIMIT	CONTROL ITEM	PERIOD	SAMPLE SIZE	TESTING DEVICE or METHOD	PERSON in CHARGE
QC-4 Pre-Drawing(C) & Gr-Drawing(Es)	1. Sliver Weight / 6 yds	standard weight	< ±A2*R-Bar (Standard±4%)	$\bar{X}$, R	1 / week	all machines n= 2 / Del	Wrap Block & Balance or Auto Sorter	Inspector
	2. U %	----	< 5 %	$\bar{X}$	1 / month	all machines n= 1 / Del.	Uster Tester	Inspector
QC-5 Comber	1. Sliver Weight / 6 yds	standard weight	< ±A2*R-Bar (Standard±4%)	$\bar{X}$, R	2 / week	all machines n= 2 / Del.	Wrap Block & Balance or Auto Sorter	Inspector
	2. U %	----	< 4.7 %	$\bar{X}$, R	1 / month	all machines n= 1 / Del.	Uster Tester	Inspector
	3. Web Condition	----	-----	----	1 / day	all machines n= 1 / Del.	at sight	Maintenance Leader
	4. Noil Percentage	standard %	(per Head) within stan.±1.5%	$\bar{X}$	1 / month	all machines n= 1 / Del.	Standard Method (200 Nips Operation)	Maintenance Leader
			(per Del.) within Stan.±3%	X				
QC-6 1st. Po-Drawing	1. Sliver Weight / 6 yds	standard weight	< ±A2*R-Bar (Standard±3%)	$\bar{X}$, R	1 / week	all machines n= 2 / Del.	Wrap Block & Balance or Auto Sorter	Inspector
	2. U %	----	< 3.5 %	$\bar{X}$	1 / month	all machines n= 1 / Del.	Uster Tester	Inspector
QC-7 2nd. Po-Drawing	1. Sliver Weight / 6 yds	standard weight	< ±A2*R-Bar (Standard±2%)	$\bar{X}$, R	2 / shift	all machines n= 2 / Del.	Wrap Block & Balance or Auto Sorter	Inspector
	2. U %	----	< 3 %	$\bar{X}$	1 / week	all machines n= 1 / Del.	Uster Tester	Inspector
QC-8 Roving Frame	1. Roving weight / 30 yds	standard weight	< ±A2*R-Bar	$\bar{X}$, R	1 / week	6 rovings/ M n= 1/roving	Wrap Block & Balance	Inspector
	2. U %	----	< 5.2 %	$\bar{X}$	1 / month	2 rovings/ M n= 1/roving	Uster Tester	Inspector
	3. Roving Strength	----	< ±A2*R-Bar	$\bar{X}$, R	1 / month	10 rovs./kind n= 5/roving	Roving Strength Tester	Inspector
	4. Number of Rov. Breakage (Breakage at front side)	----	< 3.5/100sp. /1000m	$\bar{X}$	1 / month	all machines all spindles	Check Sheet (during one doffing)	Operator

NORM OF QUALITY CONTROL

NO.3

[Combed 30Ne,40Ne,60Ne:Es/C 40Ne]

PROCESS	ITEM	STANDARD VALUE	CONTROL LIMIT	CONTROL ITEM	PERIOD	SAMPLE SIZE	TESTING DEVICE or METHOD	PERSON in CHARGE
QC-9 Ring Spinning Frame	1. Yarn Weight / 120 yds	standard weight	<± A2*R-Bar (±2 %)	X̄ , R	2 / week	40 cops/kind n= 1 / cop	Wrap Reel & Balance or Auto Sorter	Inspector
	2. CV % of Yarn Weight /120 yds	----	< 2.7 %	X̄	2 / week	::	Calculation	Inspector
	3. Moisture Regain	----	-----	X	2 / week	n= 1 / kind (120yds*40)	Oven with Balance	Inspector
	4. Single Yarn Breaking Strength	----	combed 30s>260g : 40s>198g : 60s>155g Es/C 40s>240g	X̄	1 / week	60 cops/kind n= 1 / cop	Single Yarn Tensile Strength tester	Inspector
	5. CV % of Single Yarn Breaking Strength	----	30s,40s < 10.5 60s < 12.0	X	1 / week	::	::	::
	6. Single Yarn Elongation	----	(C) > 5.4 % (Es/C)> 7.3 %	X̄	1 / week	::	::	::
	7. U %	----	combed 30s<12.1 : 40s<12.8 : 60s<13.1 E/C 40s<13.3	X̄	2 / month	10 cops/kind n= 1 / cop	Uster Tester	Inspector
	8. Imperfection Indicator (I.P.I.: pcs/1000m)	----	30s;40s;60s;E40 (Thin)< 60 115 135 100 (thick)<180 300 300 220 (Neps)<180 300 300 250	X̄	2 / month	::	::	::
	9. Number of End Down	----	< 15/400sps/Hr	X̄	1 / month	all machines	at sight	Operator
	10. Inspecting Yarn Eveness (a) Eveness (b) Nep, Leaf & Trash	 20 point*5 20 point*5	 > 85 point > 85 point	(per 1 board) 1st 2nd 3rd 20 17 14	1 /week	5 cops/kind n=1 board/cop	Seri-Plane Standard Sample	Inspector

NORM OF QUALITY CONTROL

NO.4

[Combed 30Ne,40Ne,60Ne:Es/C 40Ne]

PROCESS	ITEM	STANDARD VALUE	CONTROL LIMIT	CONTROL ITEM	PERIOD	SAMPLE SIZE	TESTING DEVICE or METHOD	PERSON in CHARGE
QC-10 Winder	1. Yarn Faults / 100km (after cleaning)	----	< 5.0	X	1 / month	n=5 cheeses / kind	Classimat (A4--D4,C3,D3,D2)	Inspector
	2. Cheese Weight	standard weight	-0.5%<$\bar{X}$<+3.5%	$\bar{X}$, R	1 / day	n=20 cheese / M	Balance	Operator
	3. Yarn Length of Cheese	standard length	± 0%<$\bar{X}$<+3.0%	$\bar{X}$, R	1 / month	n=5 cheese / kind	Yarn Length Measurer	Inspector
	4. Moisture Regain	----	-----	---	1 / month	::	Oven with Balance	Inspector
	5. Check of Cheese Appearance	----	(< 5 %)	X;(rate of reject cheese)	all cheeses	n= 1/Cheese	at sight	Operator
	6. Number of Yarn Breakage	----	< 1.5 / cop	$\bar{X}$	all cops	all machines all drums	Reading of M-AW Counter (Calculation)	Operator & Inspector

(2) Measures to Improve Quality

As for the quality control of spinning yarn of the same type (product type, yarn count, use), the most important thing is to keep the conditions of deliveries and spindles unchanged and to train the operators so as to make same operation motion. This would result in minimizing quality deviation of the same type of yarn. In order to upgrade the quality level itself, some improvement must be made in the process, machinery, raw material, and other factors are involved. Meanwhile, the basic factor of quality control is to maintain all products qualities within the normal fluctuation range. Explained below is the measure for quality control with emphasis on the operation control aspect.

a) Cleanliness of Site.

A clean and orderly site is the basis for process control, and this can determine the operation condition of the mill and the product quality level. When the site is kept in a clean and orderly condition, anything out of ordinary can be readily detected. For an example, if a white line is drawn to indicate the location of products including semiproducts, such problems as may arise from mixing of products can be prevented. Concentrating on cleanliness and orderliness is a must.

b) Review of Cleaning Procedures

So many flies are observed in the mill and more emphasis must be placed on cleaning the floors and the machines. The cleaning procedures and frequency must be improved so that there would be no accumulation of flies around the yarn passage for all machines from the blow room to the winding processes.

c) Careful Handling of Intermediate Products

Careful handling of semiproducts from the lap of the Blow Room to the cheese of the winders is required so that the product surfaces are not roughened. If the cans are roughly handled, the inside of the can will rub sliver and it becomes fluffy. Also when sliver is drawn sideways at the rear of the Drawing Frame (particularly when the can has been overfilled with sliver), slivers will break and fluffiness will be generated. Spinning cops are transported and stored in cloth bags; however, cops should be placed in plastic or in aluminum boxes so that their surfaces do not degrade.

d) Quality Control by Machine Operators

1. The machine operators are well acquainted with the details of the site A procedure

must be established so that when an operator detects an abnormality in the process, he/she reports it to his/her superior. Such procedure cannot be thoroughly practiced only by instructions but can be realized only through good human relations. Table 7-12 is abnormality check list for the machine operators.

2. It is to have everyone thoroughly realize that the quality of finished products are influenced by the motions and skills of a operator, which must be checked on a periodic basis. Examples of such motions and skills are following.

   (Motions)

   - Flies removed at machine cleaning enter the web and sliver.
   - Fluffs are caused on sliver by putting hand between the can and the sliver when transporting the cans.
   - The defective parts of the sliver are not removed even though there are narrow and wide parts formed by hanging down slackening or double feeding of the web.

   (Skills)

   - Skill of connecting lap at its replacing

     It causes unevenness in the thickness of the web.

     (The results may be checked by operator's name. The time is also measured for reference.)

   - Skill of connecting sliver at its replacing

     It causes unevenness in the thickness of the roving yarn.

     (The results of each individual are noticed. The time is measured for reference.)

   Since the motion and skills are repeated and repeated in the daily operation, it is better to instruct the workers to try to achieve B on a constant basis rather than to attain A only when their performances are checked.

Table 7-12 Visual Check Items by Machine Operators

Processes	Items
Blow room	Condition of opening: Unopened cotton tuft; existenc twist. Spray conditions to cage Free of unsatisfactory condition of cotton opening (unevenness, eddy, holes, etc) Form of lap: Free of configuration defects such as defective outer diameter, selvedge, taper, hardness, etc.
Carding	Lap licking: Free of lap licking. Web unevenness: Free of horizontal and vertical strips and cloud and minimal waste nep. Waste and condition (below taker-in, flat strips): No good fiber droppage, and short fibers, mote, leaf dust to be removed. (only cotton)
Preliminary drawing	Condition of fleece: Free of step unevenness, cloud, selvedge break, etc.
Lap former	Condition of fleece: Free of sliver overlapping, and no thick or thin slivers. Condition of lap: Free of configuration defects such as defective lap selvedge, side surface, hardness, etc.
Comber	Lap licking: Free of lap licking. Condition of fleece: Free of step unevenness, cloud, selvedge break, bending, etc. Waste and condition: Free of unevenness, thick and thin, cloud, clogging etc.
Drawing	Number of sliver supplied: Check number of sliver at sliver breakage and sliver replacement (blending machine)
Drawing	Condition of fleece: Free of step unevenness, cloud, selvedge break, etc.
Roving	Form of roving yarn: Free of defective form such as overlapping of roving yarn, deformed roving, etc.
Ring spinning	Yarn breakage examination: Number of yarn breakage in one doffing or in a fixed period of time. Yarn breakage after doffing: Whenever required
Winding	Defective cheese: Free from defects such as off twill, incorrect color, poor makeup, etc. Intermediate breakage ratio: By counter on machine Mis-knot: By counter on machine

e) Series Control and Lot Classification

The basic rule for producing the same kind of products is to use the same raw material and machinery under the same operating conditions. Nevertheless, there are cases when such production cannot be performed. When two machines with different performances must be used, the line of production should be divided in accordance with the machine types, and its products should be devided into two different lots as well.

If the different lots are mixed and one is of lower grade quality, the entire lot must be treated as the lot of lower grade quality, even though that lot is fewer one. Obviously this brings out a big loss. Also the products should be classified according to the line of the same machine so that if any problems should arise in the quality, the loss from that trouble can be minimized within that line only. This is an effective methods to detect the cause(s) of the trouble. If the mixture of different lines is unavoidable, lot distinction of its products is necessary.

7-3 Production Machinery and Equipment

7-3-1 Calculation of Production Machinery and Equipment

(1) Spinning Calculation Table

When determining the required number of production machines, various conditions should be taken into consideration. These conditions should be set up considering such facters as: technology level, expected degree of product quality, competency level of the employees, quality of the raw material to be used, and other related matters. In this renovation project, the product quality level has been set at a very high level that would permit products of expert levels. In Table 7-13, the calculation as per process is shown. The last line indicates the number of machines that would be required.

a) For the First Mill spinning calculation table is prepared for two cases: namely, when producing a combination of cotton comber yarn Ne 40 and Ne 50 and polyester and cotton blended yarn 65/35, Ne 20, 40, 40/2 for a period of approximately 6 months; and a combination of cotton comber Ne 40 and Ne 50 and polyester/cotton blended yarn 35/65 for a period of approximately 6 months.

b) For the Second Mill the spinning calculation table is prepared on an assumption that high efficiency production limited to polyester/cotton blended yarn 65/35 Ne 45 would be performed.

Table 7-13 Calculation Table for Ring Spinning Yarn

BANJARAN 1
Cotton.Polyester/Cotton

Calculation Table for Ring Spinning Yarn (33,600 sps)

Process / Item	1 Supply thickness Grain/yard	2 No of doubling	3 Draft	4 Produced thickness Grain/yard	5 Twist multiplier α e	6 Twist per inch TPI	7 Waste percent %	8 Delivery speed or Revolution		9 Package		10 Production 100% LBS per hour	11 Working hour	12 Working efficiency %	13 No of spindle /machine	14 Actual Production LBS/Shift	15 Required Production LBS/Shift	16 Calculated No of machine	17 No of machine
1 Blow Room Machinery				oz/yard				rpm	yds	mm	mL								
-1 for Polyester				14			0.5	13.0	10.8	960	50	567.00	7.5	89	1	3784.73	1994.27	0.5	1
-2 for cotton (A)				14			1.0	13.0	10.8	960	50	565.43	7.5	85	1	3604.58	7391.63	2.1	2
-3 for cotton (B)				14			2.0	13.0	10.8	960	50	565.43	7.5	85	1	3604.58	1789.60	0.5	1
2 Carding Machine	oz/yard			Grain/6yds			Reusable 0.5	rpm	yds	φ	mmH								
-1 for Polyester	14	1	95.74	380			1.0	25.0	58.9	610	1067	42.75	7.5	90	1	288.56	1974.33	6.8	7
-2 for cotton (A)	14	1	100.80	350			4.0	22.0	51.8	610	1067	34.65	7.5	85	1	220.89	7095.96	32.1	33
-3 for cotton (B)	14	1	100.80	350			4.0	22.0	51.8	610	1067	34.65	7.5	85	1	220.89	1718.02	7.8	8
3 Pre-Drawing Frame	Grain/6yds			Grain/6yds				yds	m	φ	mmH								
-1 for Polyester of Blend	380	8	7.79	390			0.3	295.3	270	508	1067	164.52	7.5	80	2	1974.29	1968.41	1.0	1
4 Pre-Combing of Cotton	Grain/6yds			Grain/yard				yds	m	W	φ								
-1 Sliver Lap Machine(A)	350	18	1.53	685			0.3	71.1	65	232	630	417.46	7.5	80	1	2504.75	7074.67	2.8	3
-2 Sliver Lap Machine(B)	350	18	1.53	685			0.3	71.1	65	232	630	417.46	7.5	80	1	2504.75	1712.86	0.7	1
-3 Ribbon Lap Machine(A)	685	6	5.48	750			0.3	65.6	60	300	630	421.71	7.5	80	1	2530.29	7053.45	2.8	3
-4 Ribbon Lap Machine(B)	685	6	5.48	750			0.3	65.6	60	300	630	421.71	7.5	80	1	2530.29	1707.72	0.7	1
5 Comber	Grain/yard			Grain/6yds			Reusable 1.0	nip	mm	φ	mmH								
-1 for cotton (A)	750	4	43.46	350			15.5	200.0	5	508	1067	23.76	7.5	85	2	302.97	5889.63	19.4	20
-2 for cotton (B)	750	4	43.46	350			15.5	200.0	5	508	1067	23.70	7.5	85	2	302.19	1425.95	4.7	5
6 1st Drawing Frame	Grain/6yds			Grain/6yds				yds	m	φ	mmH								
-1 Polyes/cotton Yarn(P)	390	6	8.57	350			0.3	273.4	250	508	1067	136.70	7.5	83	2	1701.92	3019.24	1.8	2
-2 (C)	350	3																	
-3 Cotton Combed Yarn(A)	350	8	8.00	350			0.3	251.5	230	508	1067	125.75	7.5	80	2	1509.00	4815.23	3.2	4
-4 Cotton Combed Yarn(B)	350	8	8.00	350			0.3	251.5	230	508	1067	125.75	7.5	80	2	1509.00	1421.67	0.9	1
7 2nd Drawing Frame	Grain/6yds			Grain/6yds				yds	m	φ	mmH								
-1 Polyes/cotton Yarn	350	8	8.00	350			0.3	273.4	250	508	1067	136.70	7.5	83	2	1701.92	3010.18	1.8	2
-2 Cotton Combed Yarn(A)	350	8	8.00	350			0.3	251.5	230	508	1067	125.75	7.5	80	2	1509.00	4800.78	3.2	4
-3 Cotton Combed Yarn(B)	350	8	8.00	350			0.3	251.5	230	508	1067	125.75	7.5	80	2	1509.00	1417.41	0.9	1
8 Simplex Fly Frame	Grain/6yds			Grai/30yds				rpm		φ	mmL								
-1 Polyes/cotton Yarn	350	1	7.14	245	0.78	0.79	0.5	850		152	406	2.0921	7.5	83	108	1406.53	2995.13	2.1	3
-2 Cotton Combed Yarn(A)	350	1	7.14	245	1.10	1.11	0.5	900		152	406	1.5766	7.5	83	108	1059.93	4776.78	4.5	5
-3 Cotton Combed Yarn(B)	350	1	7.95	220	1.25	1.33	0.5	900		152	406	1.1815	7.5	85	108	813.48	1410.32	1.7	2
9 Ring Spinning Frame	Grai/30yds			Ne				rpm		mmR	mmL								
-1 Polyes/cotton Yarn	245	1	19.60	20	3.45	15.43	1.0	14000		47	203	0.0900	8.0	90	960	622.16	1240.60	2.0	2
-2 Polyes/cotton Yarn	245	1	39.20	40	3.45	21.82	1.0	15000		44	203	0.0341	8.0	93	960	243.55	1694.63	7.0	7
-3 Cotton Combed Yarn	245	1	31.36	32	3.70	20.93	1.2	15000		44	203	0.0444	8.0	93	960	317.38	2539.08	8.0	8
-4 Cotton Combed Yarn	245	1	39.20	40	3.80	24.03	1.2	16000		44	203	0.0330	8.0	93	960	235.90	2123.06	9.0	9
-5 Cotton Combed Yarn	220	1	44.00	50	3.85	27.22	1.4	15000		44	203	0.0219	8.0	92	960	154.51	1390.57	9.0	9
11 Steam Setter								Batch/hour		Lbs/Batch									
-1 Polyes/cotton Yarn																			
-2 Polyes/cotton Yarn								1.5		600		900.00	7.5	90	1	6075.00	5474.30	0.9	1
-3 Cotton Combed Yarn																			
12 Auto Winder	Ne			Ne				yds	m	mm	Angle								
-1 Polyes/cotton Yarn	20	1		20			0.5	1094	1000	152	5.57	3.9071	7.5	83.5	60	1468.11	1234.39	0.8	1
-2 Polyes/cotton Yarn	40	1		40			0.5	1094	1000	152	5.57	1.9536	7.5	84.5	60	742.85	1686.16	2.3	2
-3 Cotton Combed Yarn	32	1		32			0.5	1039	950	152	5.57	2.3192	7.5	83.5	60	871.44	2526.38	2.9	3
-4 Cotton Combed Yarn	40	1		40			0.5	1094	1000	152	5.57	1.9536	7.5	85.5	60	751.64	2112.45	2.8	3
-5 Cotton Combed Yarn	50	1		50			0.5	1039	950	152	5.57	1.4843	7.5	85.5	60	571.08	1383.62	2.4	3
13 Doubler Winder	Ne			Ne				yds	m	mm									
-1 Polyes/cotton Yarn	Ne 40/2	2		40			0.6	492	450	152		1.7571	7.5	85	120	1344.21	815.37	0.6	1
14 Two for One Twister	Ne			Ne				rpm		mm	Angle								
-1 Polyes/cotton Yarn	Ne 40/2	1		40		17.46	0.5	10000		152	5.57	0.1136	8.0	93	120	101.46	311.30	8.0	8

Table 7-14 Calculation Table for Ring Spinning Yarn

BANJARAN 1
Cotton & Cotton/Polyester 35/65

Calculation Table for Ring Spinning Yarn (33,600 sps)

	Process / Item	1 Supply thickness Grain/yard	2 No of doubling	3 Draft	4 Produced thickness Grain/yard	5 Twist multiplier α e	6 Twist per inch TPI	7 Waste percent %	8 Delivery speed or Revolution		9 Package		10 Production 100% LBS per hour	11 Working hour	12 Working efficiency %	13 No of spindle /machine	14 Actual Production LBS/Shift	15 Required Production LBS/Shift	16 Calculated No of machine	17 No of machine
1	Blow Room Machinery				oz/yard				rpm	yds	mm	mL								
-1	for Polyester				14			0.5	13.0	10.8	960	50	567.00	7.5	89	1	3784.73	1046.31	0.3	1
-2	for cotton (A)				14			1.0	13.0	10.8	960	50	565.43	7.5	85	1	3604.58	8468.48	2.3	2
-3	for cotton (B)				14			2.0	13.0	10.8	960	50	565.43	7.5	85	1	3604.58	1789.60	0.5	1
2	Carding Machine	oz/yard			Grain/6yds			Reusable 0.5	rpm	yds	ϕ	mmH								
-1	for Polyester	14	1	98.33	370			1.0	24.0	56.5	610	1067	39.96	7.5	90	1	269.73	1036.85	3.8	4
-2	for cotton (A)	14	1	100.80	350			4.0	23.0	54.2	610	1067	36.22	7.5	85	1	230.93	8129.74	35.2	36
-3	for cotton (B)	14	1	100.80	350			4.0	23.0	54.2	610	1067	36.22	7.5	85	1	230.93	1718.02	7.4	8
3	Pre-Drawing Frame	Grain/6yds			Grain/6yds				yds	m	ϕ	mmH								
-1	for Polyester of Blend	370	7	8.25	314			0.3	251.5	230	508	1067	112.82	7.5	80	2	1353.79	1032.74	0.8	1
4	Pre-Combing of Cotton	Grain/6yds			Grain/yard				yds	m	W	ϕ								
-1	Sliver Lap Machine(A)	350	18	1.53	685			0.3	71.1	65	232	630	417.46	7.5	80	1	2504.75	8105.35	3.2	3
-2	Sliver Lap Machine(B)	350	18	1.53	685			0.3	71.1	65	232	630	417.46	7.5	80	1	2504.75	1712.86	0.7	1
-3	Ribbon Lap Machine(A)	685	6	5.48	750			0.3	65.6	60	300	630	421.71	7.5	80	1	2530.29	8081.03	3.2	3
-4	Ribbon Lap Machine(B)	685	6	5.48	750			0.3	65.6	60	300	630	421.71	7.5	80	1	2530.29	1707.72	0.7	1
5	Comber	Grain/yard			Grain/6yds			Reusable 1.0	nip	mm	ϕ	mmH								
-1	for cotton (A)	750	4	43.46	350			15.5	210.0	5	508	1067	24.95	7.5	85	2	318.12	6747.66	21.2	22
-2	for cotton (B)	750	4	43.46	350			15.5	200.0	5	508	1067	23.70	7.5	85	2	302.19	1425.95	4.7	5
6	1st Drawing Frame	Grain/6yds			Grain/6yds				yds	m	ϕ	mmH								
-1	COtton/Polyester Yarn	314	3	7.92	340			0.3	273.4	250	508	1067	132.79	7.5	83	2	1653.29	2941.83	1.8	2
-2	(C)	350	5																	
-3	Cotton Combed Yarn(A)	350	8	8.00	350			0.3	251.5	230	508	1067	125.75	7.5	80	2	1509.00	4816.23	3.2	4
-4	Cotton Combed Yarn(B)	350	8	8.00	350			0.3	251.5	230	508	1067	125.75	7.5	80	2	1509.00	1421.67	0.9	1
7	2nd Drawing Frame	Grain/6yds			Grain/6yds				yds	m	ϕ	mmH								
-1	COtton/Polyester Yarn	340	8	8.00	340			0.3	273.4	250	508	1067	132.79	7.5	83	2	1653.29	2933.00	1.8	2
-2	Cotton Combed Yarn(A)	350	8	8.00	350			0.3	251.5	230	508	1067	125.75	7.5	80	2	1509.00	4800.78	3.2	4
-3	Cotton Combed Yarn(B)	350	8	8.00	350			0.3	251.5	230	508	1067	125.75	7.5	80	2	1509.00	1417.41	0.9	1
8	Simplex Fly Frame	Grain/6yds			Grai/30yds				rpm		ϕ	mmL								
-1	COtton/Polyester Yarn	340	1	6.94	245	0.78	0.79	0.5	850		152	406	2.0921	7.5	83	108	1406.53	2918.34	2.1	3
-2	Cotton Combed Yarn(A)	350	1	7.14	245	1.10	1.11	0.5	900		152	406	1.5766	7.5	83	108	1059.93	4776.78	4.5	5
-3	Cotton Combed Yarn(B)	350	1	7.95	220	1.25	1.33	0.5	900		152	406	1.1815	7.5	85	108	813.48	1410.32	1.7	2
9	Ring Spinning Frame	Grai/30yds			Ne				rpm		mmR	mmL								
-1	COtton/Polyester Yarn	245	1	19.60	20	3.54	15.84	1.0	14000		47	203	0.0877	8.0	90	960	606.06	1208.48	2.0	2
-2	COtton/Polyester Yarn	245	1	39.20	40	3.54	22.39	1.0	15000		44	203	0.0332	8.0	93	960	237.35	1651.49	7.0	7
-3	Cotton Combed Yarn	245	1	31.36	32	3.70	20.93	1.2	15000		44	203	0.0444	8.0	93	960	317.38	2539.08	8.0	8
-4	Cotton Combed Yarn	245	1	39.20	40	3.80	24.03	1.2	16000		44	203	0.0330	8.0	93	960	235.90	2123.06	9.0	9
-5	Cotton Combed Yarn	220	1	44.00	50	3.85	27.22	1.4	15000		44	203	0.0219	8.0	92	960	154.51	1390.57	9.0	9
11	Steam Setter								Batch/hour		Lbs/Batch									
-1	COtton/Polyester Yarn																			
-2	COtton/Polyester Yarn								1.5		600		900.00	7.5	90	1	6075.00	5399.05	0.9	1
-3	Cotton Combed Yarn																			
12	Auto Winder	Ne			Ne				yds	m	mm	Angle								
-1	COtton/Polyester Yarn	20	1		20			0.5	1094	1000	152	5.57	3.9071	7.5	83.5	60	1468.11	1202.44	0.8	1
-2	COtton/Polyester Yarn	40	1		40			0.5	1094	1000	152	5.57	1.9536	7.5	84.5	60	742.85	1643.23	2.2	2
-3	Cotton Combed Yarn	32	1		32			0.5	1039	950	152	5.57	2.3192	7.5	83.5	60	871.44	2526.38	2.9	3
-4	Cotton Combed Yarn	40	1		40			0.5	1094	1000	152	5.57	1.9536	7.5	85.5	60	751.64	2112.45	2.8	3
-5	Cotton Combed Yarn	50	1		50			0.5	1039	950	152	5.57	1.4843	7.5	85.5	60	571.08	1383.62	2.4	3
13	Doubler Winder	Ne			Ne				yds	m	mm									
-1	COtton/Polyester Yarn	Ne 40/2	2		40			0.5	492	450	152		1.7571	7.5	85	120	1344.21	794.62	0.6	1
14	Two for One Twister	Ne			Ne				rpm		mm	Angle								
-1	COtton/Polyester Yarn	Ne 40/2	1		40		17.46	0.6	10000		152	5.57	0.1136	8.0	93	120	101.46	790.64	7.8	8

Table 7-15 caluculation Table for Ring Spinning Yarn (33,600)

BANJARAN 2
Polyester/Cotton

Calculation Table for Ring Spinning Yarn (33.696 sps)

	Item / Process	1 Supply thickness Grain/yard	2 No of doubling	3 Draft	4 Produced thickness Grain/yard	5 Twist multiplier αe	6 Twist per inch TPI	7 Waste percent %	8 Delivery speed or Revolution		9 Package		10 Production 100% LBS per hour	11 Working hour	12 Working efficiency %	13 No of spindle /machine	14 Actual Production LBS/Shift	15 Required Production LBS/Shift	16 Calculated No of machine	17 No of machine
1	Blow Room Machinery				oz/yard				rpm	yds	mm	mL								
-1	for Polyester				13			0.5	13.0	10.77	960	50	525.04	7.5	89	1	3504.63	4952.72	1.4	2
-2	for Cotton				14			2.0	13.0	10.77	960	50	565.43	7.5	85	1	3604.58	3304.07	0.9	1
2	Carding Machine	oz/yard			Grain/6yds			Reusable 0.5	rpm	yds	φ	mmH								
-1	for Polyester	14	1	95.74	380			1.0	21.0	49.5	610	1067	35.91	7.5	90	1	242.39	4878.43	20.1	20
-2	for Cotton	14	1	100.80	350			4.0	21.0	49.5	610	1067	33.08	7.5	85	1	210.85	3155.39	15.0	15
3	Pre-Drawing Frame	Grain/6yds			Grain/6yds				yds	m	φ	mmH								
-1	for Polyester of Blend	380	8	7.79	390			0.3	251.5	230	508	1067	140.12	7.5	80	2	1681.46	4863.79	2.9	3
4	Pre-Combing of Cotton	Grain/6yds			Grain/yard				yds	m	W	φ								
-1	Sliver Lap Machine	350	18	1.53	685			0.3	71.1	65	232	630	417.46	7.5	80	1	2504.75	3145.92	1.3	2
-2	Ribbon Lap Machine	685	6	5.48	750			0.3	65.6	60	300	630	421.71	7.5	80	1	2530.29	3136.48	1.2	2
5	Comber	Grain/yard			Grain/6yds			Reusable 1.0	nip	mm	φ	mmH								
-1	for cotton	750	4	43.46	350			15.5	200.0	4.987	508	1067	23.70	7.5	85	2	302.19	2618.96	8.7	9
6	1st Drawing Frame	Grain/6yds			Grain/6yds				yds	m	φ	mmH								
-1	Polyes/cotton Yarn (P)	390	5	8.57	350			0.3	251.5	230	508	1067	125.75	7.5	83	2	1565.59	7460.31	4.8	5
-2	(C)	350	3																	
7	2nd Drawing Frame	Grain/6yds			Grain/6yds				yds	m	φ	mmH								
-1	Polyes/cotton Yarn	350	8	8.00	350			0.3	251.5	230	508	1067	125.75	7.5	80	2	1509.00	7437.93	4.9	5
8	Simplex Fly Frame	Grain/6yds			Grai/30yds				rpm		φ	mmL								
-1	Polyes/cotton Yarn	350	1	7.61	230	0.76	0.79	0.5	900		152	406	2.0796	7.5	83	96	1242.75	7400.74	5.0	6
9	Ring Spinning Frame	Grai/30yds			Ne				rpm		mmR	mmL								
-1	Polyes/cotton Yarn	230	1	41.40	45	3.36	22.54	1.2	15000		44	203	0.0293	8.0	93	432	94.31	7311.93	78.0	78
10	Steam Setter								Batch/hour		lbs/Batch									
-1	Polyes/cotton Yarn								1.0		660		660.00	7.5	90	1	4455.00	7304.62	1.6	2
11	Auto Winder	Ne			Ne				yds	m	mm	Angle								
-1	Polyes/cotton Yarn	41	1		45			0.5	1039	950	152	5.57	1.6492	7.5	83.5	60	619.69	7275.37	11.7	12

7-3-2 Basic Conditions for Design of Production Machinery andAuxiliary Equipment

(1) Production Machinery

Recent spinning machines have been designed with emphasis to produce high quality products, achieve high speeds, save energy and workforce, operate at low noise levels and be safe to operate. Although high quality, high speed, low noise level and safety are basic conditions, capital investment in machines that conserve energy and workforce required due to country circumstances and market conditions does not pay sometimes. In a country where labor is abundant and labor cost is low, capital investment for auto doffers on the ring spinning frames and coupling of the ring spinning frames and the winders would be meaningless.

It is necessary to select the machine combination enabling smooth operation for each process besides fundamental conditions of high quality products, high productivity, low noise level, and be safe to use.

Enlarging the package size within the allowable range in order to secure high productivity as well as high quality over an extended period of time should be considered. Machinery should be equipped with automatic cleaning and easy maintenance system. Furthermore, the existing machines that are in serviceable condition should be used to the fullest extent as much as possible.

Due to foregoing reasons and to some problems in the sliver grain deviation, the chutes from the blowing room machines to the carding machines, ring spinning frame auto doffers, and the coupling of the ring spinners and winders are not envisaged in the present renovation project. In the Senayan Mill, there are TOYODA carding machines in serviceable conditions. After modifying these carding machines into semi-high production cards, 48 sets will be transferred to the First Mill and 35 set to the Second Mill.

All production machines other than the carding machines will be completely renewed for the First Mill. This mill aims at production in small quantity of various kinds of products comprising high grade fine combed yarn and polyester and cotton blended yarn. The second Mill will be made into a mill specialized in mass production of polyester and cotton blended yarn by dint of rehabilitation performed with emphasis placed mainly on pre-spinning process.

(2) Auxiliary Machinery

As the mills are currently operated, to utilize as many ancillary machines and accessories

for operation as possible is planned.

However, auxiliary equipment and accessories to be employed for machines to be renewed as well as those extremely worn out that are currently being used should be completely checked and replaced with new ones. To select and purchase the new machines, high performance, operability and safety will be the guidelines. The minimum required quantities of items for operation will be planned so that the flow of products can be performed without interruption.

The transporting carts, currently available, will be utilized, and if these shortfall, fabrication at site will be necessary.

(3) Laboratory Equipment

Banjaran I, II and Cental Laboratory at the Head Office are each equipped with testing facilities.

The First Mill is equipped with only instruments for grain control necessary for operation, while the Second Mill has a set of equipment such as an evenness tester of USTER.

Main testing facilities such as the USTER CLASSIMAT for judging and recording the overall yarn defects are not available in the mills but are all gathered in the central laboratory in the head office.

To improve the structure or the process control to respond quickly to claims from the users, the mills must be equipped with instruments for control such as the USTER CLASSIMAT so that the mills would be able to take prompt action. For this purpose, a thorough check of the performances and functions of the existing facilities and its classification will be necessary, listing existing facilities that can be utilized, those requiring replacement and those to be newly purchased.

The equipment to be selected and adopted will not be for the purpose of testing but equipment that will contribute to enhance productivity and upgrade quality of the products by feeding back results of tests to operation and maintenance.

7-3-3 Concept and Specifications of Production Machines and Auxiliary Equipment

(1) Production Machines of Banjaran I

a) Blow Room Machines

The cotton processes of this mill will be directed towards numerous high grade products and emphasis will be placed on fiber opening and dust prevention as well

as on good blending properties with good lapping quality properties. The automatic cotton feeding device such as BLENDMAT and OPTOMIX is not adopted because they are not be capable of removing miscellaneous foreign matters such as colored cloth pieces and polypropylene strings. Further, this has such demerit that it takes time to change products and it is too expensive.

In regards to lap increasing of unit weight, automatic weight adjustment, and sure prevention of lap licking are considered. The equipment will consist of two lines with three scutchers, and change of production line is freely possible at any line.

The super mixer and other machines will be used to meet the requirement for better blending and saw teeth rollers will be utilized for fiber opening and dust prevention. For polyester line the scutchers will be the same type as the above mentioned scutchers for cotton. The line will be a non-lattice and non-grip type so that the fiber opening properties can be improved and damage to fiber can be held to minimum as well as the quality of lap are improved.

b) Carding Machine

Out of TOYODA made Carding Machines (thick cylinder bend type of 1960's) installed at Senayan Mill, 48 machines will be transferred and modified into semi-high production cards.

After modification the cylinder rotating speed is expected to be increased from 300 to 350 rpm and the doffer rotating speed from 23 to 25 rpm. The main points of modifications to be performed will be as follows:

1 Cylinder: Adjustment of dynamic balance.

2 Replacement of the metallic wire, garnet wire, and flat needle.

3 Modification and repair of drive mechanism.

4 Replacement of coilers and cans.
(24" dia X 48" high will be adopted in consideration to space area in the mill and weight of one lap)

5 Replacement of undercasing.

6 For automatic dust collector, winding up type (under waste) and suction type (flat waste and others) to be used jointly.

7 Automatic stopping device

8 Roller doffing device

Modifications shall be as above, but as the yarn quality is substantially influenced by the performance of the card, the rotating speed of the doffers will be kept at a comparatively low speed.

c) Lap Former

The Lap Former to be installed will be a sliver lap machine and a ribbon lap machine which are coupled together to save installation space and to produce uniform lap at a high speed. In addition, the lap former has the following capabilities and is equipped with the following devices to improve the machine's efficiency and to simplify maintenance control:

- Minimizes fluctuation of lap weight and increases lap winding diameter.
- Reduce hooked fiber and lap licking.
- Automatic weight adjustment: device to record one lap weight.
- Automatic sliver lap delivery unit: automatic loading unit of ribbon lap transporting carts.

d) Combing Machine

The number of combers to be installed will be 27 which are rationally designed of eight heads with two cans and will be capable of stable high speed operation. The high combs will be equipped on the cylinders that are made light and well balanced. Matched together with the unique nipper mechanism, operation to produce high quality products at high productivity (max 250 nip/min) can be attained. The automatic dust collector will be an intermittent type of centralized method.

e) Drawing Frame

The Drawing Frames will be high speed machines that are capable of producing high quality products with reduced power consumption, and at the same time the machines are easy to operate and require less care in respect to operation and maintenance.

The draft part will be a five over four pressure bar type with optimum pressure applied to the fleece which provides good control of the fibers and enhances the quality of sliver. The dust collector device to be equipped will be built-in type. In order to improve the mechanical efficiency an automatic can exchange device will be added.

The grain adjuster for polyester has the same specifications as the above for cotton and has the mechanism of sliver eight doubling and uses 20" dia × 42" high cans.

f) Roving Frame

Among roving frames of high speed, large package and qualified products, the selected one has the highest stability at the present time.

The size of roving is 152 mm dia × 416 mm high in order to lengthen the time of the doffing cycle and the doffing of large size bobbins is easy by the upper support flyer. There is almost no vibration of the flyer top even under high rotating speed, and vibration of the machine is very low as well.

Also as the generation of turbulence caused by the rotation of the flyer is limited, the flow of roving is stable and generation of fluff and fly is minimal. It is also not necessary to provide large twist which contributes to enhance productivity. Other functions include:

- Roving tension fine adjustment device
- Automatic cone belt return equipment
- Full bobbins stop motion at optimum position
- Preventive device of shoulder stop of bobbin
- Roving unevenness preventive device
- Line blow and pneumafil
- Bobbin release preventive device
- Stop motion at sliver and roving breakage
- Gear end and side door safety device

The draft mechanism is four lines double apron type equipped with SKF top arm.

g) Ring Spinning Frame

Aiming at easy operation and quality, 45 mm and 47 mm dia. rings with 205 mm (8") lift have been adopted in order to reduce the work load by extending the time between doffings as much as possible. The out end drive method has been selected and the gear end is completely sealed. There is no flow of air in and out for the motor heat and cooling, therefore the invasion of flies can be avoided. The gears for the draft, twist, and lifter are lined up orderly in front of the head stock and their easy handling and interchangeability makes maintenance easy. The roller part adopted is three lines double apron system equipped with SKF top arm.

Many automatic devices are adopted for the purpose of contributing to operational stability.

For example:

- Full bobbin stop motion
- Automatic lowering device and stop motion at optimum position of ring rail
- Not full bobbin stop motion at optimum position and emergency stop
- Cushion starter and snarl prevention device
- Automatic spindle speed changer
- Automatic lappet reversing and returning device

It is possible to furnish this machine with automatic doffing, but for economic reasons, automatic doffing system will not be equipped.

h) Automatic Cone Winder

The winder is a one drum, one knotter system with a very short waiting time for knotting and is therefore a high efficiency machine.

The knotter is revolutionized air splicer knotter which joins yarn without knots, eliminating all problems orignated in knots in the weaving and knitting processes. Concerning quality, the following considerations have been made:

- The electrical slub catcher perfectly cuts defective parts off.
- The yarn length counter is equipped and the yarn length of cheese is well controlled.
- When yarns are knot, the yarn ends from the winding side and the feeding side are alternately checked by the electrical slub catcher. eliminating double yarn and triple yarn.
- The ribbon breaker is drived with an independent drum motor for each spindle with intermittent speed change mechanism, which will prevent ribbon winding.
- Adhesion of fly and waste yarn are prevented by air blow at every yarn knot.

It is easy to see and readily monitor the splicer knotter, electrical slub catcher and peg part. Almost all of the maintenance work can be readily performed while the machine is in operation by tilting forward one spindle unit. Similarly, each unit can be readily removed.

Each part of the splicer knotter and the tenser are of cassette type, and maintenance is very simple.

As highly compressed air is required, a centralized compressed air system is adopted to save energy.

i) Doubler

Taking into consideration such factors as quality, operability and working

environment, unique devices are thought out for operating system, cradle, drum, tension, yarn breakage stop motion and brake plate.

In addition, devices and improvement have been made to simplify maintenance and for safety.

j) Double Twister

The feature of this twister is that the number of knots is reduced by winding up into a package of 250 mm diameter. This twister contributes to labour saving and can twist yarn from low count to high count of over Ne 100. Another advantage is its excellent operability.

Also consideration is taken into for the sake of maintenance and safety. Devices and improvements have been given to the spindle part winding device, tenser gear box, and automatic tension device of driving belt.

k) Steam Setter

Yarns that require steam setting in Banjaran I are transported to Mill II where steam setting is performed. Considering steam setting quantity in Mill II will increase and the distance of transportation, one set of steam setter will be installed in Mill I as well. This will be a steam heating jacket type, and the entire operation from loading of cheese transporting cart and switch on to the completion of steam set will be fully automatic, thus saving workforce and eliminating the irregularity of steam set effect.

One set of boiler will be installed to provide necessary steam.

(2) Production Machines of Banjaran II

Banjaran II will mass-produce polyester and cotton blended yarn and will be required to produce high quality yarn with stable production.

Under the present plan a portion of existing machines will be removed and replaced with high performance machines. What is also proposed is to replace the main parts of the existing equipment or to perform complete maintenance on such equipment so that the equipment will recover their original performance to the ultimate level.

a) Blow Room Machines

The scutchers are extensively worn out, and the weight per lap is small and much fluctuates. The rotating speed of the lap rollers are also slow, causing low productivity. The scutchers will be renewed with new parts. Serviceable parts

from existing three sets will be salvaged to be made into one line with two scutchers. Scutchers will be four instead of the former three so that productivity and high quality can be attained.

In the process from blending feeder (MBK) to the hopper feeder (KS), maintenance will be performed on the bearings, gears, gauge rollers, lattice parts, etc. of all machines so that the machines can function and be used in their original top condition.

b) Carding Machines

There are problems in the performance and maintenance aspects of the existing CK-7 Carding Machines. Therefore, 35 Carding Machines made by TOYODA in Senayan Mill will be transferred and modified into semi-high production carding machines. The following modifications will be involved.

- The dynamic balance of the cylinders to be made perfect for high speed operation.
- Metallic wires, garnet wires, flat fillets on the cylinders and doffers to be replaced.
- Driving mechanism to be modified and repaired.
- Preliminary opening device to be added.
- Automatic dust collecting system to be installed. (to be two lines)
- Doffer to be equipped with automatic speed changer.
- To be equipped with roller doffing device.
- Automatic stop motion to be installed.
- Casings to be replaced.
- Doffer pedestal to be equipped with ball bearings.
- All brushes to be replaced.
- All safety covers to be replaced.
- Coilers to be 24" dia. X 42" high.

The main modifications will be as noted above with cylinder rotating speed at 300 rpm and doffer rotating speed from 22 rpm to 26 rpm. The machine will be modified with emphasis on product quality and productivity. The existing machines to be removed can be used for spinning OES yarn.

c) Drawing Frames

The present Drawing Frames will be used after making some changes in the layout. It would therefore be necessary to replace parts such as gears around the draft part and also to perform a complete maintenance in order to restore their function.

d) Lap Former

If the comber lap made by the lap former using sliver made by the drawing frames is used in the comber, there is generated much lap licking, making quality poor. There are currently two sets of TOYODA SK-4A installed, which are better to be removed and replaced by two new sets of lap former that integrate both sliver lap machine and ribbon lap machine.

This machine can produce uniform lap at a high speed, occupying less installation space and lap licking and hooked fiber decrease and lap winding diameter increases, thus providing excellent productivity and quality.

The machines will be equipped with automatic weight adjusters, automatic forwarding device, and automatic loading device for loading on the lap transporting cart, and its maintenance is easier.

e) Combing Machines

The eleven sets of TOYODA CM-8 will not be moved, and three sets of CM-8 will be transferred from the First Mill, so that there will be a total of 14 sets of combers.

These machines will be modified and repaired and also complete maintenance will be performed so that the machines will be restored to have their original performance.

Modification and repair will be carried out as follows:

- Cylinder half lap to be made into high comb.
- Cylinder brushes to be made brushes with piano wire.
- Modify and repair nipper related parts
- Modify and repair related cam and gear parts.
- Maintenance of other parts.

f) Roving Frames

Out of eight sets of TOYODA FL-16, the No.1 frame will be moved to the north side of No.5 in the center line. Modification and rapair will be performed on major parts of all frames.

The parts to be modified and repaired are as follows:

- Replacement of flyers.
- Maintenance of flyer related parts (replacement of bearings, bobbin wheel, and gears).

- Replacement of roller part and top arm (from Sussen to SKF).
- Also maintenance of draft part.

By modifying and repairing the parts indicated above, satisfactory results are expected in operation, quality and especially roving yarn U%, C.V.%, etc.

g) Ring Spinning Frame

The existing frames will be used as they are, but modification and repair will be performed mainly on the spindle related parts in order to increase the rotating speed of the spindles for enhancing productivity. In the near future, rings and parts of draft part that have exceeded their service life should be replaced as earlier as possible using daily maintenance budget.

h) Winders

The 22 sets of MURATA GILBOS winders, presently installed in the mill, will be removed and scrapped and be replaced with three sets of new auto winders (machine with 60 drums) with splicers. The autowinders (with splicers) that are currently operating will be used in the present condition. However, the space between winders are not uniform, and there are some winders whose working space is very restricted. Slight alteration of layout will be necessary. The three sets of new winders to be added will be equipped with electronic slub catchers in addition to yarn length counters and monitoring system, and will significantly contribute to production and quality control.

Out of the RT winders in the First Mill, it is recommended that one set in good condition be moved to this mill for rewinding defective bobbins.

i) Steam Setting Process

The Steam Setter will be used in the present condition, and since it is planned to install one set of new steam setter in the First Mill, it would be necessary to consider moving one small set after reviewing the volume that requires steam setting process at Mill No.1 and Cipadung Mill.

(3) Specifications of production equipment are shown in Table 7-16.

(N) means "new", (RE) "rehabilitated" and (E) "existing".

(4) Specifications of auxiliary and laboratory equipments to be purchased are shown in Table 7-17 and 7-18 respectively.

(5) Production flow chart

The flow sheet of Banjaran I and II are shown in Figure 7-7 and 7-8 respectively.

Table 7-16-(1) Specifications of Main Production Machinery 1st Mill

Item No	Machine/Equipment	Quantity
	Blowing Section	
RBS-1-1	Blow Room Machinery	3 lines (N)
	1)Lap feeding system to card	
	2)Individual waste collecting system	
	3)Line arrangement	
	for Cotton line 2 lines(3 scutchers)	
	2 - Belt conveyor	
	2 - Blending feeder	
	2 - Magnetic separator	
	2 - Fan condenser	
	2 - Control tower with cylinder	
	2 - Cellular roller	
	2 - Super cleaner	
	2 - Cellular roller	
	2 - Belt conveyor opener	
	2 - Cellular roller	
	2 - Change box for air cylinder	
	2 - Two roller cleaner	
	2 - Cellular roller	
	2 - Change box for air cylinder	
	2 - Transport fan	
	2 - Multimixer 4 chamber	
	2 - Control panel	
	3 - Two way distributor	
	7 - Shutter damper	
	3 - Fan condenser	
	3 - Evener cleaning feeder	
	3 - Cellular roller	
	3 - Single cage scutcher	
	3 - Digital lap scale	
	3 - Control panel	
	for Synthetic line 1 line(1 scutcher)	
	1 - Belt conveyor	
	1 - Mixing cylinder	

Item No	Machine/Equipment	Quantity
	1 - Spiked feeder	
	1 - Micro tuft opener	
	1 - Contorol panel	
	1 - Two way distributor	
	1 - Shutter damper	
	1 - Fan condenser	
	1 - Evener cleaning feeder	
	1 - Cellular roller	
	1 - Single cage scutcher	
	1 - Digital lap scale	
	1 - Control panel	
	Carding Section	
RBS-1-2	Semi High Production Card(to be rehabilitated)	48 sets (RE)
	1)To modify all existent carding machine to semi high production type	
	2)Lap feeding system	
	3)Roller doffing system	
	4)Sliver can size : ϕ610(24") x 1,067mmH(42")	
	5)Individual waste collecting system	
	Combing Section	
RBS-1-3	Lap Former	4 sets (N)
	1)Number of feeding sliver per set : 20 slivers	
	2)Feeding can size : ϕ610mm(24") x 1,067mmH(42")	
	3)Drafting System :	
	Sliver lap machine 4 over 4 curve system	
	Ribbon lap machine 4 over 4	
	4)Taking up size of lap :	
	Sliver lap machine ϕ600mm x 232mm	
	Ribbon lap machine ϕ600mm x 300mm	
	5)Number of drafting head per set : 6 heads	
	6)Automatic doffing system	
	7)Grain adjuster & Weighing device	

Item No	Machine/Equipment	Quantity
	8)Wagon for above (4 laps on a wagon)	
RBS-1-4	Combing Machine	27 sets (N)
	1)Number of combing heads per set : 8 heads	
	2)Number of deliveries per set : 2 deliveries	
	3)Delivery can size ϕ508mm(20") x 1,067mm(42")H	
	4)Staff : 530mm	
	5)Lap to be fed : 300mmW x up to ϕ 600mm	
	6)Number of nips : up to 250	
	7)Comb cylinder (Hi-comb) : ϕ150mm	
	8)Drafting system at draw box : 2 over 2	
	Drawing section	
RBS-1-5	Drawing Frame (Pre-drawing for polyester fiber)	1 set (N)
	1)Number of feeding slivers per delivery : 8 slivers	
	2)Number of deliveries per set : 2 deliveries	
	3)Feeding can size : ϕ610mm(24") x 1,067mmH(40")	
	4)Delivery can size : ϕ508mm(20") x 1,067mmH(42")	
	5)Drafting system : 5 over 4 roller with pressure bar	
	6)Automatic cans changer	
RBS-1-6	Drawing Frame (1st & 2nd Drawing)	7x2=14 sets (N)
	1)Number of feeding slivers per delivery : 8slivers	
	2)Number of deliveries per set : 2 deliveries	
	3)Feeding can size : ϕ508mm(20") x 1,067mmH(42")	
	4)Delivery can size : ϕ 508mm(20") x 1,067mmH(42")	
	5)Drafting system : 5 over 4 roller with pressure bar	
	6)Automatic cans changer	
	Roving Section	
RBS-1-7	Roving Frame	10 sets (N)
	1)Number of spindles per set : 108 spindles	
	2)Lift : 406mm(16")lift	
	3)Nominal full bobbin diameter : ϕ152mm(6")	

Item No	Machine/Equipment	Quantity
	4)Drafting system : 4 roller double apron	
	5)Feeding can size : ϕ508mm(20") x 1,067mmH(42")	
	6)Weighting arm : SKF PK-1500 001938	
	7)Light alloy metal flyer	
	Spinning Section	
RBS-1-8	Ring Spinning Frame	35 sets (N)
	1)Number of spindle per set : 960 spindles	
	2)Spindle gauge : 75mm	
	3)Lift : 205mm(8")	
	4)Draft system : 3-line roller double apron	
	5)Weighting arm : SKF PK 225	
	6)Pnueumatic suction under clearer	
	7)Spindle insert : SKF HF 21	
	8)Diameter of single flange ring : ϕ45mm	
	9)Overheaed travelling cleaner	
	Winding Section	
RBS-1-9	Automatic Cone Winder (Magazine Type)	12 sets (N)
	1)Number of drums per set : 60 drums	
	2)Take-up package : 152mm(6") traverse x 5°57'cone	
	3)Supply package : Ring spinning bobbin	
	4)Air splicer knotter : Individual type	
	5)Centralized compressed air & exhaust air system	
	6)Auxiliary equipment	
	◦Electronic slub catcher	
	◦Waxing device	
	◦Yarn length control device	
	◦Package brake device	
	◦Splicer dust collector device	
	◦Ceramic cutter device	
	◦Overhead travelling cleaner	

Item No	Machine/Equipment	Quantity
RBS-1-10	Double Winder(2ply) 1)Rotary traverse type wind from cone to cheese 2)Number of drums per set : 120 drums 3)Auxiliary equipment ◦Yarn length control device ◦Blow cleaner	1 set (N)
RBS-1-11	Double Twister 1)Number of spindles per set : 120spindles 2)Take-up package : 152mm(6")traverse x 3°30'cone 3)Waxing device for knitting yarn 3 sets	8 sets (N)
RBS-1-12	Steam Setter 1)Steaming cabinet : 1600mmx3000mmL 2)Production capacity A)In cheese or cone 500Kg/batch approx. B)In cop (Ring bobbin) 320Kg - 350Kg/batch approx. 3)Operating time : 40 50 min. per batch 4)Temperature controlled in the range of 60°c to 138°c 5)Normal vacuum intensity : 720mmHg(40Torr) - 730mmHg(30Torr) 6)Cycle : Loading - Carrier into cabinet - Door seal - - 1st vacuum - 1st steam - 2nd vacuum - 2nd steam - - 3rd vacuum - Vacuumbreak - Doorunseal - Unloading 7)Control Panel 8)Vacuum device ◦Oil sealed rotary type vacuum pump 2sets ◦Condenser 1set 9)Steam boiler 1set ◦Capacity : 1,000Kg/cm ◦Pressure : 7.0Kg/cm ◦Fuel oil : IDO	1 set (N)

Item No	Machine/Equipment	Quantity
	◦Auxiliary equipment	
	1-Water softener	
	1-Chemical injection	
	1-Feed water device	
	1-Fuel oil service tank	

(Remarks)

(N)means equipments to be newly ivstalled

(RE)means equipments to be rehabilitated

(E)means existimg equipments

Table 7-16-(2) Specifications of Main Production Machinery 2nd Mill

Item No	Machine/Equipment	Quantity
	Blowing Section	
RBS-2-1	Blow Room Machinery	2 lines
	1)Lap feeding system to card	
	2)Line arrangement	
	a)Opening line for cotton 1 line(2 scutchers)	
	4 MBK(Blending feeder) (E)	
	1 V C(Belt conveyor) (E)	
	1 M Z(Magnetic trap) (E)	
	1 K D_2(Fan condenser) (E)	
	1 S F(Filter) (E)	
	1 H R_6(Step cleaner) (E)	
	1 V O (Porcupine opener) (E)	
	1 K D_2(Fan condenser) (E)	
	1 S F(Filter) (E)	
	2 V O_2(Porcupine opener) (E)	
	2 K D_1(Fan condenser) (E)	
	2 S F(Filter) (E)	
	2 K S_1(Hopper feeder) (E)	
	2 S W_2(Scutcher with lap scale) (N)	
	b)Opening line for man made fiber 1 line(1 scutchers)	
	1 C L(Clipper lattice) (E)	
	1 MBK(Blending feeder) (E)	
	1 V O (Porcupine opener) (E)	
	1 K D (Fan condenser) (E)	
	1 K S(Hopper feeder) (E)	
	1 K S(Hopper feeder) (N)	
	1 S W_3(Scutcher with lap scale) (E)	
	1 S W_3(Scutcher with lap scale) (N)	
	Carding Section	
RBS-2-2	Semi High Production Card	35 sets (RE)
	1)To modify all existent carding machine to semi high production type	
	2)Lap feeding sysytem	

Item No	Machine/Equipment	Quantity
	3)Roller doffing system	
	4)Sliver can size : ϕ610mm(24") x 1,067mm(42")H	
	5)Individual waste collecting system	
	Combing Section	
RBS-2-3	Lap Former	2 sets (N)
	1)Number of feeding sliver per set : 20slivers	
	2)Feeding can size : ϕ610mm(24") x 1,067mmH(42")	
	3)Drafting system :	
	Sliver lap machine 4 over 4 curve system	
	Ribbon lap machine 4 over 4	
	4)Taking up siz of lap :	
	Sliver lap machine ϕ600mm x 232mm	
	Ribbon lap machine ϕ600mm x 300mm	
	5)Number of drafting head per set : 6 heads	
	6)Automatic doffing system	
	7)Grain adjuster & weighing device	
	8)Wagon for above : 4 laps on wagon	
RBS-2-4	Combing Machine (TOYODA CM-8)	14 sets (RE)
	1)To modify all existent combing machine to high comb type	
	2)Number of combing head per set : 8 heads	
	3)Number of deliveries per set : 2 deliveries	
	4)Delivery can size : ϕ508mm(20") x 1,067mmH(42")	
	5)Comb cylinder : High comb	
	6)Drafting system : 2 over 2	
	Drawing Section	
RBS-2-5	Pre-Drawing Frame (For polyester fiber.HARA D-1200)	3 sets (E)
	1)Number of feeding sliver per delivery : 8 slivers	
	2)Number of deriveries per set : 2 deliveries	
	3)Draft system : 4 over 4 presserbar	
	4)Delivery can size : ϕ508mm(20") x 1,067mmH(42")	

Item No	Machine/Equipment	Quantity
RBS-2-6	Drawing Frame (HARA CHERRY D-800F) 1)Number of feeding slivers per delivery : 8 slivers 2)Number of deliveries per set : 4 deliveries 3)Number of passage : 2 4)Draft system : 4 over 4 presser bar 5)Delivery can size : ϕ508mm(20") x 1,067mmH(42")	3 sets (E)
	Roving Section	
RBS-2-7	Roving Frame (TOYODA FL=16) 1)To modify all existent Roving frame to SKF top arm system 2)Number of spindles per set : 96 spindles 3)Lift : 16" 4)Draft system : SKF 4 over 4 apron draft	8 sets (RE)
	Spinning Section	
RBS-2-8	Ring Spinning Frame (TOYODA RY) 1)Spindle parts to be rehabilitated 2)Number of spindles per set : 432 spindles 3)Spindle gauge : 75mm 4)Lift : 8" 5)Draft system : 3 over 3 apron 6)Over head travelling cleaner : LUWA	78 sets (RE)
	Winding Section	
RBS-2-9	Winding Machine (MURATA MACH splicer) 1)Number of drum per set : 60 drums 2)Take-up package : 6"Traverse cone	9 sets (E)
RBS-2-10	Automatic Cone Winder (Magazine type) 1)Number of drums per set : 60 drums 2)Take-up package : 152mm(6") traverse 3)Supply package : Ring spinning bobbin 4)Air splicer knotter : Individual type	3 sets (N)

Item No	Machine/Equipment	Quantity
	5)Auxiliary equipment ◦Electronic slub catcher ◦Waxing device ◦Yarn length control device ◦Package brake device ◦Splicer dust collector device ◦Ceramic cutter device ◦Over head travelling cleaner	
RBS-2-11	Steam Setter (ASHIDA AV_1 AV_2) 1)Steaming cabinet AV_1 1000mm x 1800L AV_2 1200mm X 2500L	2 sets (E)

Table 7-17-(1) Specifications of Newly Purchased Auxiliary Equipment 1st Mill

Item No	Equipment/Accessories	Quantity
RBA-1-1	Roving Stripper	1 set
	1)Cleaning capacity Max 1800 bobbin/hour	
	2)Bobbin length up to 460mm	
	3)Bobbin diameter up to 70mm	
RBA-1-2	Can with Spring & Caster	260 set
	1)Can size for carding	
	Diameter : 610mm(24")	
	Height : 1,067mm(42")	
	2)Spring size	
	Diameter of plate : 590mm	
	Height : 970mm	
	3)Single caster : 3 pcs/set	
RBA-1-3	Can with Spring & Caster for Drawing & Roving	1,730 sets
	1)Can size	
	Diameter : 508mm (20")	
	Free height : 1,067mm (42")	
	2)Spring size	
	Diameter of plate : 490mm	
	Free height : 1,052mm	
	3)Single caster : 3 pcs/set	
RBA-1-4	Bobbin for Roving	50,400 sets
	1)Size	
	Diameter of straight part : 45mm	
	Total length : 445mm	
	2)Material : Plastic resin	
RBA-1-5	Bobbin for Ring Spinning	134,400 sets
	1)Specification of spindle	
	Spindle type : Taper touch	
	Lift : 205mm	
	2)Bobbin length : 235mm	

Item No	Machine/Accessories	Quantity
	3)Material : Plastic resin	
RBA-1-6	Cart for roving 1)Size Length : 1,200mm Width : 560mm Height : 1,645mm 2)Wheel Fixed wheel : 200mm 2 pcs Swivel wheel : 130mm 2 pcs 3)Loading cappacity approx, 400Kg	12 sets
RBA-1-7	Carrier for steame setter 1)Size Length : 1,100mm Width : 420mm Height : 1,020mm 2)Wheel Fixed steel wheel : 60mm 4 pcs Fixed wheel : 100mm 2 pcs Swivel wheel : 100mm 2 pcs 3)Loading cappacity : approx. 250Kg	16 sets

Table 7-17-(2) Specifications of Newly Purchased Auxiliary Equipment 2nd Mill

Item No	Equipment/Accessories	Quantity
RBA-2-1	Gum cot grinding machine with attachment 1)Maximum working length : 500mm 2)Maximum working outer diametre : 180mm 3)Traverse speed : 435mm, 706mm, 1,153mm/min 4)Revolution of grinding wheel spindle 2100, 2400 rpm 5)Outer diametre of grinding wheel : 305mm 6)Width of grinding wheel : 38mm 7)Bore diametre of grinding wheel : 44.45mm 8)Auxiliary equipment & accessories (a)Attached equipment : 1 lot (b)Exhaust equipment : 1 set (c)Tool & gauges : 1 lot	1 set
RBA-2-2	Can with Spring & Caster for Carding 1)Can size Diameter : 610mm(24") Height : 1,067mm(42") 2)Spring size Diameter of plate : 590mm Free height : 970mm 3)Single caster : 3 pcs/set	250 sets

Table 7-18-(1) Specifications of New Laboratory Equipment 1st Mill

Item No	Equipment	Quantity
RBL-1-1	Evenness Testing Installation (U%) 1)Measuring unit and control unit : 1 set (a)Mesuring range : (approximate) 4 tex 12 Ktex (Nm250 12g/m) (b)Sensitivity : 4 ranges (12.5%, 25%, 50%,& 100%) (c)Material feed : 25, 50, 100, 200 & 400m/min (d)Evaluating time : 1, 2.5, 5, 7.5, 10 and 20 minutes (e)Diagram speed : 2.5, 5, 10, 25, 50 & 100 cm/min 2)Spectrograph with spectrogram recorder (SPG) : 1 set Analysing range from 2 cm to 40 m wavelength in one measurement at 400 m/min material feed and at least 5 minutes evaluating time. 3)Imperfection indicator (IPI) : 1 set Electronic counting Thin places : -30, -40, -50, and -60% Thick places : +35, +50, +70, and +100% Neps : +140, +200, +280, and +400% 4)Small unrolling device : 1 set 5)Air compressor : centralized compressed air system Pressure : minimum 2 bar Consumption : maximum 16 m /hr 6)Recommended reserve material : 1 lot Diagram paper Recording ink Recording pen Filter	1 set

Item No	Equipment	Quantity
RBL-1-2	Yarn Fault Classifying Installation with Existent R.T Winder to be modified	1 set

1)Classimat

(a)CLassiflying instrument with built-in printer for data distribution and length measuring arrangement 1 set

(b)Measuring heads 6 sets

(c)Data transducers 6 sets

(d)Testing instrument 1 set

(e)Fitting material 6 sets

(f)Spare parts & printer-paper

2)R.T. Winder

(a)To modify all existant R.T. cone winder

(b)Number of drums per machine : 6 drums

(c)Take-up package :
6"traverse x 5 57'cone

(d)Supply package : ring spinning bobbin
& 6"traverse x 5 57'cone

(e)Auxiliary equipment

Yarn length counter 3 drums

Electronic yarn clearer 3 drums

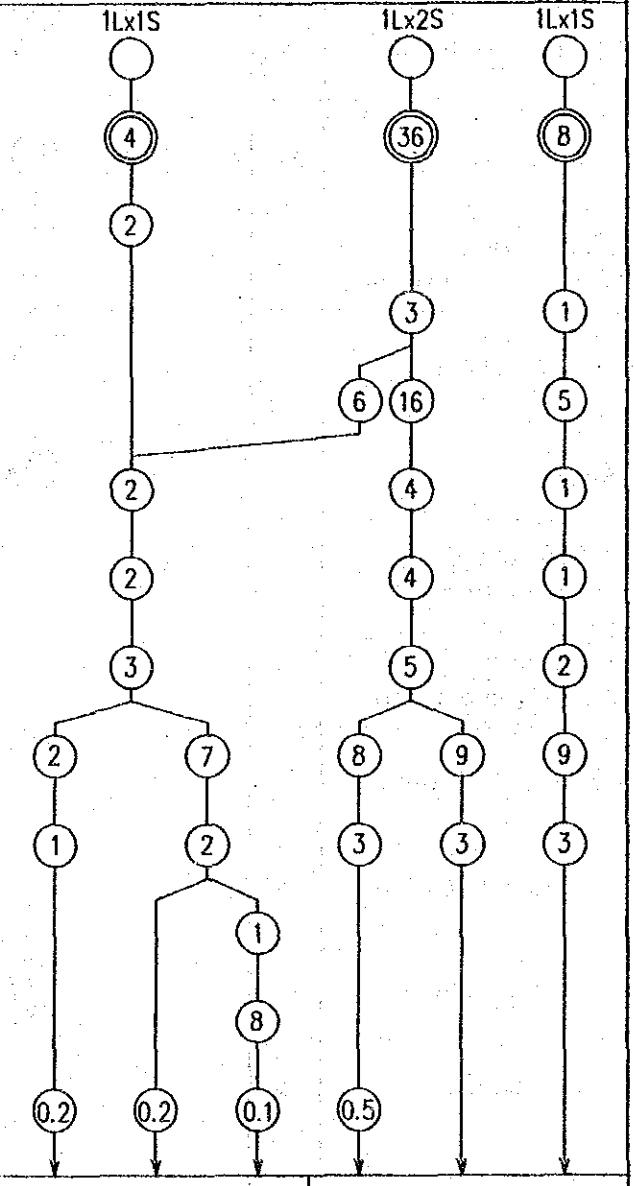
Table 7-18-(2) Specifications of New Laboratory Equipment 2nd Mill

Item No	Equipment	Quantity
RBL-2-1	Evenness Testing Installation (U%)	1 set
	1)Measuring unit and control unit : 1 set	
	(a)Measuring range :	
	approx. 4 tex 12 Ktex	
	(Nm 250 12g/m)	
	(b)Sensitivity :	
	4 ranges. (12.5%, +25%, 50% & 100%)	
	(c)Material feed : 25, 50, 100, 200 & 400 m/min	
	(d)Evaluating time : 1, 2.5, 5, 7.5, 10 and 20 minutes	
	(e)Diagram speed : 2.5, 5, 10, 25, 50 & 100 cm/min	
	2)Spectrograph with spedtrogram recorder	
	(SPG) 1 set	
	Analysing range from 2 cm to 40 m	
	wavelength in one measurement at	
	400 m/min material feed and at least	
	5 minutes evaluating time.	
	3)Imperfection indicator (IPI) : 1 set	
	Electronic counting	
	Thin places : -30, -40, -50, and -60 %	
	Thick places : +35, +50, +70, and +100 %	
	Neps : +140, +200, +280 and +400 %	
	4)Small unrolling device : 1 set	
	5)Air compressor : centralized compressed air system	
	Pressure : minimum 2 bar	
	Consumption : maximum 16m /hr	
	6)Recommended reserve material : 1 lot	
	Diagram paper	
	Recording ink	
	Recording pen	
	Filter	
RBL-2-2	Dry Range	1 set
	1)Max power comsumption 2.8 kw	

Item No	Equipment		Quantity
	2)Balance capacity	500 grams	
	3)Balance sensitivity	50 mg	
	4)Inner size of oven	50 x 50 x 40 cm	

Process Flow Chart of Banjaran I

Main Machinery	No. of M/C
Blow Room Machinery	3 line
Carding Machine	48
Pre-Drawing Frame	2
Pre-Comber	4
Comber	27
1st-drawing Frame	7
2nd-drawing Frame	7
Simplex Fly Frame	10
Ring Spinning Frame	35
Automatic Winder	12
Double Winder	1
Two-for-one Twister	8
Steam Setter	1



Production LBS/Shift	Blended Yarn			Combed Yarn		
	Ne 20	Ne 40	Ne 40/2	Ne 32	Ne 40	Ne 50
	1208.0	872.4	778.6	2539.1	2123.1	1391

○ New Machine ◎ Rehobilitation Machine

Figure 7-7 Process Flow Chart of First Mill

Process Flow Chart of Banjaran II

Main Machinery	No. of M/C	Chart
		Polyester 65/Cotton 35
Blow Room Machinery	2 line	1Lx2S 1Lx2S
Carding Machine	35	15 20
(2D/Frame) Pre-Drawing Frame	3	3
Pre-Comber	2	2
Comber	14	14
(4D/Frame) 1st-drawing Frame	3	3
(4D/Frame) 2nd-drawing Frame	3	3
Simplex Fly Frame	8	8
Ring Spinning Frame	78	78
Automatic Winder	12	9 3
Steam Setter	2	2
Production LBS/Shift		Blended Yarn Ne 45 7311.9

○ New Machine ◎ Rehabilitation Machine

Figure 7-8 Process Flow Chart of Second Mill

7-3-4 Layout of Production Machines

There are various conditions to be considered in determining the layout of spinning machines which are as follows:

- Configuration of the building, floor space, and distance between columns
- Types and number of machines and packages and their combination
- Method of operation, types of products, and flow of products
- Method of performing machine maintenance and location of maintenance room
- Power wiring, position of ducts and air condition system
- Expansion plan in the frture

It is necessary to review such conditions prior to determining layout. A drawing of the mill building layout after the renovation has been completed is shown.

All equipments and facilities will be accommodated in the existing buildings of Banjaran I and II. The basic designs and the features of respective mills are explained below.

(1) Banjaran I

The layout of the production machines after renovation of Banjaran I is shown in Figure 7-9.

The overall arrangement has been designed in accordance with the following concept.

- To minimize expansion and repair of the present buildings.
- Under the present process flow layout, raw cotton is fed from the south side and the last winding process is located on the north side. This layout will not be changed.
- In the existing building the column spans are not uniform and narrow. New layout will be decided by taking the positions of the columns into consideration so that workability will not be interrupted.
- Machine location and distance between the machines were decided aiming at the operation without loss taking into account easy monitoring by operators and minimized transportation distance.
- Machine location was decided from the view point of securing an appropriate quantity of semi-elaborated products in the process.
- High power machines requiring large air conditioning loads will be positioned as close to the air conditioning room as possible so that the air conditioning effect can be maximized.

a) Blow Room Process

Blow room process will consist of two lines only for cotton and one line only