Chapter 5. SCHEMATIC PLAN AND CONCEPTIONAL DESIGN OF PROJECT

5 SCHEMATIC PLAN AND CONCEPTIONAL DESIGN OF PROJECT

5-1 Production Plan and Product Mix

Full particulars with respect to present conditions, mooted points and future prospect of the textile market in Nepal were described in the Chapter 2. The production plan and the product mix for the Project are hereby set forth as hereunder, in consideration of the trend of future supply and demand of textiles as well as the payability of the Project.

1) The products will aim at being a substitute of imported goods as much as possible. And fashionableness, wash-and-wear-ability and durability will be taken into account. In consequence, polyester/cotton blended fabrics to be manufactured in the Mill.

   However, the production for synthetic fabrics shall comply with the Government Regulations.

2) It shall also comply with the government policy of making best use of local cotton to foster cotton cultivation in Nepal.

3) In consideration of payability (i.e. production cost and quality of products), the Mill shall consist of Spinning, Weaving and Processing and the most economical size shall be selected.

4) For the above reasons, the product mix, although it shall attach importance to the marketability, shall be selected as less kinds as possible.

   Further, the integrated textile mill in Nepal is in the process of development and thus the equipment for yarn dyeing and printing shall not be installed by reason of neccesities of high technology and maintenance for these machines.

5) The product mix to be applied for the Mill are as follows.

   a) Shirting

      To be utilized for a gentleman's shirting, a lady's blouse, a petticoat, a saree and interior use like curtains, etc.

      Shirtings will be a main product since they are being used widely. In addition to the plain weave, the dobby weave shall be included in order to add further value and diversity.

   b) Suiting

      To be utilized for a gentleman's trousers and coat, and for a lady's skirt and slacks etc.

      The suiting is also being used widely. In general, the dobby weave shall be adopted with a view to adding value and diversity, but the plain weave shall also be made available.

c) Twill

To be utilized for a gentleman's trousers and coat, uniforms for army, students and policemen, and a lady's skirt and slacks etc.

Since the twill has also good demand, it is included as one of the products.

6) In view of the market demand, bleached fabrics shall be of 10 % of the total production. This ratio may vary in accordance with the future demand. The rest is to be all dyed fabrics with a light or medium-light colour and a dark colour, accounting for 70 % and 30 % respectively.

The details of each production plan —Spinning, Weaving and Processing Departments are described in the following section.

5-1-1 Spinning

1) Production Plan

In order to utilize domestic cotton effectively, the products in Spinning shall be of high quality cotton 50 %/polyester 50 % blended yarns.

The production plan at full capacity is shown in Table 1, based on 7920 operation hours per annum. (24 hrs/day × 330 days/year) with 3 shifts a day by 4 groups of workers.

Table 2 gives stagewise production plan for the first year after start-up of the Mill.

Table 1 Spinning Production Plan

(kg/Year)

Kind of Product		Production
Polyester 50 % / Cotton 50 % Yarn Ne 45	Warp	376,566
	Weft	263,618
Sub-Total		640,184
Polyester 50 % / Cotton 50 % Yarn Ne 30	Warp	757,084
	Weft	446,009
Sub-Total		1,203,093
Total		1,843,277

Table 2 Production of Yarn for the 1st. Year after Start-up

Kinds / Month	Polyester 50 % / Cotton 50 % Blended Yarn						TOTAL (kg/Month)
	Ne 45			Ne 30			
	Warp	Weft	Sub-Total	Warp	Weft	Sub-Total	
1	6,276	4,394	10,670	12,618	7,433	20,051	30,721
2	9,414	6,590	16,004	18,927	11,150	30,077	46,081
3	10,983	7,689	18,672	22,082	13,008	35,090	53,762
4	10,983	7,689	18,672	22,082	13,008	35,090	53,762
5	14,121	9,886	24,007	28,391	16,725	45,116	69,123
6	15,690	10,984	26,674	31,546	18,583	50,129	76,803
7	17,258	12,083	29,341	34,700	20,441	55,141	84,482
8	20,396	14,280	34,676	41,010	24,157	65,167	99,843
9	20,396	14,280	34,676	41,010	24,157	65,167	99,843
10	25,103	17,575	42,678	50,474	29,732	80,206	122,884
11	28,241	19,772	48,013	56,782	33,449	90,231	138,244
12	31,379	21,969	53,348	63,092	37,165	100,257	153,607
Total	210,241	147,190	357,431	422,715	249,007	671,722	1,029,153

2) Quality

The quality of yarns to be produced after completion of the Project shall be with higher evaluation in Nepal, and at the same time be of high standard which has a international currency. Generally, to express the quality level in numerical terms, using data of Uster Statistics is convenient. The quality of yarn, expressed by such data, to be set as a target is indicated in Table 3.

Table 3 Target Values of Yarn Quality

Characteristic Values	Target Lines (Range)
Simple Yarn Strength (Breaking length R Km)	50 - 25 % line
Uster % (Mean linear irregularity %)	50 - 25 % line
Thick Yarn	50 - 25 % line
Thin Yarn	50 - 25 % line
Neps	50 - 25 % line

5-1-2 Weaving

The production plan of each product in Weaving at full capacity and production of the grey cloth for the first year after start-up are shown in Table 4 and Table 5 respectively.

The annual working hours are set as the same as Spinning, i.e. 7920 hours (24 hrs/day X 330 days/year) with 3 shifts a day by 4 groups of workers,

Table 4 Weaving Production Plan

Production \ Kinds	Shirting (Dobby)	Shirting (Plain)	Suiting (Dobby)	Twill (2/1)
Raw Material	Polyester 50 % Cotton 50 %	Polyester 50 % Cotton 50 %	Polyester 50 % Cotton 50 %	Polyester 50 % Cotton 50 %
Yarn Count : Ne	45	45	30	30
Density (Grey) End X Pick/inch	110 X 76	96 X 72	100 X 62	118 X 68
Cloth Width Grey : inch	47.5	47.5	61.5	61.5
Production Grey : m/year	2,598,000	2,744,000	2,677,000	2,440,000
Total Production Grey : m/year	10,459,000			

Table 5 Production of Grey Cloth for the 1st Year after Start-Up

(m/Month)

Month \ Kinds	Shirting (Dobby)	Shirting (Plain)	Suiting (Dobby)	Twill (2/1)	TOTAL (m/Month)
1	43,300	45,730	44,610	40,660	174,300
2	64,950	68,600	66,920	60,990	261,460
3	75,750	80,030	78,080	71,160	305,020
4	75,750	80,030	78,080	71,160	305,020
5	97,400	102,900	100,380	91,500	392,180
6	108,250	114,300	111,540	101,660	435,750
7	119,070	125,760	122,700	111,830	479,360
8	140,720	148,630	145,000	132,160	566,570
9	140,720	148,630	145,000	132,160	566,510
10	173,200	182,930	178,460	162,660	697,250
11	194,850	205,800	200,770	182,990	784,410
12	216,500	228,660	222,900	203,460	871,520
Total	1,450,460	1,532,000	1,494,440	1,362,390	5,839,290

5-1-3 Processing

The production plan of the final products i.e. Shirting, Suiting and Twill, and production of each fabrics for the 1st year after start-up are shown in Table 6 and Table 7 respectively.

The working conditions are based on the following.

- for one shift 8 hrs/day X 330 days/year = 2,640 hrs/year
- for two shifts 16 " X 330 " = 5,280 "
- for three shifts 24 " X 330 " = 7,920 "

Table 6 Processing Production Plan

Items / Kinds	Yarn	Production Plan (m/Year)		
		Bleached	Dyed	Total
Shirting (Dobby)	Polyester/Cotton 50/50 (%)	256,000	2,304,000	2,560,000
Shirting (Plain)	"	274,000	2,466,000	2,740,000
Suiting (Dobby)	"	262,000	2,358,000	2,620,000
Twill (2/1)	"	238,000	2,142,000	2,380,000
Total	–	1,030,000	9,270,000	10,300,000

Table 7 Production of Final Cloth for the 1st Year after Start-Up

(X 1000 m/Year)

Kind / Month	Shirting		Suiting	Twill	Total
	Dobby	Plain			
1	30	45	–	–	75
2	60	65	–	–	125
3	75	75	150	–	300
4	80	80	–	140	300
5	–	80	150	150	380
6	100	100	100	125	425
7	120	120	120	120	480
8	120	200	160	–	480
9	120	130	120	200	570
10	120	150	100	200	570
11	250	200	150	150	750
12	300	250	150	150	850
Total	1,375	1,495	1,200	1,235	5,305

5-2 Construction and Consumption of Raw Materials

5-2-1 Raw Cotton and Polyester Fiber

1) Quality Characteristics of Raw Cotton

It is needless to say that in order to produce high quality yarn, selection of appropriate raw cotton is the most important factor. The raw cotton to be utilized in the new Mill will be all Nepali products. The test results of Nepali raw cotton are shown in Table 8..

Table 8 Quality of Raw Cotton

Items checked		Characteristics
Staple Length	50 % Span-Length	0.52 in (13.2 mm)
	25 % Span-Length	1.13 in (28.7 mm)
	Uniformity (%)	46.0
Tensile Strength of Staple (1,000 Lbs/in^2)		79.7
Fineness by Micronaire Method		3.35

Remarks : Test results of Nepali raw cotton sampled by the Field Study Team

2) Quality Characteristics of Polyester Fiber

All polyester fibers are to be imported, because there is no polyester plant in Nepal. Although the polyester fibers are being produced in many countries, the quality of such fibers varies and it affect on yarn quality to a grest extent.

The assumed quality of polyester fibers to be utilized in the new Mill is shown in Table 9. It is really crucial to obtain polyester fibers, having equivalent or better characteristics than those in this Table.

Table 9 Assumed Quality of Polyester Fibers

Items	Specifications
Denier	1.4 ~ 1.5 D
Deviation Ratio of Denier	± 5 %
Cut Length	38 mm
Percentage of Deviation for Cut Length	± 5 %
Dry Strength	6.7 g/d more than
Dry Elongation Percentage	25.5 ± 4 %
25 mm Crimp Count	14 ± 2.5 %
Oil Pick up Percentage	0.11 ± 0.05 %
Melting Point	262 ± 5 °C
Water Content Ratio (as standard condition)	0.4 %

3) Blending Ratio

Blending ratio to be adopted at the new Mill for produceing blended yarns is:

- Polyester fibers . . . . . 50 %
- Raw Cotton . . . . . 50 %

4) Consumption of Raw Materials

It is assumed that the Mill will utilize the raw cottons and polyester fibers of appropriate characteristics/specifications above mentioned and the estimated consumption of raw materials per annum at full capacity is as per Table 10.

Table 10 Consumption of Raw Materials

(kg/Year)

Raw Material \ Yarn		Ne 45		Ne 30		Total
		Warp	Weft	Warp	Weft	
Raw Cotton	Quantity	237,033	165,948	477,556	281,312	
	Sub-Total	402,981		758,868		1,161,849
Polyester Fiber	Quantity	189,550	132,705	380,353	224,053	
	Sub-Total	322,255		604,406		926,661
Total		725,236		1,363,274		2,088,510

Remarks The re-useable fibers to be generated at various spinning processing shall be re-used. The figures in the table above do not include the quantity of such re-usable fibers, instead they are based on only virgin fibers.

Table 11 shows quantity of raw materials required for the initial operation and Table 12 indicates expected consumption of raw materials for the 1st. year after start-up.

Table 11 Quantity of Raw Materials required for Initial Operation

(kg)

Raw Material \ Yarn		Ne 45		Ne 30		Total
		Warp	Weft	Warp	Weft	
Raw Cotton	Quantity	4,852	3,397	8,119	4,782	
	Sub-Total	8,249		12,901		21,150
Polyester Fiber	Quantity	4,087	2,862	6,577	3,874	
	Sub-Total	6,949		10,451		17,400
Total		15,198		23,352		38,550

Table 12 Expected Consumption of Raw-Materials for the 1st Yeasr After Start-Up.

United : kg/Month

Kinds / Month	Raw Cotton					Polyester Fiber				
	Ne 45		Ne 30		Total	Ne 45		Ne 30		Total
	Warp	Weft	Warp	Weft		Warp	Weft	Warp	Weft	
1	3,950	2,766	7,959	4,689	19,364	3,159	2,212	6,339	3,734	15,444
2	5,926	4,149	11,939	7,033	29,047	4,739	3,318	9,509	5,601	23,167
3	6,914	4,840	13,929	8,205	33,888	5,528	3,871	11,093	6,535	27,027
4	6,914	4,840	13,929	8,205	33,888	5,528	3,871	11,093	6,535	27,027
5	8,889	6,223	17,909	10,549	43,570	7,108	4,977	14,263	8,402	34,750
6	9,876	6,915	19,898	11,722	48,411	7,898	5,530	15,848	9,336	38,612
7	10,864	7,606	21,888	12,893	53,251	8,688	6,082	17,433	10,269	42,472
8	12,839	8,989	25,867	15,238	62,933	10,268	7,188	20,603	12,136	50,195
9	12,839	8,989	25,867	15,238	62,933	10,268	7,188	20,603	12,136	50,195
10	15,803	11,063	31,837	18,754	77,457	12,637	8,847	25,357	14,937	61,778
11	17,778	12,446	35,817	21,098	87,139	14,217	9,953	28,526	16,804	69,500
12	19,753	13,829	39,796	23,443	96,821	15,796	11,059	31,696	18,671	77,222
Sub-Total	132,345	92,655	266,635	157,067	648,702	105,834	74,096	212,363	125,096	517,389
Total	225,000		423,702			179,930		337,459		

5) Kind of Waste and Disposal Method

In Table 13, kinds of waste originating from each machine during spinning production processes as well as disposal method for them are shown.

In order to achieve cost saving by improving yield of raw cotton, its re-cycling use as far as possible is needed.

It is required to try to minimige volume of waste threads originating from winders or spinning frames. Generated waste are better to be used for cleaning machines for maintenance purpose.

Table 13 Production of Waste and its Disposal Method

(kg/Year)

Production Machined	Kinds of Waste	Material	Production per Year (kg)	Treatment
Blow Room	Dropping and Sweeping Waste	Cotton	34,673	Sale
	Dropping and Sweaping Waste	Polyester	4,704	Sale
	Sweeping Waste, Stain, Dust	Blended	1,218	Sale
	Lap Waste	Cotton	5,964	Re-use
	Lap Waste	Polyester	4,814	Re-use
Carding Engine	Flat Strip	Polyester	4,767	Sale
	Dropping and Sweeping Waste	Cotton	12,989	Sale
	Dropping and Sweeping Waste	Polyester	2,916	Sale
	Sweeping Waste and Dust	Blended	1,993	Sale
	Lap and Sliver Waste	Cotton	5,748	Re-use
	Lap and Sliver Waste	Polyester	4,850	Re-use
Drawing Frame	Sliver Waste	Cotton	3,308	Re-use
	Sliver Waste	Polyester	2,810	Re-use
	Sliver Waste	Blended	7,540	Re-use
	Sweeping Waste and Dust	Blended	137	Sale
Lap Former	Sliver Waste	Cotton	3,305	Re-use
Comber	Lap and Sliver Waste	Cotton	11,029	Re-use
	Comber Noil	Cotton	143,341	Sale
Roving Frame	Roving Waste	Blended	5,619	Re-use
	Sweeping Waste and Dust	Blended	57	Sale
Ring Spinning Frame	Pneumafil Dust	Blended	20,984	Re-use
	Sweeping Waste and Dust	Blended	213	Sale
	Waste Yarn	Blended	107	Use for cleaning
Winder	Waste Yarn	Blended	18,610	Use for cleaning

5-2-2 Auxiliary Materials

1) Sizing Materials

Sizing to warps is one of the most important process in Weaving, and proper selection of sizing materials, method of mixture as well as appropriateness of sizing conditions have a great influence on the weaveability and the quality of products.

It is intended that PVA as the main materials, starch and acrylic sizing materials shall be utilized in consideration of the better adherence of the sizing to polyester fibers.

2) Kinds and Consumption of Sizing Materials

Kinds of sizing materials together with their annual consumption against assumed production plan are shown in Table 14.

Table 14 Kinds and Consumption of Sizing Materials

Materials	Consumption (kg/Year)
PVA	114,180
Cornstarch	61,480
Acrylic Size	15,840
Wax	10,560
After Wax	260

5-2-3 Dyestuffs and Chemicals

It is generally understood that the integrated textile mill, consisting of Spinning, Weaving and Processing processes consumes a lot of dyestuffs and chemicals, and subsequently this results in increase of production cost.

Especially, the country like Nepal has a very limited oppotunity to obtain such materials locally and therefore, it is indispensable to make strict control of them and to keep their consumption as minimum requirement as possible.

At present, for the reason that almost dyestuffs and chemicals are being imported via Calucatta Port and brought to Nepal by inland transportation, delivery of such materials is costly, unstable and takes long time.

It is therefore assumed that at least 3 months consumption of dyestuffs and chemicals are to be in stock in the Mill.

According to the study on the raw materials mentioned in the Chapter 2, dyestuffs and chemicals are being imported mainly from West Germany and China (dyestuffs), China (Caustic Soda) and India (other chemicals).

Assumed consumption of major dyestuffs and chemicals are as per Table 15.

Table 15 Assumed Consumption of Dyestuffs and Chemicals

(liter or kg/Year)

No.	Item	Spec.	Consumption
	< Desizing Chemicals >		
1	Ractogen KC		3,600
2	Caustic Soda (NaOH)	Solid	21,600
3	Daisurf LF		2,900
	< Scouring & Bleaching Chemicals >		
4	Hydrogen Peroxide	100 %	4,400
5	Na-Silicate		2,900
6	Caustic Soda (NaOH)	Solid	1,800
7	Daisurf LF		2,900
	< Mercerizing Chemicals >		
8	Coustic Soda (NaOH) (additonal requirement amount only)	Solid	285,000
	< Dye Stuff >		
9	Disperse Dyes		14,170
10	Vat Dyes		7,085
11	Reactive Dyes		7,085
	< Chemicals & Agents for Dyeing by Disperse/Vet >		
12	Migration inhibiting Agent (Al · gin)		629
13	Caustic Soda (NaOH)	Solid	11,400
14	Na-Hydrosulfite	90%	12,600
15	Acetic Acid	100%	7,200
16	Hydrogen Peroxide	100%	4,100
17	Soaping stuff (Monogen 170)	Conc	1,300
	< Chemicals & Agents for Dyeing by Disperse/Reactive >		
18	Migration inhibiting Agent (Al · gin)		700
19	Caustic Soda (NaOH)	Solid	6,300
20	Salt (NaCl)	Solid	157,400
21	Acetic Acid	100%	3,900
22	Soaping Stuff (Lipotol BGF)		1,300
	< Chemicals & Agents for Finishing >		
23	Base Resin (Glyoxal type)		116,000
24	Control Resin (Methylol Melamine type)		7,300
25	Catalyzer (Mixed Solt type)		29,000
26	Softener (Silicon type)		7,300
27	Penetrating Agent		1,500
28	Soaping Agent		6,000
29	Soda Ash.		3,000

5-2-4 Packing Materials and Others

Kinds and consumption of the packing materials are influenced by the type of packing. The type of packing is firstly decided by the destination, i.e. whether the goods are exported or domestic use.

In case that the goods are to be exported, the type of packing shall have to comply with the customer's requirement and regulations. Whereas, the products of the Mill shall be regarded as all local use, and there will be no such requirements and regulations in Nepal, the type of packing to be applied shall be quite free and flexible in consideration of present market status provided that there have been no hindrance to the transportation.

Table 16 gives assumed consumption of packing and auxiliary materials to be utilized in the new Mill.

Table 16 Consumption of Packing and Auxiliary Materials

No.	Item	Spec.	Consumption (per Year)	Note
1	Carton Box	670 X 350 X 330 mm	1,000 pcs	
	〃	1270 X 500 X 500 mm	1,000 pcs	
2	Gum Tape	50 mm X 100 m/pc	250 pcs	
3	Paper Tube	50 mmφX 1160 mm	2,500 pcs	As 50 % of all Winding
	〃	50 mmφ X 1520 mm	2,500 pcs	
4	Carton Plate for Double	150 mm X 600 mm	5,000 pcs	As 50 % of all D. Lapping
	Lapping Machine	150 mm X 750 mm	5,000 pcs	
5	Film for Wrapping	1500 mm X 0.1 mm	25,000 m	As 50 % of all Wrapping
6	Paper for Wrapping	1500 mm X 0.1 mm	25,000 m	As 50 % of all Wrapping.
7	Sewing Thread	P/C 30 1/3 X 500 m/cone	160 Cone	
8	Lead Tape	C 50 mm X 60 m/Roll	20 Rolls	
9	P.P Band for Packing	15.5 mm X 2500 m/Roll	54 Rolls	

5-3 Basic Design of Production Machinery

5-3-1 Spinning Process

1) Basic Disign Conditions and Specifications for Spinning Machinery

The Spinning Machinery shall be selected among those modernized machines, which ensure the high product quality through high speed operation (i.e. high productivity) and also energy saving and lower noise level.

The operation conditions are set at reasonable and appropriate level for the smooth and stable operation for all processes. In addition, in order to ensure both high productivity and high quality, large packages are to be applied as far as possible.

a) Blow Room Machinery

The Blow Room machines shall be those of less breakdown through utilizing strong frame and high quality bearings and less numbers of parts through simplifying the mechanism. Each section of the Blow Room machines shall be driven separately by individual electrical motors.

By adopting blending feeder with creeper lattice of 7 m in length, it is able to mix 10 bales of raw cotton simultaneously which will ensure stable quality of product.

Further, the machines shall have effective cleaning and opening capability and also effective mixing capability with large hopper. The scutcher shall have the capability of producing uniform laps with less licking through single cage system as well as electronic speed regulation device, which controls pedal roller speed instantaneously.

In addition, the Lap Winding System shall have the capability to produce uniform laps through lap feeder with pressure device which shall automatically controls the power of pressurization, adjusting to the increase of lap diameter.

b) Carding Engines

The Carding Engines shall be selected among those machines with the following characteristics which ensure high productivity and high speed operation,

- Steel made cylinder and doffer
- Reinforced cylinder head
- Doffer speed changing device
- Roller doffing device

The machines shall be capable producing high quality slivers through:–

- Control roller device
- Special cylinder under casing
- Individual dust collector

c) Sliver Lap Former

The Lap Former shall be capable to produce uniform laps at high speed, and to feed up to 42 slivers, since laps of high degree of fiber parallelism and uniformity can reduce comber noil to a considerable extent.

The Lap Former shall be equipped with Full Automatic Lap Doffing Device, including lap carriers to take automatically up to 4 laps, in order to realize continuous operation and consequent higher operating efficiency.

In addition, the Lap Former shall be equipped with electrical stop motion devices for stopping machines instantaneously in case of trouble so that waste shall be minimized and operation efficiency shall be improved.

d) Comber

The Comber shall be with 8 combing heads enabling spinning of heavy grain lap as well as high speed and stable running without stopping for a long time, thanks to the reasonable design. Driving mechanism with camless motion, strong nipper knife, separate driving motor of brushes, make the machine of less wear and of less breakdown.

Further, uni-comb on cylinder and safty devices at various places within Comber shall ensure safety, high productivity and high quality product.

e) Drawing Frame

The Drawing Frame shall be of high speed, producing high quality product, and shall be of less power consumption, of easy operation and of easy maintenance.

The draft part shall be 4-over-3 with pressure bar type which gives optimum loading to fleece and hence controls fibers well, in order to contribute to produce slivers of better quality.

The Drawing Frame shall be equipped with automatic can changing device and dust collecting device.

The Drawing Frame shall be also equipped with electrical stop motion device in order to improve operating efficiency.

f) Simplex Fly Frame (Roving Frame)

The Roving Frame shall be of high speed aiming at producing high product quality. That is to say, the Roving Frame shall be capable to produce large roved bobbins of 152 mmϕ X 406 mm lift, in order to offset the increase in work load and in order to lengthen the doffing cycle time. The flyers supported at the top are offering such advantages as easier doffing works for large bobbins, shorter doffing operation time almost no vibration of flyer-top even at high speed operation, and less vibration of the frame itself. Furthermore, since the flyer rail is located at the top of spindle which drives flyers from the top, the following

advantages in terms of product quality and productivity are expected:—

- In the case that the roving is broken between the front roller and the flyer top, the photo-electric stop motion works surely and stops the machine, and hence prevents fly mixture and breakage of adjacent roving as well.
- The roving is passing steadily and smoothly from front rollers to flyer tops, because the rotation of flyers generates air turbulence very little.

  Consequently, less fluff and less fly shall be generated, and higher production can be expected than conventional roving frames due to less twist number to be required.
- The doffing operation requires less hours, because the easy doffing mechanism is equipped and hence it is not necessary to take off the flyers during doffing as the case of conventional roving frames.

The draft mechanism shall be 4-line with double apron system, which generates less fly, produces good roving of less fluff.

In addition, the following auxiliary devices shall be equipped, in order to ensure high productivity and quality.

- Optical electronic type slivers stop motion device
- Preventing device for uneven roving,
- Fine adjusting device for roving tension,
- Cone belt automatic return motion,
- Full bobbin proper position stop motion,
- Package shoulder collapse preventing device,
- Line blow and pneumatic apparatus,
- Safety devices for gear-end and side doors.
- Front foot step

g) Ring Spinning Frames.

The Ring Spinning Frames of 45/47 mmϕ ring and 205 mm (8") lift shall be utilized in order to reduce the work load as much as possible through making doffing cycle time as longer as possible. The Headstock shall be totally enclosed because of out-end driving system, and shall prevents invasion of fly to yarns due to no air flow to be caused by the heat generated by a motor and by the motor cooling fan.

In addition, the change gears such as draft, twist, and lifter change gears shall be interchangable and neatly arranged at the end face of the headstock, in order to make the maintenance works convenient.

The draft mechanism shall be 3-line with double apron system.

The following automatic devices shall be equipped in order to ensure the

stable operation:–

- Automatic full bobbing stop motion,
- Automatic lifting and optimum position stop motion of ring rail,
- Push button switch for emergency stop.
- Cushion starter and snarl preventing device.
- Automatic speed changer of spindle
- Automatic lappet tilting and reversing device

h) Automatic Cone Winder

The Automatic Cone Winders shall be equipped with knotters of 1-drum 1-knotter type which allows excellent operating efficiency because of almost no waiting time for knotting. The knotters shall be of epoch-making air-splicer type which joins yarn ends without a knot, and which prevents troubles due to knots in the subsequent weaving or knitting process.

The following devices shall be equipped in order to ensure the better product quality:–

- Electric slub catcher shall be mounted in order to remove defectives thoroughly.
- When knotting, the electric clearer shall check yarn tips of both supply and bobbin side. If double or triple ends are detected, it is cut away for sure.
- Ribbon breaker of intermittent and variable speed mechanism driven by independent motor does not generate ribboning.
- Fly and yarn waste is removed by air blow at every yarn knot.

The machines shall be generally made of simple and of strong-built structure and have following characteristics.

- Easy access to yarn path including splicer knotters, electrical slub catchers, and pegs for easy checking.
- Each winding unit can be swung down individually without stopping other units for the purpose of easy maintenance works.
- Each winding unit can be easily taken off.
- Knotters and tension devices shall be of cassette type for easier maintenance.

The machine requires strong blower and compressed air, hence it shall be designed as energy saving type.

i) Full Automatic Steam Setter

The Steam Setter shall be of fully automatic type by means of reasonable mechanism, except carrying in or transfer out operation of products. The automations include all heat treatment elements, such as operation time, temperature, pressure, vacuum air exhaust and water drainage, etc. This permits heat setting under the same conditions for each batch and gives the uniform products free

from uneven setting.

Repetition of vacuuming and steaming can considerably reduce the partial pressure of the air remained in the steaming cabinet and allows the steam to penetrate evenly and quickly to the both inside and outside of the fibers. Thus perfect steam setting is realized.

Safety is the prime factor for the steam-setter as it has a pressure vessel.

The Steam-Setter shall be equipped with following mechanically and electically functioning double and tripple safety devices so as to be able to cope with any troubles

- Vacuum checking device
- Over heating checking device.

j) Re-Winder

The Re-Winder shall have the capability of winding yarns of fine to coarse count in order to utilize re-winding purpose of remained yarns as well as defective bobbins/corns generated at the Automatic Winder and Weaving process.

The body frame shall be constructed of rigid steel plates.

By adopting special drum with traverse slit and by maintaining constant pressure and tension, it might be possible to produce the package with uniform density throughout the inner and outer layers free from ribboning and deformation.

In additon, all yarn guides and tensors shall be of structures and arrangement with smooth threading path.

2) Calculation Table and Machine List

The required numbers of production machinery shall be, carefully calculated taking into consideration of various factors such as number of yarns to be doubled, drafting ratio, spinning speed, machine efficiency etc.

Such factors shall be set up at the proper level respectively by means of judging comprehensively the skill level of operators, assumed product quality, experiences of workers, quality of raw materials etc.

Calculation of production machinery for each spinning process has been established at being a model spinning mill in Nepal. Table 17 gives the calculation results on each process and Table 18 indicates main spinning machine list.

This calculation is carried out on the basis of producing polyester 50%, cotton 50% blended yarn of Ne 45 and Ne 30.

Blending shall be made in the form of sliver at 1st. Roving Frame. The same spinning conditions shall be applied up to Roving Frames and thus pre-determined yarn count shall be obtained at Spinning Frame by means of drafting of yarn.

Table 17 Calculation Table for Polyester 50/Cotton 50 Blended Yarn

Process \ Item		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		Supply thickness (Grain/yard)	No. of doubling	Draft	Produced thickness (Grain/yard)	Twist multiplier (αe)	Twist per/inch (TPI)	Waste percent (%)	Delivery speed or Revolution (per min.)	Package	100 % Production (LBS) (per hour and unit)	Working hour	Working efficiency) (%)	No. of spindle (per machine)	Actual Production (per machine) (LBS/Hour)	Required Production (LBS/Hour)	Calculated No. of machine	No. of machine
1.	Blow Room Machinery																	
-1	for Cotton.	–	–	–	13 OZ/1	–	–	3.0 + 0.5	Lap Roller (8.67 m) 11.5 rpm X 9.48 yds	960 mm X 50 mL	462.15	1	90	1	415.94	319.97	0.8	1
-2	for Polyester	–	–	–	14 OZ/1	–	–	0.5 + 0.5	Lap Roller (8.67 m) 11.5 rpm X 9.48 yds	960 mm X 45 mL	497.70	1	90	1	447.93	268.23	0.6	1
2.	Card																	
-1	for Cotton	13 OZ/1	1	94.58	350/6	–	–	3.0 + 0.5	Doffer (72.6 m) 25 rpm X 79.4 yds	24 φ X 42″H	39.70	1	85	1	33.75	308.77	9.2	10
-2	for Polyester	14 OZ/1	1	94.69	385/6	–	–	0.8 + 0.5	Doffer (87.1 m) 30 rpm X 95.2 yds	24 φ X 42″H	52.36	1	85	1	44.51	264.74	6.0	6
3.	Pre-drawing Frame																	
-1	for Cotton	350/6	6	6	350/6	–	–	0.3	218.7 yds (200 m)	20″φ X 42″H	109.35	1	80	2	174.96	307.84	1.8	2
-2	for Polyester	385/6	8	8.56	360/6	–	–	0.3	355.4 yds (325 m)	20″φ X 42″H	182.78	1	80	2	292.45	263.95	0.9	1
4.	Lap Former for Cotton	350/6	36	2.80	750/1	–	–	0.3	65.62 yds (60 m)	11″W	421.84	1	80	1	337.47	306.92	0.9	1
5.	Comber for Cotton	750/1	4	43.5	360/6	–	–	13 + 1	200 NIP X 5.54 mm	20″φ X 42″ H	27.11	1	85	2	46.08	263.95	5.7	6
6.	1st Drawing Frame																	
-1	for Ne 45	C 360/6 P 360/6	4 4	8.23	350/6	–	–	0.2	246.1 yds (225 m)	20″φ X 42″H	123.05	1	80	2	196.88	182.74	0.9	1
-2	for Ne 30	C 360/6 P 360/6	4 4	8.23	350/6	–	–	0.2	246.1 yds (225 m)	20″φ X 42″H	123.05	1	80	2	196.88	344.10	1.8	2

Process \ Item		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		Supply thickness (Grain/yard)	No. of doubling	Draft	Produced thickness (Grain/yard)	Twist multiplier (αe)	Twist per/inch (TPI)	Waste percent (%)	Delivery speed or Revolution (per min.)	Package	100 % Production (LBS) (per hour and unit)	Working hour	Working efficiency (%)	No. of spindle (per machine)	Actual Production (per machine) (LBS/Hour)	Required Production (LBS/Hour)	Calculated No. of machine	No. of machine
7.	2nd Drawing Frame																	
-1	for Ne 45	350/6	8	8	350/6	–	–	0.2	251.5 yds (225 m)	20"φ X 42"H	123.05	1	80	2	196.88	182.37	0.9	1
-2	for Ne 30	350/6	8	8	350/6	–	–	0.2	251.5 yds (225 m)	20"φ X 42"H	123.05	1	80	2	196.88	343.41	1.7	2
8.	Simplex Fly Frame																	
-1	for Ne 45	350/6	1	7.61	230/30	0.75	0.782	0.3	1,000 rpm	5 3/4"φ X 16"L	2.33	1	82	96	183.42	181.82	1.0	1
-2	for Ne 30	350/6	1	7.61	230/30	0.75	0.782	0.3	1,000 rpm	5 3/4 "φ X 16"L	2.33	1	82	96	183.42	342.38	1.9	2
9.	Ring Spinning Frame																	
-1	for Ne 45	230/30	1	41.4	Ne 45	3.58	24.015	1.0	14,500 rpm	47 mmφ X 205 mmL	0.027	1	93	480	12.05	180.00	14.9	15
-2	for Ne 30	230/30	1	27.6	Ne 30	3.58	19.608	1.2	13,500 rpm	47 mmφ X 205 mmL	0.046	1	91	480	20.09	338.27	16.8	17
10.	Automatic Winder																	
-1	for Ne 45	Ne 45	1	–	Ne 45	–	–	1.0	1,093.6 yards (1,000 m)	6" X 4°20'	1.74	1	86	60	89.78	178.20	2.0	2
-2	for Ne 30	Ne 30	1	–	Ne 30	–	–	1.0	984.3 yards (900 m)	6 " X 4°20'	2.34	1	85	60	119.34	334.89	2.8	3
11.	Steam Setter																	
-1	for Ne 45	Ne 45	–	–	Ne 45	–	–	0	Operating time 48 min/batch	220 Lbs/batch	275.0	1	80	1	220.0	73.38	0.3	1
-2	for Ne 30	Ne 30	–	–	Ne 30	–	–	0			275.0	1	80	1	220.0	124.15	0.6	

Table 18 List of Main Production Machinery (Spinning)

Item No.	Machine/Equipment	Quantity
S – 1	Blow Room Machinery	2 lines
	1) Lap feeding system to card	
	2) Individual waste collecting system (Bag filter system)	
	3) Centralized compressed air system	
	4) Line arrangement & number of machine	
	a) for cotton line 1 line	
	1-creeper lattice (7 m length)	
	1-blending feeder	
	1-magnetic separator	
	1-exhaust fan & dust filter	
	2-evener cleaner with 3-cylinders	
	1-fine opener	
	1-fan condenser	
	1-dust cage filter with 15-filters	
	1-hopper feeder	
	1-single cage scutcher	
	1-control panel	
	b) for polyester line : 1 line	
	1-creeper lattice (7 m length)	
	1-blending feeder	
	1-fine opener	
	1-magnetic separator	
	1-fan condenser	
	1-dust filter with 1-filter	
	1-hopper feeder	
	1-single cage scutcher	
	1-control panel	
S – 2	High Production Card	16 sets
	1) Number of machine	
	a) for cotton : 10 sets	
	b) for polyester : 6 sets	
	2) Lap feeding system	
	3) Roller doffing system	
	4) Sliver can size : 610 mm (24″)ϕ X 1067 mm (42″)H	
	5) Individual waste collecting system	

Item No.	Machine/Equipment	Quantity
S – 3	High Speed Pre-drawing Frame	3 sets
	1) Number of machine	
	a) for pre-comber : 2 sets	
	b) for polyester : 1 set	
	2) Number of deliveries per frame : 2 deliveries	
	3) Number of feeding slivers per delivery : 8 slivers	
	4) Feeding can size : 610 mm (24″) ϕ X 1067 mm (42″) H	
	5) Delivery can size : 508 mm (20″) ϕ X 1067 mm (42″) H	
	6) Drawing system : 4 over 3 drafting system with pressure bar included turning roller	
	7) Automatic can changing device	
S – 4	Sliver Lap Former	1 set
	1) Number of heads per frame : 3 heads	
	2) Number of feeding slivers per frame : 42 slivers	
	3) Feeding can size : 508 mm (20″) ϕ X 1067 mm (42″) H	
	4) Drafting system : 3 over 2 drafting system	
	5) Taking up size of lap : Max. 600 mmϕ X 267 mmW	
	6) Automatic lap doffing system	
S – 5	High Production Comber	6 sets
	1) Number of combing heads per frame : 8 heads	
	2) Number of deliveries per frame : 2 deliveries	
	3) Delivery can size : 508 mm (20″) ϕ X 1067 mm (42″) H	
	4) Comb cylinder : 127 diameter with hi-comb	
	5) Drafting system : 2 over 2 drafting system	
	6) Individual waste collecting system	
S – 6	1st High Speed Drawing Frame	3 sets
	1) Number of machine	
	a) for Ne 45 yarn : 1 set	
	b) for Ne 30 yarn : 2 sets	
	2) Number of deliveries : 2 deliveries	
	3) Number of feeding slivers per delivery : 8 slivers	
	4) Feeding can size : 508 mm (20″) ϕ X 1067 mm (42″) H	
	5) Delivery can size : 508 mm (20″) ϕ X 1067 mm (42″) H	
	6) Drawing system : 4 over 3 drafting system with pressure bar included turning roller	
	7) Automatic can changing device	

Item No.	Machine/Equipment	Quantity
S – 7	2nd High Speed Drawing Frame	3 sets
	1) Number of machine	
	a) for Ne 45 yarn : 1 set	
	b) for Ne 30 yarn : 2 sets	
	2) Number of deliveries : 2 deliveries	
	3) Number of feeding slivers per delivery : 8 slivers	
	4) Feeding can size : 508 mm (20″) ϕ X 1067 mm (42″) H	
	5) Delivery can size : 508 mm (20″) ϕ X 1067 mm (42″) H	
	6) Drawing system : 4 over 3 drafting system with pressure bar included turning roller	
	7) Automatic can changing device	
S – 8	Simplex Fly Frame	3 sets
	1) Number of machine	
	a) for Ne 45 yarn : 1 set	
	b) for Ne 30 yarn : 2 sets	
	2) Number of spindles per machine : 96 spindles	
	3) Lift : 406 mm (16″)	
	4) Nominal full bobbin diameter : 146 mm (5 3/4″)	
	5) Drafting system : 4 roller double apron overhead type	
	6) Feeding can size : 508 mm (20″) ϕ X 1067 mm (42″) H	
S – 9	Ring Spinning Frame	32 sets
	1) Number of machine	
	a) for Ne 45 yarn : 15 sets	
	b) for Ne 30 yarn : 17 sets	
	2) Number of spindles per machine : 480 spindles	
	3) Spindle gauge : 70 mm	
	4) Lift : 205 mm	
	5) Inside diameter of ring : 47 mm	
	6) Drafting system : 3 line 2 zone double apron with mini tension	
	7) Overhead travelling cleaner : BS type	
S – 10	Automatic Winder	5 sets
	1) Number of machine	
	a) for Ne 45 yarn : 2 sets	
	b) for Ne 30 yarn : 3 sets	
	2) Number of drums per machine : 60 sets	
	3) Take-up package : 6″ traverse X 4°20′ cone	
	4) Supply package : Ring spinning bobbin	
	5) Air splicer knotter : Individual type	

Item No.	Machine/Equipment	Quantity
	6) Centralized compressed air system	
	7) Individual blower system	
	8) Auxiliary equipment	
	a) Electronic yarn clearer	
	b) Overhead travelling cleaner : B. S. type	
S – 11	Full Automatic Steam Setter	1 set
	1) Housing capacity : 6" X 4°20' cone about 100 kg/batch	
	2) Steaming cabinet : Approximate 100 mm X 1800 mmL	
	3) Temperature : Controlled in the range of 60°C to 138°C	
	4) *Vacuum pump displacement : Max. 1500 liter/minute*	
	5) Control panel	
	6) Yarn box carrier : 6 sets	
S – 12	High Speed Re-winder	1 set
	1) Number of drums per machine : 120 drums	
	2) Take-up package : 6" traverse X 4°20' cone	
	3) Supplying cheese size : 6" traverse X 4°20' cone (cone to cone)	
	4) Auxiliary equipment	
	a) Tension release device	
	b) Overhead travelling cleaner : B type	

3) List of Auxiliary Equipment and Accessories

a) Auxiliary Equipment and Accessories

On selecting auxiliary equipment and accessories, high quality, high operation efficiency and safety, which are all well-adapted to the production machinery shall be taken into account. The number of such equipment and accessories shall be determined in accordance with their utilizing frequencies. Furthermore special attention shall be drawn to the maintenance tools and equipment.

The numbers of consumables shall be carefully planned in order to allow appropriate quantity of stocks within processes for the smooth and stable operation.

b) Laboratory Equipment

Laboratory equipment shall be selected from the viewpoint that it is useful for the betterment of the preduct quality through the feedback of their data to operation and that the handling is simple and the tested data are accurate.

The list of auxiliary equipment, accessories and laboratory equipment is show in Table 19.

4) Flow Chart of Spinning Process

Table 20 shows the flow chart of spinning process, based on the calculation results and selected production machinery.

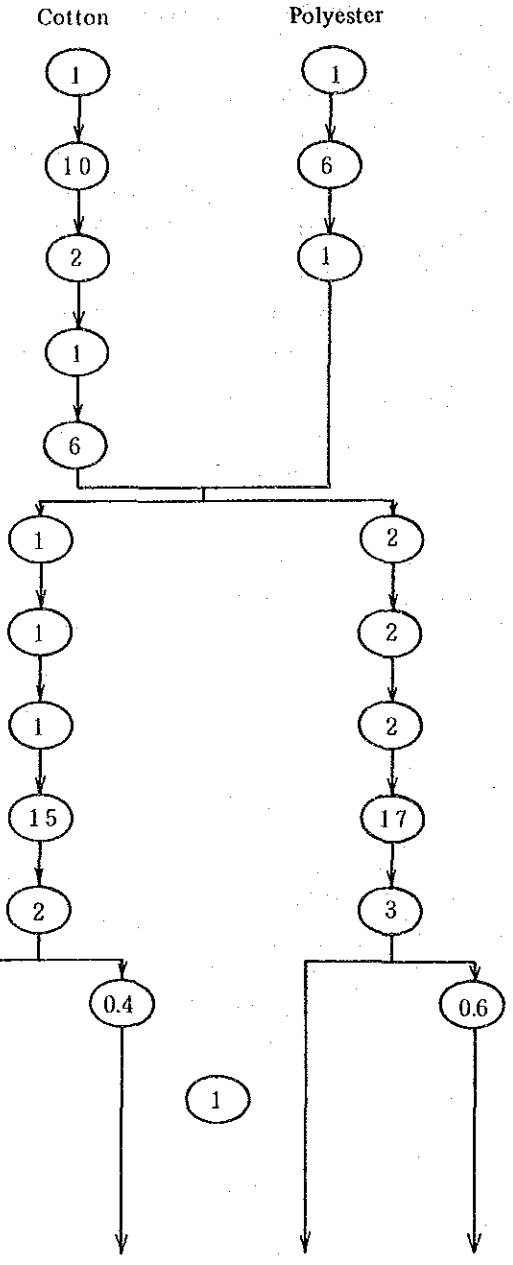
Table 19 List of Accessories and Auxiliary Equipment (Spinning)

Item No.	Equipment/Accessories	Quantity
AUX–1	**For Blowing Section**	
AUX–1–1	Cart for lap transport	10 sets
1–2	Carrier for waste and reusable fiber	10 sets
1–3	Fork lift with side cramp	1 set
1–4	Double beam platform scale	1 set
1–5	Cutter for bale band	4 pcs
1–6	Lap sheet	200 pcs
1–7	Trolley for raw material bale	1 set
1–8	Baling tower	4 sets
AUX–2	**For Carding Section**	
AUX–2–1	Bare surface grinder	1 set
2–2	Metallic wire mounting machine	1 set
2–3	Licker-in roller mounting machine	1 set
2–4	Flat clipping machine	1 set
2–5	Flat grinding machine	1 set
2–6	Flat tester	1 set
2–7	Traverse hose roller grinder for M.C.C.	2 pcs
2–8	Traverse hose roller grinder for Top	1 pc
2–9	Stripping roller	2 pcs
2–10	Burnishing roller	2 pcs
2–11	Long grinding roller	1 pc
2–12	Movable motor device for stripping & barnishing roller	1 set
2–13	Chain washing machine	1 set
2–14	Truck for flat bar	2 sets
2–15	Truck for traverse hose roller	1 set
2–16	Side scope	1 set
2–17	Cylinder & doffer jack set	2 sets
2–18	24″ϕ can with spring & caster	80 sets
AUX–3	**For Combing & Drawing Section**	
AUX–3–1	Bobbin for comber	150 pcs
3–2	20″ϕ can with spring & caster	800 pcs
AUX–4	**For Roving Section**	
AUX–4–1	Cart for roving	10 sets

Item No.	Equipment/Accessories	Quantity
AUX–4–2	Cart for roving bobbin	5 sets
4–3	Bobbin for simplex fly frame	20,000 pcs
AUX–5	**For Spinning Section**	
AUX–5–1	Rubber pat clearer for back bottom roller	32 pcs
5–2	Cop box with separator	150 pcs
5–3	Hanger for doffing	12 sets
5–4	Cart for cop transportation	10 sets
5–5	Spira clean for spindle oil	1 set
5–6	Clearer cleaning machine	1 set
5–7	Heating press for spindle tape	1 set
5–8	Roller picker with hose	10 sets
5–9	Can containing travellers	50 boxes
5–10	Traveller magazine	34 pcs
5–11	Bobbin for ring spinning frame	69,000 pcs
5–12	Blow cleaner for ring spinning frame	32 sets
5–13	Magnetize device	1 set
AUX–6	**Winding Section**	
AUX–6–1	Cart for cone	35 sets
6–2	Scale for auto winder	5 sets
6–3	Fisherman's knotter	5 sets
6–4	6" X 4°20' cone bobbin	6,000 pcs
6–5	Blow cleaner for R.T.winder	1 set
AUX–7	**Maintenance Section**	
AUX–7–1	Movable tool box with vise	4 sets
7–2	Movable tool box	2 sets
7–3	Handling carrier	4 sets
7–4	Portable crane with chain block	1 set
7–5	General tool	1 lot
AUX–8	**Roller Shop**	
AUX–8–1	Gum cot grinding machine	1 set
8–2	Roller eccentricity tester	1 set
8–3	Heavy type roller assembling machine	1 set
8–4	Roller tester	1 set
8–5	E. C. master	1 set
8–6	Hardness tester for gum cot	1 set

Item No.	Equipment/Accessories	Quantity
AUX-8-7	Automatic ultraviolet rays rubber roller treatment machine	1 set
8-8	Rubber roller cleaning machine	1 set
8-9	Miscellaneous accessories	1 lot
AUX-9	**Laboratory Equipment**	
AUX-9-1	Raw cotton fiber high volume testing installations	1 set
9-2	Evenness testing installation	1 set
9-3	Yarn fault classifying installation	1 set
9-4	Lap yard tester	1 set
9-5	Single yarn tensile strength tester	1 set
9-6	Seri-plane with board	1 set
9-7	Yarn evenness checking device	1 set
9-8	Shirley analyser for cotton fiber	1 set
9-9	Autosorter	1 set
9-10	Wrap reel	1 set
9-11	Wrap block	1 set
9-12	Comber waste percentage balance	1 set
9-13	Chain adjusting balance	1 set
9-14	Tachometer	1 set
9-15	Stroboscope	1 set
9-16	Stop watch	1 set
9-17	Even balance	1 set
9-18	Twist tester	1 set
9-19	Handling carrier	1 set
9-20	Hygro & Thermograph	6 sets
9-21	Wet & dry thermometer	20 sets
9-22	Miscellaneous accessories	1 lot

Table 20 Flow Chart of Spinning Process

	Main Production Machinery	Process
S–1	Blow Room Machinery	
S–2	High Production Card	
S–3	High Speed Pre-Drawing Frame	
S–4	Sliver Lap Former	
S–5	High Production Comber	
S–6	1st High Speed Drawing Frame	
S–7	2nd High Speed Drawing Frame	
S–8	Simplex Fly Frame	
S–9	Ring Spinning Frame	
S–10	Automatic Winder	
S–11	Full Automatic Steam Setter	
S–12	High Speed Re-Winder	

Production kg/Year	376,566	263,618	757,084	446,009
Thread Kinds	Warp	Weft	Warp	Weft
	Ne 45		Ne 30	

* Figure in circle means the number of machine.

5-3-2 Weaving Process

1) Basic Design Conditions and Specifications for Weaving Machinery

In preparation process of Weaving, the machines shall be selected among those high quality types in order to produce high quality semi-processed goods, i.e. beams with less defectives, which will make it possible to improve quality of cloth at the following process.

In weaving, Rapier Looms shall be adopted from the viewpoint of quality, economy and operation efficiency.

a) Warper

The structure and materials of the frame shall be rigid and strong that allow high-speed revolution of considerably heavy beams as well as quick stop of revolution in case of yarn breakage. Yarn breakage shall be electrically detected and stop-motion shall work automatically. The machine shall be equipped with reversing device which enables to find out winded yarn easily and is effective against formation of ribbon. The attachment and detachment of beams shall be carriged out safely, firmly and automatically.

b) Sizing Machine

Sizing is the most important process in preparation section, hence Multi-cylinder system with preliminary dryer device shall be adopted so as to size evenly and to make fluffs lie properly.

Introduction of high pressure squeezing method shall admit of making good penetration of size as well as reducing steam consumption.

The machine shall be of single sizing box, double squeezing roller system, and after squeezing the warp yarn sheet, it shall be devided into two pieces of sheet in order to dry it up promptly and help in making fluffs lie effectively.

The temperatune of Multi-cylinder shall be adjusted automatically to the pre-set degree. Further, moisture indicator shall make it possible to graspe moisture content of the sized yarns at a glance which prevents problems of weaving attributed to the insufficient drying of yarns.

Tension control shall be made at each part of beam creel, size-box, cylinder dryer and winder in order to obtain beams winded by yarns with even tension.

c) Warp Tying Machine

This machine shall be of a portable type, permitting to carry out yarn tying works on the beam of looms.

In order to increase efficiency of tying work, two sets of tying frame, functioning as tying preparation shall be installed against one set of tying head.

d) Reaching-in Machine

This machine shall be of type, enabling reaching in works to Dropper, Healds,

and Reeds by one operator.

Warps loaded to the frame shall be accurately separated one by one and placed at appropriate spacing for easy reaching-in.

e) Loom

Weft insertion shall be made by the carrier with gripper, catching weft tips accurately which makes it possible to utilize wefts ranged from fine to coarse yarn.

Unsymetrical shedding cam shall be adopted so that carrier shall run smoothly and clash of carrier head as well as mistake on weft delivery shall be avoided.

In the case that yarn breakage of both warp and weft is detected, stop-motion shall work quickly and steadily through electrical detecting device and the cause of stop shall be simultaneously indicated at the pilot lamp with different colour. Furthermore, the machine shall be equipped with weft storage feeder and weft pick feeder so as to reduce weft breakage and to prevent deterioration of quality.

The machine shall be of automatic oil-supply type with timer, hence appropriate quantity of oil shall be supplied automatically at regular intervals, which shall prevent wearing of parts and deterioration of functions.

The loom shall also have the capability of producing cloth of wide range and generating good working conditions with less noise and vibration.

f) Inspecting Machine

The machine shall have all functions necessary for inspecting cloth, such as forwarding and backwarding device, speed control device, length measuring device, see-through device, plaiting device, etc. and all of them shall be of simple structures which will ensure less troubles.

g) Folding Machine

The machine shall have functions of folding cloth accurately at every one meter (or yand) in length. It shall also be capable to fold cloth up to 150 mm in height.

2) Calculation Table and Machine List

The required numbers of production machinery shall be carefully calculated taking into consideration of various factors.

Such factors shall be set up at the proper level respectively by means of judging comprehensively the skill level of operators, assumed product quality, experiences of workers, quality of raw materials, etc.

Calculation of production machinery for each weaving process has been set up at rather high quality, aimed at being a model weaving mill in Nepal.

Table 21 gives calculation results and Table 22 shows list of production machinery for weaving process.

3) List of Auxiliary Equipment and Accessories

The list of auxiliary equipment and accessories necessary for operating the production machinery is shown in Table 23.

4) Flow Chart of Weaving Process

The flow chart from the cheesed yarn produced in Spinning processs to the grey cloth for processing is as per Table 24.

Table 21 Calculation Table for Weaving

Item No. / Process/Machine	Cloth	Delivery Speed of Revolution Per Min.	100 % Production Per Hour and Unit	Eff. %	Actual Production Per Hour and Machine	Required Production Per Hour	Calculated No. of Machine	Total Calculated No. of Machine	No. of Machine
W–1 Direct Warper	Shirting Dobby	400 m	24,000 m	35	8,400 m	3,630 m	0.43	1.86	2
	Shirting Plain	400 m	24,000 m	35	8,400 m	2,976 m	0.35		
	Suiting Dobby	400 m	24,000 m	35	8,400 m	4,524 m	0.54		
	Twill 2/1	400 m	24,000 m	35	8,400 m	4,485 m	0.54		
W–2 Sizing Machine	Shirting Dobby	40 m	2,400 m	65	1,560 m	363 m	0.23	0.97	1
	Shirting Plain	40 m	2,400 m	65	1,560 m	372 m	0.24		
	Suiting Dobby	40 m	2,400 m	60	1,440 m	377 m	0.26		
	Twill 2/1	40 m	2,400 m	60	1,440 m	345 m	0.24		
W–3 Tying Machine	Shirting Dobby	200 Knots	12,000 Knots	25	3,000 Knots	685 Knots	0.23	1.28	2
	Shirting Plain	200 Knots	12,000 Knots	25	3,000 Knots	540 Knots	0.18		
	Suiting Dobby	200 Knots	12,000 Knots	25	3,000 Knots	1,132 Knots	0.38		
	Twill 2/1	200 Knots	12,000 Knots	25	3,000 Knots	1,478 Knots	0.49		
W–4 Reaching-in Machine	Shirting Dobby	5 Warps	300 Warps	85	255 Warps	206 Warps	0.81	4.12	5
	Shirting Plain	6 Warps	360 Warps	85	306 Warps	162 Warps	0.53		
	Suiting Dobby	5 Warps	300 Warps	85	255 Warps	340 Warps	1.33		
	Twill 2/1	6 Warps	360 Warps	85	306 Warps	444 Warps	1.45		

Item No.	Process/Machine	Cloth	Delivery Speed of Revolution Per Min.	100 % Production Per Hour and Unit	Eff. %	Actual Production Per Hour and Machine	Required Production Per Hour	Calculated No. of Machine	Total Calculated No. of Machine	No. of Machine
W–5	Rapier Loom	Shirting Dobby	250 rpm	5.01 m	85	4.26 m	328.02 m	77	308	308
		Shirting Plin	250 rpm	5.29 m	85	4.50 m	346.50 m	77		
		Suiting Dobby	210 rpm	5.16 m	85	4.39 m	338.03 m	77		
		Twill 2/1	210 rpm	4.71 m	85	4.00 m	308.00 m	77		
W–6	Inspecting Machine	Shirting Dobby	25 m	1,500 m	25	375 m	328.08 m	0.87	3.51	4
		Shirting Plain	25 m	1,500 m	25	375 m	346.50 m	0.92		
		Suiting Dobby	25 m	1,500 m	25	375 m	338.03 m	0.90		
		Twill 2/1	25 m	1,500 m	25	375 m	308.00 m	0.82		
W–7	Folding Machine	Shirting Dobby	50 m	3,000 m	50	1,500 m	328.02 m	0.22	0.89	1
		Shirting Plain	50 m	3,000 m	50	1,500 m	346.50 m	0.23		
		Suiting Dobby	50 m	3,000 m	50	1,500 m	338.03 m	0.23		
		Twill 2/1	50 m	3,000 m	50	1,500 m	308.00 m	0.21		

Table 22 List of Main Production Machine (Weaving)

Item No.	Machine		Quantity
W – 1	Direct Warper		2 sets
	1) Cheese creel		
	a) H-shape turn table		
	b) Creel peg: 576 pcs		
	2) Warping head		
	a) Direct warping system		
	b) Up roller type reversing device		
W – 2	Sizing Machine		1 set
	1) Sizing section		
	a) Double squeezing roller		
	b) High pressure squeezing system		
	2) Drying section		
	a) No. of cylinder :	9 pcs	
	3) After waxing device		
	4) Beaming head :	Pneumatic beam doffing	
W – 3	Tying Machine		2 sets
	1) Construction :	Tying head 1 pce/set	
		Tying frame 2 pce/set	
	2) Portable system		
W – 4	Reaching-in Machine		5 sets
	1) Construction :	Carriage 1 pce/set	
		Frame 1 pce/set	
W – 5	Rapier Loom		308 sets
	1) Construction		
	RS 145 cm with dobby :	77 sets	
	RS 145 cm with plain tappet :	77 sets	
	RS 170 cm with dobby :	77 sets	
	RS 170 cm with twill tappet :	77 sets	
	2) Gripper system weft insertion		
	3) False selvage leno motion		
	4) Electric warp stop motion		
W – 6	Inspecting Machine		4 sets
	1) Cloth speed :	15 ~ 40 m/min.	
	2) Working width :	1,800 mm	
W – 7	Folding Machine		1 set
	1) Max. folding speed :	60 folds/min.	
	2) Max. folding height :	150 mm	
	3) Working width :	1,800 mm	

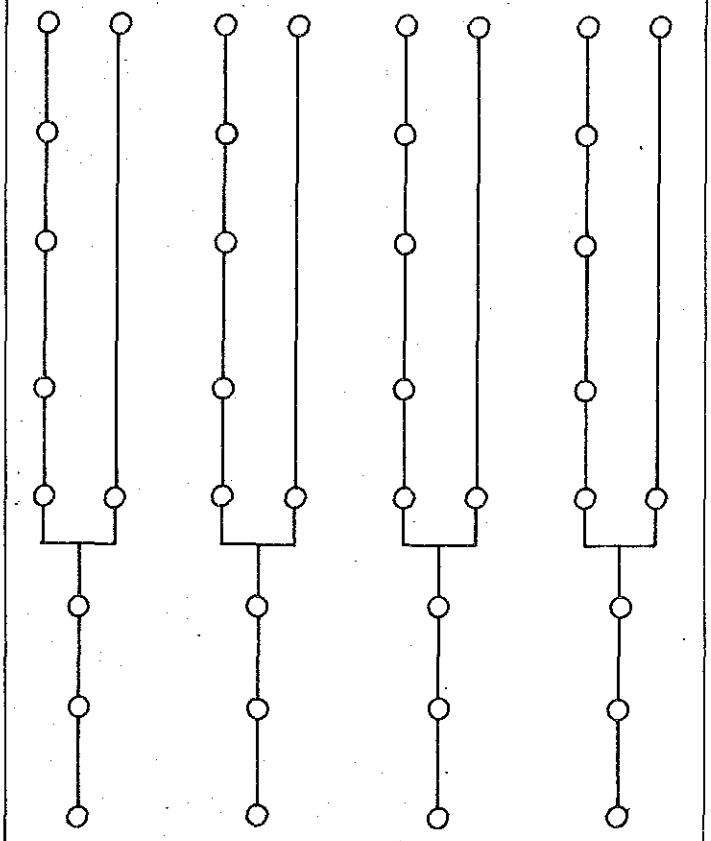
Table 23 List of Auxiliary Equipment and Accessories (Weaving)

Item No.	Equipment/Accessories	Quantity
AUX – 1	**For Direct Warper**	
AUX – 1 – 1	Warper's beam	40 pcs
1 – 2	Weighing scale	1 pce
AUX – 2	**For Sizing Machine**	
AUX – 2 – 1	Mixing kettle	1 pce
2 – 2	High pressure cooker	1 pce
2 – 3	Storage kettle	2 pcs
2 – 4	Weighing scale	1 pce
2 – 5	Empty beam carrier	1 pce
2 – 6	Full beam carrier	1 pce
2 – 7	Beam stocker	1 set
2 – 8	Viscosity cup	2 pcs
AUX – 3/4	**For Tying/Reaching-in Machine**	
AUX – 3/4 – 1	Beam carrier	1 pce
3/4 – 2	Beam carrier with heald support	1 pce
3/4 – 3	Empty beam carrier	1 pce
AUX – 5	**For Rapier Loom**	
AUX – 5 – 1	Spare beam for RS 145 cm	30 pcs
5 – 2	Spare beam for RS 170 cm	30 pcs
5 – 3	Spare cloth roller for RS 145 cm	25 pcs
5 – 4	Spare cloth roller for RS 170 cm	35 pcs
5 – 5	Heald frame for RS 145 cm	1,602 pcs
5 – 6	Heald frame fro for RS 170 cm	1,694 pcs
5 – 7	Spare heald rod RS 145 cm	2,140 pcs
5 – 8	Spare heald rod RS 170 cm	2,300 pcs
5 – 9	Flat heald	2,340,000 pcs
5 – 10	Dropper	2,230,000 pcs
5 – 11	Spare dropper bar for RS 145 cm	185 pcs
5 – 12	Spare dropper bar for RS 170 cm	185 pcs
5 – 13	Punching and coppying machine	1 set
5 – 14	Dobby paper	40 rolls
5 – 15	Point paper	40 rolls

Item No.	Equipment/Accessories	Quantity
AUX – 5 – 16	Paper dine	20 tubes
5 – 17	Spare middle hook	10,000 pcs
5 – 18	Reed for RS 145 cm	462 pcs
5 – 19	Reed for RS 170 cm	462 pcs
5 – 20	Cloth doffing carrier	3 pcs
5 – 21	Lubrication equipment	4 sets
AUX – 6/7	**For Inspecting Machine/Folding Machine**	
AUX – 6/7 – 1	U. type cloth carrier	16 pcs
6/7 – 2	Cloth carrier	9 pcs
6/7 – 3	Pallet truck	1 pce
AUX – 8	**Maintenance Tools**	
AUX – 8 – 1	Vice	2 pcs
8 – 2	Electric grinder	1 pce
8 – 3	Surface plate	1 pce
8 – 4	Hardness tester	1 pce
8 – 5	Miscellaneous tools	1 lot
AUX – 9	**Spare Parts of Main Production Machine for 3 years normal operation**	1 lot

Table 24 Flow Chart of Weaving Process

Main Production Machinery \ Cloth	Shirting (Dobby)	Shirting (Plain)	Suiting (Dobby)	Twill (2/1)
	Warp Weft	Warp Weft	Warp Weft	Warp Weft
(Spinning Department)				
W – 1 Direct Warper				
W – 2 Sizing Machine				
W – 3/4 Tying Machine/Reaching-in Machine				
W – 5 Rapier Loom				
W – 6 Inspecting Machine				
W – 7 Folding Machine				
(Processing Department)				



5-3-3 Dyeing and Finishing Process

1) Basic Design Conditions and Specifications for Dyeing and Finishing Machinery

The production machinery shall be designed on the basis of producing and controlling high quality and value added products, and also taking into account of structures of easy maintenance.

In consideration of easy changing and handling of carriers and effective inspection of running cloth at exit of the machine, plaiting-down device of the processing machinery other than Singeing Machine shall be of carrier cloth receiving type. In addition, the cooling device shall be equipped to prevent folding crease of polyester/cotton blended cloth at the plaiting down position.

a) Receiving and Jointing of Grey Cloth

Grey cloth produced in Weaving process shall be carried into the processing mill by the folklift or handpallet in the form of folded shape on pallets.

Then, the cloth shall be stored or immediately sewed and jointed by the overlock stitch sewing machine according to the production programme.

b) Singeing and Desizing Machine

The singeing machine, the first machine in dyeing and finishing process shall have the function of burning fluffs on cloth.

The lustre, colour evenness and texture are affected by the results of singeing. Therefore, in order to achieve assumed aims and effects of singeing, brushing device shall be installed at the inlet of the machine, and jet gas burner system for getting even gas singeing frame and two staged burner for singeing both sides of cloth shall be employed as well.

For cotton and synthetic blended fabrics, cooling roller shall be adopted which enables both surface and penetration burning.

Since this machine utilize the gas combustion frame, careful attention shall be made to safety devices.

The machine shall also have devices for washing cloth by hot water after singeing and for impregnating desizing chemicals in the saturator.

The cloth, after singing shall be washed by hot water and then impregnated by desizing chemicals in the saturater.

The cloth, following impregnation of desizing chemicals, shall be squeezed and then wound up by batching-up device into the maximum diameter of 1500 mm.

The wounded batch shall then be wrapped and shut tightly and left for 3 to 6 hours under the condition of slow speed rotation. During this period, desizing reaction shall proceed. The cloth shall then be carried to the next process, that is washing, scouring and bleaching processes.

c) Scouring and Bleaching Range

The superiority or inferiority of this process gives a great influence on the quality of goods, hence the machine shall be selected among those of new types with open width as well as continuous operation system.

The reaction device, the main part of the machine shall be so designed as to get sufficient time of reaction (60 ~ 90 min. in case 120 g/m^2 cloth with 4000 m capacity). Hydro Peroxide (H_2O_2) method shall be adopted for the scouring and bleaching processes instead of Sodium Chlorite ($NaClO_2$) method by reason of obtaining whiter cloth and better texture as well as less polution and easier maintenance. This method shall be of, so called one stage, one impregnation system.

d) Mercerizing Range

In order to meet the requirements of dimension set and silky finishing and from the view point of easy operation and maintenace, the machine of chain type (Clip type) shall be selected.

And dry-mercerizing system shall be employed to attain easy control of caustic soda concentration which is very important factor in this process. Further cooling device and circulating device for the control of caustic soda temperature which is also important shall be installed.

Caustic soda is an imported article in Nepal, although its price (0.3 US$/kg) is not so high. However, this chemical is one of the heavy chemical stuffs and in consideration of pollution at the time of discharging, caustic soda recovery device shall have to be installed. And it shall be placed outdoor near the machine.

Impregnation of caustic soda shall be of 10 tons, 3 bowls mangle – one stage method in view of the characteristic of polyester, cotton blended fabrics.

e) Heat Setter

This machine shall be installed as the pre-setter in order to improve the quality and value of width setting, texture and optical whiteness for bleaching finished goods.

In addition, L.P. Gas direct burning system shall be employed for easy operation and maintenance.

The timing of cloth shall be between 15 and 20 minutes.

f) Pad Hot Air Dryer

Padder shall be of combination type with pneumatic and oil pressures so that even dark colour dyeing to be fulfilled.

Infra-red pre-dryer shall be installed at the outlet of padder in order to obtain high quality dyeing products free from stain and migration of dye stuffs.

The Dryer shall be of steam hot air circulation type in consideration of producing non-crease cloth and making easy cleaning of guide rollers.

(Method of Dyeing)

Dyeing for light or medium colour shall be done by the One Beck method, using Disperse + Reactive dyestuffs or Disperse + Vat dyestuffs. Dark colour shall be done by Two Beck, – one beck of Disperse dyestuff plus one beck of Reactive or Vat dyestuff.

g) Thermosol Machine

Polyester part in blended fabrics shall be dyed by Disperse dyestuffs and its colour fixing shall be done continuously by this machine through thermosol fixing method.

This machine shall also be utilized for colour fixing of Disperese + Reactive

dyestuffs for light or medium colour dyeing. As a heat source, L. P. Gas burning system, in view of easy operation, safety and uniform temperature shall be adopted.

h) Pad Steamer

Cotton part in blended fabrics shall be dyed by Reactive or Vat dyestuffs and its colour fixing shall be done by this machine contiunously. Namely, such series of processes as padding of reduction stuffs and agents – steaming – curing – oxidization – soaping – washing and drying are carried out continuously.

i) Finishing Stenter

This machine shall be designed as pre-drying machine in resin finishing process and shall have the capability of adding values such as wash-and-wear ability, non-shrinking, dimension set and texuture adjustment.

Although heat source shall be steam energy, parts and elements of the machine, including pin-clips shall be of the same type with the Heat Setter, which allows interchangeability.

j) Baking Machine

This machine's function shall be heat curing in resin finishing process. The curing time shall be 2 ~ 3 minutes and non-crease on fabrics shall also be taken into account in designing.

The same heat source and machine mechanism with thermosol machine shall be adopted in view of interchangeability.

k) Inspection Machine

All finished products shall be inspected by this machine. It is widely understood that woman operators are more suitable for this work.

The number of machines shall be calculated on the 2 shifts basis without mid-night work, taking into account of the Nepali labour regulations.

The cloth shall be conveyed by the carrier to the machine and then inspected by means of reflection and see-through light of the fluoressent lamps.

l) Doubling and Lapping Machine

As the same as the Inspecting machine, this machine shall be designed on the basis of woman operators with 2 shifts a day. This machine shall have the capability of making up required lapping style which is widely applied in Nepal.

m) Winding Machine

This machine shall also be designed on the same basis of the above. Although almost imported fabrics are winded on paper tubes, domestic products are normally lapped and sold at retailers in the shape of double folded and lapping.

However, there have been potential demands of tube winding in garment industries, thus this machine shall be needed.

2) Calculation Table and Machine List

The required number of the production machinery shall be calculated on the basis of machine efficiencies against assumed production and machine efficiencies shall be decided taking into account of various factors.

Such factors shall be set up at the proper level respectively by means of judging comprehensively the skill level of operators, assumed product quality, experiences of workers, quality of raw materials, etc.

Calculation of production machinery for each dyeing and finishing processes has been set up at rather high quality level in consideration of supply-demand trend of markets as well as the internationalization from now on.

Table 25 gives calculation results of production machinery for dyeing and finishing processes and Table 26 shows list of such machinery.

3) List of Auxiliary Equipment and Accessories

The list of auxiliary equipment and accessories necessary for operating the production machinery is shown in Table 27.

4) Flow chart of Dyeing and Finishing Process

Flow chart from grey cloth produced in weaving to final products is as per Table 28.

Table 25 Calculation Table for Dyeing and Finishing Process

No.	Machinery	Fibre/Fabric	Delivery Speed m/min.	100% Production per Machine m/Hr.	Effi-ciency %	Actual Production per Machine	Shift	Required Production m/Hr.	Calculated No. of Machine	Total No. of Machine	Proposed No. of Machine
P–1	Gas Singeing/Desizing	P/C. Shirting	90	5,400	80	4,320	1	2,024	0.47		
		P/C. Suiting	80	4,800	80	3,840	1	1,014	0.26	0.97	1
		P/C. Twill	80	4,800	80	3,840	1	924	0.24		
P–2	Scouring/Bleaching Range	P/C. Shirting	50	3,000	80	2,400	2	1,012	0.42		
		P/C. Suiting	40	2,400	80	1,920	2	507	0.26	0.92	1
		P/C. Twill	40	2,400	80	1,920	2	462	0.24		
P–3	Mercerizing Range	P/C. Shirting	50	3,000	80	2,400	2	1,012	0.42		
		P/C. Suiting	40	2,400	80	1,920	2	507	0.26	0.92	1
		P/C. Twill	40	2,400	80	1,920	2	462	0.24		
P–4	Heat Setter	P/C. Shirting	50	3,000	70	2,100	3	607	0.29		
	· Setting (90%)	P/C. Suiting	40	2,400	70	1,680	3	304	0.18		
		P/C. Twill	40	2,400	70	1,680	3	277	0.17	0.77	1
	· Whitening & Setting (10 %)	for Bleaching	25	1,500	70	1,050	3	141	0.13		
P–5	Pad Hot Air Dryer	P/C. Shirting	60	3,600	60	2,160	3	425	0.20		
	· Light, Medium Colour	P/C. Suiting	50	3,000	60	1,800	3	213	0.12		
	(each 70% dyeing cloth)	P/C. Twill	50	3,000	60	1,800	3	194	0.11	0.79	1
	· Dark Colour	P/C. Shirting	60	3,600	60	2,160	3	182 X 2	0.17		
	(each 30% dyeing cloth)	P/C. Suiting	50	3,000	60	1,800	3	91 X 2	0.10		
		P/C. Twill	50	3,000	60	1,800	3	83 X 2	0.09		
P–6	Thermosol Machine	for Dyeing	40	1,800	75	1,350	3	1,188	0.88	0.88	1

No.	Machinery	Fibre/Fabric	Delivery Speed m/min.	100 % Production per Machine m/Hr.	Effi-ciency %	Actual Production per Machine	Shift	Required Production m/Hr.	Calculated No. of Machine	Total No. of Machine	Proposed No. of Machine
P–7	Pad Steamer	P/C. Shirting	60	3,600	70	2,520	3	425	0.17		
	. Light, Medium Colour	P/C. Suiting	50	3,000	70	2,100	3	213	0.10		
	(each 70% dyeing cloth)	P/C. Twill	50	3,000	70	2,100	3	194	0.09	0.67	1
	· Dark Colour	P/C. Shirting	60	3,600	70	2,520	3	182 X 2	0.14		
	(each 30% dyeing cloth)	P/C. Suiting	50	3,000	70	2,100	3	91 X 2	0.09		
		P/C. Twill	50	3,000	70	2,100	3	83 X 2	0.08		
P–8	Finishing Stenter	P/C. Shirting	50	3,000	75	2,250	2	1,102	0.45		
		P/C. Suiting	40	2,400	75	1,800	2	507	0.28	0.99	1
		P/C. Twill	40	2,400	75	1,800	2	462	0.26		
P–9	Baking Machine	P/C. Shirting	35	2,100	80	1,680	3	675	0.40		
		P/C. Suiting	30	1,800	80	1,440	3	338	0.24	0.90	1
		P/C. Twill	25	1,500	80	1,200	3	308	0.26		
P–10	Inspecting Machine	for all cloth	30	1,800	50	900	2	2,113	2.35	2.35	3
P–11	Doubling/Lapping Machine	P/C. Shirting	60	3,600	40	1,440	2	1,079	0.75		
		P/C. Suiting	50	3,000	40	1,200	2	541	0.45	1.61	2
		P/C. Twill	50	3,000	40	1,200	2	493	0.41		
P–12	Winding Machine (50% of all cloth alterna-tely)		50	3,000	40	1,200	2	1,056	0.88	0.88	1

Table 26 List of Main Production Machinery (Processing)

Item No.	Machine/Equipment		Quantity
P – 1	Gas Singeing & Desizing Machine		1 set
	1) Type		
	Jet type 2-burner gas singeing machine		
	2) Width & speed		
	a) Roller width	1,800 mm	
	b) Machine speed	Max. 100 m/min.	
	c) Normal operation speed	80 ~ 90 m/min.	
	3) Construction		
	a) Cloth entering device	1 set	
	b) Front brushing unit	1 set	
	c) Gas singeing chamber	1 set	
	d) Washing machine with 5-ton 3-bowl mangle	1 set	
	e) Washing machine with 2-ton 2-bowl mangle	1 set	
	f) Cloth delivery device	1 set	
	g) Driving & controlling arrangement	1 set	
P – 2	Scouring & Bleaching Range		1 set
	1) Type		
	1-stage, "Round-piler type" reaction chamber range		
	2) Width & Speed		
	a) Roller width	1,800 mm	
	b) Machine speed	Max. 80 m/min.	
	c) Normal operation speed	40 ~ 50 m/min.	
	3) Construction		
	a) Cloth entering device	1 set	
	b) Washing machine with 2-ton 2-bowl mangle	2 sets	
	c) Washing machine with 5-ton 3-bowl mangle	1 set	
	d) Open saturator with 2-ton 2-bowl mangle	1 set	
	e) "Round-piler type" reaction chamber	1 set	
	f) Delivery washing machine with 3-ton 2-bowl mangle	1 set	
	f) Washing machine with 1-ton 2-bowl mangle	3 set	
	g) Washing machine with 1-ton 3-bowl mangle	1 set	
	h) Washing machime with 5-ton 3-bowl mangle	1 set	
	i) 20-cylinder vertical dryer (including 2-cooling cylinder)	1 set	
	j) Cloth delivery device	1 set	
	k) Driving & controlling arrangement	1 set	

Item No.	Machine/Equipment	Quantity
P – 3	Mercerizing Range	1 set

1) Type

Clip type mercerizing range

2) Width & speed

a) Roller width . . . . . 1,800 mm

b) Machine speed . . . . . Max. 80 m/min.

c) Normal operation speed . . . . . 40 ~ 50 m/min.

3) Construction

a)	Cloth entering device	1 set
b)	3-bowl pneumatic mangle with caustic soda impregnator	1 set
c)	Tension cylinder unit	1 set
d)	12 M. (40 ft.) long clip type mercerizing stenter	1 set
e)	2-bowl delivery feeding mangle	1 set
f)	Caustic soda removing cistern with 3-ton 2-bowl mangle	1 set
g)	Washing machine with 1 ton 2-bowl mangle (open type)	3 set
h)	Washing machine with 2-ton 2-bowl mangle	2 sets
i)	Washing machime with 5-ton 3-bowl mangle	1 set
j)	20-cylinder vertical dryer (including 2-cooling cylinder)	1 set
k)	Cloth delivery device	1 set
l)	Driving & controlling arrangement	1 set

P – 4	Heat Setter	1 set

1) Type

18 M. (60 ft.) long pin type, gas burning system heat-setting machine

2) Width & speed

a) Roller width . . . . . 1,800 mm

b) Machine speed . . . . . Max. 80 m/min.

c) Normal operation speed . . . . . 25 ~ 50 m/min.

3) Construction

a)	Cloth entering device	1 set
b)	2-bowl pneumatic padder	1 set
c)	6-cylinder vertical dryer	1 set
d)	Cloth connecting arrangement	1 set
e)	18 M. (60 ft.) long pin type Gas burning system heat setting chamber (chamber : 3 M. long X 4 sections) Auto-temperature controller (Max. 220 °C)	1 set
f)	Cloth delivery device	1 set
g)	Driving & controlling arrangement	1 set

Item No.	Machine/Equipment	Quantity
P – 5	Pad Hot Air Dryer	1 set

1) Type

Padding mangle, infra-red pre-dryer and unit type hot air dryer

2) Width & speed

a) Roller width ..... 1,800 mm

b) Machine speed ..... Max. 80 m/min.

c) Normal operation speed ..... 50 ~ 60 m/min.

3) Construction

a) Cloth entering device — 1 set

b) "V. C." mangle with dye solution beck — 1 set

c) Infra-red ray non-touch dryer — 1 set

d) Tensionless hot-air roller dryer, steam heating type (cloth content capacity' Approx. 60 M.) — 1 set

e) Cloth delivery device — 1 set

f) Driving & controlling arrangement — 1 set

P – 6	Thermosol Machine	1 set

1) Type

Gas burning system, heated air type baking machine

2) Width & speed

a) Roller width ..... 1,800 mm

b) Machine speed ..... Max. 60 m/min.

c) Normal operation speed ..... 30 m/min.

3) Construction

a) Cloth entering device — 1 set

b) Thermo-fixing chamber (cloth content capacity: Approx. 90 M.) — 1 set

Gas burning system with auto-temperature controller (Max. 220°C)

c) Cloth delivery device — 1 set

d) Driving & controlling arrangement — 1 set

P – 7	Pad Steamer	1 set

1) Type

Padding mangle, steamer, airing, washing and dryer

2) Width & speed

a) Roller width ..... 1,800 mm

b) Machine speed ..... Max. 80 m/min.

c) Normal operation speed ..... 50 ~ 60 m/min.

3) Construction

a) Cloth entering device — 1 set

Item No.	Machine/Equipment	Quantity

b) 3-ton 2-bowl inclined type-chemical padder 1 set

c) Developing steamer 1 set
(stainless steel SUS-316)
(cloth content capacity : Approx. 40 M.)

d) 2-bowl delivery feeding mangle 1 set

e) Airing arrangement 1 set
(cloth content capacity : Approx. 40 M.)

f) Washing machine with 2 ton 2-bowl mangel (open type) 1 set

g) Oxidation machine with 2-ton 2-bowl mangle 1 set

h) Washing machine with 2-ton 2-bowl mangle (open type) 2 sets

i) Washing machine with 2-ton 2-bowl mangle
(enclosed type) 3 sets

j) Washing machine with 5-ton 3-bowl mangle
(enclosed type) 1 set

k) 20-cylinder vertical dryer (including 2-cooling cylinder) 1 set

l) Cloth delivery device 1 set

m) Driving & controlling arrangement 1 set

P – 8 Finishing Stenter 1 set

1) Type

18 M. (60 ft.) long pin type, steam heating resin finishing range

2) Width & speed

a) Roller width . . . . . 1,800 mm

b) Machine speed . . . . . Max. 80 m/min.

c) Normal operation speed . . . . . 40 ~ 50 m/min.

3) Construction

a) Cloth entering device 1 set

b) 2-bowl pneumatic padder 1 set

c) 6-cylinder vertical dryer 1 set

d) Cloth connecting arrangement 1 set

e) 18 M. (60 ft.) long pin type, steam heating hot-stenter 1 set
(chamber : 3 M. long X 4 sections)
Auto-temperature controller (Max. 130°C)

f) Cloth delivery device 1 set

g) Driving & controlling arrangement 1 set

P – 9 Baking Machine 1 set

1) Type

Gas burning system, heated air type baking machine

2) Width & speed

a) Roller width . . . . . 1,800 mm

Item No.	Machine/Equipment	Quantity
	b) Machine speed . . . . . Max. 60 m/min.	
	c) Normal operation speed . . . . . 25 ~ 30 m/min.	
	3) Consturction	
	a) Cloth entering device 1 set	
	b) Baking chamber 1 set	
	(cloth content capacity: Approx. 90 M.)	
	Gas burning system with auto-temperature controller (Max. 220°C)	
	c) Cloth delivery device 1 set	
	d) Driving & controlling arrangement 1 set	
P – 10	Inspecting Machine	3 sets
	1) Type	
	Fluorescent lamp-cloth inspecting machine	
	2) Width & speed	
	a) Roller width . . . . . 1,800 mm	
	b) Machine speed . . . . . Max. 36 m/min.	
	c) Normal operation speed . . . . . 30 m/min.	
	3) Construction	
	a) Cloth entering device 1 set	
	b) Inspection board 1 set	
	c) See-through device 1 set	
	(fluorescent lamp 40 W X 1 line)	
	d) Cloth length measuring device 1 set	
	(integrated counter. 6-digit scale 0.1 m indication)	
	e) Cloth delivery device 1 set	
	f) *Operation system : reversible magnetic switch* 1 set	
	g) Driving & controlling arrangement 1 set	
P – 11	Doubling & Lapping Machine	2 sets
	1) Type	
	Cloth doubling and lapping machine	
	2) Width & speed	
	a) Roller width . . . . . 1,800 mm	
	b) Machine speed . . . . . Max. 100 m/min.	
	c) Normal operation speed . . . . . 40 ~ 50 m/min.	
	d) Lapping diameter . . . . . Max. 400 mm	
	3) Construction	
	a) Cloth entering device with cloth guider 1 set	
	b) Cloth take-in device with feed and draw roller 1 set	
	c) Doubling device 1 set	

Item No.	Machine/Equipment	Quantity
	d) Cloth selvage arrangement — 1 set	
	e) Lapping device with tightness adjustement — 1 set	
	f) Auto-stop motion by cutting mark detector — 1 set	
	g) Operation system : Forward and stop motion — 1 set	
	h) Driving & controlling arrangement — 1 set	
P – 12	Winding Machine	1 set
	1) Type	
	Indirect surface winding machine	
	2) Width & speed	
	a) *Roller width* . . . . . 1,800 *mm*	
	b) Machine speed . . . . . Max. 150 m/min.	
	c) Normal operation speed . . . . . 50 m/min.	
	d) *Winding diameter* . . . . . Max. *300 mm*	
	3) Construction	
	a) Cloth entering device with cloth guider — 1 set	
	b) Winding tension adjustment device — 1 set	
	c) Auto-stop motion by cutting mark detector — 1 set	
	d) Paper tube supply device — 1 set	
	e) Driving & controlling arrangement — 1 set	

Table 27 List of Auxiliary Equipment and Accessries

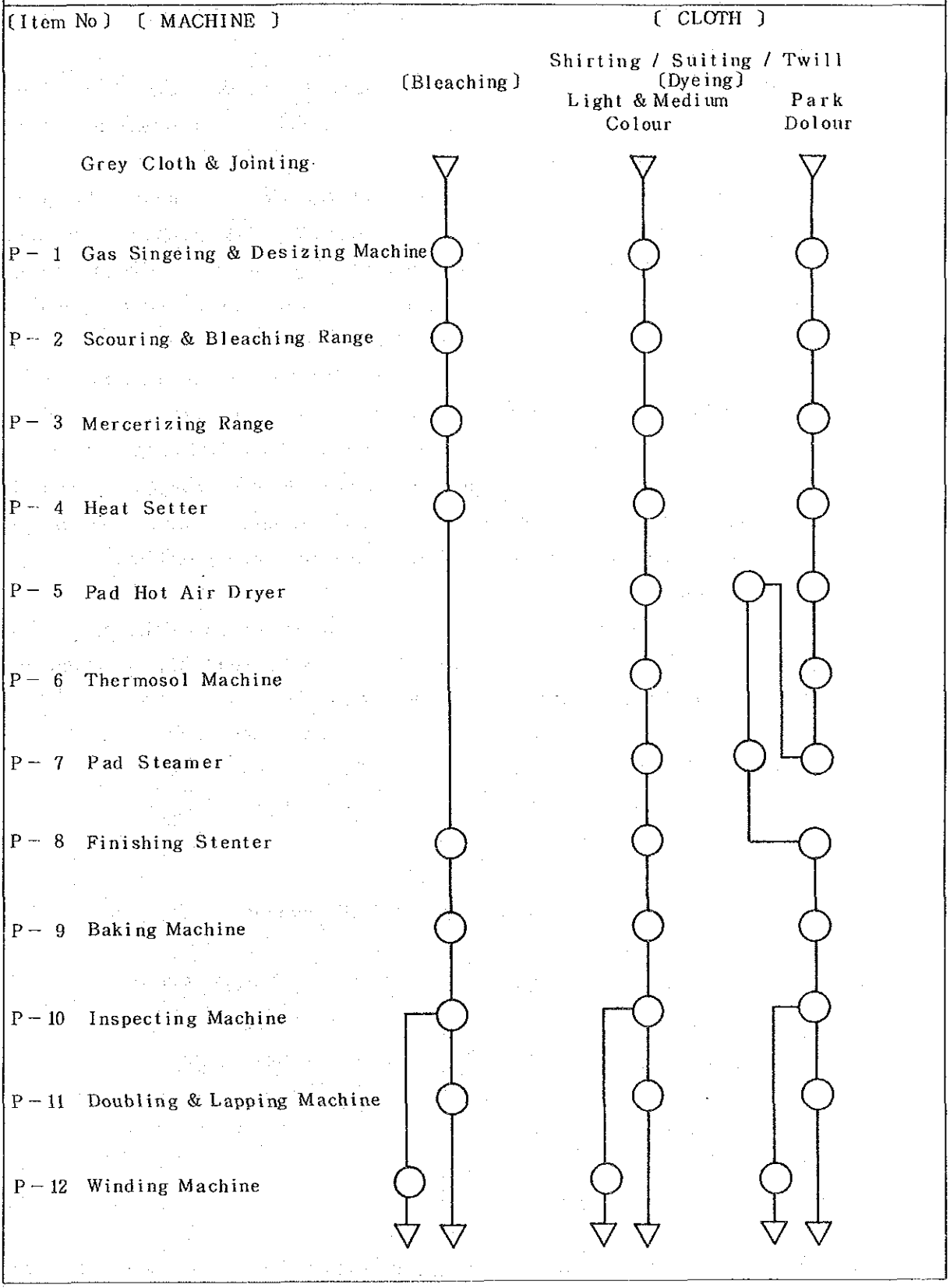
(Processing)

Item No.	Equipment/Accessories	Quantity
AUX – 1	**For Gas Singeing & Desizing Machine**	
AUX – 1 – 1	Dust Collector	1 set
1 – 2	Batching-up carrier with self-rotating device	5 sets
1 – 3	Chemical feeding arrangement	1 set
1 – 4	Secondary electric wiring material	1 set
AUX – 2	**For Scouring & Bleaching Range**	
AUX - 2 – 1	Chemical feeding arrangement	1 set
2 – 2	Secondary electric wiring material	1 set
AUX – 3	**For Merceriziang Range**	
AUX – 3 – 1	Caustic soda recovery equipment	1 set
3 – 2	Caustic soda cooling arrangement	1 set
3 – 3	Secondary electric wiring material	1 set
3 – 4	Cooling tower for refrigerator	1 set
3 – 5	Caustic soda dissolving device	1 set
AUX – 4	**For Heat Setter**	
AUX – 4 – 1	Chemical feeding arrangement	1 set
4 – 2	Secondary electric wiring material	1 set
AUX – 5	**For Pad Hot Air Dryer**	
AUX - 5 – 1	Chemical feeding arrangement	1 set
5 – 2	Secondary electric wiring material	1 set
AUX – 6	**For Thermosol Machine**	
AUX – 6 – 1	Secondary electric wiring material	1 set
AUX – 7	**For Pad Steamer**	
AUX – 7 – 1	Chemical feeding arrangement	1 set
7 – 2	Secondary electric wiring material	1 set
AUX – 8	**For Finishing Stenter**	
AUX – 8 – 1	Chemical feeding arrangement	1 set
8 – 2	Secondary electric wiring material	1 set

Item No.	Equipment/Accessories	Quantity
AUX – 9	**For Baking Machine**	
AUX – 9 – 1	Secondary electric wiring material	1 set
AUX – 10	**Auxiliary Equipment/Parts for Production Process**	
AUX – 10 – 1	Banding machine	1 set
10 – 2	Overlock sewing machine	6 set
10 – 3	Chain stitch sewing machine	3 sets
10 – 4	Fork lift truck 5 ton	1 set
10 – 5	Hand pallet truck 1 ton 42" L fork	4 sets
10 – 6	Cloth carrier 1,650 W X 1,090 ℓ	100 sets
10 – 7	L-type carrier 600 W X 900 ℓ	5 sets
10 – 8	Heavy duty carrier L-type	2 sets
10 – 9	Maintenance carrier	2 sets
10 – 10	Cloth pallet (wood)	–
10 – 11	Rubber glove	20 sets
10 – 12	Rubber boot (small, medium, large)	50 sets
10 – 13	Protect goggle	10 sets
10 – 14	Safety glass	10 sets
10 – 15	Plastic hose for clean up 25 mmϕ, 20 mmϕ	100 m
10 – 16	Stop valve 15A, 20A, 25A	60 pcs
10 – 17	Sewing thread 5,000 m/cone	80 cones
10 – 18	Scissors for thread & cloth cut	40 sets
10 – 19	Lead tape cotton 50 mm X 60 M/roll	20 rolls
10 – 20	Length counter	2 sets
10 – 21	Erection & Maintenance tool & equipment	1 lot
AUX – 11	**Auxiliary Equipment/Parts for Laboratory**	
AUX – 11 – 1	Pneumatic test heavy padder	1 set
11 – 2	Baking testing oven	1 set
11 – 3	Hot air drying oven	1 set
11 – 4	Electric water bath	1 set
11 – 5	Cylinder dryer & test steamer	1 set
11 – 6	Xenon fade tester	1 set
11 – 7	Launder tester	1 set
11 – 8	Dyed fabrics rubbing tester	1 set
11 – 9	Schopper textile strength tester	1 set
11 – 10	Elemendorf's tearing tester	1 set
11 – 11	Scorch tester	1 set
11 – 12	Anemomaster	1 set

Item No.		Equipment/Accessories	Quantity
AUX –	11 – 13	PH-meter	1 set
	11 – 14	Hydrometer	1 lot
	11 – 15	Densimeter	1 lot
	11 – 16	Tachometer	2 sets
	11 – 17	Homo mixer	2 sets
	11 – 18	Hardness tester	1 set
	11 – 19	Electronic digital balancer	2 sets
	11 – 20	Glass beaker, flask, pipette, burette, cylinder etc.	1 lot
	11 – 21	Thermometer	1 lot
	11 – 22	Plastic bottle, beaker etc.	1 lot
	11 – 23	Magnetic stirrer	2 sets
	11 – 24	Distiller	1 set
	11 – 25	Chemicals & indicater for laboratory	1 lot

Fig. 28 Flow Chart of Dyeing and Finishing Process



5-4 Utility and Auxiliary Equipment

5-4-1 Mechanical Equipment

1) Air-Conditioning

The Terai region where the proposed Site is located, has a weather characteristic of sub-tropical monsoon and the temperature is generally high with clear distinction of dry and wet seasons.

Under such external weather conditions, to install air-conditioning equipment is really important factor by reason of not only improving working conditions but also maintaining production of high quality goods with high process efficiencies. In particular, the mill, dealing with polyester, cotton blended yarns or fabrics in spinning or weaving processes requires special attention to the temperature-humidity control in terms of quality requirement and inside humidity shall always have to be controlled within the pre-determined temperature range.

Therefore, the Spinning and Weaving processes of the Mill are needed to be equipped with full and central type air-conditioning system. Although, dyeing and finishing process will not require any special air-conditioning, it will be necessary to look into the building structures in order to create good working conditions.

a) Design Conditions

Although the weather data arround the Site have not been available, the external weather conditions for designing air-conditioning equipment shall be set out as follows with reference to clause 4-2-3 in Chapter 4.

	Dry Bulb D. B. (°C)	Wet Bulb W. B. (°C)	Relative Humidity (%)	Max. Min. Temperature (°C)
At High Level	38 °C	28 °C	47 %	42 °C
At Low Level	8 °C	–	–	3 °C

Design conditions for operation shall be set out as hereunder.

		Aimed Dry Buld D. B. (°C)	Aimed Relative Humidity (%)
Spinning :	Blow Room	28 ~ 30	65 ± 2
	Carding to Roving	28 ~ 30	55 ± 2
	Spinning	22 ~ 30	55 ± 2
	Winding	22 ~ 35	60 ± 3
Weaving :	Preparation	20 ~ 32	55 ± 3
	Weaving	20 ~ 34	80 ± 3

When outside temperature is higher, the heat enters into rooms through walls or

roofs and this will raise room temperature higher. Since the heat penetration through roofs accounts for the most of the heat loads, the roofing material shall be selected among those of high heat insulating materials (i.e. less total heat transmission coefficient).

The air-conditioning system of the Mill shall be designed on the assumption that total heat transmission coefficients for roofs and walls are less than 0.8 kcal/m² h°C and 2.0 kcal/m² h°C respectively.

b) Air-Conditioning Equipment for Spinning Process

The refrigerator shall be installed, because enthalpy of external air is less than that of internal air under the aimed design conditions during hot season.

The return air or occasionally the mixed air of return air and outside air shall be cooled at the air washer of air-conditioning equipment by means of spraying chilled water produced by the refrigerator.

The cooled air shall be transfered to the room by the Supply fan through supply ducts. The air in the Mill shall then be conveyed back to the air-washer by the Return Fan through filters on the internal walls.

The method of using underground ducts for return air has also been checked, however, it is not to be adopted this time due to its high construction cost as well as lengthy construction period.

Since the Blow Room and Winding processes require higher humidity than others, the humidity in such area shall be adjusted and accurately controlled by means of spraying water from direct humidifier.

For saving energy, inlet and outlet sizes of air-conditioning equipment shall be made larger which allows to maintain inside conditions properly without operating refrigerator, when outside temperature and humidity are not so high.

Taking into account of foregoing, layout of air-conditioning system for spinning process is shown on Fig. 1 (left side).

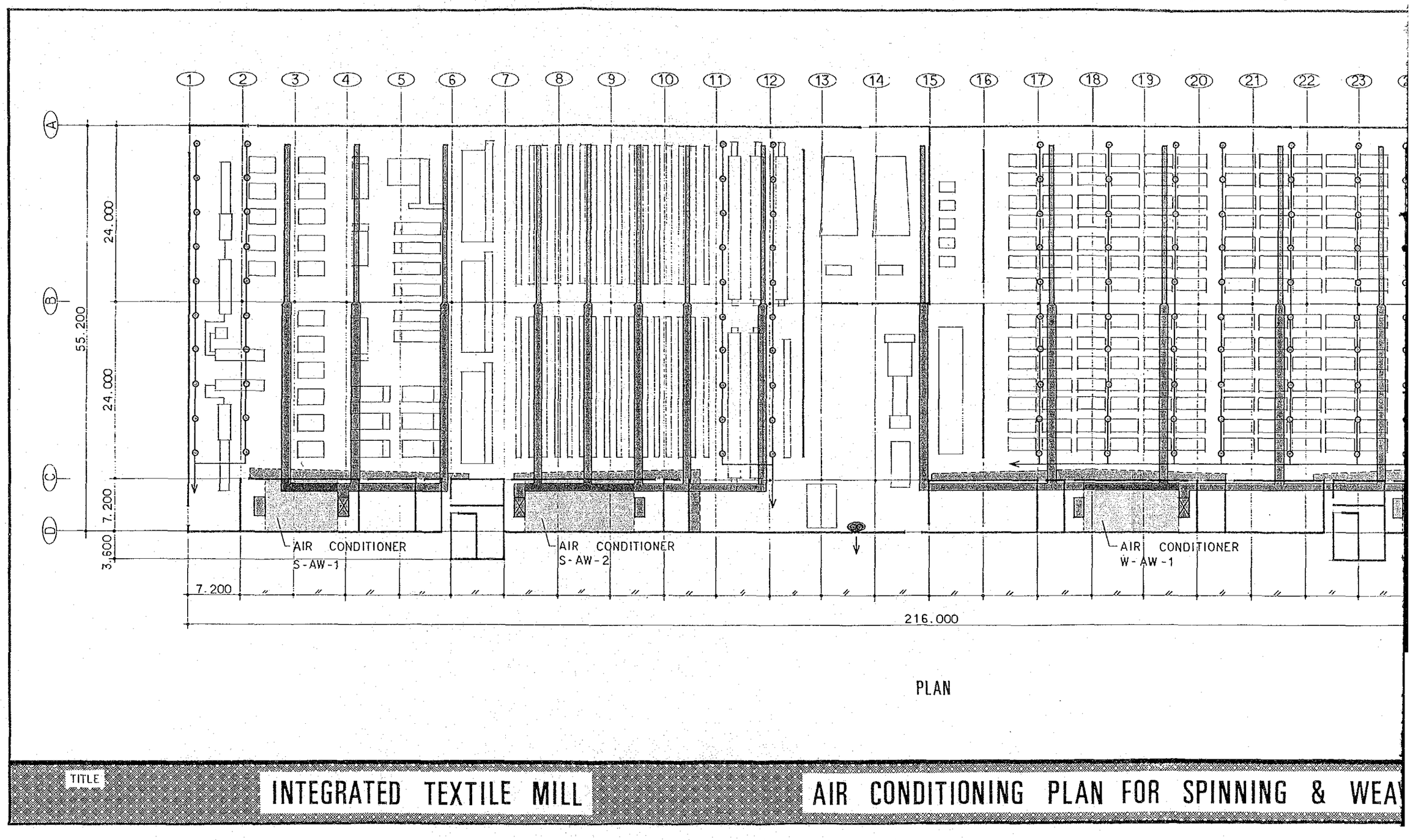
c) Air-Conditions Equipment for Weaving Process

Although this process require more humidity and thus adiabatic air-conditioning system to be employed, the structure of air-conditioning applied are basically corresponding to that of spinning process.

As the adiabatic system, utilizing normal water, (not chilled water from refrigerator) shall make cooling air through latent heat of vaporization of sprayed water, the room temparature becomes considerablly high, as this system is deeply influenced by the external climate conditions.

Since single humidification by this system requires a great deal of supply air, humidification by direct humidifier shall be futher applied for the sake of reducing equipment and maintenance cost.

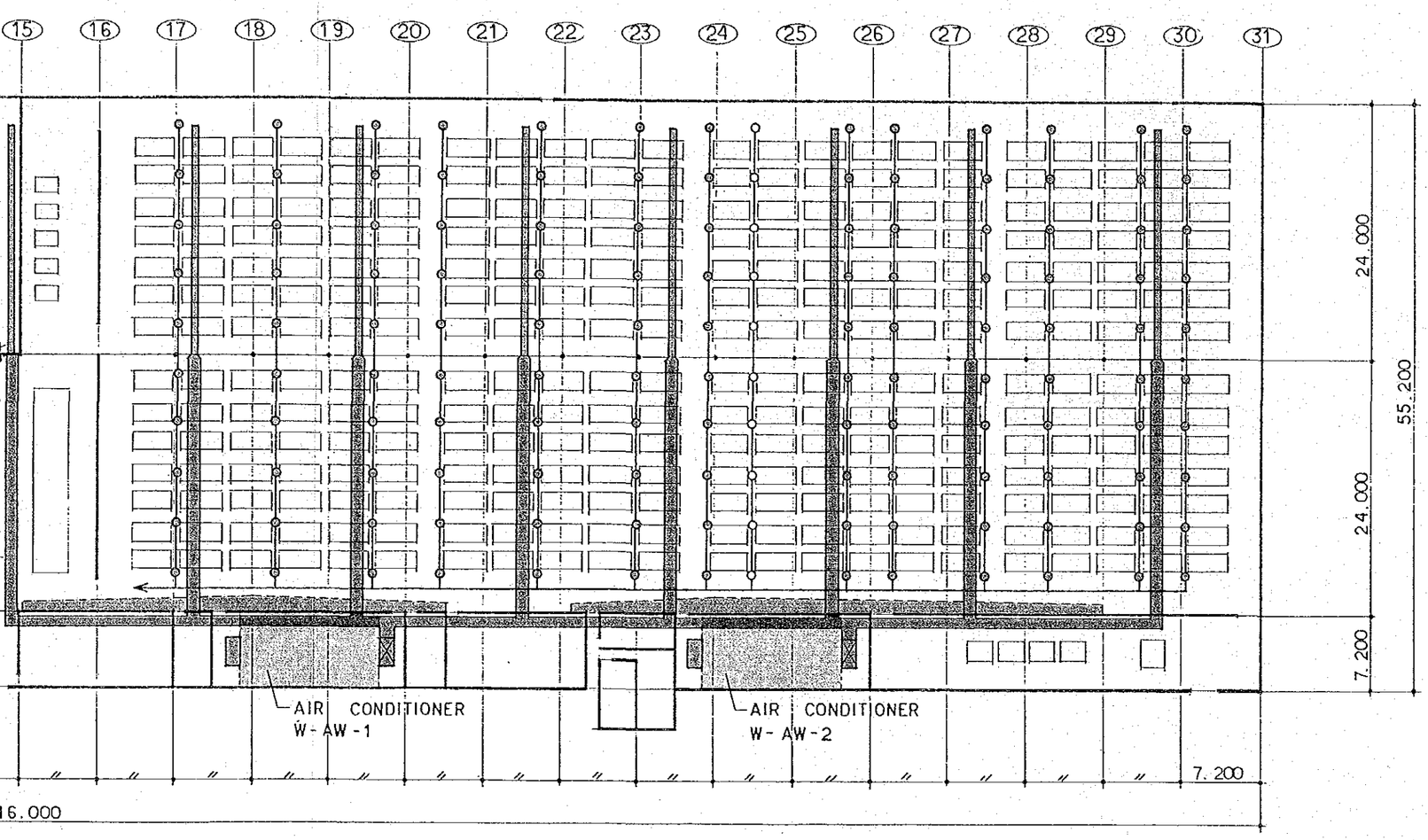
Fig. 1 Air Conditioning Plan for Spinning and Weaving Department



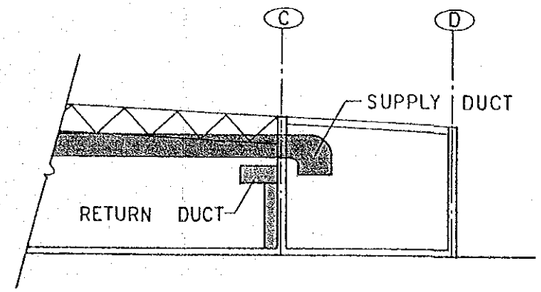
PLAN

TITLE INTEGRATED TEXTILE MILL AIR CONDITIONING PLAN FOR SPINNING & WEA

Fig. 1 Air Conditioning Plan for Spinning and Weaving Department



PLAN



SECTION

LEGEND:

- PIPE FOR DIRECT HUMIDIFIER
- SUPPLY DUCT
- RETURN DUCT (WITH FILTER)
- SUPPLY FAN
- RETURN FAN
- VENTILATION FAN

DITIONING PLAN FOR SPINNING & WEAVING DEPT.

DWG. NO. EX-166-U-02

From the viewpoints above mentioned, the air-conditioning system for weaving process is shown on Fig. 1 (right side)

d) Refrigerator

Chilled water less than 17°C shall be required for the purpose of cooling and dehumidifying the air at air-washer for Spinning process.

It is, of course unnecessary to install a refrigerator in the case that sufficient chilled water be obtained though wells or other means. However it seems to be very difficult to get such water at the site, hence the turbo type, moter driven refrigerator which permits easy operation shall be installed.

In addition, cooling tower shall be provided for the purpose of cooling water.

e) Other Equipment for Air-Conditioning

- The package type air-conditioner shall be installed in the laboratory of Spinning.
- The exhaust fan shall be installed at rooms where there are machines generating high temperature (Sizing room, etc.)
- The electric ceiling fan shall be fixed in the office generally and installation of small air-conditioner shall also be considered in offices for senior staffs.

2) Steam Generating Equipment

The machine shall be installed for the sake of supplying steams to steam setter in the spinning process, sizing machine in weaving process and dyeing and finishing machines, and shall be composed of boiler, water supply device, stack and heat recovery system for save energy. The assumed consumption of steam is shown in Table 29.

The comparison of ecconomical efficiency between coal fired borler and oil fired boiler was made and the results are as per Table 30.

From the Table 30, it is recommended to use oil fired boiler.

As to the oil price which is always an issue of oil fired boiler, it appears that there might be some increase in oil cost due to inflation but it would not be drastic one.

Since there is no special regulations or standards for the steam generating equipment in Nepal, those of exporting country shall apply.

It is assumed that peak consumption of steam to be 8.8 tons/hr (at 4 kg/cm^2 G). and it shall become 9.6 tons/hr based on the condions of equivlaent evaporation (100°C steam) with 70°C supply water temperature.

In view of the necessity of regular maintenace of the equipment, provision for accident as well as the excess use of one boiler's capacity, two boilers shall have to be installed.

The major specifications of the boiler are as follows.

- Boiler Capacity (100°C steam) : 10 tons/hr
- Max. Pressure : 10 kg/cm^2 G
- Operation Pressure : 8 kg/cm^2 G

Since heavy-oil is to be utilized as the fuel, the boiler shall be of fire tube type which has more heat capacity.

In addition, the size of the boiler to be installed is relatively small and this will make it possible to built package type one which allows to shorten the erection periods.

Table 29 Assumed Consumption of Steam

Process/Machines	Pressure ($kg/cm^2 \cdot G$)	Max. Consumption (kg/hr)	Mean Consurption (kg/hr)	Mean Consurption (kg/Day)
Spinning Process				
Steam Setter	6	40	40	960
Weaving Process				
Sizing Machine	5	1,200	1,000	24,000
High Pressure Coocker	4	520		
Processing Process				
Gas Singeing	4	125	75	600
Scouring/Bleaching Range	4	2,200	1,580	25,280
Merce rizing Range	4	1,300	910	14,560
Soda Recovery	4	600	360	5,760
Heat Setter	2	220	132	3,170
Pad Hot Air Dryer	4	1,600	835	20,040
Pad Steamer	4	1,500	810	19,440
Finishing Stenter	4	1,700	1,020	17,490
Total		11,005	6,762	131,300

Remarks

Peak Consumption = Mean Consumption X 1.3 = 6.762 ton X 1.3 = 8.8 ton/h

Simple filtered water is not adequate for boiler due to its high handness and thus water softened by the water softener shall be utilized. In addition, in order to avoid troubles of boiler such as scale problems, etc. PH and Methyl Orange Alkalinity shall be controlled through dozing and blowing.

The oil volume of 1 month consumption shall be considered as a stock, and heavy-oil tank of 300 m^3 capacity shall be installed near to the north gate.

Table 30 Comparison of Economical Efficiencies Between Coal and Oil Fired Boilers

– Preconditons

Assumed steam consumption : Max. 9 tons/hr

Mean 131 tons/day (6.5 ton/hr X 16 + 3.4 ton/hr X 8)

Two boilers to be installed in consideration of regular maintenance and breakdown of one of two.

– Comparison Table

Items		Oil Fired Builer	Coal Fired Boiler Type A	Coal Fired Boiler Type B
Operation Condition				
(1) Evaporation Quantity	(ton/day)	131	131	131
(2) Steam Pressure	(kg/cm^2)	8	8	8
(3) Temp. of Water to be supplied	($^\circ C$)	70	70	70
(4) Boiler Efficiency	(Avarage %)	87	83	73
(5) Fuel Caloric Value (kcal/kg)	High	10,500	5,600	5,600
	Low	9,780	4,770	4,770
(6) Annual Operation Day	(Day)	330	330	330
(7) Annual Fuel Consumption	(Ton)	3,014	6,477	7,360
(8) Power Consumption	(kW)	A	A + 70	A + 40
(9) Operator	(person)	B	B + 12	B + 12
Unit Price				
(10) Fuel	(RP/kg)	6.08	1.78	1.78
(11) Power	(RP/KWH)	0.97	0.97	0.97
(12) Labour Cost	(RY/Y)	9,000	9,000	9,000
Running Cost per Year				
(13) Fuel Cost	(1,000 RP)	18,325	11,529	13,110
(14) Power Cost	(1,000 RP)	C	C + 538	C + 307
(15) Labour Cost	(1,000 RP)	D	D + 108	D + 108
(16) Difference of Runing Cost	(1,000 RP)	–	6,150	4,800
Investment Cost				
(17) 2 Boilers	(1,000 RP)	9,167	42,428	30,642
(18) Erection Cost	(1,000 RP)	720	3,058	2,749
(19) Total Investment Cost	(1,000 RP)	9,887	45,486	33,391
(20) Difference of Investment Cost	(1,000 RP)	–	35,599	23,504
Pay Back Term *1 (Year)		–	5.79	4.90

*1 $\text{Pay Back Term} = \dfrac{\text{Difference of Investment Cost}}{\text{Difference of Running Cost}}$

– Conclusion

Pay Back Term shall become approx. five years as above. Even if one boiler system is selected, pay back term is still more than two years and this is fairly long. Further, boiler's maintenance and breakdown to be taken into account, hence two boiler system shall be recommended.

Fairly long pay back term is caused as a result that steam consumption is relatively small compared to the boiler capacity and that small capacity coal fired boiler is comparatively high in cost.

3) L. P. Gas Equipment

L. P. Gas shall be utilized for heating and singeing in dyeing and finishing processes as well as for the kitchen equipment in Canteen. Assumed L. P. Gas consumption is shown in Table 31.

Table 31 L. P. Gas Consumption

	Max. Consumption	Average Consumption
– Dyeing and Finishing	124 kg/hr	1,400 kg/day
– Kitchen Equipment	–	100 kg/day

Specifications of L. P. Gas equipment shall comply with the regulations or rules of exporting country of such equipment.

Two L. P. Gas storage tanks with the capacity of 15 tons each (20 days consumption in total) shall be installed in order to make regular inspection easily.

4) Compressed Air Generating Equipment

Two lines of compressed air generating equipment shall be equipped as follows.

a) A line for Auto-Winder (A-line)

This compressed air shall have the pressure of 7 kg/cm^2 and shall be used for knotting and instrument air for auto-winder.

This air shall be free from oil-mist and moisture.

The machine shall be equipped with 3 micron and 0.3 micron oil separaters for removing oil-mist.

The moisture shall be eliminated by after-cooler and refrigerator type air cooler through condencing activity.

b) A line for Miscellaneous purposes (B-line)

This line shall be for cleaning and miscellaneous purposes. The operating pressure shall be 3 ~ 6 kg/cm^2, and the pressure shall drop occasionally during cleaning, because it consumes plenty of air at a time. Hence this line shall only apply to the purpose which has no significance in pressure varience.

Cooling of air shall be made only by after-cooler.

The assumed consumption of compressed air is shown in Table 32.

Table 32 Assumed Consumption of Compressed Air

Process	A Line (Compressed Air for Auto-Winder)	B Line (Compressed Air for Miscellaneous Use)
Spinning	139 N m^3/hr	50 N m^3/hr
Weaving	5.5	50
Processing	24.5	40
Utility	6	40
TOTAL	175	180

Five compressors, all of the same oil type shall be installed, and two of them shall be used for A line and two for B line. The rest one shall be of stand-by purpose to be used for both lines.

5) Water Supply Equipment

Raw water for the Mill shall be supplied by the pumps at shallow wells to be constructed at the river bed of Arjun River, which is running approx. 200m east of the Site. The assumed consumption of water is shown on Table 33.

The water supply equipment shall be designed on the basis of quality data as per Clause 4-3-4 in Chapter 4.

Fig. 2 shows the flow sheet of water supply.

Turbidity elements contained in raw water shall be removed by the sand-filter. At the same time, impurity elements shall be condensed by adding a little alum.

The filtered water shall directly be supplied to where high quality water is not required.

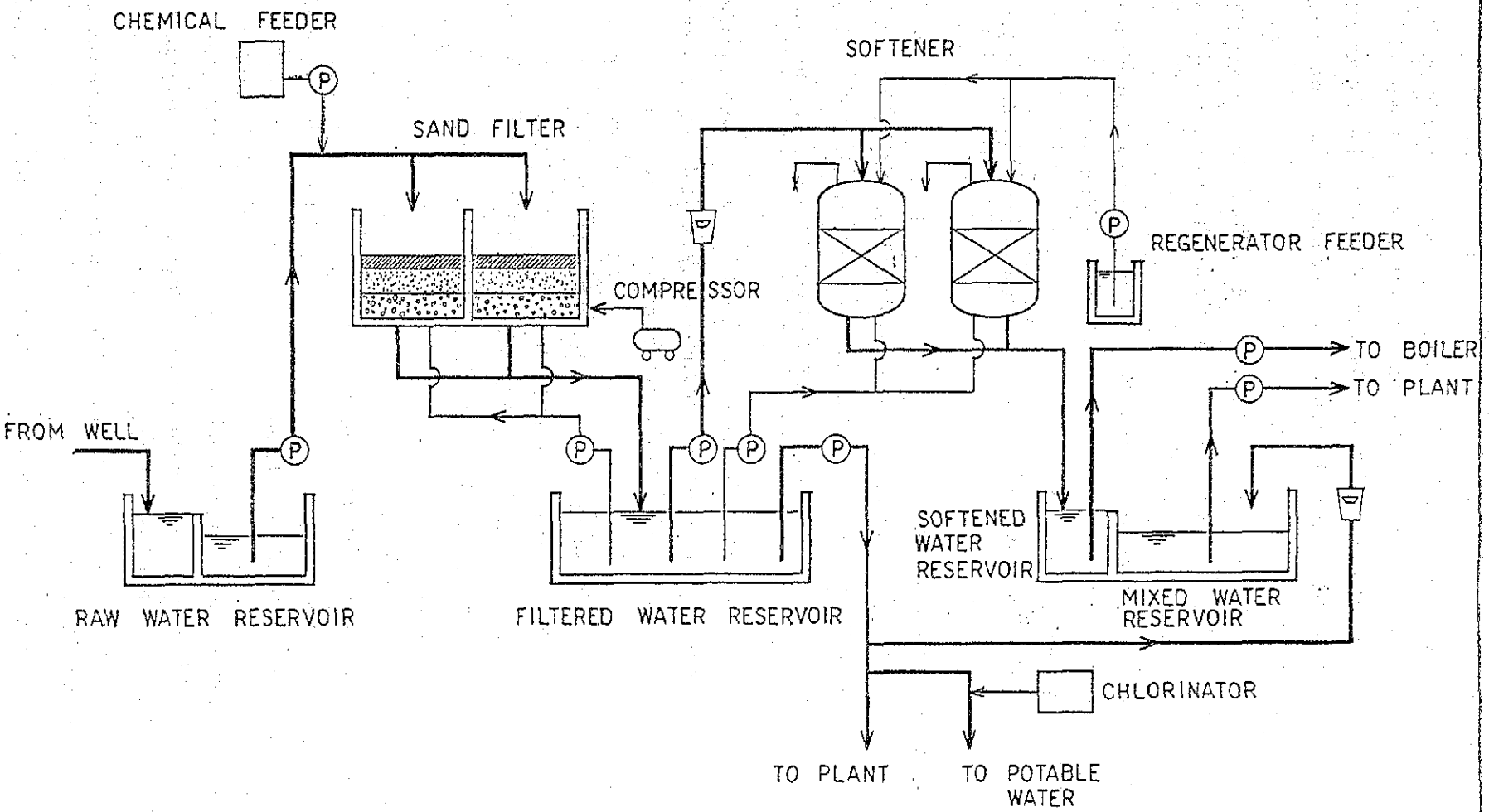
Filtered water shall be softened by water softener to the level of approx. 1 PPM hardness.

This softened water shall be used at Boiler. For air-conditioning and dyeing and finishing process, the mixture of softened water and filtered water in the 2 : 1 ratio shall have to be utilized.

Table 33 Assumed Consumption of Water

Process	Filtered Water		Softened Water	
	Maximum	Average	Maximum	Average
Spinning	0.5 m^3/hr	0.2 m^3/hr	1.8 m^3/hr	1.4 m^3/hr
Weaving	0.5	0.2	2.6	2.6
Processing	56	41.9	28	18.6
Processing Breakdown				
Pad Hot Dry	–	–	3	2.6
Pad Steamer	–	–	20	14
Dye Chemical	–	–	5	2
Final Setter	2	1		
Singeing	8	6.5		
Heat Setter	2	1		
Scouring/Bleaching	20	14.5		
Soda Recovery	6	5		
Mercerizing	16	12		
Miscellaneous	2	1.9		
Utility	12	10.5	18	12
Utility Breakdown				
Air Conditioner	7	7	8	7
Boiler			10	5
Air Compressor	3	3	–	
Miscellanous	2	0.5		
Admi Office House, Canteen	24	5		
Total	93	57.7	50.4	34.6

Fig. 2 Raw Water Treatment Process



6) Fire Fighting Equipment

It is indispensable to install fire fighting equipment in Spinning Process since this process utilize a lot of inflammable raw cotton. Although watering is the best measures for fire fighting of raw cotton, this will be applied as the last measure so as to avoid spoiling machines by watering. At any rate, in case a fire starts, prompt operation for fire fighting is really crucial.

As dry chemical fire extinguisher – specially effective for extinguishing general fire, oil fire and electric fire – is very effective for the initial fire fighting, this shall be installed at every 200 m^2.

For the purpose of large scale fire fighting, external hydrants shall be installed in the manner that overall buildings to be covered within the effective area of hydrant (50 m radius circle per each).

The drive manner of fire fighting pumps shall be of tandem type of mortor and diesel engine.

7) Maintenance Equipment

Infrastructures for industries such as maintenance workshop, etc. are not available around the Site, hence, the Mill shall have to be equipped with the minimum level of own workshop equipment and tools which allow to make smooth maintenance of the machines.

These equipment shall also be utilized in accordance with necessities during the construction periods that consequently will result in decrease of construction costs.

The major equipment to be installed are : –

- Working lathe
- Drilling Machine
- Welding Machine (DC and AC)
- Screw Machine
- Shearing Machine
- Grinder
- Electric Tools
- Electric Carpentry's Tools
- Hoist
- Car Maintenance Tools

8) Piping Equipment for Process Distribution

Distribution pipes for water supply, steam and drains, compressed air and L. P. Gas shall be installed.

Necessary insulation materials, valves, pressure controller, drainpipes, trap, etc. shall be inculded.

With a view to enabling easy maintenance and avoiding early corrosion of equipment, overhead piping shall be adopted basically instead of underground piping.

9) List of Utility Equipment

From the above, utility equipment is listed in Table 34.

Table 34 List of Utility Equipment

Item	Machine/Equipment	Quantity
U - 1	Air Conditioning Plant	
	1) Central type air-conditioner	4 Unit
	Total supply air valume : Approx. 7800 m^3 /min.	
	2) Direct humidifier	1 Lot
	Including air blower	
	3) Refrigerator and accessory	1 Lot
	340 RT, including cooling tower	
	4) Material for duct work and piping work	
U - 2	Boiler Plant	
	1) Oil fired, fire tube, packaged boiler	2 Unit
	Capacity ; 10,000 kg/hr steam	
	(from and at 100 °C)	
	Max. Working Pressure : 10 $kg/cm^2 \cdot G$	
	Accesory : feed water tank and pump	
	: oil servise tank and pump	
	: Stack (20 m height)	
	2) Heat recovery system	
	3) Oil strage tank	1 Unit
	300 m^3 with receiving pump and transfer pump	
U - 3	L. P. G. Strage Tank Equipment	
	1) Strage tank 15 ton	2 Units
	2) Vapourizer	1 Unit
	3) Receiving pump	1 Unit
	4) Valve and piping material	1 Unit
U - 4	Compressed Air Equipment	
	1) Oil lubrication type compressor	5 Units
	2.8 N m^3/min, 7 $kg/cm^2 \cdot G$	
	2) Receiving tank	2 Units
	3) After cooler	5 Units
	4) Air dryer	1 Unit

Item	Machine/Equipment	Quantity
U - 5	Raw Water Treatment Equipment	
	1) Material for sand filter	1 Lot
	2) Softener	
	Capacity 50 m^3/hr	2 Units
	3) Chlorinator	1 Unit
	4) Pump and piping maternals	1 Lot
U - 6	Raw Water Pump and Pump Plant	
	1) Deep well pump	2 Units
	1.5 m^3/min, 40 m Head	
	2) Pump for plant	3 Units
	1.5 m^3/min	
U - 7	Effluent Treatment	
	1) Aerator unit	3 Units
	2) PH control system	1 Unit
	3) Screen	1 Unit
	4) Pump and piping material	1 Lot
U - 8	Fire Eighting Equipment	
	1) Hydrant Pump	1 Unit
	Motor and diesel engine driving type	
	2) Outdoor type hydrant	19 Units
	3) Fire extinguisher	150 pcs
U - 9	Air Conditioner for Service Room	
	1) Pachage type air conditioner for Laboratory	1 Unit
	10 RT	
	2) Small size air conditioner	1 Lot
	3) Electric fan	1 Lot
U - 10	Piping Material for Steam, Water, LPG, Compressed Air Distribution	1 Lot
	1) Piping	
	2) Steal materials	
	3) Plastic piping	
	4) Insulation material	
U - 11	Iron Work Shop	
	1) Lathe	2 Units
	2) Welder	2 Units
	3) Electrical tool for maitenance and carpenter shop	1 Lot
	4) Maintenance equipment for car	1 Lot
	5) Hoist	1 Lot
	6) General tool	1 Lot

5-4-2 Electrical Equipment

1) General

The electrical equipment hereinafter described shall be such equipment as incoming and distribution lines, sub-station, lighting and plug socket facility, telephon facility and fire alarming equipment, etc. excluding electrical equipment attached to production machines or utility equipment as a part of machinery.

There are no particular standards for electrical equipment in Nepal, hence standards being used in the developed countries shall be applied in general.

However, for maintenance purpose, general items such as lighting fixtures, socket outlet etc. shall be selected among those which are commonly used in Nepal.

The consumption of power is estimated approx at 3,000 KW. The power is planned to be procured from the 33 KV feeder at Lamahi Suststation, a part of of 135 KV transmission lines between Butwal and Nepalgunj which is now under construction.

It is intended the alloted charge will be paid to NEA and exclusive line will be constructed by them from Lamahi substation to the Site.

Incoming power of 33 KV shall be received at the incoming station in Utility Center and then to be distributed to each substation, situated one in Spinning/ Weaving Building and one in Utility Center.

The voltage shall be dropped to 400 V at the substation and shall be transmitted to each distribution board in the production area.

The power source in the mill shall be therefore : –

– Motor circuit – 400 V, 3 phase, 4 wire system, 50 Hz
– Single – phase circuit – 230 V (lighting and socket)

In order to reduce demand charge, by means of maintaining power factor at 93 %, static condenser shall be installed at lower tension side.

For emergency purpose, diesel power generator of 200 KVA shall be installed, and it is intended that this generator be purchased from the Contractor who has used it during construction stage.

2) Incoming Station and Substation

a) Incoming Station

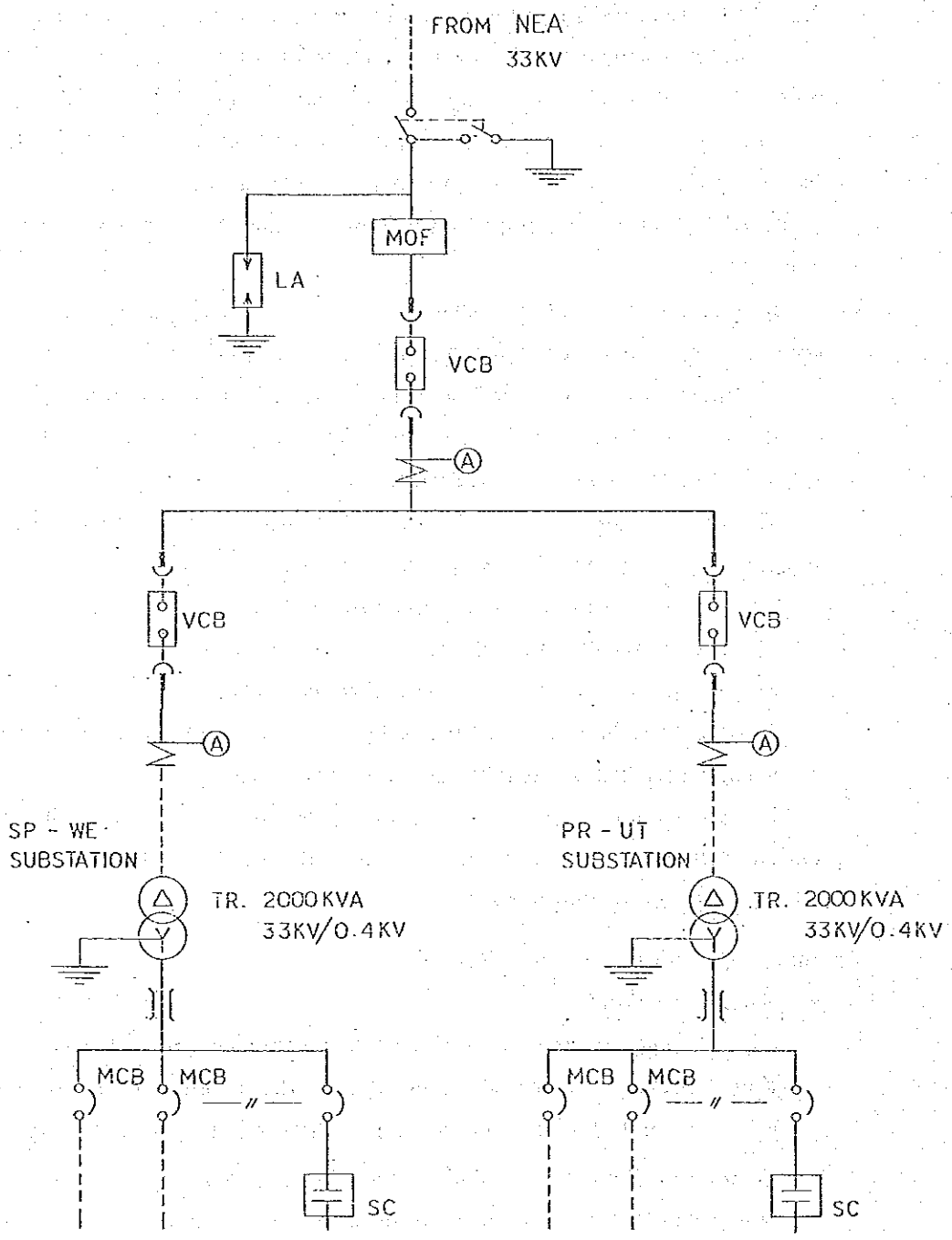
Incoming power shall be of 33 KV pressure, transmitted from Lamahi substation. Circuit breaker shall be installed at the incoming point so that the power accidents in the Mill shall not affect NEA's line. In accordance with NEA's instruction, the capacity of the circuit breaker shall be 500 MVA or more. NEA will provide the Mill with accounting service meter seytem.

Single Line Diagram for high tension lines including main low tension distri-

bution system at the substation is shown in Fig. 3.

Each branch to substation shall be equipped with circuit breaker for the sake of cutting power off when accident of feeder occurs.

Fig. 3 Single Line Diagram



Battery and its charger shall be installed in incoming station for the operation purpose of circuit breaker.

b) High Tension Cable

Between NEA's supply limit and incoming station, and between incoming station and primary side of each substation, high tension cubles of 33 KV, corrugated steel armored cable shall be used.

In case the cable is embedded in the ground, it shall be emplaced 1.2 m in depth and concrete pipe shall be used at road crossing for protection purpose.

c) Substation

Two numbers of substation shall be provided, one in the spinning/Weaving building and the other in the Utility Center as mentioned above. The power for processing shall be supplied directly from the Utility Center Substation.

Assumed power consumption at each substation is shown in Table 35.

The power from secondary side of the substation shall be transmitted to the low tension distribution board through overhead bus duct.

The power shall then be branched to each feeder by using moulded type breaker (MCB) in the distribution board.

Each substation shall be equipped with the condenser for the purpose of improving power factor, and feeder for condenser to be divided into 3 or 4 circuits for controlling manually.

3) Low Tension Distribution Line

The connecting wire from the distribution board in the substation to each electric panel of the machine, shall be of vinyle sheathed, copper cable.

Local distribution board shall be installed for branching purpose in the case that required size of wire to the panel is much smaller than that of main feeder.

The size of main feeder shall be less than 185 mm^2 and shall be installed on overhead cable rack.

The cable to the primary side of the panel shall be wired through embedded plastic conduit in the floor.

The secondary wiring and onward shall be carried out by the machine erectors, hence those are excluded from the work herein.

Table 35 Assumed Power Consumption

Process	Total Installed Capacity	Aculual Load for Machines	Actual Load for Lighting	For Refrigerator Air. Con.	Total Actual Loads
1. Spinning/Weaving					
Substation Total	2,262	1,330	160	410	1,900
– Spinning	1,410	760	90	240	1,090
– Weaving	852	570	70	170	810
2. Processing/Utility					
Substation Total	1,540	660	150	370	1,180
– Processing (Max)	570	360	70	–	430
– Ditto (Avar.)		290	70	–	360
– Utility	500	300	10	–	310
– Refrigerator (Max)	400	–	–	370	370
– Ditto Average per year (1/5 X max.)				75	75
– Administration	70	–	70	–	70
3. Total (Max)	3,802	1,990	310	780	3,080
(Avar.)	–	–	–	–	2,715

Remarks : Max. Demand

$(3080 \div 0.9) \times 1.05 \fallingdotseq 3{,}600$ KVA

Power Factor, 5 % Allowance

4) Lighting Equipment

a) General Lighting

General Lighting shall be of 2-40 W, 230 V, 50 Hz fluorescent Lamp.

Table 36 shows average intensity of illumination

Table 36 Required Intensity of Illumination

Process	Intensity of Illumination	Remarks
Pre-spinning	150 ~ 200 (lux)	
Spinning	200 ~ 250	
Weaving Preparation	150 ~ 200	Partial Lighting
Weaving	200 ~ 250	
Processing	150 ~ 200	Partial Lighting
Warehouse	100	
Boiler Room/Substation	100 ~ 200	
Office	200 ~ 300	

b) External Lighting

Mercury lamps for nighttime lighting to the external facilities like gatehouse and footpath shall be provided.

In addition, fluorescent lamps discharging near-ultraviolate ray shall be installed around the processing building in order to prevent the mill from invasion of nocturnal insects.

c) Emergency Lamp

The minimum numbers of emergency lamps shall be installed so that each worker in the mill will not be in panic in case of power failure. Furthermore, main entrance/exit shall be equipped with "Exit Light".

These light shall be of Ni-Cd battery built-in type.

d) Distribution Board for Lighting

Distribution board for lighting shall be installed in each building in order to separate lighting and socket outlet circuits.

In this board, earth leakage circuit breaker as the main shall be equipped in addition to the miniature type circuit breaker installed at each branch. Small rooms like offices shall have on-off switches for lighting.

5) Telephone Equipment

At present, no telephone facilities of Nepal Telecommunication Corporation are available at/around Lamahi.

However, the Mill shall be equipped with telephone system with 32 circuits for internal use.

Whereas telex facility is not able to be installed due to the non-availability of telephone wiring in this district.

6) Other Electrical Equipment

a) Generator for Emergency

Generator of 200 KVA which is supposed to have been utilized during construction shall be purchased and installed in Utility Center.

On emergency, the power from the generator shall be used for water supply pumps and for lighting in the Mill through manual operation.

b) Time Clocks and Audible Alarm System

Instead of adopting master clock system, a number of conventional quartz clocks shall be used in the Mill.

Audible alarm shall be made by several small siren horns in the Mill as well as a big siren horn to be placed outdoor at required time which is set by the main clock in Utility Center.

c) Fire Alarm System

Fire alarm system shall be of push-botton type. Push botton shall be placed at every 30 m centers in the Mill, and the receiver indicating the call-point shall be installed in the Gatehouse.

d) Measuring Instruments and Tools

The Mill shall have their own measuring instruments, tools and general maintenance materials because of the lack of maintenance shop around the Site.

7) List of Main Electrical Equipment

From the above, the main electrical equipment are listed in the Table 37.

Table 37 List of Electrical Equipment

Item No.	Machine/Equipment	Quantity
E - 1	Incoming Station	
	1) Incoming isolator board D. S. (200 A, 33 KV), LA, CT.	1 Set
	2) Receiving board V.C.B. (600A, 33 KV)	1 Set
	3) MOF board (MOF. will be supplied from N.E.A.)	1 Set
	4) H. T. distribution board V.C.B. (600 A, 33 KV)	2 Sets
	5) Battery 50 AH, D.C. 125 V	1 Set
E - 2	SP – WE Substation	
	1) 2,000 KVA transformer Oil-immersed, selfcooling, N_2 seal 33 KV/0.4 KV	1 Set
	2) L. T. distribution board Moulded type circuit breaker	5 Units
	3) Static condensor Total capacity 800 KVA	1 Lot
	4) Bus duct	1 Set
E - 3	Processing · Utility Dept · Substation	
	1) 2,000 KVA transformer Oil-immersed, self-coding, N_2 seal 33 KV/0.4 KV	1 Set
	2) L. T. distribution board moulded type circuit breaker	8 Units
	3) Static condensor 400 KVA	1 Lot

Item No.	Machine/Equipment	Quantity
E - 4	H. T. Cable 33 KV polyethylen insulation armoured cable, with terminal kit	1 Lot
E - 5	L. T, Cable Polyethylen insulation cable	1 Lot
E - 6	L. T. Distribution Board Metal enclosed, self stand or wall mounted type, with moulded type circuit breaker	1 Lot
E - 7	Lighting Material	1 Lot
	1) Fluorescent lighting fixture	1 Lot
	40 W X 2, 230 V, 50 Hz with reflector	
	2) Street light	1 Lot
	Mercury Light, 230 V, 50 Hz, pole height 8 m	
	3) Lighting distribution board	1 Lot
	Metal enclosed type	
	Minature type moulded type circuit breaker	
	4) Materials for lighting system	1 Lot
	5) Emergency "EXIT" light	1 Lot
E - 8	Fire Alarm System	1 Lot
F - 9	Miscellaneous Material for Erection	1 Lot
	1) Cable rack	
	2) Steel material	
	3) Consumable materials	
	4) Erection tool	
E - 10	Telephone System 32-circuit private automatic branch exchenge	1 Lot
E - 11	Maintenance Tool and Instrument	1 Lot
E - 12	Electric Home Appliance	1 Lot
	1) Refrigerator	
	2) Cooking range	
E - 13	Electrical Material for Temporary Wiring	1 Lot
	1) Cable	
	2) Temporary Lighting	

5-4-3 Miscellaneous Equipment

1) Transportation Equipment

For the purpose of transporting mill employees, goods and materials within the premise, and for use of expatriate staffs during the course of implementation of the Project, the following vehicles shall be purchased.

- Bus (60 seats) ..... 2 Nos.
- Truck (6 tons) ..... 2 Nos.
- Micro-bus (9 seats) ..... 2 Nos.
- Land Cruiser ..... 2 Nos.
- Pick-up (1 Ton) ..... 1 No.
- Saloon Car ..... 2 Nos.

2) Kitchen Equipment

Since neither dining facilities nor outside contractors of delivering foods are available around the Site, a Canteen, accomodating max. 200 persons shall be constructed. Two refrigeraters with freezer are to be installed in the kitchen.

Main kitchen equipment are as follows.

- Gas tilting Pan (140 l) ..... 3 Nos.
- Gas Table (4 burners) ..... 2 Nos.
- Hot-Water Making Machine ..... 1 No.
- Electric Refrigerater (1,000 l) .... 2 Nos.
- Sinks and Racks ..... 1 Set.
- Ventilating Equipment ..... 1 Set.

3) Dispensary Equipment

Since there are no medical facilities around the Site, medical and dispensary equipment – limited to the first-aid purposes – shall be purchased.

4) Office Equipment

Such office equipment as typewriters, copy machines, calculators, safety box, stationery etc. shall be purchased.

5) Furnitures

Necessary furnitures and fixtures such as tables, chairs, cabnets, etc. shall also be purchased.

However wooden articles required in the Mill shall be fabricated/manufactured at the carpentry workshop by utilizing timber packing materials.

5.5 Environmental Preservation

In Nepal, there is a growing concern about the environmental issues, while there have been no special regulations for protecting environmental pollution so far.

It is needless to say that discharged air from the stacks or effluent water to the river shall be treated to the quality either below internationally allowed level or below the level which ensures good health of human being as well as sound environment.

It is not practicable, however to reduce pollutant level in excess of the allowable value, taking into account of the construction cost of sophisticated treatment plant.

The Site is situated 2.5 Km west of Lamahi and there are only a few residential houses around it. And so far there is no district development plan in this area other than our Project.

Under these circumstances, the following four items in respect of environmental preservation are observed.

- Air Pollution
- Water Pollution
- Noise and Vibration
- Destruction of Forest

5-5-1 Air Pollution

There is an indication of air pollution in Kathmandu Valley which seems to be getting serious, whereas there is no such pollution at present around the Site because of no induries, and thus no regulations or rules for air pollution have been enacted so far.

However it is of course necessary for the new Mill to achive pollution level less than that of internationally allowed and following points in respect of air pollution have to be checked.

1) Sulfer Oxide

The allowable quality of sulfer oxide in discharged air varies depending on the places. Namely it is more strict at the industrial area due to the high concentration of sulfer oxide.

(Remarks : Japanese Environmental Standard for sulfer oxide is less than 0.04 PPM as an avarage value per hour per day and less than 0.1 PPM avarage value per hour). The calculation results of the maximum ground concentration and the distance from the stack at maximum concentration are :

- Max. ground concentration ..... 0.02 PPM
- Max. concentration point distance from the stack ..... 1,000 m

and these are less than Japanese standard.

The calculation above was made by applying. Bosanquets and Sutton's formulas on the basis that oil consumption: 0.461 kg/hr, stack diameter : 1 m, stack hight : 20 m. and sulfer components 3.5%.

2) Smoke Dust

By adopting oil fired boiler with a characteristic of generating less smoke dust, it will be possible to attain the quality of discharged smoke dust less than 0.3 g/N m^3 (Japanese Standard)

3) NOx

The volume of NOx contained in the discharging gas is subject to N-particle in the fuel. It is assumed that new model boiler will make it possible to achive the international standard for NOx provided that the fuel contains N-particle of less than 0.3%.

5-5-2 Water Pollution

To discharge industrial wastewater directly to the river creates water pottution and therefore, the effluent treatment plant shall be constructed in the premise, based on the following concepts.

Contamination of water of the Mill shall be originated by the wastewater through dyeing and finishing process and sewage from the toilets.

The pollutants in the wastewater from dyeing and finishing process shall be produced by removing fats and oils, wax, resin sizing materials (PVA or starch) in the process, by changing of pH through Alkali treatment at Mercerizing machine, and by changing of pH and colouring process of dyestuffs and chemicals at dyeing machines.

It is recommendable as the best treatment method to adopt lagoon system which deals with water by means of biological oxidation through aeration process. The outline of such treatment plant is shown on Fig. 4.

This system requires quite big aeration pond but neither complecated equipment nor special chemicals is required due to utilizing nutritious compounds contained in the sewage from the toilet, which consequently results in low running and maintenance costs.

In addition, as the Site is in the Terai which allows to have fairly high temperature throughout the year, it is expected to maintain constant and stable treatment of wastewater.

Table 38 shows basic design conditons for the treatment plant and Table 39 indicates expected quality of treated water.

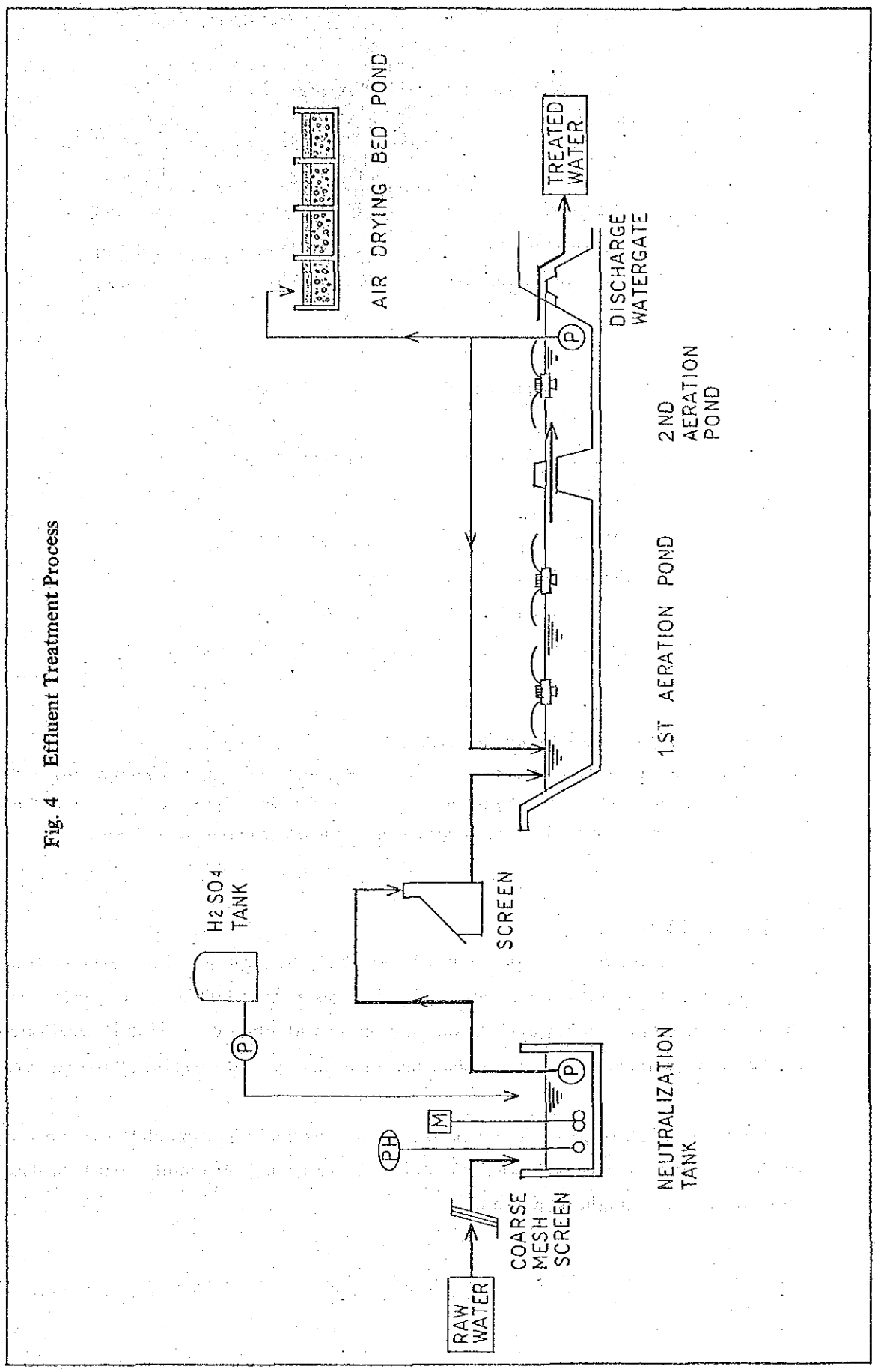


Fig. 4 Effluent Treatment Process

Table 38 Basic Design Condition for Waste Water Treatment Plant

	Wastewater from Processing	Sewage	Total
Discharged Quantity	800 m^3/day	20 m^3/day	820 m^3/day
P H	8 ~ 13	6.8 ~ 8.0	8 ~ 13
B O D	500 (400 ~ 600) ppm	(2.6 kg/day)	500 ppm
C O D	600 (500 ~ 700) ppm	(1.5 kg/day)	600 ppm
S S	200 (100 ~ 300) ppm	(4.4 kg/day)	200 ppm

Table 39 Expected Quality of Treated Water

	Expected Quantity	Permissable Value *1
P H	6.8	5.8 ~ 8.6
B O D	50 ppm (90 %)	120 ppm (76 %)
C O D	100 ppm (85 %)	120 ppm (80 %)
S S	70 ppm (65 %)	100 ppm (50 %)
Colour	No. change *2	No. Value

Remarks :

*1) Permissable Value is as per Japanese Regulations

*2) It is assumed that colour pollution at receiving river will be relatively less because no printing machines be installed and light colour mainly be utilized in dyeing process. Further it is noted that "colour" itself is not deleterious substance and decolourization plant is quite costly.

5-5-3 Noise and Vibration

The range of influence of noise and vibration is to be limited and it is experientially understood that no troubles may arise by keeping distance of 100 m or more away from the source of noise or vibration. In addition, noise and vibration are the phisical variation of wave without leaving no actual substances behind and this also allows less problems.

However, in order to make any influence of noise and vibration as less as possible, the location of source of noise and vibration shall be carefully examined (such as placement along the main mill road, etc.)

5-5-4 Destruction of Forest

The Government of Nepal has a big concern over the destruction problem of forest and any forest development plans require prior permission of the Forest Office.

The proposed Site is situated in the thin forest and this forest is not a productive one.

It is also unlikely that the Site development (Approx. area 320 m × 200 m) will cause any damages, such as invasion of excavated soil to the adjacent small scale farmland. Therefore, it is assumed that this development will not affect any ecological surroundings around the Site.

5-6 Layout of Mill

Taking into account of the access road as well as the configuration of the Site, each building of the Mill shall have to be placed, aimed at the most economical and rational position together with the understanding that spining and weaving building to be combined by reason of the same structures each other and that other buildings like processing, utility center, raw material warehouse, administration office, etc to be positioned severally.

However no consideration is envisaged in respect of future expansion of the Mill.

General conditions to be applied for deciding the layout of the Mill are :

1) Size and span of the building.
2) Kinds and numbers of machines, combination of package.
3) Operation methods, kinds and flows of production.
4) Maintenance method and location of maintenance room.
5) Method and location of power wiring, air-conditioning, steam, water, etc.

Various factors as above to be carefully examined in advance.

On top of above understanding, the layout of the production machinery for the Mill shall be designed in accordance with the concepts as hereunder.

1) Semi-products on each process shall be smoothly forwarded to the next process so that increase of production and decrease of production cost are achived.

2) Idle space for temporary storage shall be allocated as less area as possible which allows shorter distance of transportation as well as less area of overall machine installation.

3) Appropriate direction and spacing of each machine shall be established so that the operators can monitor the machines easily.

4) In order to improve equipment efficiency, utility, air-conditioning and electrical equipment shall be positioned close to the machine which consumes much of the respective utilities or power as nearer as possible.

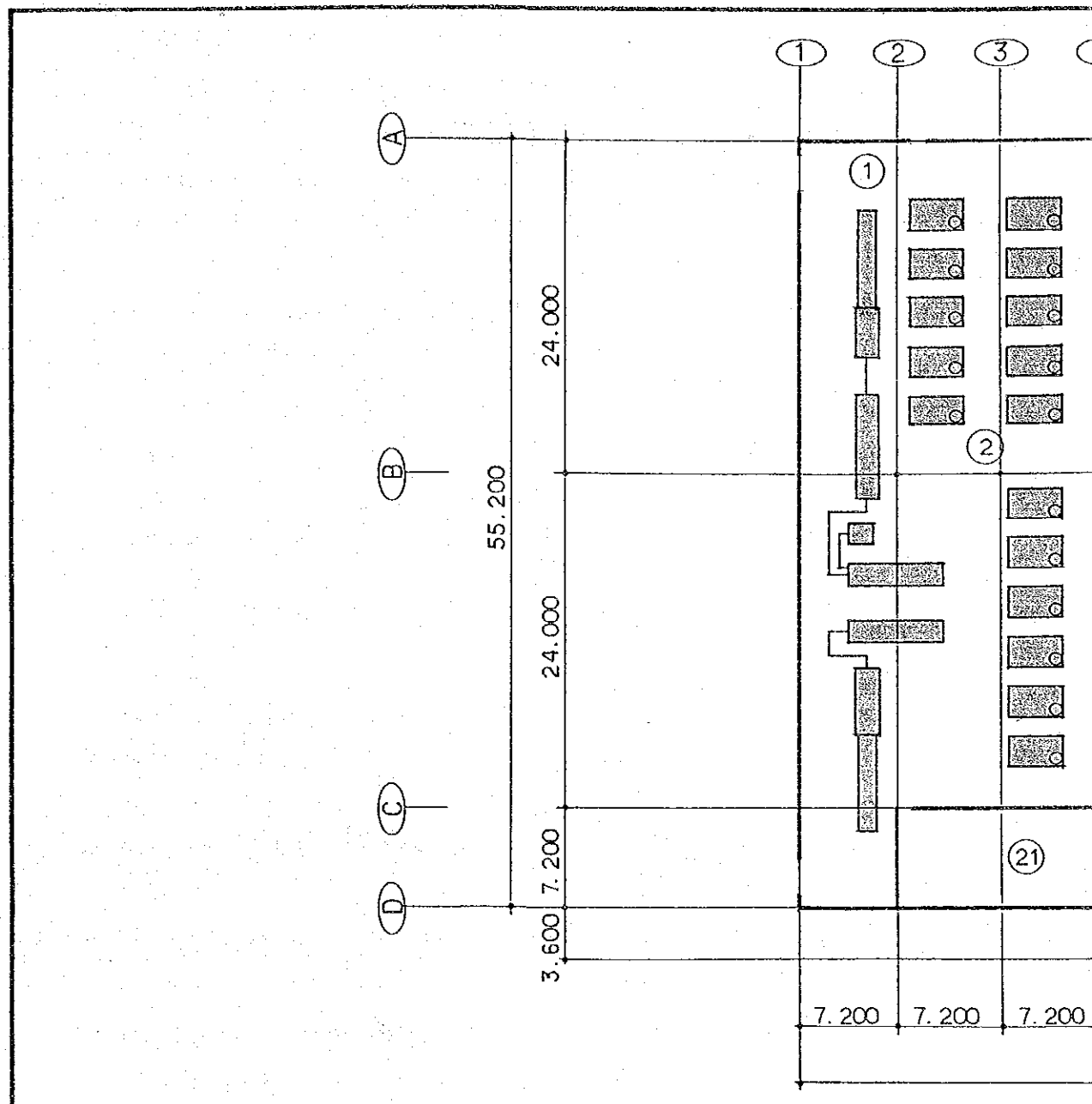
5) The minimum partitions in the Mill shall be provided so as to facilitate better air flows and easy handling of the transportation equipment.

5-6-1 Spinning

As for the spinning mill, dealing with polyester cotton blended yarn, the following points in respect of machine layout shall be taken into consideration.

1) By removing all partitions in the process, it will make it possible to achive better air flows and easy production control including transportation.

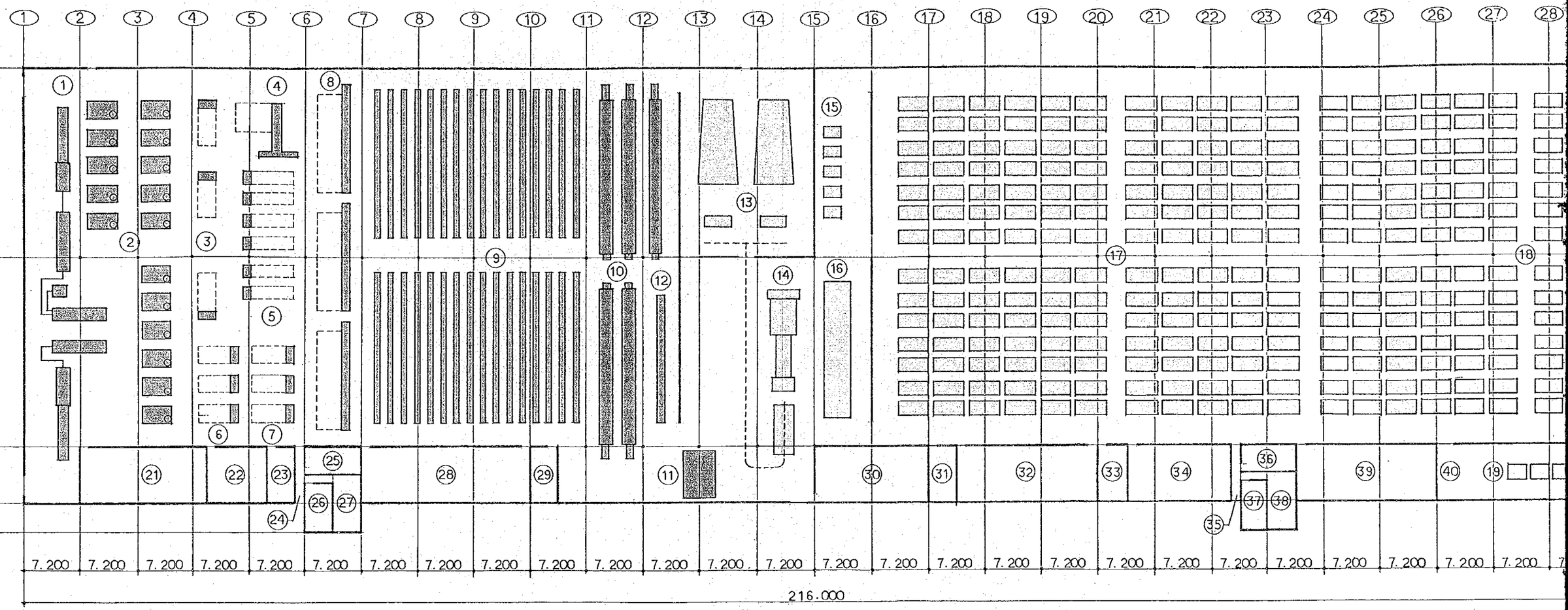
2) In order to control production rationally, the crossing of transportation of semi-



TITLE

INTEGRATED TEXTILE MILL

Fig. 5 Layout of Production Machinery (Spinning · Weaving)



MACHINE LAYOUT

MACHINE LIST

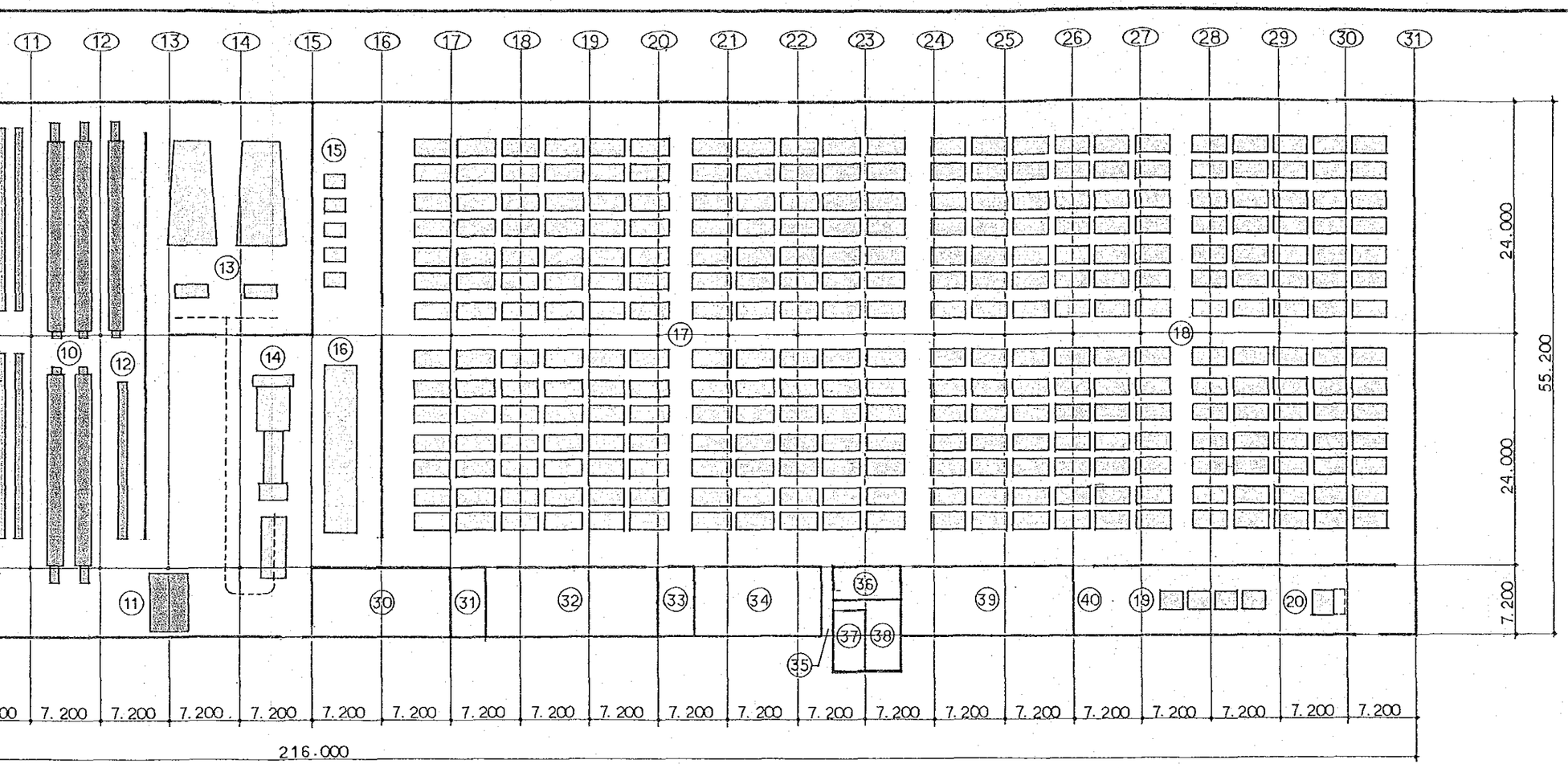
NO.	NAME OF MACHINE	SET	NO.	NAME OF MACHINE	SET
(1)	BLOW ROOM MACHINERY	2	(11)	FULL AUTOMATIC STEAM SETTER	1
(2)	HIGH PRODUCTION CARD	16	(12)	HIGH SPEED RE-WINDER	1
(3)	HIGH SPEED PRE-DRAWING FRAME	3	(13)	DIRECT WARPER	2
(4)	SLIVER LAP FORMER	1	(14)	SIZING MACHINE	1
(5)	HIGH PRODUCTION COMBER	6	(15)	REACHING IN MACHINE	5
(6)	1 ST HIGH SPEED DRAWING FRAME	3	(16)	BEAM STOCKER	1
(7)	2 ND HIGH SPEED DRAWING FRAME	3	(17)	RAPIER LOOM (RS – 170)	154
(8)	SIMPLEX FLY FRAME	3	(18)	RAPIER LOOM (RS – 145)	154
(9)	RING SPINNING FRAME	32	(19)	INSPECTING MACHINE	4
(10)	AUTOMATIC WINDER	5	(20)	FOLDING MACHINE	1

NO.	NAME OF ROOM	NO.	NAME OF
(21)	AIR-CONDITIONING ROOM	(31)	LABORATORY
(22)	MAINTENANCE ROOM	(32)	AIR-CONDITION
(23)	LABORATORY	(33)	BLOWER ROOM
(24)	PASSAGE	(34)	MAINTENANCE
(25)	LOCKERS ROOM	(35)	PASSAGE
(26)	TOILET (FEMALE)	(36)	LOCKERS ROOM
(27)	TOILET (MALE)	(37)	TOILET (FEMA
(28)	AIR-CONDITIONING ROOM	(38)	TOILET (MALE
(29)	SUBSTATION	(39)	AIR-CONDITION
(30)	SIZING MATERIAL STORE	(40)	INSPECTING R

TEXTILE MILL

SPINNING & WEAVING DEPT.

Fig. 5 Layout of Production Machinery (Spinning · Weaving)



NO.	NAME OF MACHINE	SET	NO.	NAME OF MACHINE	SET
(1)	BLOW ROOM MACHINERY	2	(11)	FULL AUTOMATIC STEAM SETTER	1
(2)	HIGH PRODUCTION CARD	16	(12)	HIGH SPEED RE-WINDER	1
(3)	HIGH SPEED PRE-DRAWING FRAME	3	(13)	DIRECT WARPER	2
(4)	SLIVER LAP FORMER	1	(14)	SIZING MACHINE	1
(5)	HIGH PRODUCTION COMBER	6	(15)	REACHING IN MACHINE	5
(6)	1 ST HIGH SPEED DRAWING FRAME	3	(16)	BEAM STOCKER	1
(7)	2 ND HIGH SPEED DRAWING FRAME	3	(17)	RAPIER LOOM (RS – 170)	154
(8)	SIMPLEX FLY FRAME	3	(18)	RAPIER LOOM (RS – 145)	154
(9)	RING SPINNING FRAME	32	(19)	INSPECTING MACHINE	4
(10)	AUTOMATIC WINDER	5	(20)	FOLDING MACHINE	1

NO.	NAME OF ROOM	NO.	NAME OF ROOM
21	AIR-CONDITIONING ROOM	61	LABORATORY
22	MAINTENANCE ROOM	62	AIR-CONDITIONING ROOM
23	LABORATORY	63	BLOWER ROOM
24	PASSAGE	64	MAINTENANCE ROOM
25	LOCKERS ROOM	65	PASSAGE
26	TOILET (FEMALE)	66	LOCKERS ROOM
27	TOILET (MALE)	67	TOILET (FEMALE)
28	AIR-CONDITIONING ROOM	68	TOILET (MALE)
29	SUBSTATION	69	AIR-CONDITIONING ROOM
30	SIZING MATERIAL STORE	40	INSPECTING ROOM

E LIST

T.

DWG. NO. EX-166-S.W

products from taking-in the raw materials to automatic winder shall be avoided.

3) The machines for polyester fibers and for cotton fibers shall be placed seperately each other between blow rooms and the feeder side of drawing machines.

4) The machines between roving frames and automatic winders shall be placed in the same direction so as to facilitate easy moniter of machines as well as smooth flows of semi-products.

5) Steam setter shall be installed near to sizing machine of weaving process and this allows economical steam pipings.

6) Air-conditioning room shall be placed near to the machines of large heat loads, and the easier position for taking return air to be considered as well.

7) Laboratory shall be placed in the center of the Mill so that communication and bringing-in samples among each process shall become convenient.

Concrete layout plan of spinning machinery is shown in Fig. 5 (left side)

5-6-2 Weaving

As for the weaving mill, dealing with polyester, cotton blended yarn or fabrics, the following points in respect of machine layout shall be taken into account.

1) The warping process where quite a few fly waste be generated and the weaving process where big noise be generated shall be made separate with other process by constructing partitions.

2) The necessary space for warper's beam shall be provided at the next to sizing machine and this allows easy transport of beams to sizing machine by overhead rail.

3) The sized beam shall be stored in the beam stocker next to sizing machine.

4) Necessary access way to be provided at every group of looms so as to facilitate monitor by operators and material transportation.

5) No storage space for grey cloth shall be provided between inspection and plaiting machines on the assumption that inspecting and plaiting works shall be carried out without a hitch.

6) Two air-conditioning rooms shall be allocated in weaving process for effective air-conditioning.

7) Laboratory shall be placed near the weaving and preparation process.

Concrete layout of weaving machinery is shown in Fig. 5 (right side)

5-6-3 Dyeing and Finishing

The following is the points to be examined for the dyeing and finishing Mill, dealing with polyester, cotton blended fabrics.

1) U-shape flow of semi-products are employed in order to perform rational control of production and maintenance.

2) Operation side of each machinery shall be placed in the same direction for easy operation.

3) The storage area for grey cloth and the inlet area for cloth jointing shall be put together.

4) The space for allocating semi-products after bleaching into each group of successive process shall be provided.

5) The place for mixing chemicals and dyestuffs shall be centralized for easy control.

6) The area for dissolution and recovery of Caustic Soda shall be placed outdoor, in consideration of environmental protection.

7) Inspection and packing room for the final goods shall be separated by partition wall so that independent control of the process is made.

8) Product warehouse with 0.5 month storage capacity shall be positioned next to processing mill.

9) Appropriate space for handling cloth carrier shall be provided in each space among main finishing machines.

10) Considerably large steel door shall be installed for taking-in, taking-out of materials or maintenance purpose.

Concrete layout of finishing machinery is shown in Fig. 6.

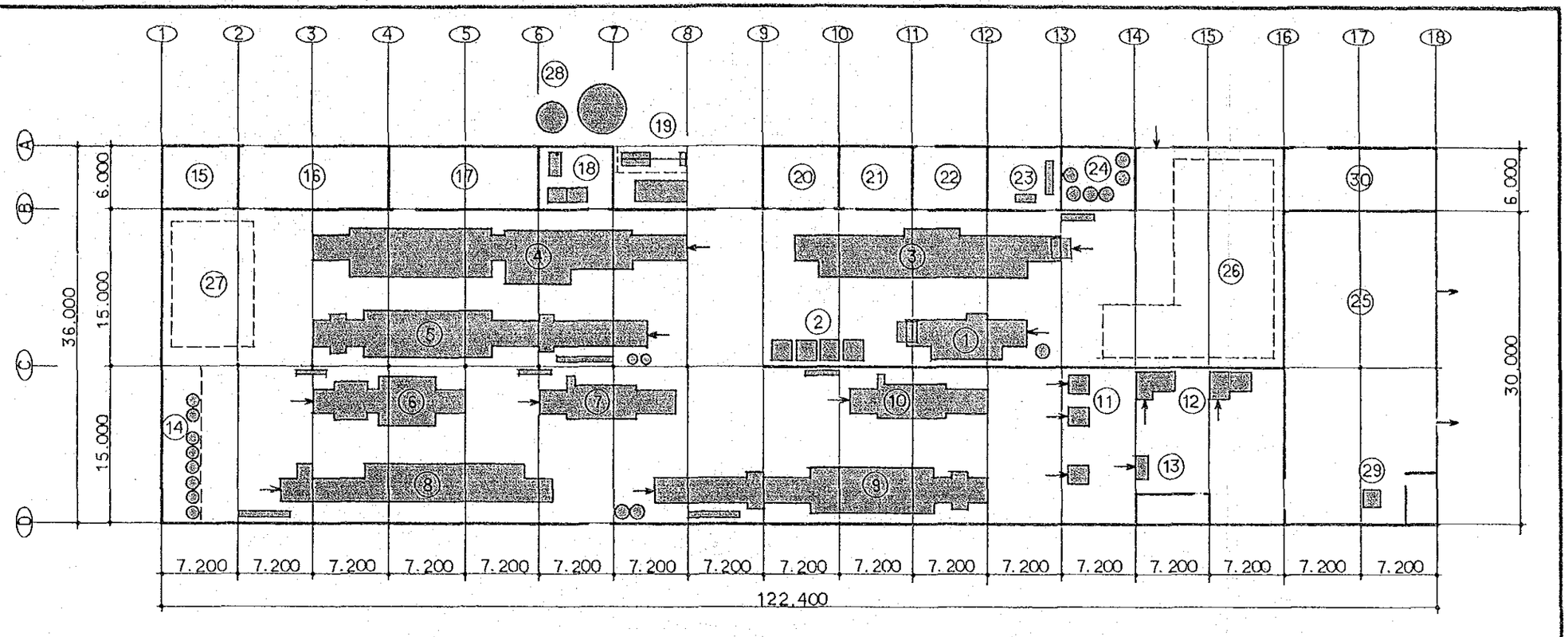
5-6-4 Utility Center

The layout of utility and electrical equipment, and personnel organization of utility and electrical department shall be set on the assumption that independent operation and maintenance from the production department shall be made.

As a consequence, all major utility or electrical equipment shall be centralized in Utility Center. This will permit appropriate maintenance and such merits as saving equipment cost, energy saving, reduction of required building area, improvement of safety and fire prevention are expected.

Utility center shall be placed in the center of spinning, weaving, and dyeing and processing departments.

Fig. 6 Layout of Production Machinery (Processing)



MACHINE LAYOUT

NO.	NAME OF MACHINE & ROOM	SET	NO.	NAME OF MACHINE & ROOM	SET
(1)	GAS SINGEING/DESIZING MACHINE	1	(16)	MAINTENANCE/S.PARTS ROOM	1
(2)	BATCH CARRIER	5	(17)	LABORATORY ROOM	1
(3)	SCOURING/BLEACHING RANGE	1	(18)	CAUSTIC SODA MIXING ROOM	1
(4)	MERCERIZING RANGE	1	(19)	C.SODA RECOVERING DISSOLVING	1
(5)	HEAT SETTER	1	(20)	TOILET	1
(6)	PAD HOT AIR DRYER	1	(21)	REST ROOM	1
(7)	THERMOSOL MACHINE	1	(22)	SUB-STATION	1
(8)	PAD STEAMER	1	(23)	SUB-MATERIAL STORAGE ROOM	1
(9)	FINISHING STENTER	1	(24)	D.S.B-CHEMICAL MIXING ROOM	1
(10)	BAKING MACHINE	1	(25)	PRODUCT GOODS WAREHOUSE	1
(11)	INSPECTING MACHINE	3	(26)	GREY CLOTH STOCK PREPARING	AREA
(12)	DOUBLING/LAPPING MACHINE	2	(27)	CLOTH CARRIER STOCK	AREA
(13)	WINDING MACHINE	1	(28)	COOLING TOWER	2
(14)	DYE/CHEMICAL MIXING TANK	8	(29)	BALING MACHINE	1
(15)	OFFICE	1	(30)	DYE STUFF, CHEMICAL-WAREHOUSE	1

MACHINE LIST

TITLE		DWG. NO.
INTEGRATED TEXTILE MILL	DYEING & FINISHING DEPT.	EX-166-P

Refrigerator in Utility Center shall be positioned at spinning side where chilled water is mainly consumed, and boilers shall be positioned at finishing side where a great deal of steam is consumed.

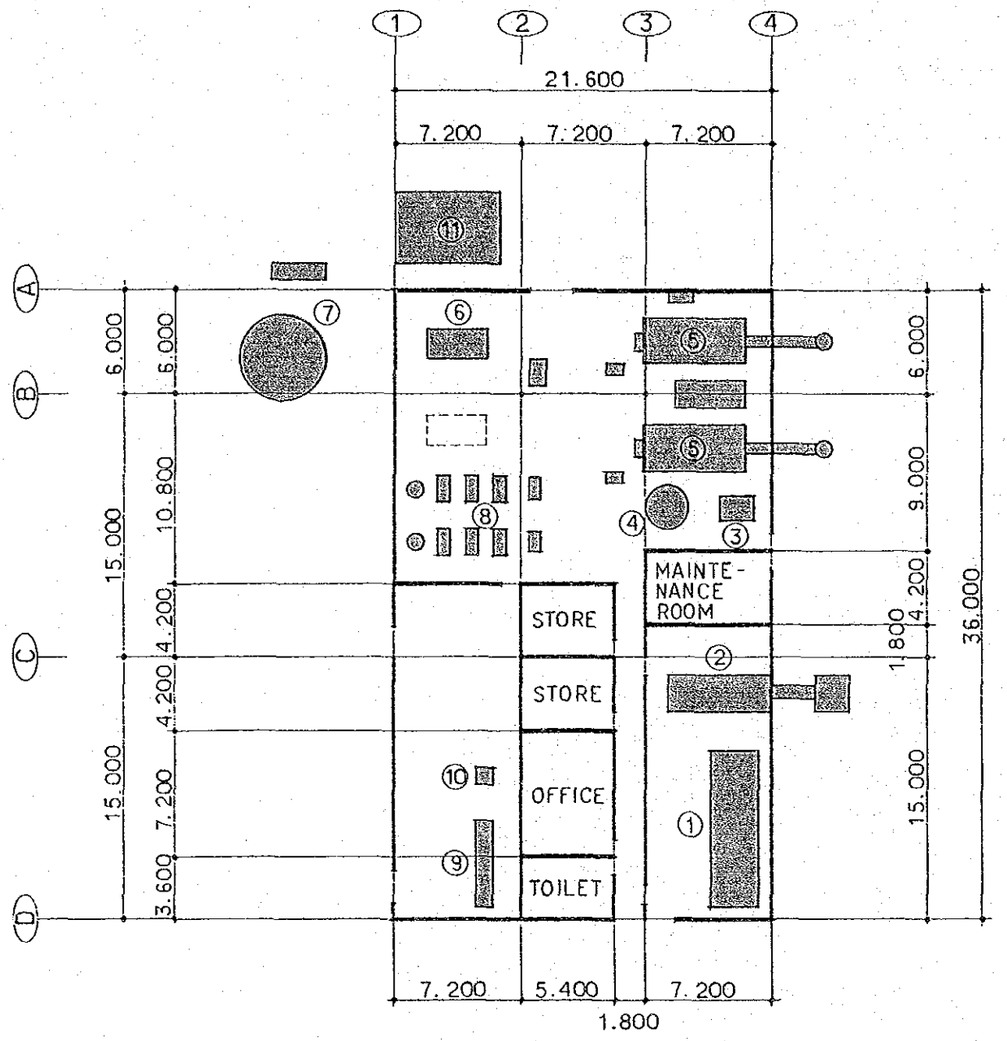
Utility center shall be equipped with common facilities to all processes, such as iron workshop, carpentry shop, electric maintenance shop, maintenance depot for vehicles.

Raw water reservoir and effluent treatment plant shall be placed outside near to dyeing and finishing mill because of the relationship between these two processes.

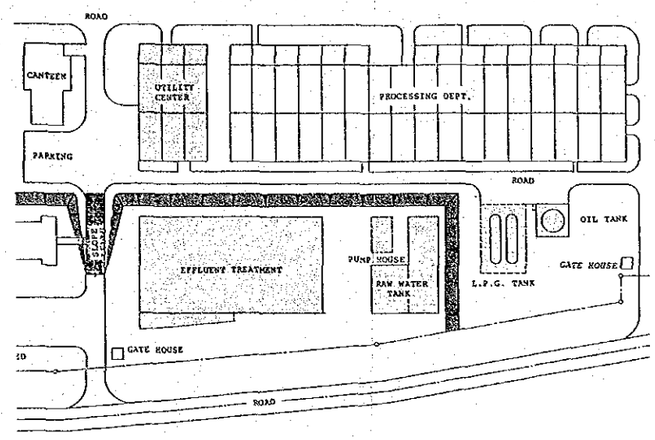
L. P. Gas tank and heavy oil tank to be placed near to the north gate and this will allow safety delivery of the fuels.

Concrete layout of Utility Center is shown in Fig. 7.

Fig. 7 Layout of Utility Equipment



MACHINE LAYOUT



LAYOUT OF UTILITY FACILITIES

NO.	NAME OF MACHINE
①	INCOMING H.T. BOARD
②	L.T. DISTRIBUTION BOARD FOR P.R AND U.T
③	GENERATOR
④	SOFTENED WATER TANK
⑤	BOILER
⑥	REFRIGERATOR
⑦	COOLING TOWER
⑧	AIR COMPRESSOR
⑨	LATHE
⑩	SHARPERING M/C
⑪	CHILLED WATER RESERVOIR

MACHINE LIST

TITLE INTEGRATED TEXTILE MILL UTILITY DEPT.

DWG. NO. EX-166-U-01

5-7 Civil and Building Design

5-7-1 General Design Description

The cost for civil and building works is unexpectedly large, accounting for 20 to 25 percents of the total investment and also the design quality of each building has a great influence on the implementation of the Project.

Prior to carrying out civil and building plan, it is therefore required to make in-depth investgation and understanding on local conditions of civil and building works so that the most economical building with good workmanship and less maintenance is constructed.

1) Necessary Building and Facility

The followings are the necessary buildings and facilities required for achiving assumed production of the Mill.

a) Production Facilities . . . . . Spinning, Weaving and Processing mills

b) Auxiliary Facilities . . . . . Raw Materials and Product Warehouse, Utility Center, Pump House.

c) Administrative and Welfare Facilities . . . . . Administration office, Canteen, Nursery School, Staff Houses.

d) Fencing and External Facilities . . . . . Perimeter Fencing, Gate, Garage, Heavy Oil Tank, Raw Water Reservoir, Effluent Treatment Plant.

2) Basic Module

For the purpose of simplifing design and excution works as well as standardizing the building elements, it is really essential to set up a basic module.

In consideration of the structures of the building and economical efficiency of the project, 1.2 m × 1.2 m (min. 0.3 m × 0.3 m) shall be applied as a basic module.

3) Structural Design

Foundations of the building shall be constructed by the Reinforced Concrete, and the size as well as bar arrangement of the footings and foundation beams shall be decided following the detailed soil investigation.

Main buildings shall be placed on the cut area in principle in order to avoid any uneven settlement, however the most suitable, economical position shall be selected from viewpoints of overall layout plan and configuration of the Site.

Raw construction above the ground level is recommended to be combined structure of R.C. Columns and Steel Truss Beams, taking into account of local availability of cement, steel bars, steel, etc.

In order to absorb heat expansion or contraction, expansion-joint shall be provided at every 70 ~ 80 meters of ridge side of building.

Since the Site is located within the seismic zones, a safe design of building against seismic power shall be observed.

4) Finishing Plan

There are many factors which will affect the selection of finishing materials. Particularly, attention to such factors as material availability, economical efficiency, workmanship, maintenance-ability is required for this Project.

Objectives and functions of each building shall also be considered carefully and it might be needed to empoly different level of finishing or to take architectual treatment into consideration.

As a consequence, exterior walls in brickwork construction with fair finish, interia walls in cement plaster finish with vinyle paint, floor in direct concrete fair finish with dust-proof paint are selected as a typical finishings of building for the Project.

5-7-2 Production Facility

Concrete design work for each building is generally carried out, following the decision on the final layout of production machinery and Utility equipment which are corresponding to the production plan. In other words, the required functions of each building are decided mainly by the production plan and plant layout.

1) *Spinning · Weaving Mill*

From the quality requirement of spinning · weaving mill, dealing with polyester, cotton blended yarn/fabrics, the strict conditions of air-conditioning to be needed; thus the mill shall be of window-less structure. In this case, the design for ventilation and insulation shall be studied carefully.

In particular, it is recommended that the total heat transmission coefficient of roofing shall be designed less than 0.8 kcal/m^2 h°C from a view point of economical efficiency of air-conditioning equipment, and internal finishing of roofing shall be selected among those of high vapour resistant materials so as to avoid condensation within roof structures in winter.

In addition in order to prevent walls or floors from piling up or adhering fly waste, the internal surface shall be finished smoothly as much as possible and further, the flooring materials shall be cleaned easily with anti-friction property.

As for the floor of weaving room, it is necessary to check on vibration isolation, however such vibration is normally isolated by increasing thickness of floor slabs to more than 18 cm.

Although, it is preferable of course to install false ceiling in view of good-looking

as well as avoiding fly waste problem, its installation is adversely affected in terms of workmanship, construction period and cost implication.

Therefore, false ceiling shall not be provided in the Mill, but this arrangement shall, necessitate regular cleaning of steel sections and inner side of roofs to remove adhered "fly waste"

2) Dyeing and Finishing Mill

It is indispensable, when designing dyeing and finishing building to look into the issue of ventilation and anti-corrosion of materials against chemicals.

And also layout of machines and material flow shall also be checked carefully in conjunction with drainage and floor pits in the mill.

5-7-3 Auxiliary Buildings

1) Raw Material Warehouse, Product Warehouse

The capacity of warehouse shall be subject to the standard storage period (i.e. Raw Cotton for 2.0 months, Polyester Fiber for 3 months, Products for 0.5 month), and in addition, the building plan shall be decided by the method of loading/off-loading, transportation system as well as the basic module of the building.

The mill shall have both raw material warehouse and product warehouse however the latter to be placed within the dyeing and finishing building in consideration of the overall layout and materials flow, and thus only raw material warehouse shall be constructed independantly.

Non-leakage of rain, anti-friction floor, dust-proof construction during dry season, size of entrance and exit, methods of loading off-loading, transportation system and protection of walls are those to be taken into consideration in designing warehouse. However the grade of finishing itself is not so important.

2) *Utility Center*

Utility center is the center of energy supply of the Mill, and hence shall be placed where the most economical and effective energy supplies are expected and where power and oils are easily obtained.

Although the specifications of the building correspond to the warehouse above, maintenance of utility and electrical equipment, weights of equipment and bearing capacity of soil, vibration isolation from compressor are items to be especially checked.

5-7-4 Administration and Welfare Building

1) Administration Building

Although there is an idea of closed office system, that is to say, every officer has his own office, administration building with open office system is recommended for the benefits of better communication as well as less construction cost.

Private office for the mill manager and meeting space are easily made by separating the open space with adequate size required.

The finishing materials shall be carefully selected and architectual treatment shall be applied in order to make the administration building be fitting the new Mill.

The administration building of the Mill shall therefore be designed as the open-system office building, accomodating 50 persons and having clinic facility in it by reason of non-availability of medical facilities around the Mill.

2) Canteen

The building specifications of Canteen shall be corresponding to the administration office, but its grade of finishing might be a little less than that of administration office because it is mainly used by general employees.

In principle, no distinction between senior employees and others shall be made. And in case of necessity, the area shall be seperated by partition wall.

In accordance with the personnel organization of the Mill, the Canteen shall have the dining capacity of 200 persons at a time.

The kitchen for 200 persons shall also be provided by reason of non-availability of outside meal facility around the Site.

Appropriate electric refrigerators and food storage room shall be provided as the countermeasures against unstable supply of food stuffs.

In designing Canteen, the following points to be checked.

- To select flooring materials of easy cleaning with non-slip property.
- To draw attention to hygienes
- To examine disposal method of garbage and wastewater from kitchen

3) Staff House and Nursery School

Staff houses and a nursery school to be constructed as a part of welfare facilities of the Mill.

Staff houses shall be for senior employees and to be used for the houses for expatriates during construction period.

Ten houses to be constructed in total, nine semi-detached houses for senior staffs and one detached house for the mill manager.

Nursery school for 20 children shall be constructed and expansion area to be con-

sidered according to the future requirement.

The building specifications of these facilities shall be corresponding to the administration building.

5-7-5 External Facilities

The main external facilities required for the Project are perimeter fancing, roads, parking area, raw water reservoir, effluent treatment plant and gatehouse.

1) Perimeter Fencing . . . . . Perimeter fencing of 2.4 m in height with cranked top shall be installed. The post to be pre-cast concrete and at 3 m spacings.

2) Roads . . . . . Main road in 6 m width and general road in 4 m width, all paved by asphalt to be constructed. Further, gravel road to be constructed arround spinning/ · weaving mill for fire fighting and evacuation purposes.

3) Parking area . . . . . Parking space for 4 cars (with cover) and for 20 motorbikes and bicycles (without cover) shall be provided in front of the administration building. In addition the parking and maintenance space for buses and trucks shall be provided south of Utility Center.

4) Others . . . . . The design for raw water reservoir, effluent treatment plant, pump house, cooling tower shall be as per basic plan of utilitity equipment.

Each facility shall be placed with good balance in consideration of functions and economical efficiences.

The effluent treatment plant shall treat sewage from toilets as well.

5-7-6 Overall Layout Plan

The overall layout of building shall be made taking into account of the economical and effective movement of men and materials, as a primary conditions.

In particular, due consideration on surface water drainage and the balance of cutting and filling of soil shall be made in the work of site leveling.

Main production buildings shall be placed on "cut" area so that no differential settlement would arise in the future.

Avoiding direct approach to the Site from the Highway, the eastern road shall be utilized for the access road of men and materials.

Two entrace system, i.e. main gate and sub-gate, shall be adopted and the road connecting the two gates above to be constructed as the major mill road, thus main production buildings shall be positioned along this road.

Main gate shall be for employees and general materials whereas subgate shall be for

product transportation and nersery school as well as houses.

In consideration of the present site configuration, the site shall be prepared with two levels.

Administration building and effluent treatment plant shall be placed on the lower side. Drainage slope of 1/200 pitch shall be provided as well aimed at economical efficiency and rationality of site preparation.

From the above, Fig. 8 shows overall site layout.

5-7-7 Outline of Building and External Facility

The outline of the site/builings is as follows.

1) Site Area · Building Coverage

Site Area : 47,000 m² Building Coverage : Approx. 42 %

2) Building

	Structure	Effective Height	Built-up Area	Reference DRG.
a) Spinning/Weaving	RC-Column S-Truss	4,500 (mm)	11,975 m²	Fig. 9
b) Dyeing/Finishing	Ditto	5,100	4,362	Fig. 10
c) Raw Materical Warehouse	Ditto	5,100	778	Fig. 11
d) Utility Center	Ditto	5,100	778	Fig. 11
e) Administration Office	RC Footing Brick Wall	3,000	498	Fig. 12
f) Canteen	Ditto	3,000	327	Fig. 12
g) Nursery Houses	Ditto	—	1,099 (1,799)	Fig. 13
Sub-Total	Built-up Area		19,817 m²	
	Total Floor Area		20,517 m²	20,517 m

Others Garage (50 m²) Gatehouse (15 × 2 = 30 m²)

3) External Facilities

Fencing : 1,100 m, Gate : 2 Nos.

Road : 5,300 m² (Paved), 2,300 m² (Gravel)

Raw and Effluent Water Treatment : 1 set

Shallow well : 2 Nos. H = 10 m R = 1.0 m etc.

5-7-8 Scheme of Execution

The civil and building works shall be carried out by the Contractor to be selected

Fig. 8 Site Layout

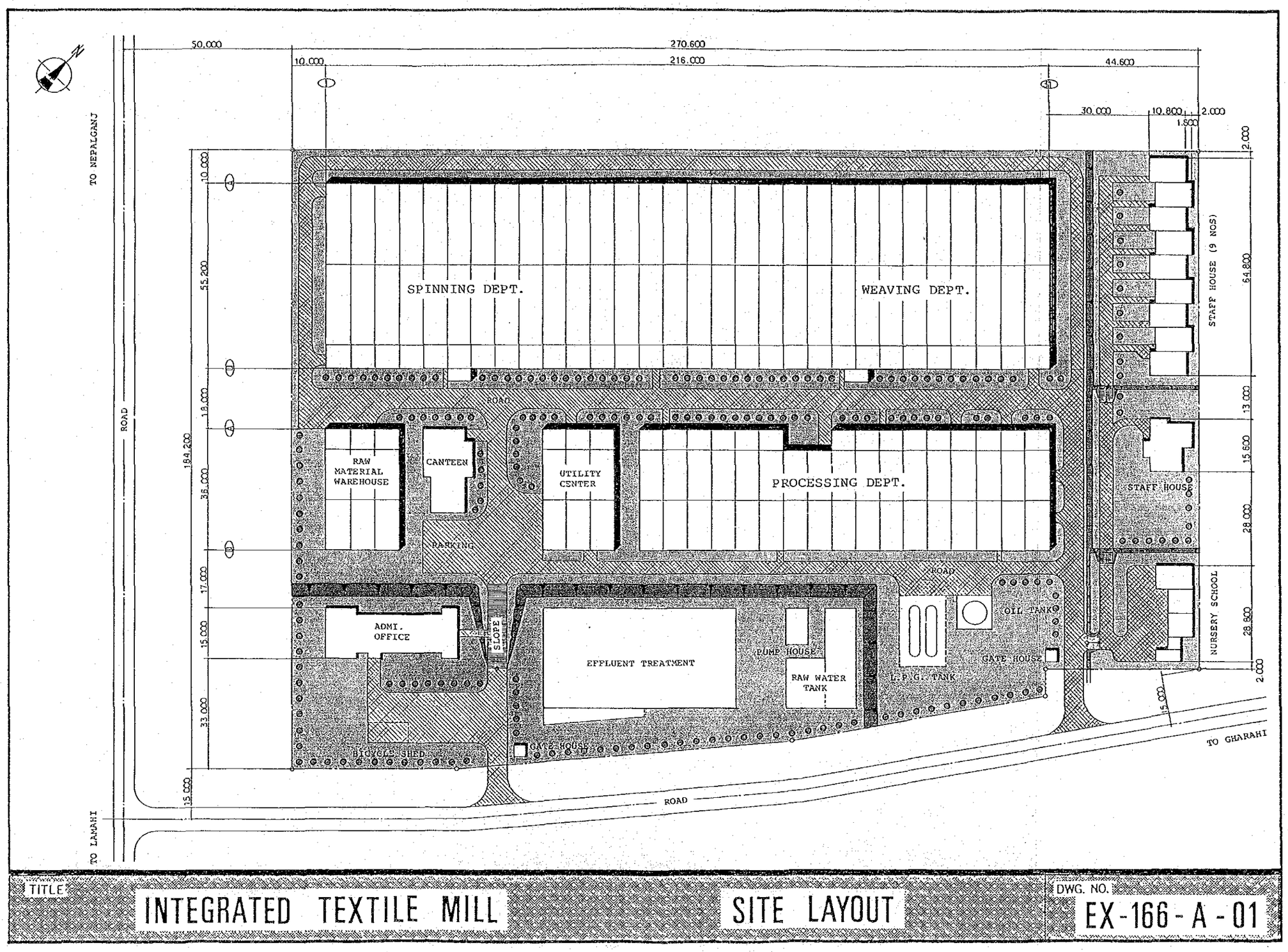
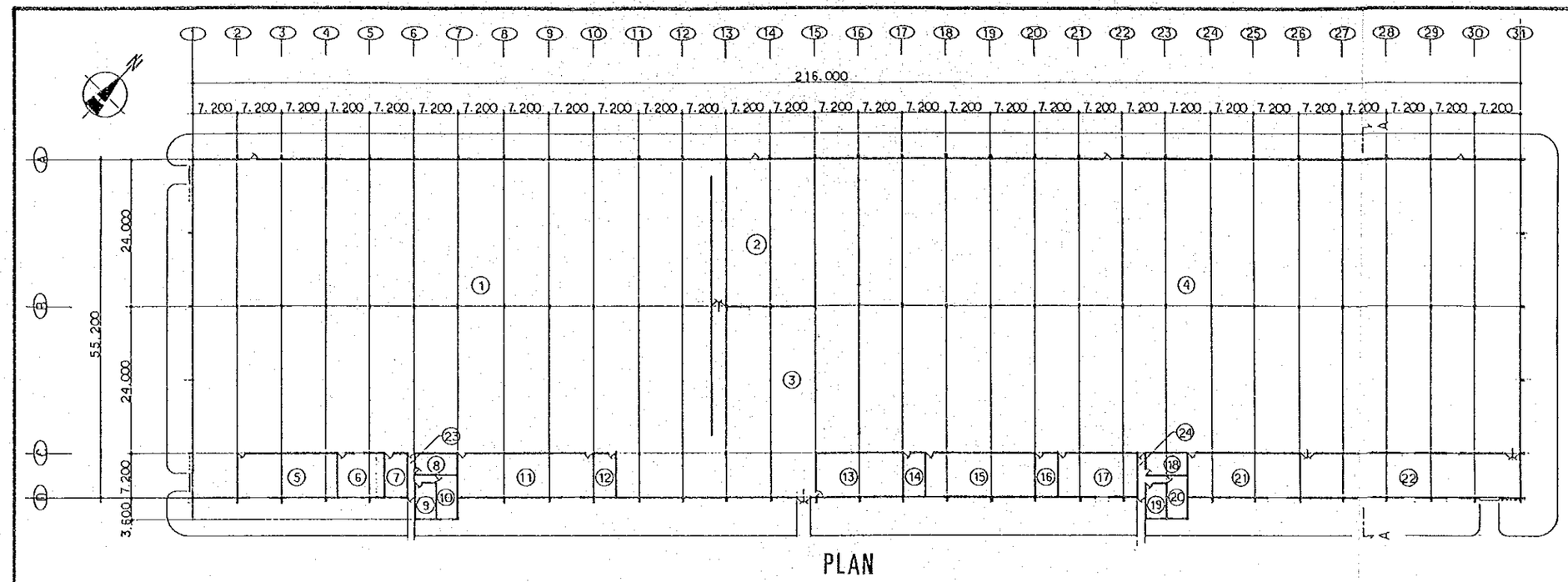
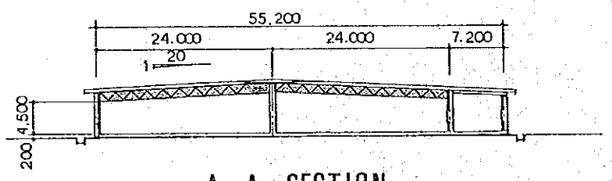


Fig. 9 Spinning · Weaving Building Plan



SOUTH ELEVATION

WEST ELEVATION



A - A SECTION

SPINNING / WEAVING DEPT. FINISH SCHEDULE

EXTERIOR FINISH SCHEDULE

STRUCTURE	ROOF	EXTERIOR WALL	DOORS/WINDOWS
REINFORCED CONCRETE COLUMN AND STEEL TRUSS CONSTRUCTION	FOLDED G.I.SHEET #24 DOUBLE CONSTRUCTION WITH GLASSWOOL T=100	BRICK WALL (1B) FAIR FACED FINISH	STEEL DOOR WOODEN WINDOW FRAME (INTERNAL ----- WOODEN DOOR)

INTERIOR FINISH SCHEDULE

R.NO	ROOM NAME	FLOOR	SKIRTING	WALL	CEILING	C.H
(1)	SPINNING ROOM	F-2	S-2	W-2		
(2)	PREPARATION ROOM	F-2	S-2	W-2		
(3)	PREPARATION ROOM	F-2	S-2	W-2		
(4)	WEAVING ROOM	F-2	S-2	W-2		
(5)	AIR-CONDITIONING ROOM	F-1	S-1	W-1		
(6)	MAINTENANCE ROOM	F-2	S-2	W-2		
(7)	LABORATORY	F-2	S-2	W-2	C-1	3.0 m

R.NO	ROOM NAME	FLOOR	SKIRTING	WALL	CEILING	C.H
(8)	LOCKERS ROOM	F-4	S-3	W-2	C-1	3.0 m
(9)	TOILET (FEMALE)	F-4	S-3	W-3	C-1	3.0
(10)	TOILET (MALE)	F-4	S-3	W-3	C-1	3.0
(11)	AIR-CONDITIONING ROOM	F-1	S-1	W-1		
(12)	SUBSTATION	F-1	S-1	W-1		
(13)	SIZING MATERIAL STORE	F-2	S-2	W-2		
(14)	LABORATORY	F-2	S-2	W-2	C-1	3.0
(15)	AIR-CONDITIONING ROOM	F-1	S-1	W-1		
(16)	BLOWER ROOM	F-1	S-1	W-1		
(17)	MAINTENANCE ROOM	F-2	S-2	W-2		
(18)	LOCKERS ROOM	F-4	S-3	W-2	C-1	3.0
(19)	TOILET (FEMALE)	F-4	S-3	W-3	C-1	3.0
(20)	TOILET (MALE)	F-4	S-3	W-3	C-1	3.0
(21)	AIR CONDITIONING ROOM	F-1	S-1	W-1		
(22)	INSPECTING ROOM	F-2	S-2	W-2		
(23)	PASSAGE	F-2	S-2	W-2		
(24)	PASSAGE	F-2	S-2	W-2		

NOTE: FINISH ABBREVIATION SEE DWG. NO. EX-166-A-03

FINISH SCHEDULE

TITLE

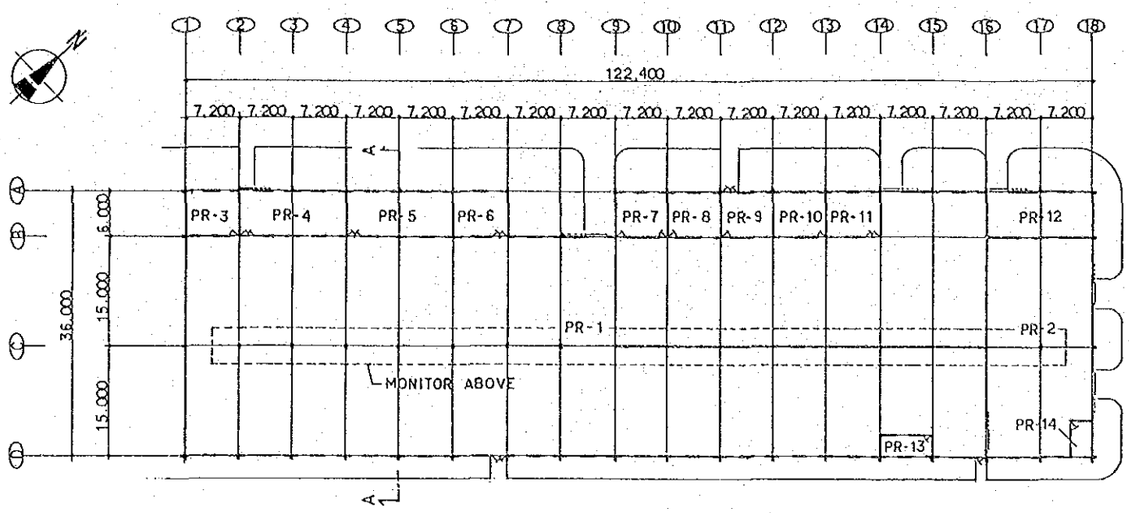
INTEGRATED TEXTILE MILL

SPINNING & WEAVING BUILDING

DWG. NO.

EX-166-A-02

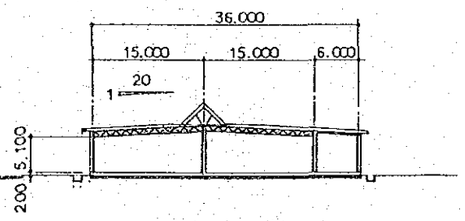
Fig. 10 Processing Building Plan



PLAN

SOUTH ELEVATION

EAST ELEVATION



A-A SECTION

PROCESSING DEPT. FINISH SCHEDULE

EXTERIOR FINISH SCHEDULE

STRUCTURE	ROOF	EXTERIOR WALL	DOORS/WINDOWS	OTHERS
REINFORCED CONCRETE COLUMN AND STEEL TRUSS CONSTRUCTION	FOLDED IRON SHEET #24 WITH VINYLE LAMINATED (BOTH SIDE)	BRICK WALL (1B) FAIR FACED FINISH	STEEL DOOR WOODEN WINDOW FRAME (INTERNAL ----- WOODEN DOOR)	WITH MONITOR ALONG AXIS Ⓒ

INTERIOR FINISH SCHEDULE

ROOM NO.	ROOM NAME	FLOOR	SKIRTING	WALL	CEILING	C.H
PR-1	MAIN PROCESSING ROOM	F-3	S-2	W-2		
PR-2	PRODUCT GOODS WAREHOUSE	F-2	S-2	W-2	C-1	3.0m
PR-3	OFFICE	F-4	S-3	W-2	C-1	3.0
PR-4	MAINTENANCE/S.PARTS ROOM	F-1	S-2	W-2	C-1	3.0
PR-5	LABORATORY ROOM	F-2	S-2	W-2	C-1	3.0
PR-6	CAUSTIC SODA ROOM	F-3	S-2	W-2	C-1	3.0
PR-7	TOILET	F-4	S-3	W-3	C-1	3.0
PR-8	REST ROOM	F-4	S-3	W-2	C-1	3.0
PR-9	SUB-STATION	F-1	S-1	W-1		
PR-10	SUB-MATERIAL STORAGE ROOM	F-2	S-1	W-1		
PR-11	O.S.S-CHEMICAL MIXING ROOM	F-3	S-2	W-2		
PR-12	DYE STUFF-CHEMICAL-WAREHOUSE	F-2	S-2	W-2		
PR-13	OFFICE	F-4	S-3	W-2	C-1	3.0
PR-14	OFFICE	F-4	S-3	W-2	C-1	3.0

NOTES

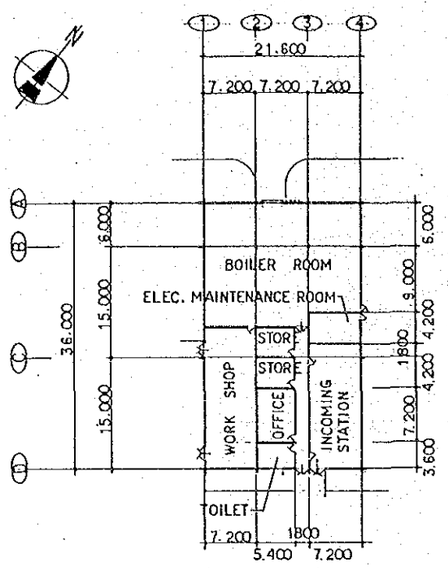
FLOOR	SKIRTING	WALL	CEILING
F-1 CEMENT MORTAR	S-1 CEMENT MORTAR	W-1 CEMENT MORTAR	C-1 CHIPBOARD WITH O.P
F-2 CONCRETE DIRECT FINISH WITH DUST PROOF PAINT	S-2 DITTO WITH O.P	W-2 DITTO WITH V.P	
F-3 DITTO WITH ACID PROOF PAINT	S-3 TERRAZZO H=100	W-3 TILES H=1.200	
F-4 TERRAZZO	S-4 TIMBER H=100 WITH O.P		

FINISH SCHEDULE

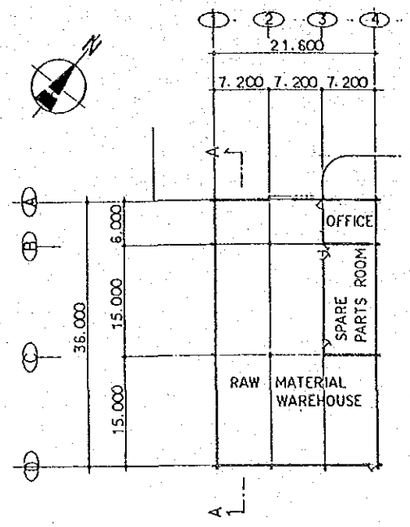
TITLE: INTEGRATED TEXTILE MILL PROCESSING BUILDING WITH PRODUCT WAREHOUSE

DWG. NO. EX-166-A-03

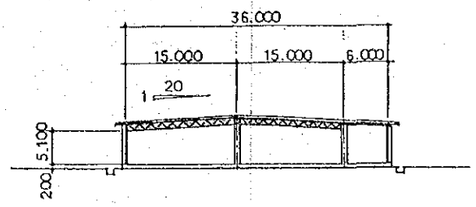
Fig. 11 Utility Center, Raw Material Warehouse



PLAN

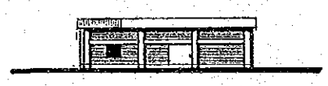


PLAN



A - A SECTION

SOUTH ELEVATION



NORTH ELEVATION

WEST ELEVATION

EAST ELEVATION

UTILITY CENTER / RAW MATERIAL WAREHOUSE - FINISH SCHEDULE

EXTERIOR FINISH SCHEDULE

STRUCTURE	ROOF	EXTERIOR WALL	DOORS / WINDOWS
REINFORCED CONCRETE COLUMN AND STEEL TRUSS CONSTRUCTION	FOLDED IRON SHEET ϕ24 WITH VINYLE LAMINATED (BOTH SIDE)	BRICK WALL (18) FAIR FACED FINISH	STEEL DOOR - WOODEN WINDOW FRAME (INTERNAL ------ WOODEN DOOR)

INTERIOR FINISH SCHEDULE

ROOM NAME	FLOOR	SKIRTING	WALL	CEILING	C.H
OFFICE	F - 4	S - 3	W - 2	C - 1	3.0 m
SPARE PARTS ROOM	F - 1	S - 2	W - 2	C - 1	3.0
RAW MATERIAL WAREHOUSE	F - 2	S - 2	W - 2		
BOILER ROOM	F - 1	S - 2	W - 2		
ELEC. MAINTENANCE ROOM	F - 1	S - 2	W - 2	C - 1	3.0
INCOMING STATION	F - 1	S - 1	W - 1		
STORE	F - 1	S - 1	W - 1		
WORK SHOP	F - 1	S - 2	W - 2		
TOILET	F - 4	S - 3	W - 3	C - 1	3.0

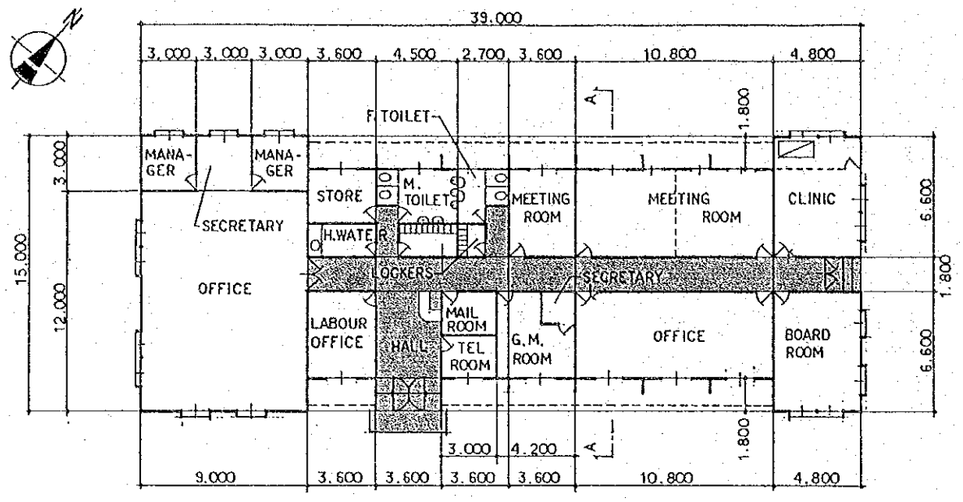
NOTE: FINISH ABBREVIATION SEE DWG. NO. EX - 166 - A - 03

FINISH SCHEDULE

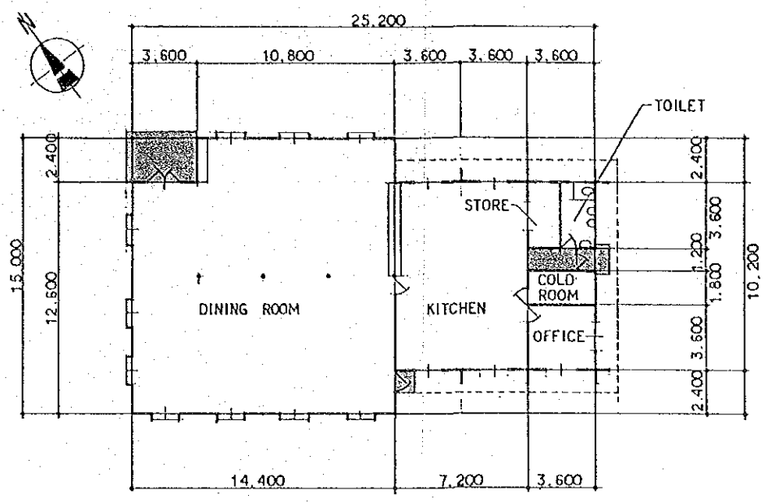
TITLE
INTEGRATED TEXTILE MILL UTILITY CENTER & RAW MATERIAL WAREHOSE

DWG. NO.
EX-166 - A - 04

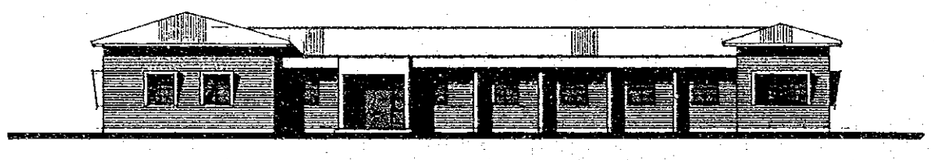
Fig. 12 Administration Building and Canteen



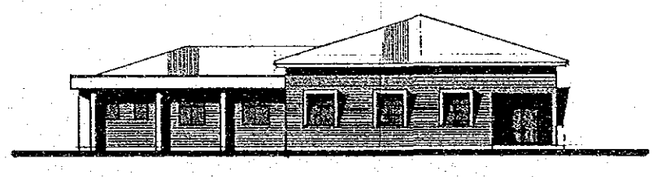
PLAN



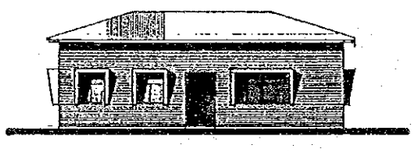
PLAN



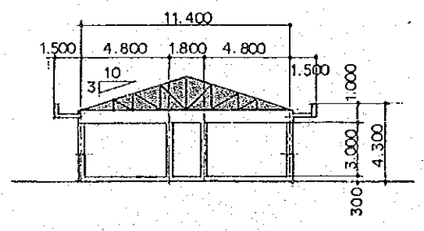
SOUTH ELEVATION



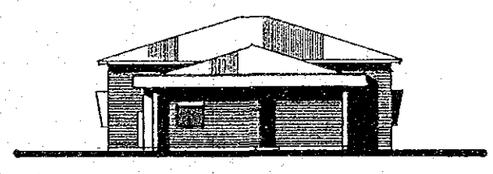
NORTH ELEVATION



EAST ELEVATION



A-A SECTION

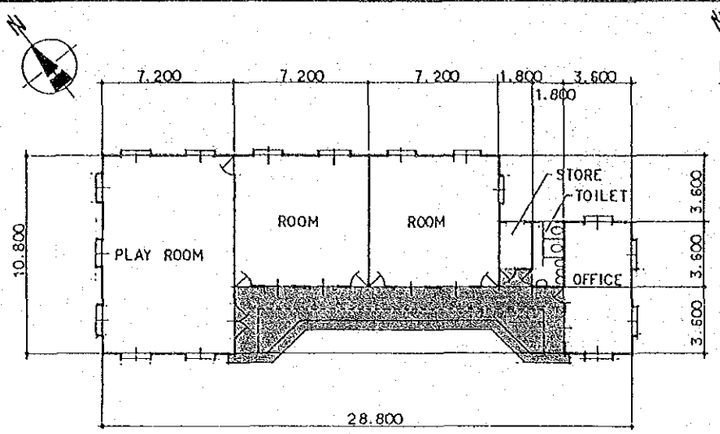


EAST ELEVATION

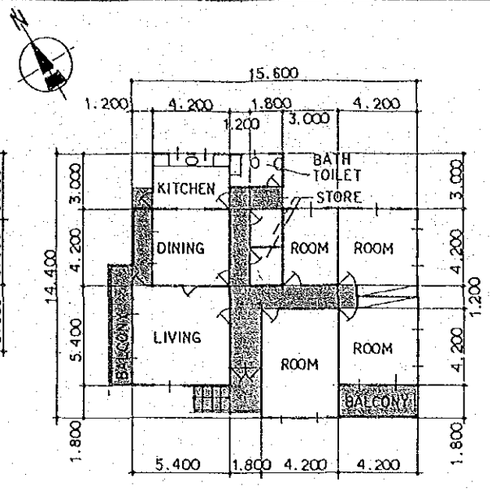
TITLE: INTEGRATED TEXTILE MILL ADMINISTRATION OFFICE & CANTEEN

DWG. NO. EX-166-A-05

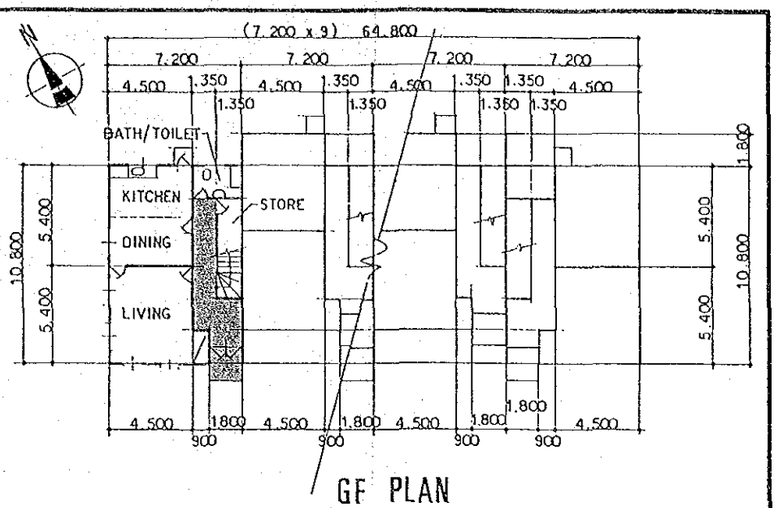
Fig. 13 Nursery School and Staff Houses



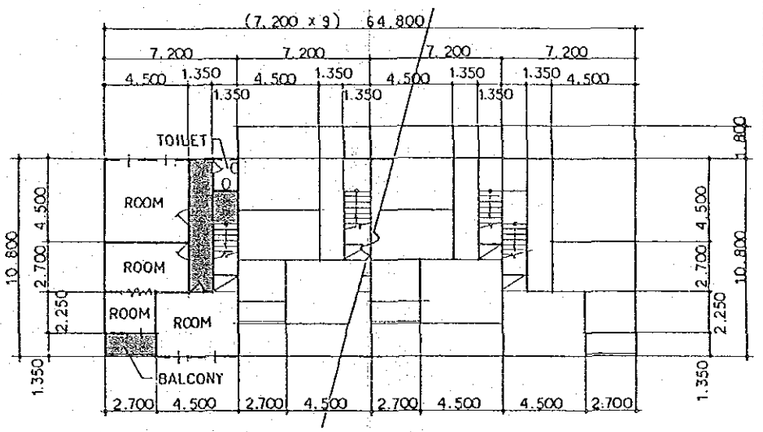
PLAN



PLAN



GF PLAN



1F PLAN

SOUTH ELEVATION

SOUTH ELEVATION

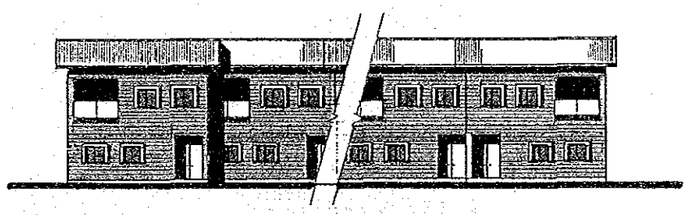
OFFICE / AMENITY BLOCK - FINISH SCHEDULE IN GENERAL

FOOTING	R.C. CONTINUOUS FOOTING
EXTERNAL WALL	1 BRICK WALL FAIR FINISH PRASTER VP AT LINTEL / CANOPY / COLUMN
ROOF	GALVANIZED IRON SHEET (#24) TIMBER TRUSS
DOOR WINDOW	WOODEN FLUSH OR FRAMED DOOR-/ WINDOW

INTERNAL FINISH

ROOM	FLOOR	SKIRTING	WALL	CEILING	REMARKS
OFFICE / G.ROOM	TERAZZO	TIMBER H=100	PLASTER VP	PLYWOOD OP	
KITCHEN / TOILET	TERAZZO	TERAZZO H=100	PLASTER VP TILES AT TOILET H=1.200	PLYWOOD	
STORE	MORTAR	-	PLASTER VP	PLYWOOD OP	

FINISH SCHEDULE



SOUTH ELEVATION

TITLE INTEGRATED TEXTILE MILL STAFF HOUSE & NURSERY SCHOOL

DWG. NO. EX-166-A-06

through bid procedure.

However, it is advisable that the civil and building works to be carried out together with procurement and erection of machinery under the one contract (i.e. on turn-key basis) which will make it possible to simplify various procedures, to reduce construction period and to proceed with local works smoothly.

In executing the works, the following points to be checked carefully.

1) Laws and Regulations

Although no legal hindrance to excution of works would have been observed, upon completion of schematic design of the Project, it would be necessary to hold discussion with the Authorities concerned in respect of application procedures, construction schedule etc.

Since there are no particular standards applicable for civil and building works, JIS, BS, ASTM or equivalent shall be basically applied in preparing specifications.

2) Preparation and Preliminary Works

The temporary water shall be obtained from Arjun River, whereas the temporary power shall be from diesel generator with approx. 200 KVA capacity. This generator shall be handed-over to the Mill by the Contractor upon completion of the Project for emengency purpose.

'Site office, worker's camp, construction plant and transportation of materials are those to be examined carefully in advance.

3) Earthworks

Well balanced cut and fill shall be required in earthworks and careful attention shall be drawn to the sufficient compaction in filling and backfilling.

4) Reinforced Concrete Work

Material test for reinfocement and cement shall be carried out in advance in order to reaffirm required strength of such materials. Also, inspection for bar arrangement as well as quality test of concrete shall be performed regularly at the site.

5) Structural Steel Works

Strength test for steel materials and bolts, product test for worked or manufactured steel, check on welded parts, tightness check on fixed bolts, etc. shall be carried out.

In addition, rust-proof painting shall be done thoroughly.

The method and order of erection shall be examined carefully in order to have erection works proceeded smoothly and effectively.

6) Roofing Works

Roofing materials shall be selected from viewpoint of weather-resistance, better workmanship and economical efficiency and the most crucial point is to construct water-proof roofing. To this end, the method of fixing, jointing details and effect on heat stress are those to be carefully studied and checked.

From the above, it is recommend that long roofing made of folded iron sheet is recommended (double construction with glasswool insulation for roofs of Spinning and Weaving)

7) Plastering Works

The plastered surface shall be smoothly finished, observing thicknes, curing and drying period of cement mortar. V-groove shall be made at the joint with other materials.

8) Brickwork

Exterior fair finish of brickwall shall require special workmanship and in order to prevent "efflorescence" of wall, the mixture of joint mortar to be examined carefully.

Furthermore, appropriate R. C. columns and lintels shall be provided for reinforcing the brick walls.

9) Doors and Windows

Steel sash shall be utilized at erternal wall and where corrosion resistance property is required.

General internal doors and windows shall be made of local wooden frame. The steel hunger doors or shutters to be adopted at large machine or material entrance.

10) Finishing Works

Appropriate selection of finishing materials shall be made.

Especially the influence of various factors such as moisture contents, chemical resistance, corrosion, heat, ultra violet ray shall be examined in advance.

High quality workmanship is required at the joint of materials as well as finishing of the high graded rooms.

11) External Works

The progress of external works is greatly affected by the weather condition, and thus the effect of rain season is carefully studied.

In addition, external works shall have quite a few relations with works for electric cables and mechanical pipings and therefore working schedule is to be adjusted so as to avoid idle works.

12) Others

Careful consideration in respect of accident prevention and safety shall have to be required.

5-8 Implementation and Operation Plan

5-8-1 Implementation Schedule

Table 40 shows overall implementation schedule and this schedule shall be clasified into three stages as below.

- The first stage from consultancy agreement, detailed design, documentation and tendering, evaluation of tenders till Award of Contract with Supplier (or Contractor) ..... 6 Months
- The second stage from Award of Contract with Supplier (or Contractor), civil and building works, erection of machincry till test run and commissioning of the Mill ..... 24 Months
- The third stage from commencement of operation to commencement of full operation. ..... 12 Months

Total 42 Months

The following indicates the points to be checked so as to complete the works in accordance with the schedule above.

1) Contract : To appoint reliable consultants and contractor who have sufficient experiences in the similar project.

2) Procedure : To make effort in smooth handling of various procedures such as contract negotiation, contract formality, opening of L/C, issurance of import licence.

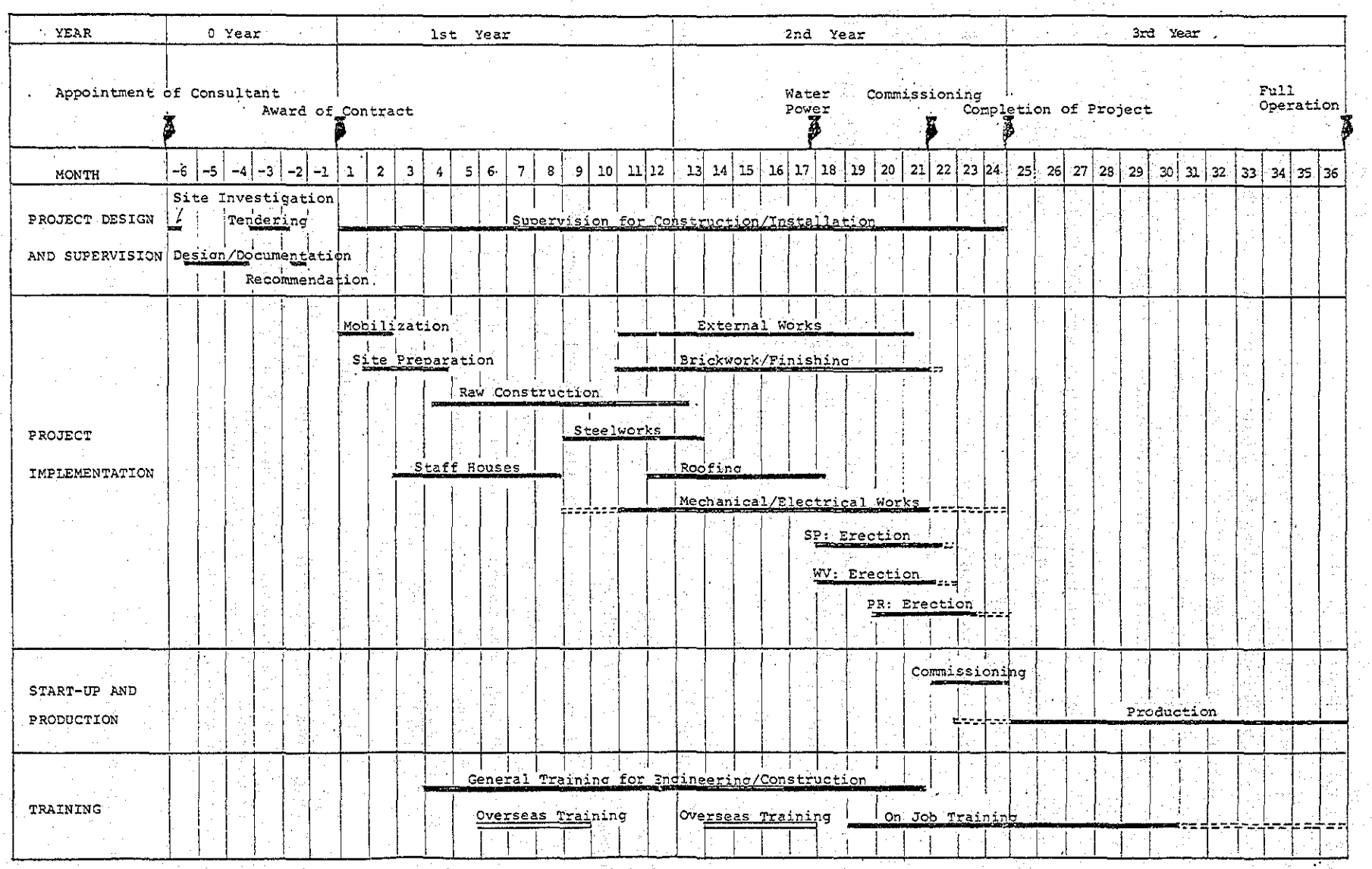
3) Survey : To carry out site survey, soil test in advance in order for the consultant to proceed with detailed design without a hitch.

4) Works in rainy season : To take into account of adverse effect of rain on implementation of works, in preparing final implementation schedule.

5) Power Supply : To make elaborate excution plan with an assistance of NEA for the power supply works from Lamahi to the Site, as it would influence a great deal on test-run or commissioning of the Mill.

6) Construction Material : To carry out in-depth survey on availability of local construction materials and machines in advance so that these would not cause delays in implementation.

Table 40 Overall Time Schedule



5-8-2 Site Organization during Consturction

In general, civil and building works, mechanical and electrical works, and erection of machinery are carried out at site, affecting and interrelating each other among themselves.

Therefore it is indispensable to make proper co-ordinations and co-operation among suppliers or contractors and which also would allow reduction of construction period as well as retrenchment of site expenditure.

The suppliers or contractors are selected through open tender procedure in general but the most suitable method of selection shall be carefully examined in advance in consideration of nature and contents of the Project.

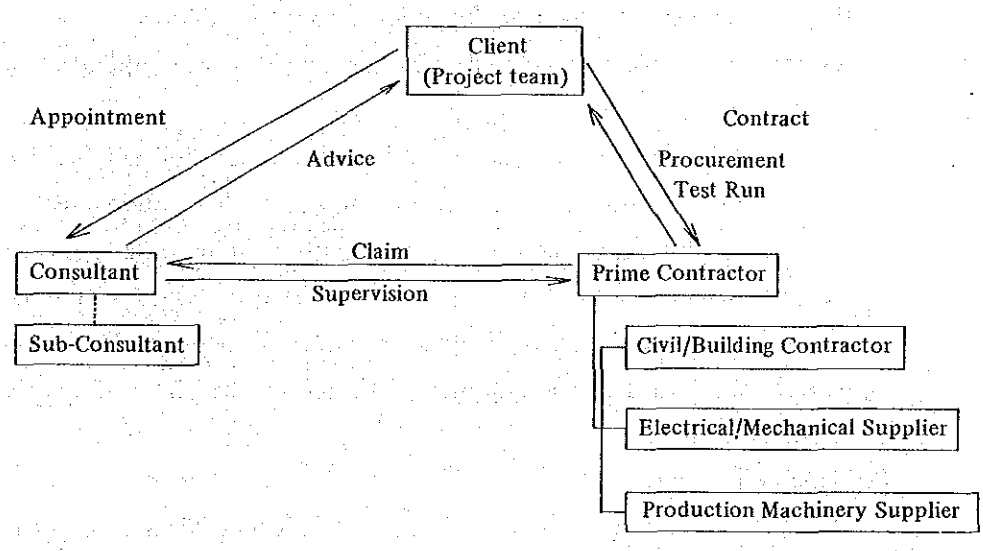
This Project is the construction of integrated textile mill and with a view to enabling easy co-ordination and co-operation as well as establishing clear-cut lines of responsibility, and thus it is advised to adopt "turn-key" system which, one main Supplier (or Contractor) will carry out all works involved till test-run of machinery under his sole responsibility.

However this system requires special attention to preparation of tender documents and evaluation in order to avoid cost increase than "partial package" system.

In addition technological transfer for design and excution of works to be considered and for this purpose, the establishment of project team within the Client organization and assignment of local sub-contractor or sub-consultants have to be considered.

The proposed site organization of the Project is as follows (Fig. 14)

Fig. 14 Expected Site Organization



5-8-3 Consultant

The consultant plays an important role on behalf of the Client in preparing tender documents and report on evaluation, in advising terms of contract and in supervising the excution of works. In other words, to appoint competent and experienced consultant is a key for the success of the Project.

In addition, it is necessary to transfer engineering technology through the consultant and in this sense, the project team of the Client shall have to be formed at the early stage of the Project so that they could carry out management and supervision of works together with the consultant.

It is also necessary to consider participation of local consultant as the sub-consultant for this purpose.

5-8-4 Execution and Training Plan

1) General Idea of Training

a) Purpose of Work Training :

The purpose of work training is to make all employees working at their job site capable of effecting their given works correctly, safely, conscientiously and yet speedily. From viewpoint of responsibility in an organization, each controller or supervisor is taking their share of the total responsibility of the whole of the organization. Then, it should be the status of course that this whole responsibility is divided and shared to employees under their jurisdiction in forms of concrete works, whereby the ultimate goal is accomplished through cooperation, participation and endeavour of each employee concerned.

– Following are the result of classification of the work training by purpose;

Preparatory Training:

This is the training to be conducted before a certain job is taken by an employee, its purpose being to give the employee the required techniques at works in a mill as conducted for new recruits or in in-house technical school. As the preparatory training is in any sense Preparatory, the training course is conducted based on a curriculum drafted from the result of "About to this extent, the knowledge is required". Therefore, the effect of the training is relatively indirect.

Proficiency Training:

This training is conducted with an aim that the working ability of employees now working is improved more. Because control as well as technology is progressing day by day, if the training is not always leading the advancement, the mill will be left from the front. This is required for all people at any level

of the organization.

Promotional Training:

This is the training for those whom the company schedules to promote, for his fulfillment of duty after the promotion. In other words, it could be called as training for deputies.

General Culture Training:

This seems to have no direct relation with the work. However, this has been approved in respect of personnel control as well, as one of the training item having to be conducted in working places, the reason being that if human being is not always given a spiritual nourishment such as mental food, he would have a danger of falling into corruption. The method may be through lectures, movies or theatregoing.

– The following 2 items are the result of classification of the work training by its contents:

Those by which the required knowledge is given:

By this training, the knowledge proper to each employee's job such as mechanism or principle of a machine, knowledge about materials, knowledge concerning the job such as about products or knowledge on job responsibilities such as annual and monthly target, labour agreement and rules of employment are given.

Those by which the required technique is given:

Mainly, 3 techniques in common for every supervisor such as how to instruct them in works, how to improve in work method and how to treat others in human relations are considered to be dealt with.

– The following 2 items are the result of classification of the work training by its place:

On-the-job Training:

This training is conducted directly on the works being done.

Off-the-job Training:

This training is conducted at a place off the site of the work.

Depending on contents of the training, the training may be conducted off job site or off the work, which sometimes produces better results. However, generally speaking, inhouse training conducted by on-the-job method accounts for 80 to 90 % of them, which is said to be more effective.

b) Executional Method of Work Training:

As for details of current executing method according to the training program, there are standard tactics.

There must be some rules for the job training to make the training effective. Namely, the fundamental rule must be to teach according to the procedure set forth in the Standard Operations Manual.

Even the scientific training method can only be effective, if the method follows this procedure. To achieve more effect, the training must be conducted using the five senses. Shares of the senses contributing to the training are as follows:

- Sense of Vision 60 %
- Sense of Hearing 20 %
- Sense of Touch 15 %
- Sense of Taste 3 %
- Sense of Smell 2 %

The positive motive which induces an unskilled worker toward the job are;

- To earn living expenses (Measure)
- Universally accepted idea that working is a matter of course (Duty), and
- To wish to be skilled in work and improve himself. (Objective)

Contrary to the above, there are another factors influencing the unskilled worker negatively as the result of nature of the work and working environment in the mill, which are;

- Overwhelmed by the need of learning several techniques at the same time, being shrinked back,
- Among skilled workers, losing his composure, and
- A problem of being unable to be accustomed to the place of "production".

With the above factors giving the positive and negative influences to the learning desire of the trainees, the training course is developed. When these relationship are indicated in a diagram by means of an average representative learning curve collected from hundreds of data, we can obtain the following Figure 15.

As indicated in the figure, the beginner progresses by 30–50 % in the beginning, however, his subsequent progress speed becomes slow. Therefore, if the negative factor could be got rid of and the positive factor could be encouraged, the learning curve would emerge as the following;

From the above, it is noted that a period required for getting to 100 % production level on an average over the whole mill is remarkably shortened. This

Fig. 15 Learning Curve

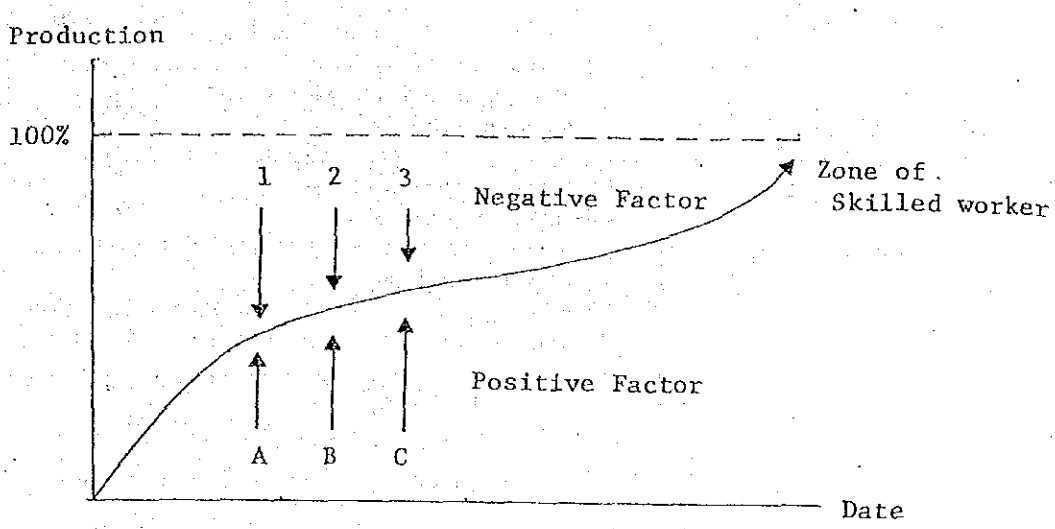
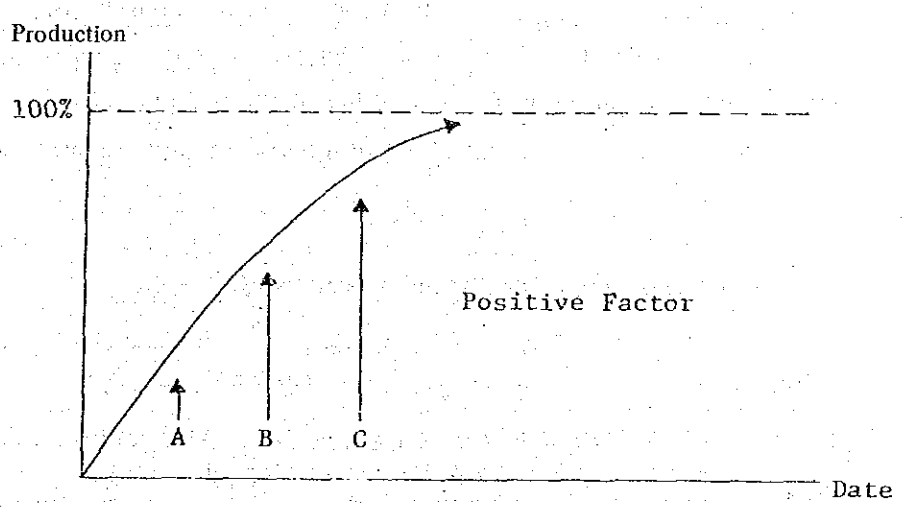


Fig. 16 Corrected Learning Curve



is the aim of the training programme.

Shortcoming in individual worker's ability is discovered and incorporating this shortcoming into systematical training programme is required. For this purpose, the problem of whom, for which work, by what date should be trained up, must be clarified, and the points must be filled in the Training Schedule.

The filling order of the Training Schedule and items to be filled in are shown in Table 40.

Table 41-1 Filling Order of the Schedule

Filling Order	Items to be filled in
1	Job Place, Name and date, Kind of work Names of subordinates
2	Circle the work he is in charge Check for works he can do
3	Changes in production Changes in personnel For which to be trained Working attitude
4	Whom, for which work, by what date Scheduled date

Moreover, what is to be prepared and considered before teaching particulars of work is that the contents of works to be taught should be well assorted. For this purpose, a supervisor (teacher) should refrain himself from such instances that he overlooks the important point while analysing the work and tabulaing it into a table, or he even does not think of the technique for conveying an idea to the other. Table 41 indicates a procedural example or preparing method of a Work Analysis Table.

Table 41-2 Preparing method of work analysis table

Filling order	Items	Procedures
1	Fill in title	Clarify name of work to be taught, parts (objects of the work), tools (to be used at work) and materials (consumable goods, etc.)
2	Decide major working orders and fill them in	At teaching works, teach by section of the work without doing it in slovely way. Consider how to section the work to teach the trainee in explicit terms, and decide the working orders one by one while practicing the work actually.
3	Fill in with the point determined	Consider, for each major working order, where the point is while doing the work by yourself. The point means the determinant (the deciding factor of whether the work is accomplished or failed), safety (things by which workers are likely to be injured) and ease (percepted or knack). Make sure whether it could be the point or not, by the 6 queries.
4	Check it once again	Check the following while doing the work once again: Is the volume of work to be taught at a time appropriate? Is there anything overlooked?

2) Excution of Training Plan

It is sincerely recommendable to receive not only production and operation technology but also the technology of quality control and preventive maintenance as well as maintenance technology and knowledge of the auxiliary equipment.

These technology and knowledge have been rapidly developing along with the development of auxiliary equipment and market demand of higher quality and hence it is essential to exert efferts to obtain modern and latest technology and knowledge.

It is the best way to carry out education and training throughout the Project, i.e. from the stage of initial construction and erection of machinery to the stage of test-run and operation.

It is sometimes observed that the training consultant is different from the engineering consultant, however it is very difficult to get intended results from this system due to the lack of consistency in the machinery and training.

In early stage of construction before commencement of erection of machinery, it may be worthwhile to carry out overseas training of key personnels of the Mill at overseas machine manufacturesrs or modern and developed mill for a short period.

As a consequence, the following is supposed to be the actual measures of education and training for the proposed Mill.

- Education on engineering activities, such as planning, contract, procurement, supervision, etc. along with the implementation of the Project.
- Training on various aspects at overseas machine manufacturers or modern operating mills for a short period.
- Training on the basic maintenance and operation skill by means of perticipating in machine erection works, test-runs and commissioning of the Mill.
- Education and training on the production control, quality control, preventive maintenance, maintenance technology and knowledge of the auxiliary equipment after commencement of operation.

3) Period of Training

The training is ideally to start with the commencement of engineering activities, however in considering the point of recruiting trainees and procedural matters, the period of training is planned to be 27 months in total beginning from the time when full scale construction activity commences to 6 months after completion of test-runs.

This period shall be classified into the following stages, although some parts are overlapped somehow.

- The first stage

  Training through actual engineering works

– The second stage

Overseas training

– The third stage

Training through erection and test-runs of the Mill

– The fourth stage

Training through actual operation of the Mill.

Although the training courses mentioned above shall be completed in four stages, it is further recommended to continue education and training for higher levels in some way in accordance with the achivement made by the end of training course.

4) Training Staff

The training shall begin in accordance with the training programme to be prepared by the training experts.

The number and period of training staffs to be despatched from abroad to participate in the above training programme are estimated as below.

	Number	Period
a) Training Manager	1	12 months
b) Spinning Chief Trainer	1	12 months
c) Spinning Trainer	2	18 months
d) Weaving Chief Trainer	1	12 months
e) Weaving Trainer	1	6 months
f) Processing Chief Trainer	1	12 months
g) Processing Trainer	1	6 months
h) Mechanical Trainer	2	18 months
i) Electrical Trainer	2	15 months

The despatch schedule of these staffs is as per Table 42.

It should be planned that resident engineers of consultant as well as supervisors despatched by machine manufacturers shall also carry out training and technological transfer to local staffs positively through the works on site.

5) Trainees to be Sent Abroad

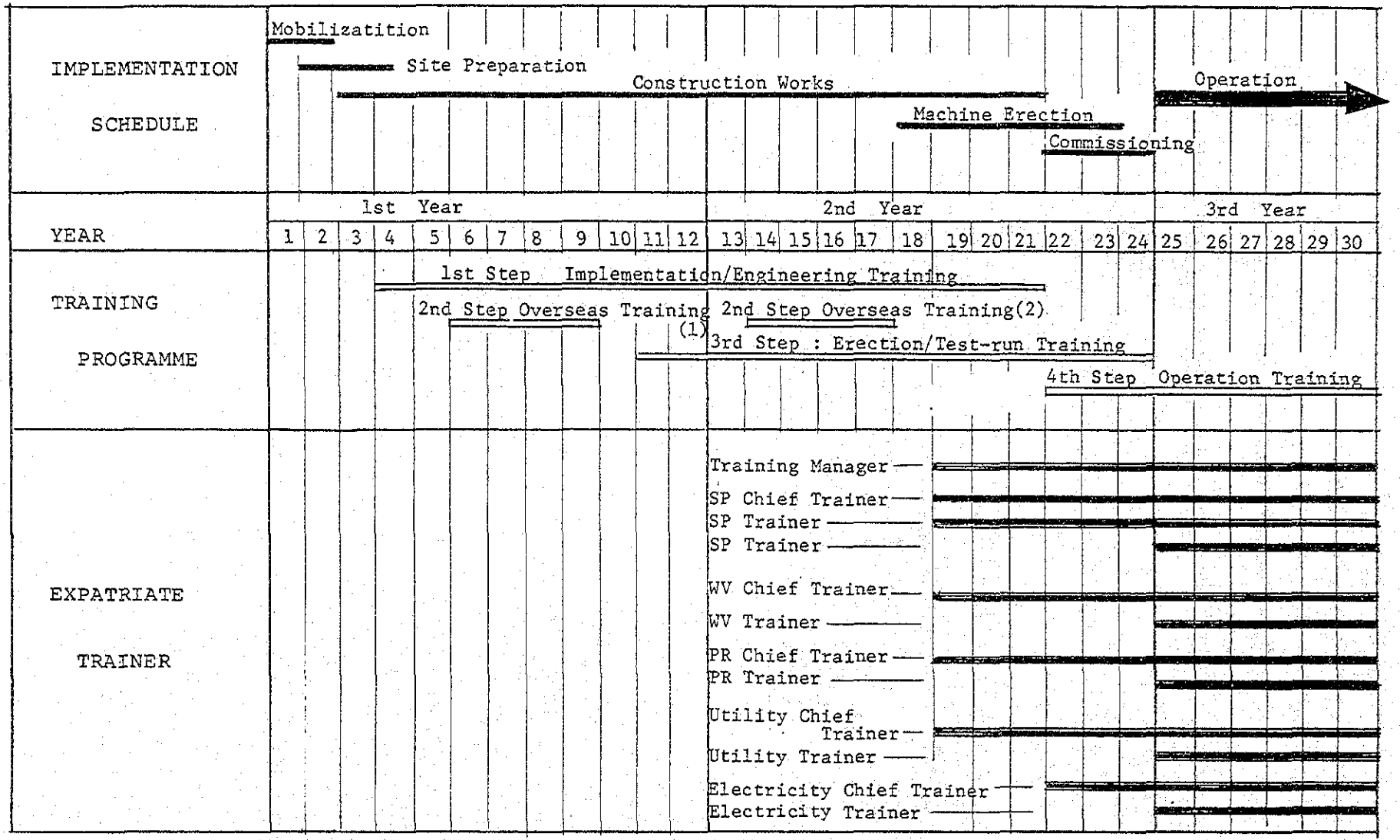
Two stage overseas training to be conducted and following indicates the number of trainees to be sent abroad and the expected training period in the various field.

(The first stage)	Number	Period
a) Mill Manager or equivalent	2	4 months
b) Electrical Engineer	1	4 months
c) Mechanical Engineer	2	4 months

(The second stage)	Number	Period
a) Spinning Engineer/Supervisor	4	4 months
b) Weaving Engineer/Supervisor	3	4 months
c) Processing Engineer/Supervisor	3	4 months

Table 42 shows also overall education and training schedule for the Project.

Table 42 Training/Education Schedule



5-8-5 Personnel Organization and Planning

1) Personnel Set-up Plan during Construction Period

The recruitment of required personnels shall commence in accordance with the progress of the site works as mentioned in the previous clause and it is recommended that such recruitment to be made in line with the education and training programme. It is also important to make systematical and effective recruitment in view of the lack of experienced and proficient persons in Nepal.

Consequently, the recruitment plan for the Project shall be formulated on the following assumption.

- The recruitment of staffs to be made from the early stage of the Project and managerial training shall be conducted to the senior staffs including overseas training. Engineering training through construction works shall be conducted to general officers and supervisors.
- "On the Job Training" shall be carried out to the local staffs to be recruited during the period of machine. Their competence and diligence shall then be assessed and they will be assigned to the appropriate position after commencement of mill operation.

Table 43 shows manning schedule during the period of machine erection and Table 44 shows employment schedule of local staffs during the construction period as well as the 12 months from the commencement of the operation to the commencement of full capacity operation.

Table 43 Erection Manning Schedule

YEAR		1st Year				2nd Year												TOTAL
MONTH		9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
IMPLEMENTATION SCHEDULE		Mechanical/Electrical Works									SP Erection							
											WV Erection							
													PR Erection					
EXPATRIATE SUPERVISOR	Spinning										5	8	6	5	2	1		27
	Weaving										3	3	4	5	1	1		17
	Processing													3	4	4	3	14
	Utility	1	2	3	5	8	8	9	7	9	8	7	8	8	5	3	1	92
	Sub-total	1	2	3	5	8	8	9	7	9	16	18	18	21	12	9	4	150
1 FOREMAN TECHNICIAN	Spinning										8	10	7	6	3			34
	Weaving										5	6	6	5	1			23
	Processing												6	6	6	6	4	28
	Utility	3	3	5	7	7	8	8	8	8	8	8	8	7	6	5	1	100
	Sub-total	3	3	5	7	7	8	8	8	8	21	24	27	24	16	11	5	185
2 SKILLED LABOUR	Spinning										10	12	9	8	4			43
	Weaving										15	15	20	16	4			70
	Processing												12	12	17	17	12	70
	Utility	7	10	11	16	16	18	25	25	27	27	25	22	20	16	13	7	285
	Sub-total	7	10	11	16	16	18	25	25	27	52	52	63	56	41	30	19	468
3 UNSKILLED LABOUR	Spinning										24	28	21	18	16			97
	Weaving										25	25	31	25	6			112
	Processing												17	17	22	22	15	93
	Utility	6	13	13	16	16	18	31	31	38	38	35	33	25	17	8	8	346
	Sub-total	6	13	13	16	16	18	31	31	38	87	88	102	85	51	30	23	648
TOTAL 1-3	Spinning										42	50	37	32	13	-	-	174
	Weaving										45	46	57	46	11	-	-	205
	Processing												35	35	45	45	31	191
	Utility	16	26	29	39	39	44	64	64	73	73	68	63	52	39	26	16	731
	TOTAL	16	26	29	39	39	44	64	64	73	160	164	172	166	108	73	47	1,301

Table 44 Mill Staff's Employment Schedule

YEAR		1st Year												2nd Year												3rd Year											
MONTH		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
IMPLEMENTATION SCHEDULE		Mobilization				Civil/Building Works																															
						Overseas Training								Overseas Training								Mechanical/Electrical Works															
																			Erection of Machinery							Operation										
																						Commissioning															
1 GENERAL MANAGER					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2 ADMINISTRATIVE MANAGER					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3 PRODUCTION MANAGER					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4 ADMINISTRATION	Chief Officer				1	1	1	1	1	1	2	2	2	2	2	2	2	2	4	4	4	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Officer				1	1	1	1	1	1	3	3	3	3	3	3	3	3	5	5	5	5	7	7	7	7	7	7	7	10	10	10	10	13	13	13
	Skilled Labour																		3	3	3	3	11	11	11	11	11	11	11	15	15	15	15	15	23	23	23
	Unskilled Labour				2	2	2	2	2	2	5	5	5	5	5	10	10	10	10	10	10	10	15	15	15	15	15	15	15	20	20	20	20	20	25	25	25
	Secretory for GM				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Sub-total				5	5	5	5	5	5	11	11	11	11	11	16	16	16	23	23	23	23	38	39	39	39	39	39	39	51	51	51	51	51	67	67	67
5 SPINNING	Division Head													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Chief/Supervisor													3	3	3	3	3	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	Foreman/Leader																			6	7	13	26	29	29	29	38	38	38	38	42	42	47	47	47	47	47
	Skilled Labour																			10	25	39	66	66	105	105	124	124	144	144	163	163	183	183	183	183	183
	Unskilled Labour																			6	6	19	30	30	30	30	37	37	44	44	51	51	58	58	58	58	58
	Sub-total													4	4	4	4	4	7	29	45	78	129	132	171	171	206	206	233	233	263	263	295	295	295	295	295
6 WEAVING	Division Head													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Chief/Supervisor													2	2	2	2	2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Foreman/Leader																			14	14	14	16	16	16	25	25	25	25	36	36	36	47	47	47	47	47
	Skilled Labour																			21	21	30	72	72	72	132	132	132	132	191	191	191	250	250	250	250	250
	Unskilled Labour																			9	9	9	9	9	9	14	14	14	14	19	19	19	24	24	24	24	24
	Sub-total													3	3	3	3	3	6	50	50	59	103	103	103	177	177	177	177	252	252	252	327	327	327	327	327
7 PROCESSING	Division Head													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Cheif/Supervisor													2	2	2	2	2	2	2	3	3	3	3	5	5	5	5	5	5	5	5	5	5	5	5	5
	Foreman/Leader																							10	15	15	15	25	25	28	28	28	28	43	43	43	43
	Skilled Labour																					8	8	24	24	24	24	24	24	48	48	48	48	71	71	71	71
	Unskilled Labour																							6	6	6	12	12	12	12	12	25	25	25	25	25	25
	Sub-total													3	3	3	3	3	3	3	4	12	12	34	44	51	57	57	67	67	94	94	107	107	145	145	145
8 UTILITY	Division Head					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Officer/Supervisor					2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	Foreman/Leader									2	2	3	3	3	3	7	7	7	9	10	11	11	11	11	12	12	12	14	14	14	14	14	16	16	16	16	16
	Skilled Labour									2	2	3	3	3	3	6	6	6	8	8	11	11	11	11	12	12	17	17	17	21	21	21	21	21	26	26	26
	Unskilled Labour											1	1	1	1	2	2	2	3	3	3	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	Sub-total					3	3	3	3	7	7	10	10	10	10	18	18	18	23	24	28	31	31	31	33	33	38	40	40	44	44	44	46	46	51	51	51
9 TOTAL 4-8	Division Head			1	2	2	2	2	2	3	3	3	6	6	6	6	6	6	8	8	8	8	8	9	9	9	9	9	9	9	9	9	9	9	9	9	9
	Officer/Supervisor			1	3	3	3	3	3	5	5	5	12	12	12	12	12	12	20	20	21	21	23	23	23	25	25	25	25	28	28	28	28	28	31	31	31
	Foreman/Leader (Secretary for GM)	1	1	1	1	1	1	1	3	3	4	4	4	4	8	8	8	10	31	33	39	54	57	68	82	91	93	103	114	121	121	139	139	154	154	154	
	Skilled Labour									2	2	3	3	3	3	6	6	6	11	42	60	91	168	184	224	284	308	308	328	395	438	438	517	517	553	553	553	
	Unskilled Labour		2	2	2	2	2	2	2	5	6	6	6	6	12	12	12	13	28	28	44	60	66	66	71	84	84	91	101	108	108	133	133	138	138	138	
GRAND TOTAL		5	8	8	8	8	12	18	21	21	31	31	44	44	44	62	129	150	203	313	339	390	471	517	519	556	647	704	704	826	826	885	885	885			

2) Mill Organization and Number of Personnel per Department

In order to have the Mill operated smoothly and produced high quality products with high productivity, not only machines and equipment but also those personnel who operates and controls those machines and equipment are indispensable. Particularly, because the textile industry is a labour-intensive industry, it is very important that the right personnel to be positioned at the right working place.

Even though too many personnels are recriuted and organization is made larger, the smooth operation cannot be expected, and to the contrary, controlling the subordinates by the senior personnel as well as training those subordinates will pose problems.

If number of trasmission spot where orders from the superiors pass through is numerous and number of personnel belonging to these transmission sports are also numerous, not only the order transmission will take longer time, but also leakage will take place in the transmitting period. Consequently, the ideal status should be that less numbers of well-trained personnel work in an simplified organization.

The organization and personnel set-up planning are considered on the assumption of the following points:

a) In principle, the Mill organization shall be of the same type which is being applied to the similar textile industries in Nepal.

b) In order to secure sufficient working days, and to rationalize working hours as well as to promote working efficiency through teamwork system, attendance system of 3 shifts with 4 groups shall be employed in Spinning and Weaving departments.

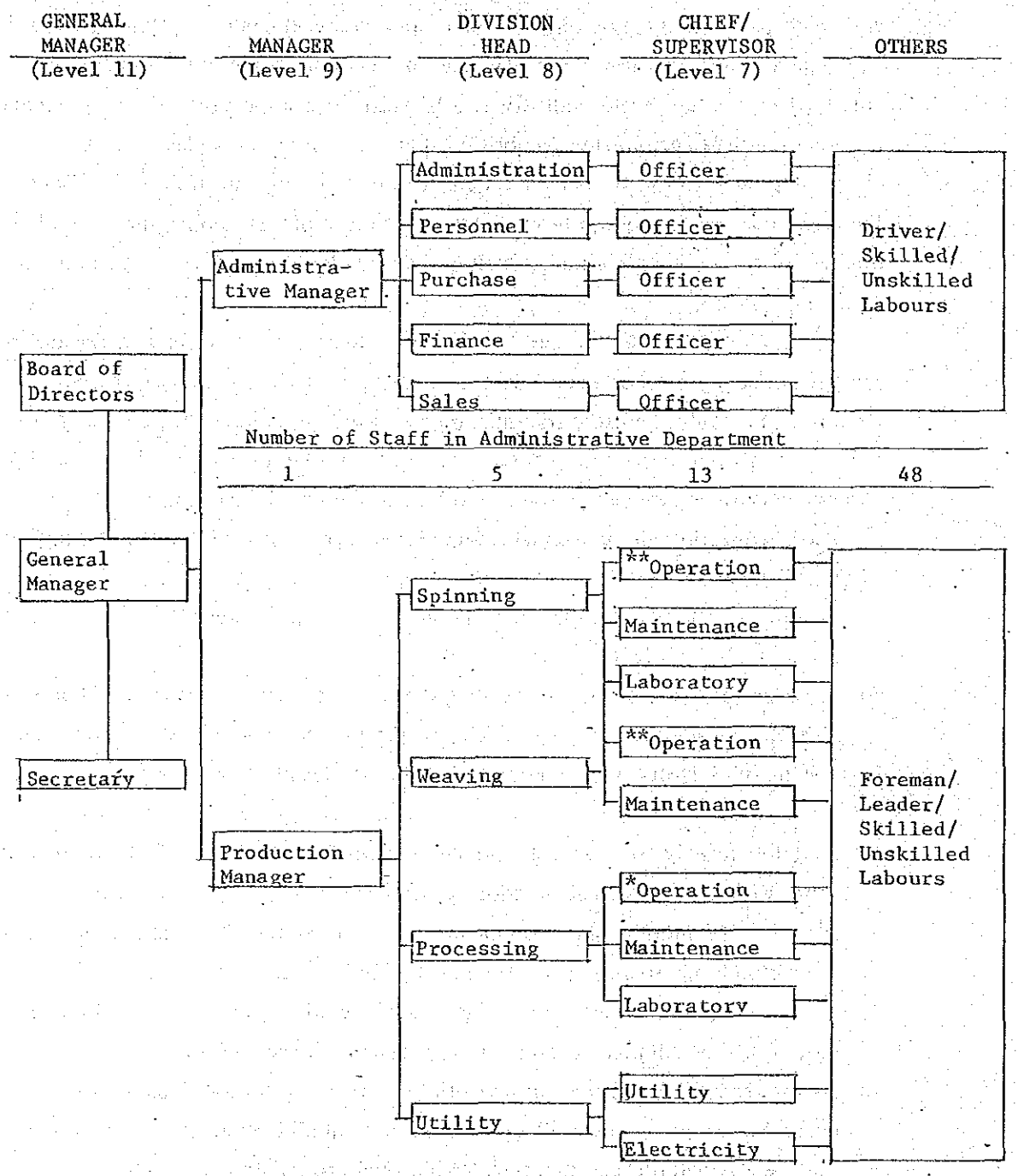
Subsequently, stagewise attendance system from 1 shift with 1 group to 2 shifts with 2 groups shall be adopted after commencement of operation and in the 10 ~ 11 months after commencement of operation 3 shifts with 4 groups to be established so as to attain the target of full operation at 12 months.

In Processing department, either 2 shifts with 2 groups or 3 shifts with 3 groups shall be adopted according to the capacity of each machine.

c) As for production department and utility and administration department, excess or useless employment shall be avoided and simplification of the organization shall be attained through thorough training and profficient personnels.

As a result above mentioned, Table 45 indicates mill organization with total numbers of personnels per grade per department, and Table 46 to Table 50 show the detailed organization and numbers of personnels of each department.

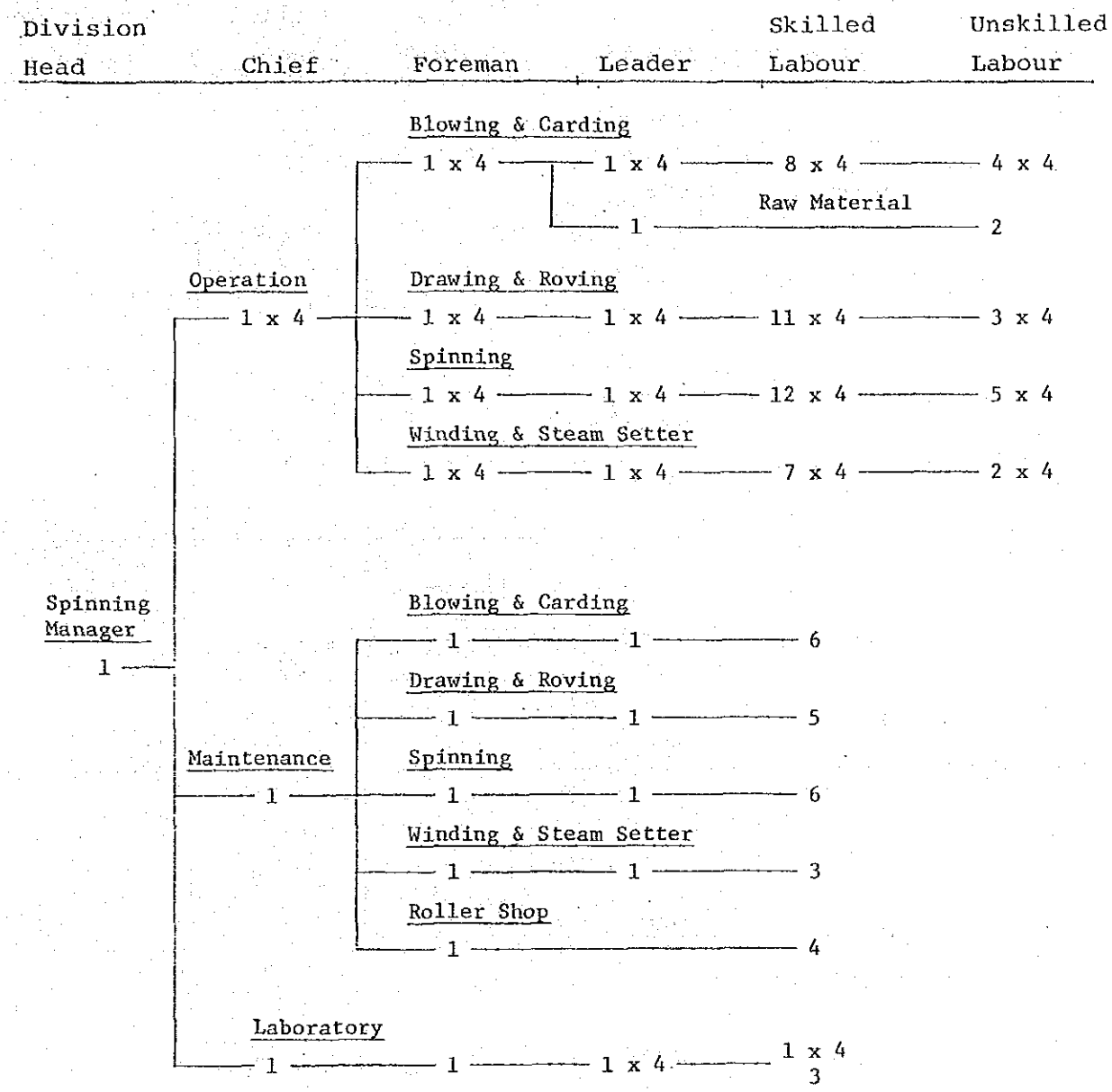
Table 45 Mill Organization and Number of Staff



TOTAL NUMBER OF MILL STAFF

2	2	9	31	844
			TOTAL	888

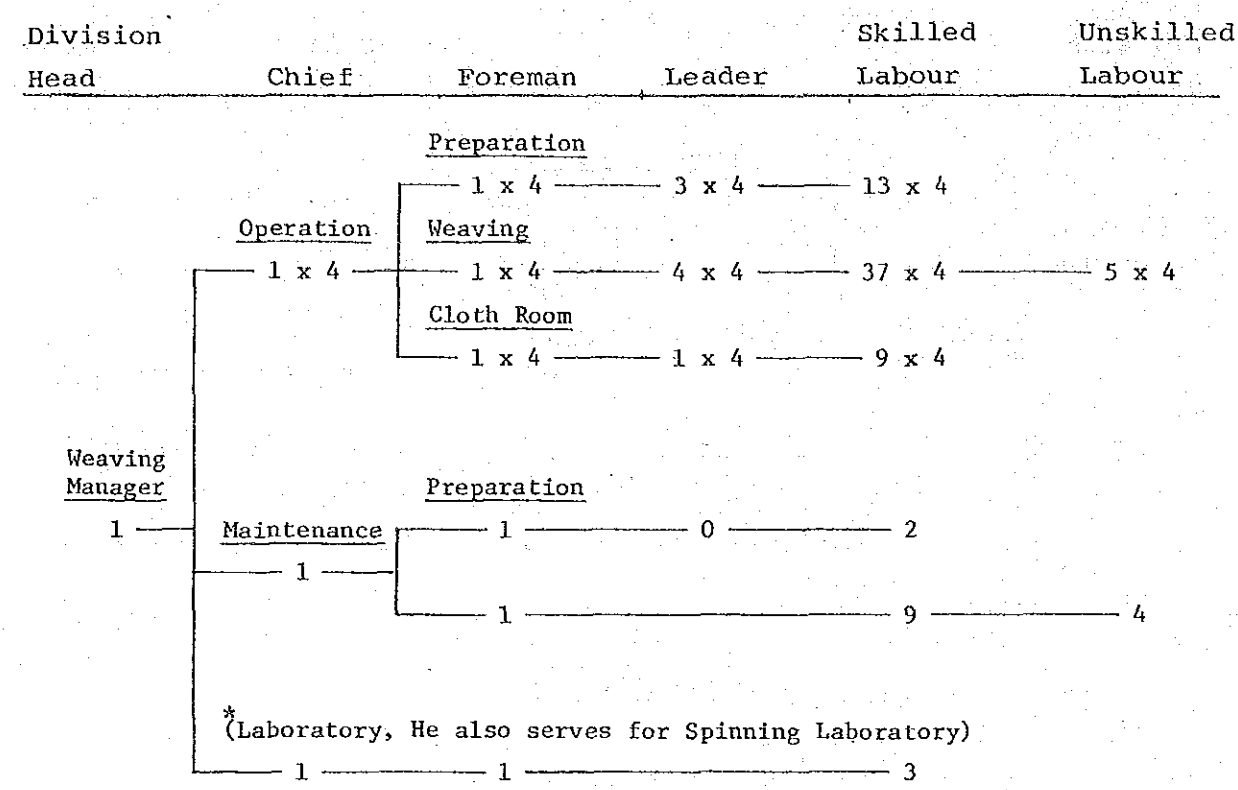
Table 46 Spinning Staff Organization



Total	1	6	22	25	183	58

TOTAL 295

Table 47 Weaving Staff Organization



Total	1	5	15	32	250	24

TOTAL 327

Table 48 Processing Staff Organization

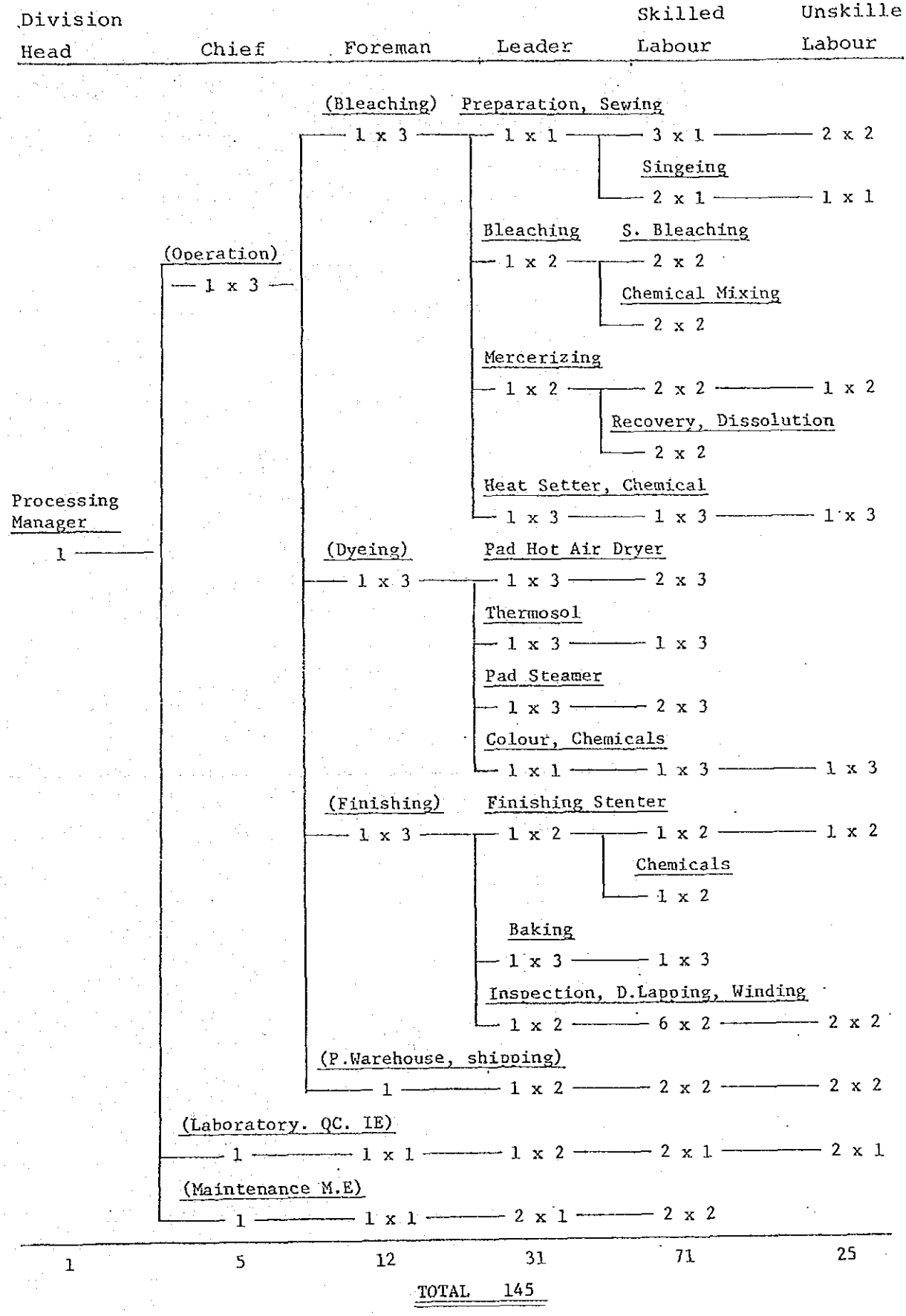


Table 49 Utility Staff Organization

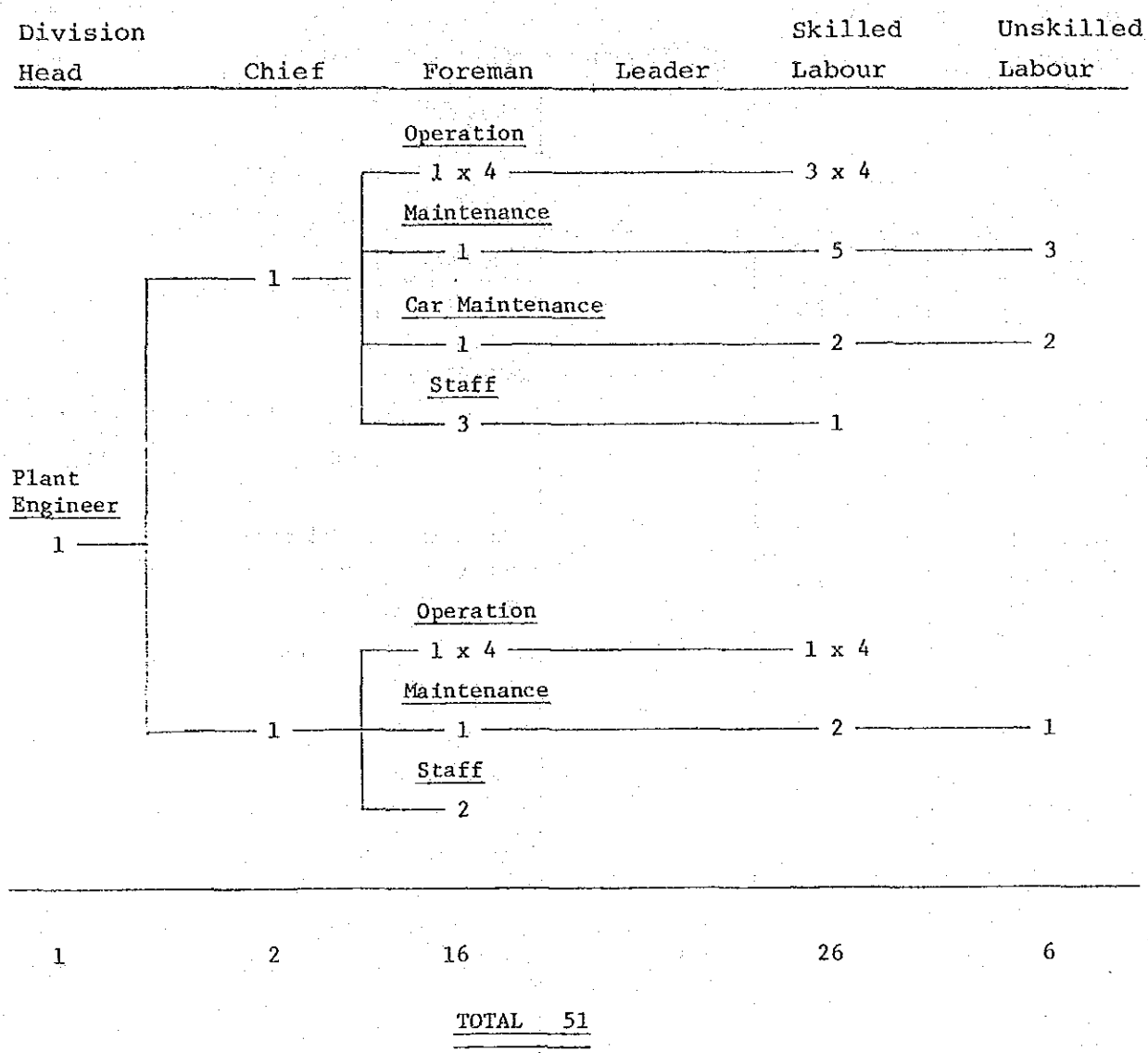
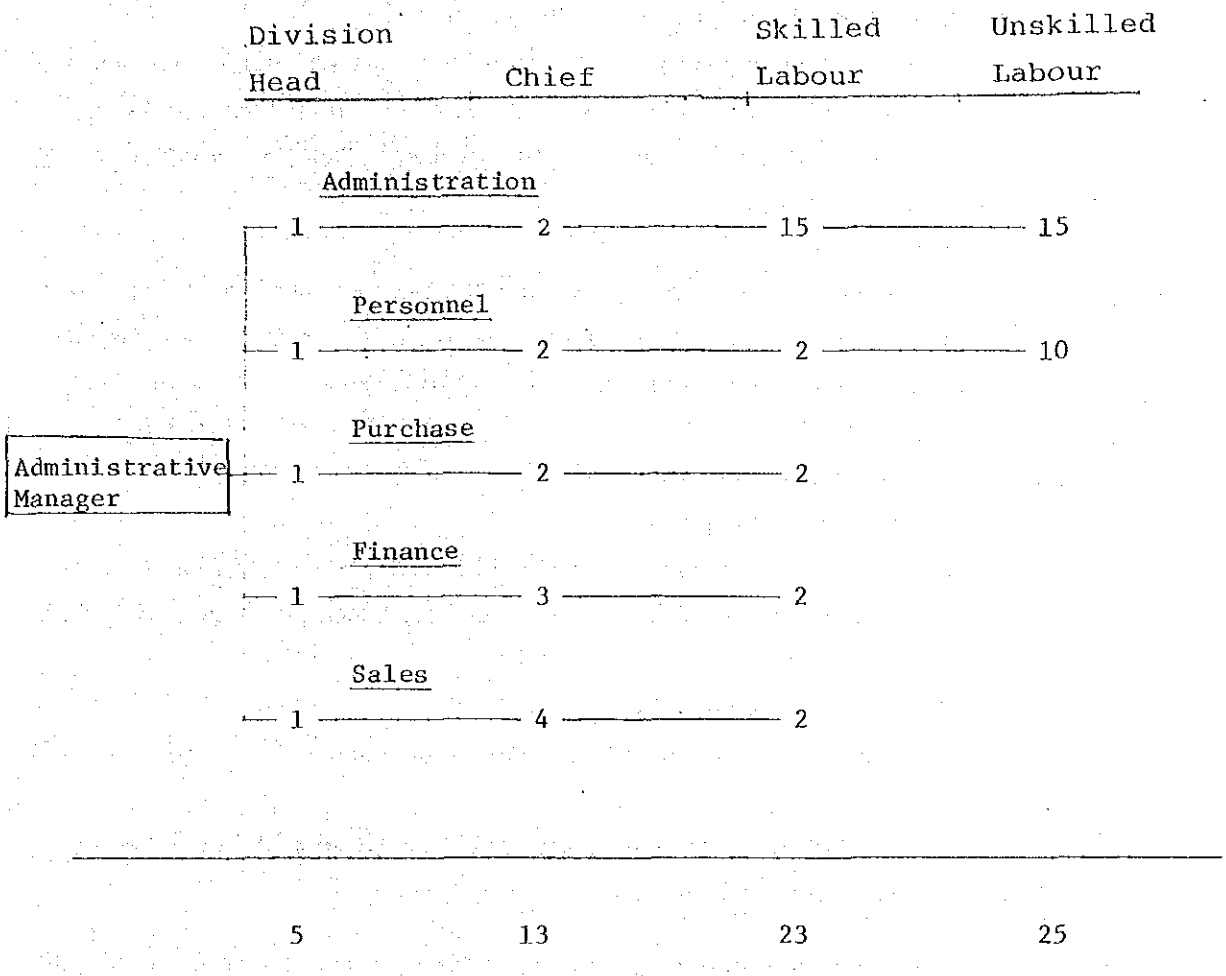


Table 50 Administrative Staff Organization



TOTAL 66 + 1 (GM's Secretary)

3) Talent required to each Grade

The following is the general idea on talents required to each grade.

a) General Manager

He has desirably an experience as the mill manager.

He is supposed to have graduated from university and has an experience in studying abroad. At least he has an experience of more than 5 years at the position as Industrial Engineer, Textile Engineer, Plant Super-intendant, or Administrative Manager.

b) Manager

He is also graduated from university and has an experience in studying abroad.

Further he has experienced the job as Textile Engineer, Mechanical Engineer, Chemical Engineer, Electrical Enginner, Industrial Engineer, Plant Engineer or Maintenance Engineer.

c) Chief, Supervisor, Technologist

He is to be a front commander.

He is supposed to be complete the course of collage or high school. He should have a qualification of Technologist, Supervisor, Specialist, Expert or Officer.

d) Foreman

He is to be technician or Assistant.

He is supposed to be complete the course of secondary school (or high school)

e) Worker

He will work for operation, maintenance and cleaning and desirably he has finished the study of primary school.

The above are the geneal ideas on talents to be required to each grade of work, However in view of the present position of industrialization in Nepal, it seens to be very difficult to employ sufficient personnels who have an experience in textile industries and hence only way to be taken is that foreman or the lower level to be trained on technology and expertize within mill education programme on top of basic knowledge obtained through school education.