DRAWINGS

PLAN - 1

(ARRANGEMENT OF WORKSHOP)

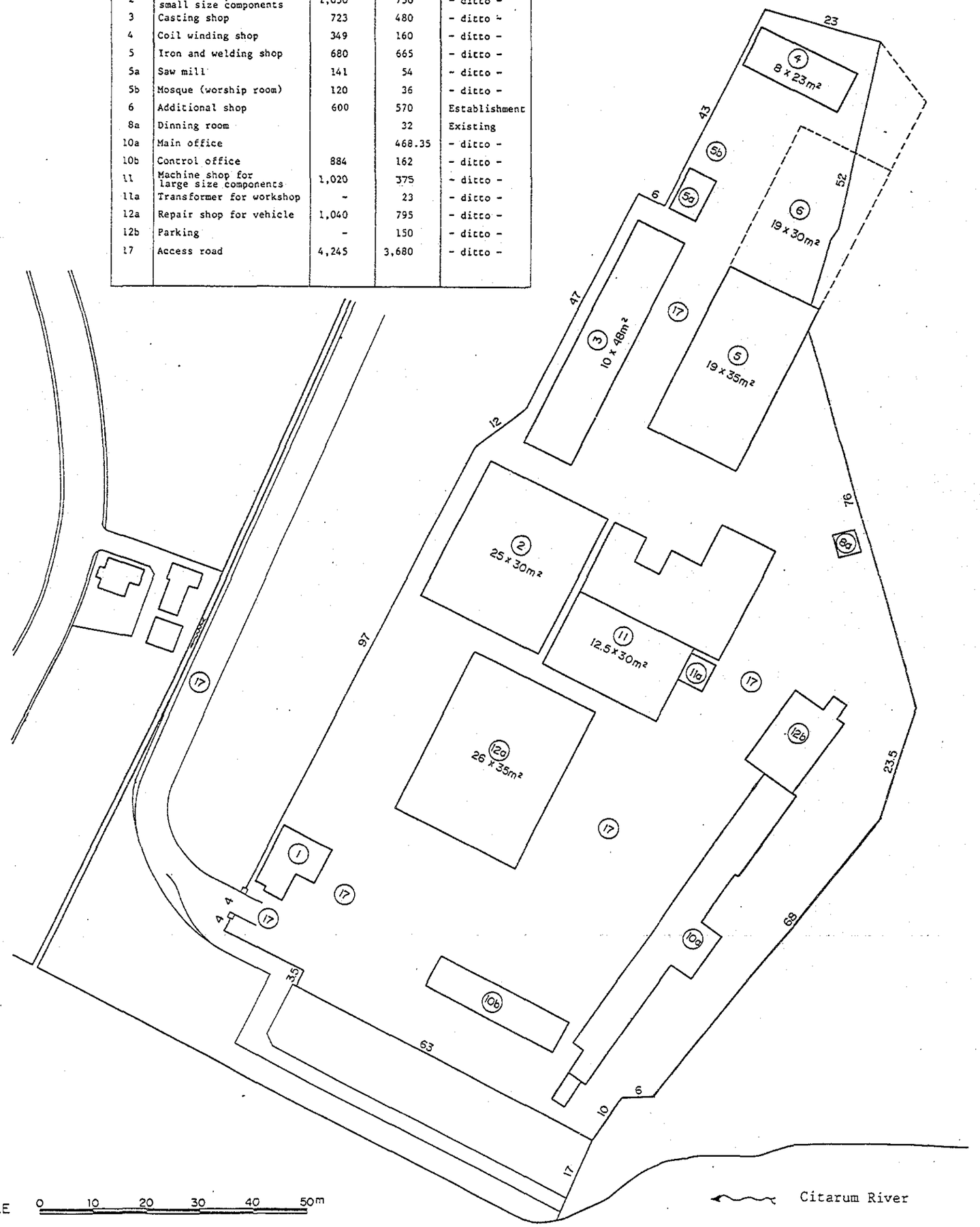
DRAWING LIST

PLAN-1 (ARRANGEMENT OF WORKSHOP)

Serial No.	Drawing No.	Description
1.	R-100	General Arrangement of Workshops PLAN-1
2.	R-101	Arrangement of Machine Shop No. 2 for Small Size Components
3.	R-102	Arrangement of Casting Shop No. 3
4.	R-103	Arrangement of Iron and Welding Shop No. 5
5.	R-104	Arrangement of Machine Shop No. 11 for Large Size Components

Drawing No. R-100 General Arrangement of Workshops PLAN-1

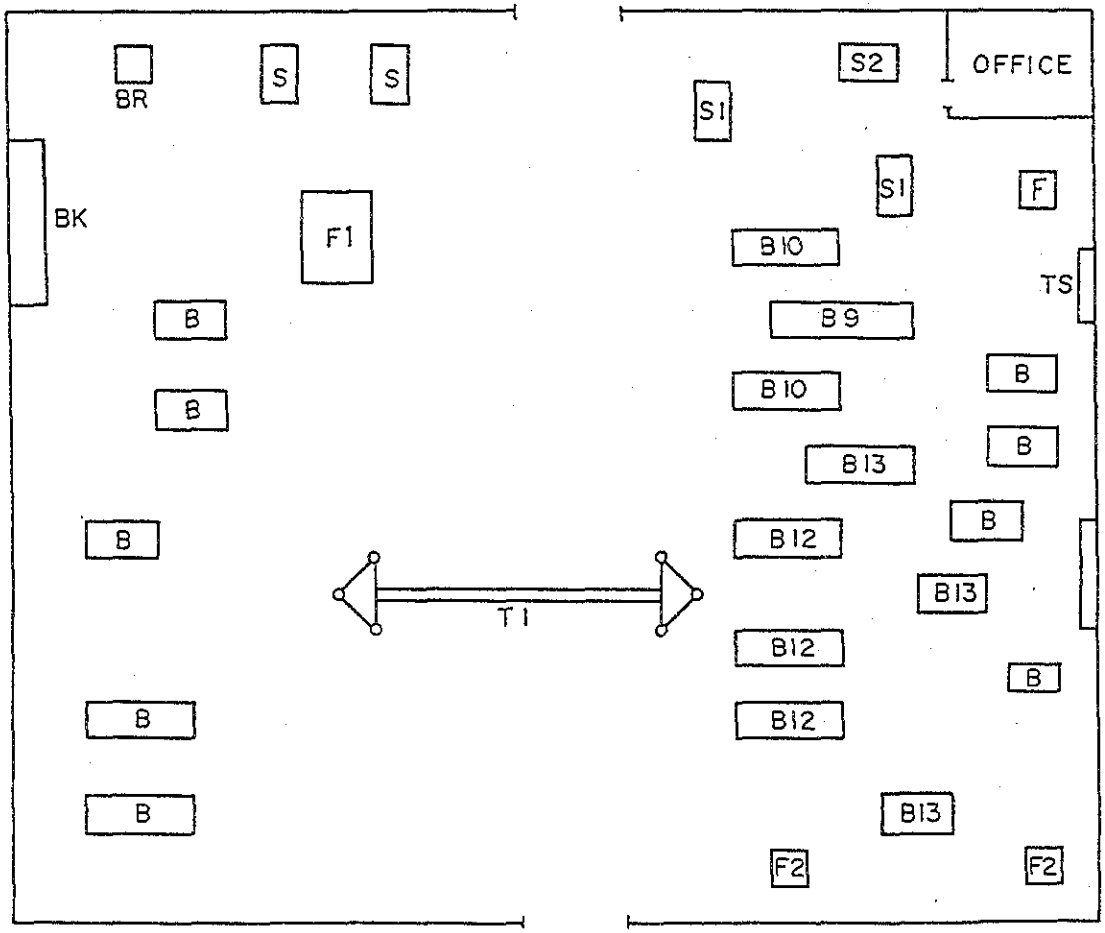
Shop No.	Description	Area m²		Remarks
		Plottage	Floor	
1	Guard house	326	103.25	Existing
2	Machine shop for small size components	1,050	750	- ditto -
3	Casting shop	723	480	- ditto -
4	Coil winding shop	349	160	- ditto -
5	Iron and welding shop	680	665	- ditto -
5a	Saw mill	141	54	- ditto -
5b	Mosque (worship room)	120	36	- ditto -
6	Additional shop	600	570	Establishment
8a	Dinning room		32	Existing
10a	Main office		468.35	- ditto -
10b	Control office	884	162	- ditto -
11	Machine shop for large size components	1,020	375	- ditto -
11a	Transformer for workshop	-	23	- ditto -
12a	Repair shop for vehicle	1,040	795	- ditto -
12b	Parking	-	150	- ditto -
17	Access road	4,245	3,680	- ditto -



Drawing No. R-101

Arrangement of Machine Shop No.2 for Small Size Components

Scale: 1/200 Area: 25 x 30 m = 750 m²



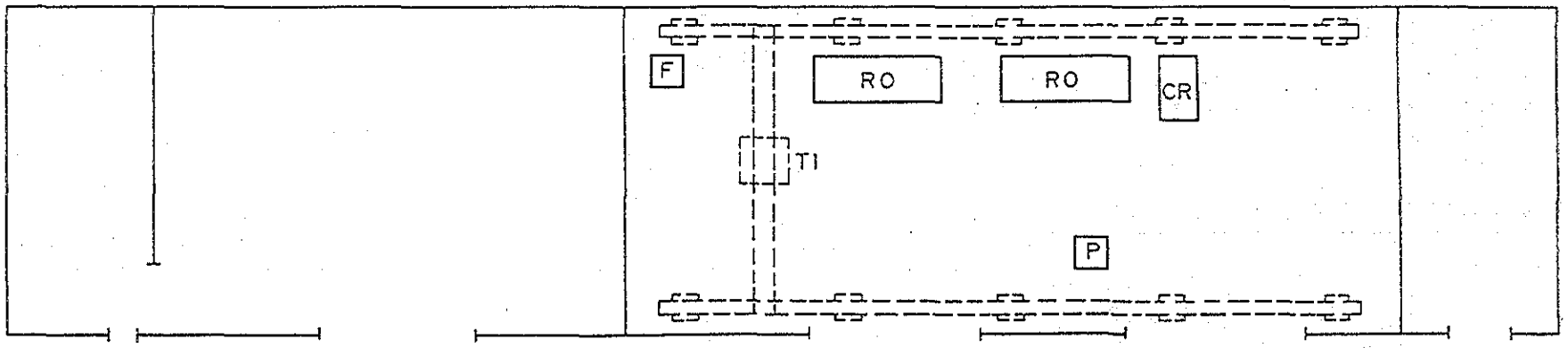
Code	Description	Specifications	Q'ty
B9	Heavy lathe	600 x 2,000 mm	1
B10	Lathe	500 x 2,000 mm	2
B12	- ditto -	700 x 1,200 mm	3
B13	- ditto -	400 x 1,000 mm	3
S1	Shaper	630 x 1,400 mm	2
S2	- ditto -	500 x 850 mm	1
F1	Milling machine	300 x 1,300 mm	1
F2	- ditto -	380 x 1,650 mm	2
T1	Gantry crane	5 tons	1

Drawing No. R-102

Arrangement of Casting Shop No.3

Scale: 1/200 Area: 48 x 10 m = 480 m²

Code	Description	Specifications	Q'ty
CR	Crucible furnace	700 - 800 kg	1
TI	Electric hoist	1 ton	1
F	Electric fan		1
RO	Coke furnace		2
P	Cupola		1



Drawing No. R-103

Arrangement of Iron and Welding Shop No.5

Area: 19 x 35 m = 665 m²

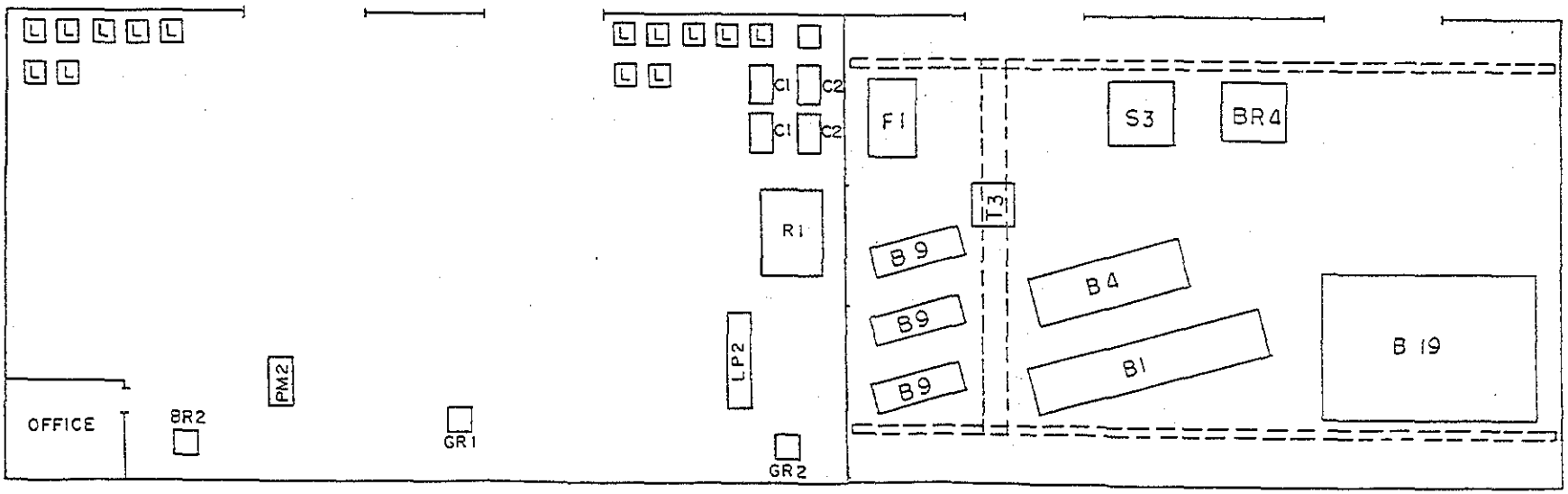
Code	Description	Specifications	Q'ty
L1	Arc welding machine	AC 400 A	6
	- ditto -	AC 250 A	1
L2	DC welding machine with generator	DC 10 ~ 295 A	7
	- ditto -	DC 40 ~ 350 A	1
	- ditto -	DC 20 ~ 470 A	1
L4	TIG Argon welding machine	57 A	1
L5	TIG Welding machine	300 A	2
L6	Plazuma spraying welding machine	170 A	1
L7	Variowing welding machine	94 A	1
L8	Metal spraying machine		1
L9	Seleccron	10 - 20 A	1

Code	Description	Specifications	Q'ty
BR2	Upright drilling machine	300 x 650 mm	1
GR2	Cutting grinder	10"	1
GR1	Bench grinder	10"	1
PM2	Mechanical press	125 kg	1
LP2	Bending roller	3 t x 1,000 mm	1
C1	Air compressor	12 kgf/cm²	2
C2	- ditto -	7 kgf/cm²	2
R1	Waving roller		1

Arrangement of Additional Workshop No.6

Area: 19 x 30 m = 570 m²

Code	Description	Specifications	Q'ty
B1	Lathe for shaft	810 x 7,000 mm	1
B4	Heavy lathe	810 x 4,000 mm	1
B9	- ditto -	600 x 2,000 mm	3
B19	Vertical lathe (Gantry type)	3,000 mm	1
S3	Shaper with copying attachment	700 mm	1
F1	Milling machine	380 x 1,650 mm	1
BR4	Rudial drilling machine	3,000 mm	1
T3	Gantry crane	30 m x 15 m, 10 tons	1



NO. 5

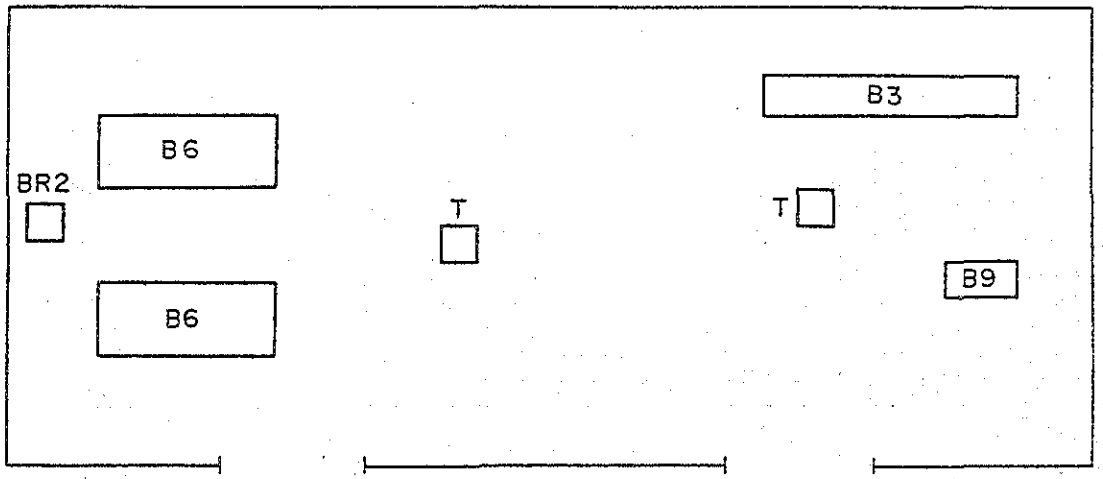
NO. 6

Drawing No. R-104

Arrangement of Machine Shop No.11 for Large Size Components

Scale: 1/200 Area: 30 x 125 m = 375 m²

Code	Description	Specifications	Q'ty
B3	Lathe for shaft	700 x 4,000 mm	1
B6	Face lathe	2,000 x 2,000 mm	2
B9	Lathe	600 x 2,000 mm	1
BR2	Upright drilling machine	300 x 650 mm	1
T	Derrick crane		2



PLAN - 2 AND PLAN - 3

(ARRANGEMENT OF WORKSHOP)

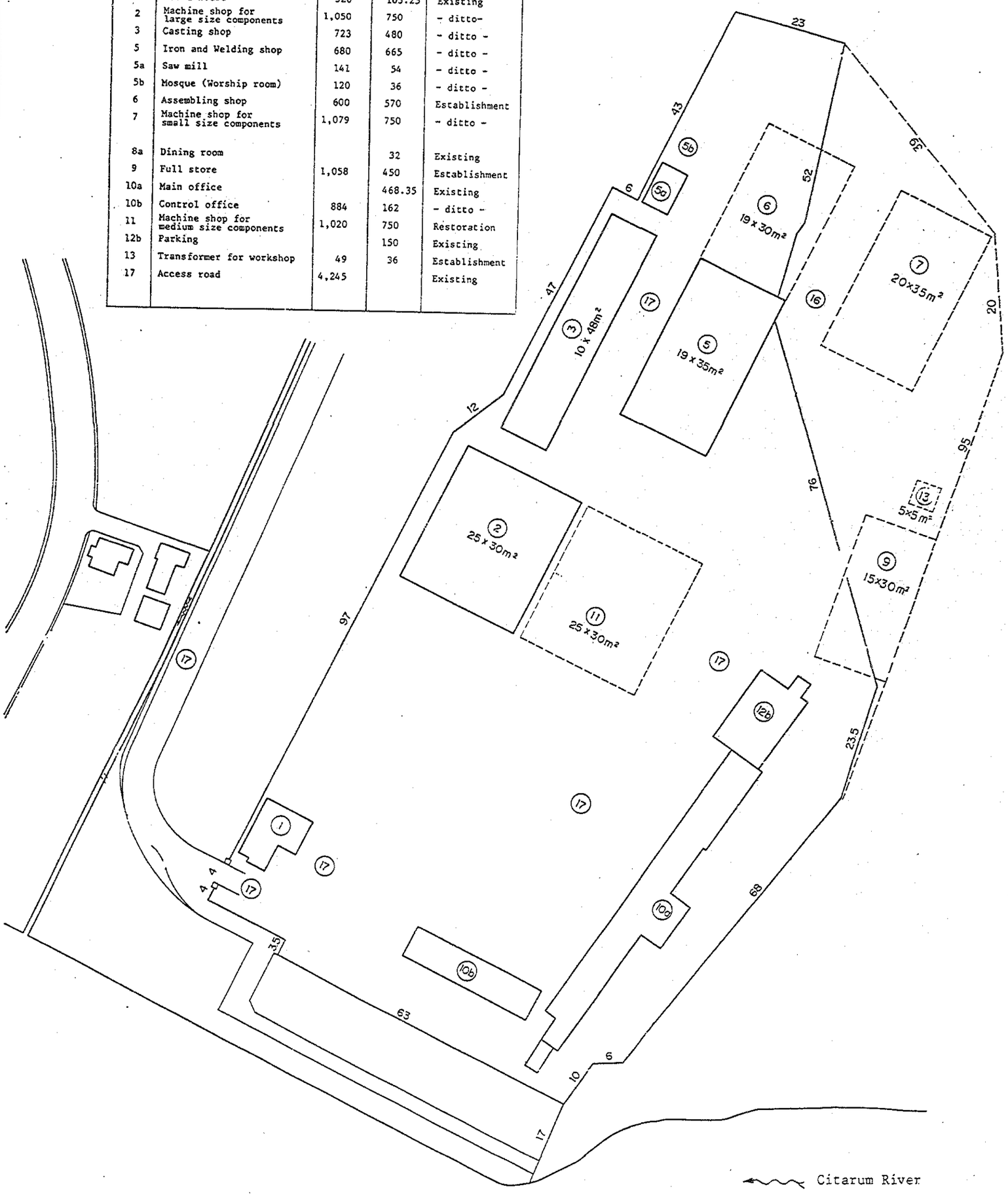
DRAWING LIST

PLAN-2 and PLAN-3 (ARRANGEMENT OF WORKSHOP)

Serial No.	Drawing No.	Description
1.	R-200	General Arrangement of Workshop PLAN-2 and PLAN-3
2.	R-201	Arrangement of Machine Shop No. 2 for Large Size Components
3.	R-202	Arrangement of Welding Shop No. 5 and Assembling Shop No. 6
4.	R-203	Arrangement of Machine Shop No. 7 for Small Size Components
5.	R-204	Arrangement of Machine Shop No. 11 for Medium Size Components

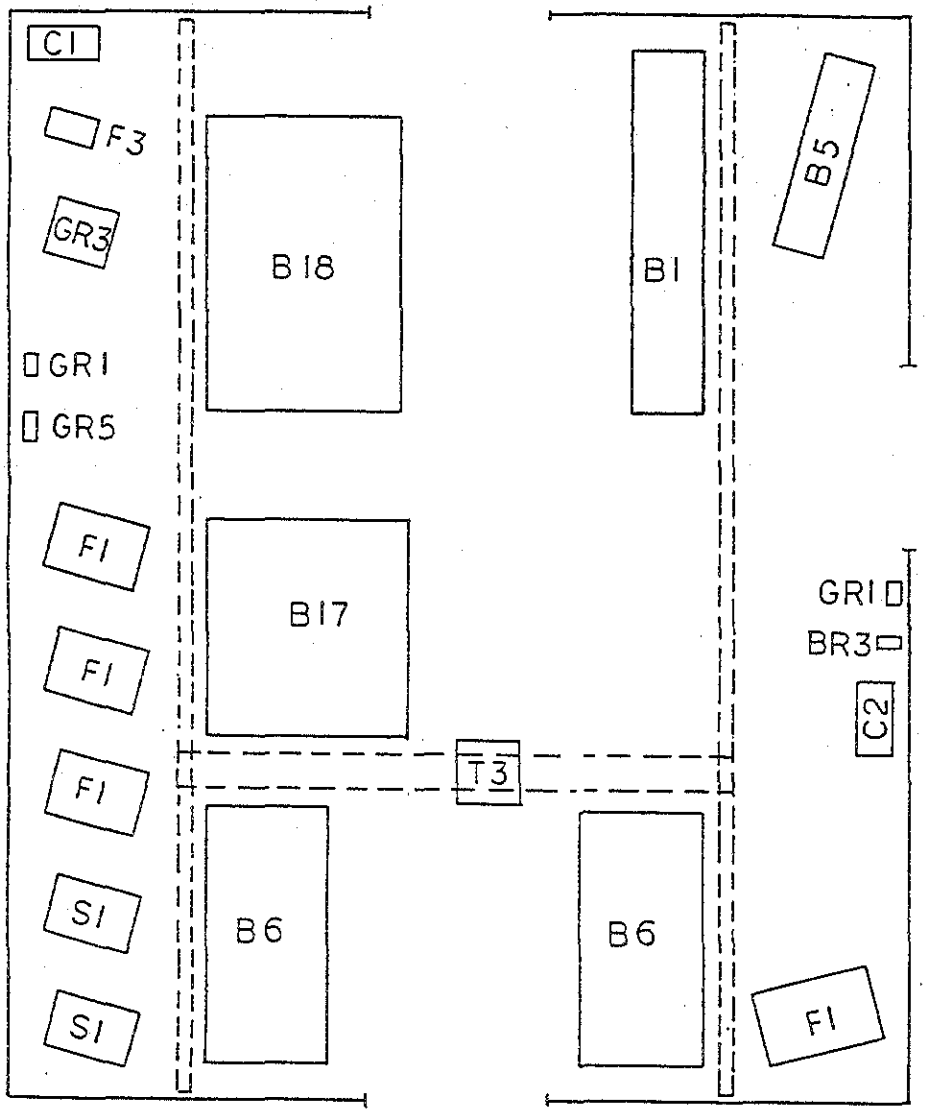
Drawing No. R-200 General Arrangement of Workshop PLAN-2 and PLAN-3

Shop No.	Description	Area m²		Remarks
		Plottage	Floor	
1	Guard house	326	103.25	Existing
2	Machine shop for large size components	1,050	750	- ditto-
3	Casting shop	723	480	- ditto -
5	Iron and Welding shop	680	665	- ditto -
5a	Saw mill	141	54	- ditto -
5b	Mosque (Worship room)	120	36	- ditto -
6	Assembling shop	600	570	Establishment
7	Machine shop for small size components	1,079	750	- ditto -
8a	Dining room		32	Existing
9	Full store	1,058	450	Establishment
10a	Main office		468.35	Existing
10b	Control office	884	162	- ditto -
11	Machine shop for medium size components	1,020	750	Restoration
12b	Parking		150	Existing
13	Transformer for workshop	49	36	Establishment
17	Access road	4,245		Existing



Drawing No. R-201 Arrangement of Machine Shop No.2 for Large Size Components

Scale: 1/200 Area: 25 x 30 m = 750 m²



Code	Description	Specifications	Q'ty	Existing	Providing
B1	Lathe for shafts	810 x 7,000 mm	1	-	1
B5	Heavy lathe	600 x 3,000 mm	1	-	1
B6	Face lathe	2,000 x 2,000 mm	2	2	-
B17	Horizontal boring and milling machine	1,830 mm	1	-	1
B18	Vertical boring and milling machine	2,800 mm	1	-	1
S1	Shaper	630 x 1,400 mm	2	2	-
F1	Milling machine	300 x 1,300 mm	3	3	-
F1	- ditto -	380 x 1,650 mm	1	-	1
F3	Key seater	450 mm	1	-	1
L1	Arc welding machine	AC 250 A	1	1	-
L2	DC welding machine with generator	DC 10 - 295 A	1	-	1
GR1	Bench grinder	10"	2	-	2
GR3	Universal tool and cutter grinder		1	-	1
GR5	Pedestal grinder with dust collector		1	-	1
GR7	Electric handy grinder	180 mm	2	-	2
BR3	Bench drilling machine		1	-	1
C1	Air compressor	12 kgf/cm²	1	-	1
C2	- ditto -	7 kgf/cm²	1	-	1
T3	Gantry crane	30 m x 15 m x 10 tons	1	-	1

Drawing No. R-202 Arrangement of Welding Shop No.5

Area: 19 x 35 m = 665 m²

Code	Description	Specifications	Q'ty	Existing	Providing
L1	Arc welding machine	AC 400 A	2	2	-
	- ditto -	AC 250 A	5	-	5
L2	DC welding machine with generator	DC 40 - 350 A	2	1	1
	- ditto -	DC 20 - 470 A	1	1	-
L4	TIG Argon welding machine	57 A	1	1	-
L5	TIG welding machine	300 A	2	2	-
	- ditto -	20 - 300 A	1	-	1
L6	Plasma spraying welding machine	120 A	2	1	1
L7	Variuming welding machine	9k A	1	1	-
L8	Metal spraying machine		1	1	-
L9	Selectron	10 - 20 A	1	1	-
RP3	Bending roller machine	5 - 6 t x 1,270 mm	2	-	2
G3	Shearing machine	3 t x 1,270 mm	2	-	2
P1	Punching machine	1 - 2 t	1	-	1
GR1	Bench grinder	10" dia.	2	1	1

Code	Description	Specifications	Q'ty	Existing	Providing
GR2	Cutting grinder	10" dia.	2	1	1
GR6	Air grinder	180 mm	2	-	2
GR7	Electric handy grinder	180 mm	2	-	2
BR1	Upright drilling machine	500 x 1,000 mm	1	-	1
BR2	- ditto -	300 x 650 mm	2	1	1
BR3	Bench drilling machine		1	-	1
PM2	Mechanical press	125 kg	1	1	-
LP2	Bending roller machine	3 t x 1,000 mm	1	1	-
C1	Air compressor	12 kgf/cm²	1	1	-
C2	- ditto -	7 kgf/cm²	1	1	-
T2	Gantry crane	30 m x 15 m x 5 tons	1	-	1
MG1	Magnetic-particle testing machine		1	-	1
MG2	Ultrasonic testing machine		1	-	1
LP1	Bending machine	5 - 6 t - 2,500 mm	1	-	1
PM1	Mechanical press	10 - 30 tons	1	-	1

Arrangement of Assembling Shop No.6

Area: 19 x 30 m = 570 m²

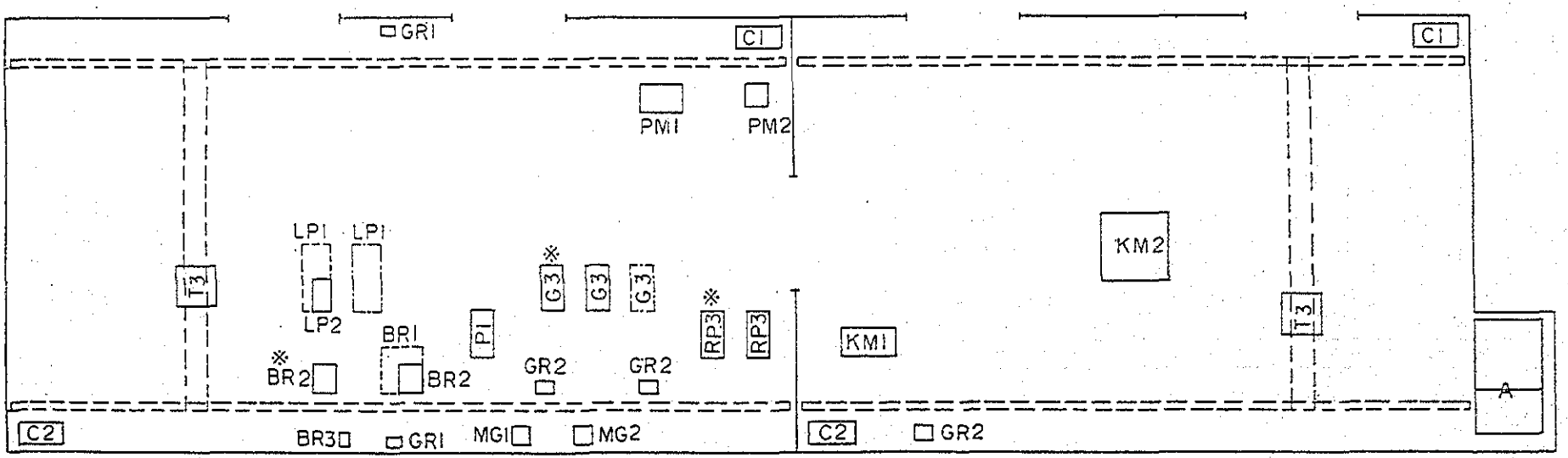
Code	Description	Specifications	Q'ty	Existing	Providing
GR2	Cutting grinder	10"	1	-	1
GR6	Air grinder	180 mm	2	-	2
GR7	Electric handy grinder	180 mm	2	-	2
KM1	Surface table	1,200 x 2,400 mm	1	-	1
KM2	Assembling table	3,000 x 3,000 mm	1	-	1
T3	Gantry crane	30 m x 15 m - 10 tons	1	-	1
C1	Air compressor	12 kgf/cm²	1	1	-
C2	- ditto -	7 kgf/cm²	1	1	-
A	Annealing furnace	3,000 x 3,000 mm	1	-	1

Note-1: In case of PLAN-3 adopted, BR1 shall be replaced by BR2.

Note-2: [ ] shows PLAN-3.

※ marked machines will be used for the processing parts of thermal power plant and others.

[ ] shows the spaces for the future machines.



Drawing No. R-203 Arrangement of Machine Shop No.7 for Small Size Components

Scale: 1/200 Area: 20 x 35 m = 700 m²

Code	Description	Specifications	Q'ty	Existing	Providing
B12	Lathe	700 x 1,200 mm	3	3	-
	- ditto -	510 x 1,000 mm	5	-	5
B13	- ditto -	400 x 1,200 mm	3	3	-
	Numerically controlled lathe	460 x 800 mm	1	-	1
B15	Screw cutting lathe	1/4" - 2"	3	-	3
L1	Arc welding machine	400 A	1	-	1
L4	TIG Argon welding machine	25 - 57 A	1	-	1
L9	Selectron	10 - 20 A	1	-	1
GG5	Hack sawing machine		2	-	2
GR1	Bench grinder	10"	2	-	2
GR5	Pedestal grinder with dust collector		1	-	1
GR6	Air grinder	180 mm	2	-	2
GR7	Electric handy grinder	180 mm	2	-	2

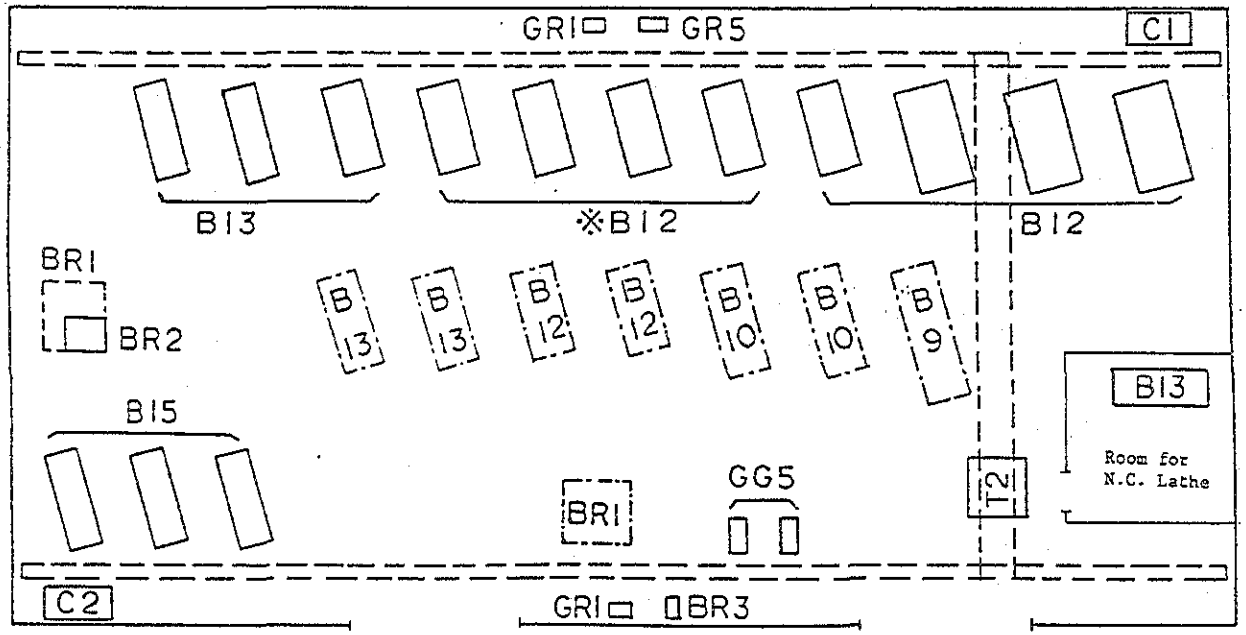
Code	Description	Specifications	Q'ty	Existing	Providing
BR1	Upright drilling machine	500 x 1,000 mm	1	-	1
BR2	- ditto -	300 x 650 mm	1	1	-
BR3	Bench drilling machine		1	-	1
C1	Air compressor	12 kgf/cm²	1	-	1
C2	- ditto -	7 kgf/cm²	1	-	1
T2	Gantry crane	30 m x 15 m - 5 tons	1	-	1

Note-1: In case of PLAN-3 adopted, BR1 shall be replaced by BR2.

Note-2: [ ] shows PLAN-3.

※ marked machines will be used for the processing parts of thermal power plant and others.

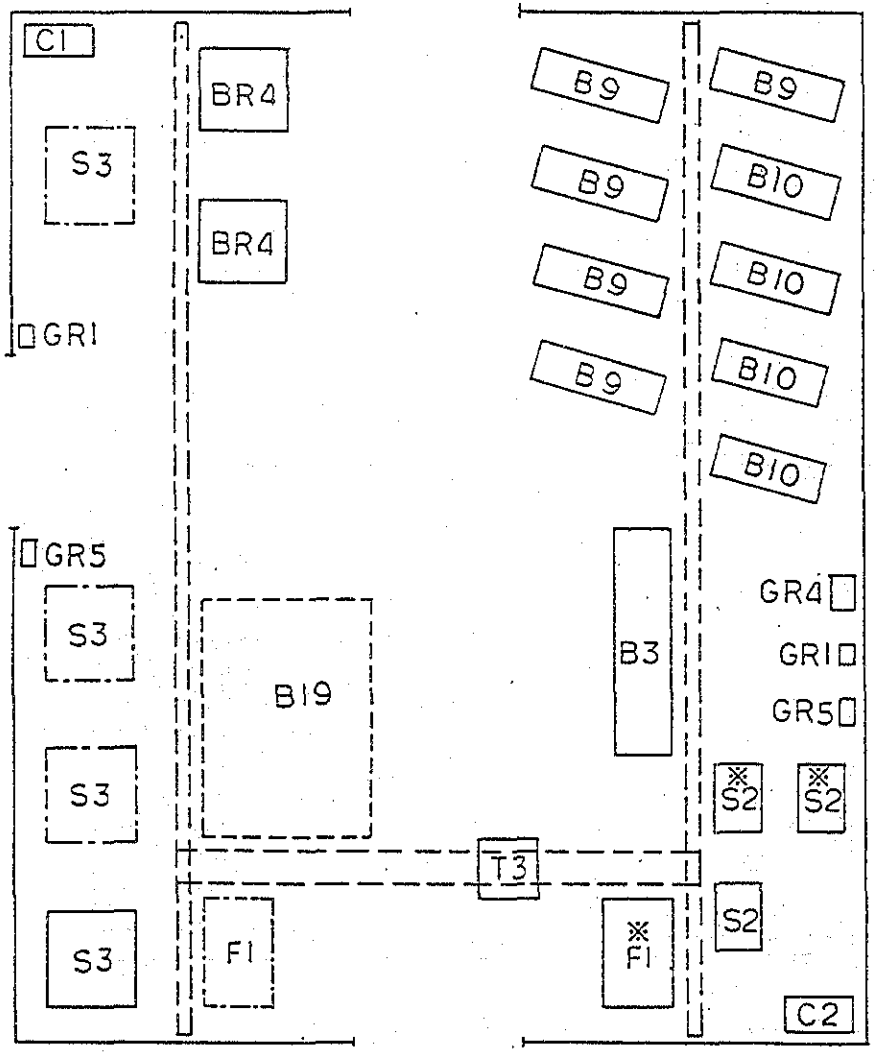
[ ] shows the spaces for the future machines.



Drawing No. R-204 Arrangement of Machine Shop No.11 for Medium Size Components

Scale: 1/200 Area: 25 x 30 = 750 m²

5 m



Code	Description	Specifications	Q'ty	Existing	Providing
B3	Lathe for shaft	700 x 4,000 mm	1	1	-
B9	Heavy lathe	600 x 2,000 mm	5	2	3
B10	Lathe	500 x 2,000 mm	2	2	-
	- ditto -	510 x 1,500 mm	2	-	2
B19	Vertical lathe (Gantry type)	3,000 mm	1	-	1
S2	Shaper	500 x 850 mm	3	1	2
S3	Shaper with copying attachment	700 x 1,000 mm	1	-	1
F1	Milling machine	300 x 1,300 mm	1	-	1
L1	Arc welding machine	AC 250 A	1	-	1
L2	DC welding machine with generator	DC 10 - 295 A	1	1	-
GR1	Bench grinder	10"	2	-	2
GR4	Bench tool and cutter grinder		1	-	1
GR5	Pedestal grinder with dust collector		2	-	2
GR7	Electric handy grinder	180 mm	2	-	2
BR4	Radial drilling machine	3,000 mm	2	-	2
C1	Air compressor	12 kgf/cm²	1	-	1
C2	- ditto -	7 kgf/cm²	1	-	1
T3	Gantry crane	30 m x 15 m - 10 tons	1	-	1

Note: [ ] shows for PLAN-3.

※ marked machines will be used for the processing parts of thermal power plants and others.

[ ] shows the spaces for the future machines.

PLAN - D

(ARRANGEMENT OF WORKSHOP)

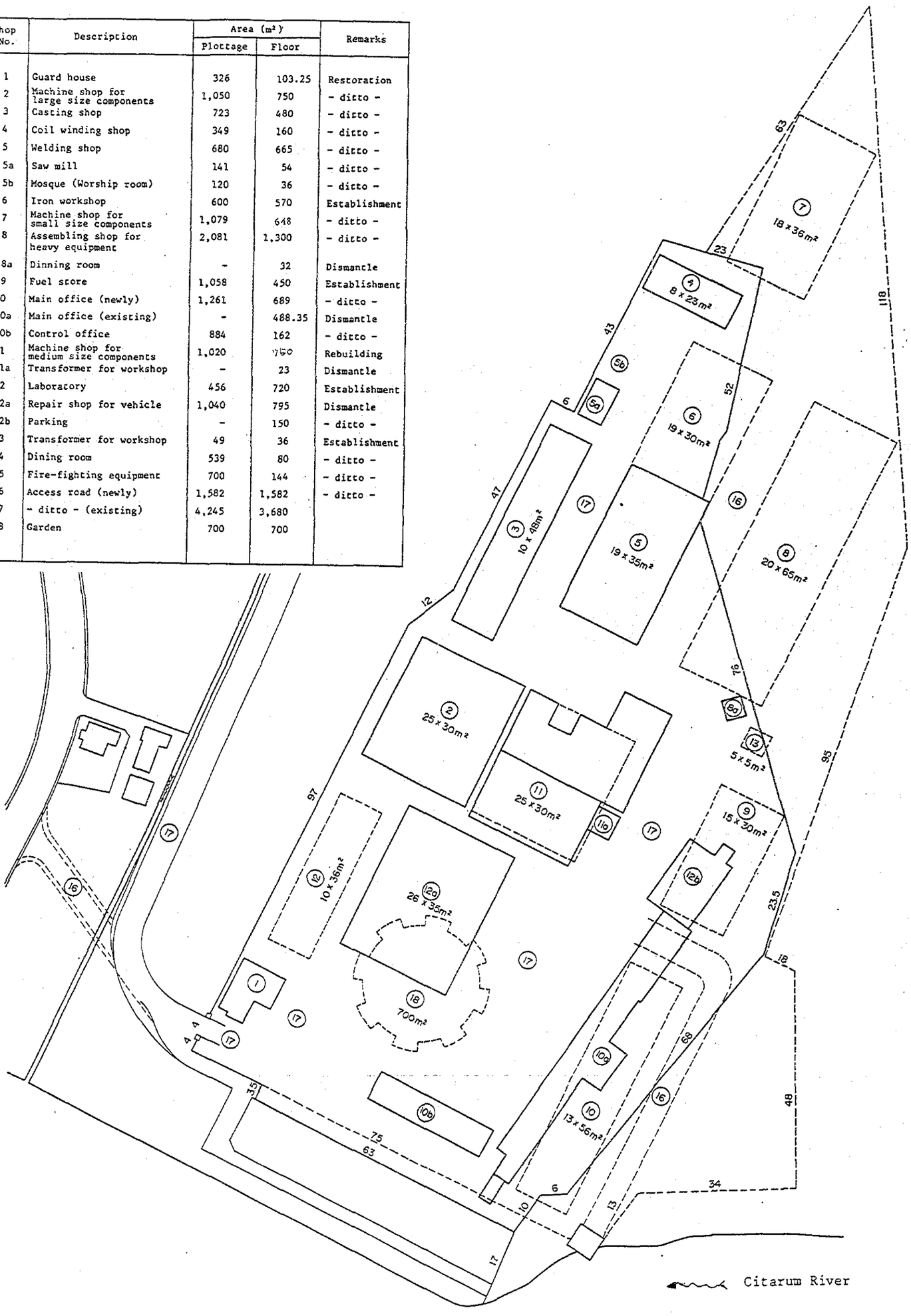
DRAWING LIST

PLAN-D (ARRANGEMENT OF WORKSHOP)

Serial No.	Drawing No.	Description
1.	R-300	General Arrangement of Workshop PLAN-D
2.	R-301	Arrangement of Machine Shop No. 2 for Large Size Component
3.	R-302	Arrangement of Casting Shop No. 3
4.	R-303	Arrangement of Coil Winding Shop No. 4
5.	R-304	Arrangement of Welding Shop No. 5
6.	R-305	Arrangement of Machine Shop No. 7 for Small Size Components
7.	R-306	Arrangement of Assembling Shop No. 8 for Large Size Components
8.	R-307	Arrangement of Machine Shop No. 11 for Medium Size Components
9.	R-308	Arrangement of Laboratory No. 12

Drawing No. R-300 General Arrangement of Workshop PLAN-D

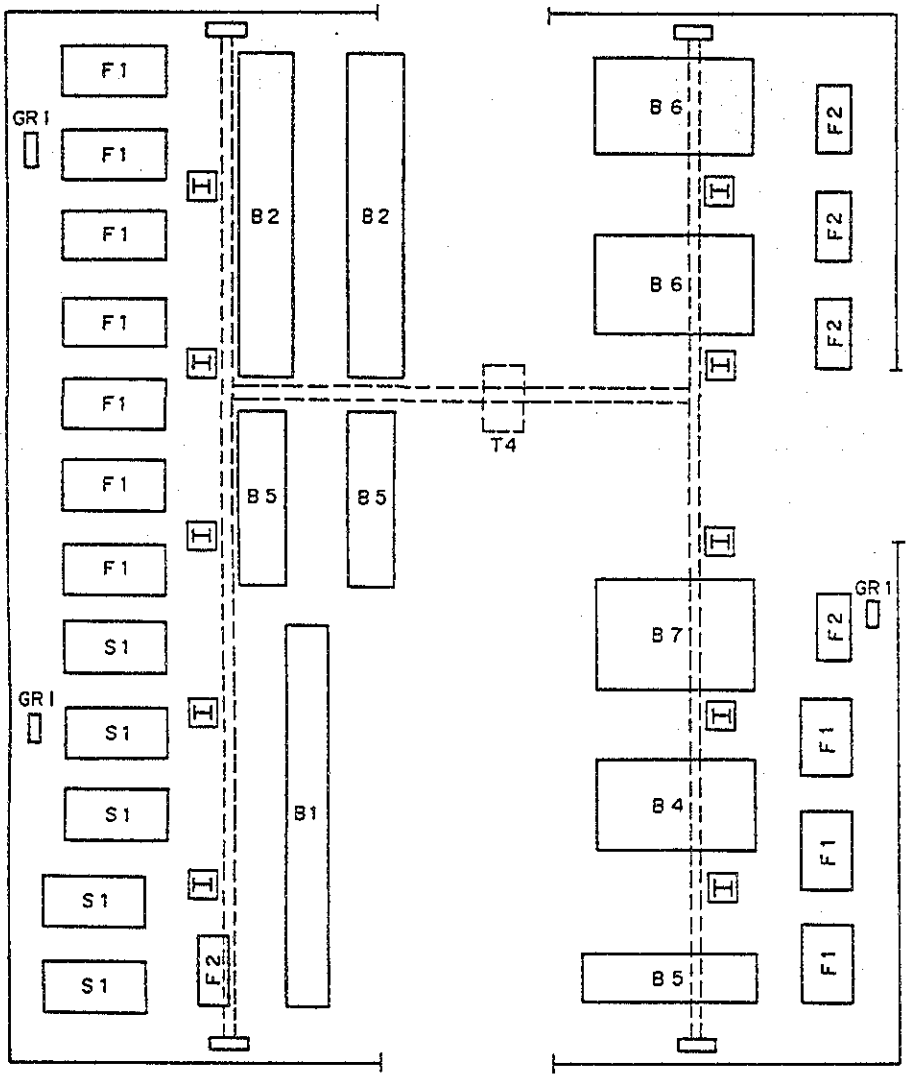
Shop No.	Description	Area (m²) Plottage	Area (m²) Floor	Remarks
1	Guard house	326	103.25	Restoration
2	Machine shop for large size components	1,050	750	- ditto -
3	Casting shop	723	480	- ditto -
4	Coil winding shop	349	160	- ditto -
5	Welding shop	680	665	- ditto -
5a	Saw mill	141	54	- ditto -
5b	Mosque (Worship room)	120	36	- ditto -
6	Iron workshop	600	570	Establishment
7	Machine shop for small size components	1,079	648	- ditto -
8	Assembling shop for heavy equipment	2,081	1,300	- ditto -
8a	Dinning room	-	32	Dismantle
9	Fuel store	1,058	450	Establishment
10	Main office (newly)	1,261	689	- ditto -
10a	Main office (existing)	-	488.35	Dismantle
10b	Control office	884	162	- ditto -
11	Machine shop for medium size components	1,020	750	Rebuilding
11a	Transformer for workshop	-	23	Dismantle
12	Laboratory	456	720	Establishment
12a	Repair shop for vehicle	1,040	795	Dismantle
12b	Parking	-	150	- ditto -
13	Transformer for workshop	49	36	Establishment
14	Dining room	539	80	- ditto -
15	Fire-fighting equipment	700	144	- ditto -
16	Access road (newly)	1,582	1,582	- ditto -
17	- ditto - (existing)	4,245	3,680	
18	Garden	700	700	



SCALE 0 10 20 30 40 50m

Drawing No. R-301 Arrangement of Machine Shop No.2 for Large Size Components

Scale: 1/200 Area: 30 x 25 = 750 m²

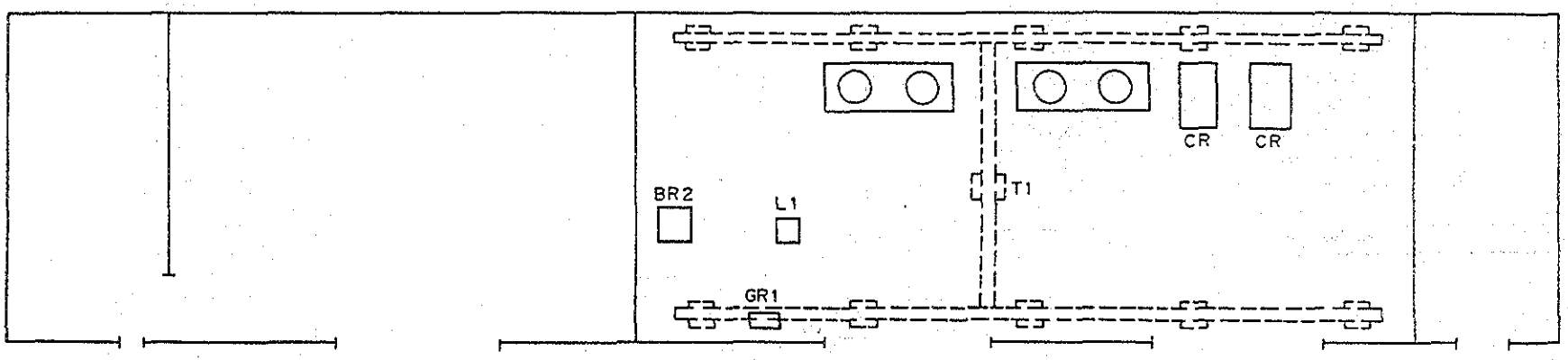


Code	Description	Specifications	Q'ty	Existing	Procurement
B1	Lathe for shaft	1,000 x 10,000 mm	1	-	1
B2	- ditto -	1,000 x 8,000 mm	2	-	2
B4	Heavy lathe	1,000 x 2,000 mm	1	-	1
B5	- ditto -	600 x 3,000 mm	3	-	3
B6	Face lathe	2,000 x 2,000 mm	2	2	-
B7	- ditto -	3,000 x 2,000 mm	1	-	1
S1	Shaper	630 x 1,400 mm	5	2	3
F1	Milling machine	300 x 1,300 mm	10	3	7
F2	- ditto -	200 x 1,000 mm	4	-	4
GR1	Bench grinder	10"	3	-	3
GR7	Electric handy grinder	180 mm	2	-	2
T4	Overhead crane	25 t	1	-	1

Drawing No. R-302 Arrangement of Casting Shop No.3

Scale: 1/200 Area: 10 x 36 = 360 m²

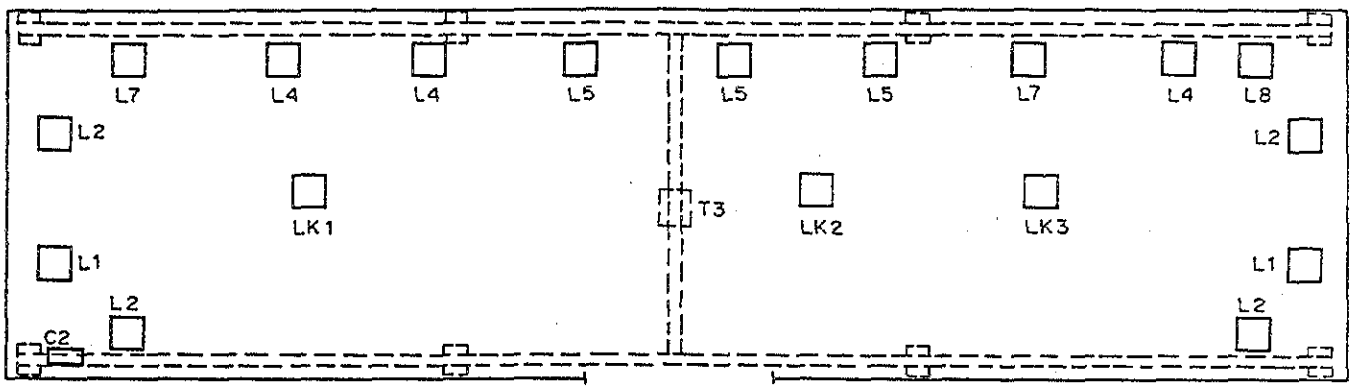
Code	Description	Specifications	Q'ty	Existing	Procurement
L1	Arc welding machine	250 A	1	1	-
GR1	Bench grinder	10"	1	1	-
GR7	Electric handy grinder	180 mm	1	-	1
BR2	Upright drilling machine	300 x 650 mm	1	-	1
CR	Crucible furnance	700 x 800 kg	2	1	1
T1	Electric hoist	1 ton	1	1	-



Drawing No. R-303 Arrangement of Coil Winding Shop No. 4

Scale: 1/200 Area: 8 x 23 = 184 m²

Code	Description	Specifications	Q'ty	Existing	Procurement
L1	Arc welding machine	AC 400 A	1	1	-
	- ditto -	AC 250 A	1	-	1
L2	DC welding machine with generator	DC 10 - 295 A	2	1	1
	- ditto -	DC 40 - 350 A	1	1	-
	- ditto -	DC 20 - 470 A	1	1	-
L4	TIG Argon arc welding machine	57 A	3	1	2
L5	TIG Welding machine	300 A	3	2	1
L7	Varioming welding machine	94 A	2	-	2
L8	Metal spraying machine		1	1	-
GR7	Electric handy grinder	180 mm	1	-	1
C2	Air compressor	7 kgf/cm²	1	1	-
T3	Overhead crane	10 tons	1	-	1
LK1	Coil winding machine (Small sized)		1	-	1
LK2	- ditto - (Medium sized)		1	-	1
LK3	- ditto - (Large sized)		1	-	1



Drawing No. R-304 Arrangement of Welding Shop No.5

Area: 19 x 35 = 665 m²

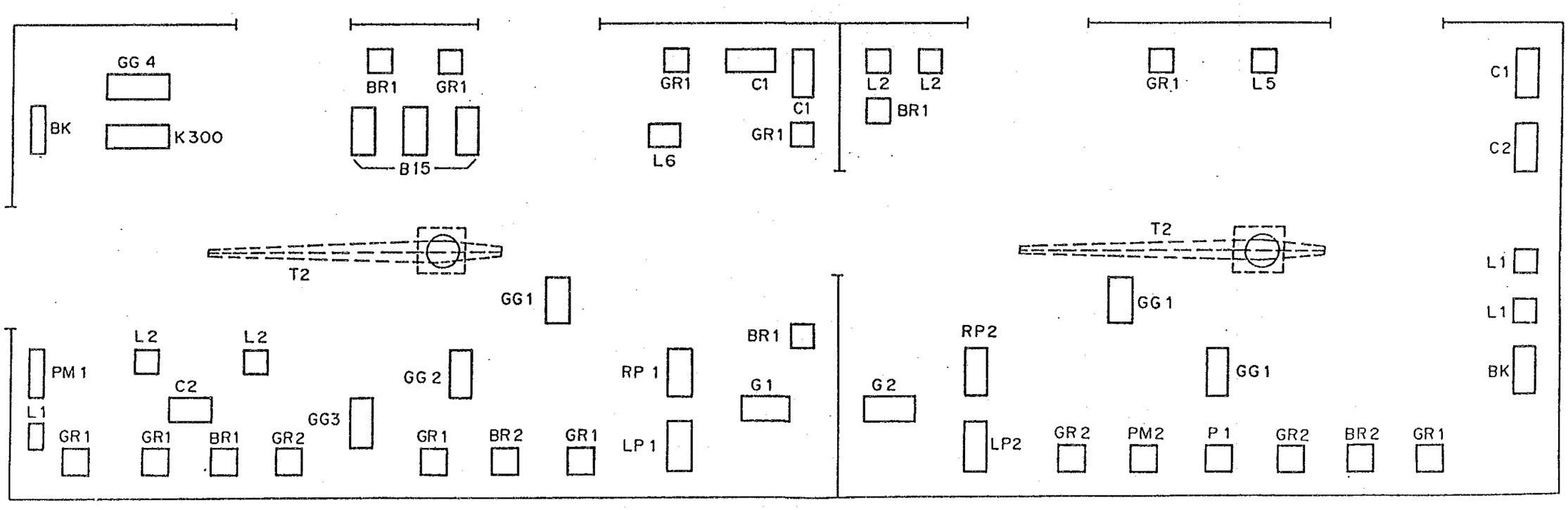
Code	Description	Specifications	Q'ty	Existing	Procurement
L1	Arc welding machine	AC 400 A	1	-	1
L2	DC welding machine with generator	DC 10 - 295 A	1	-	1
	- ditto -	DC 40 - 350 A	1	-	1
L6	Plazuma spraying welding machine	120 A	1	1	-
RP1	Bending roller machine	25 x 2,500	1	-	1
G1	Shearing machine	12	1	-	1
GG1	Band saw machine	150 mm	1	1	-
GG2	- ditto -	500 mm	1	1	-
GG3	Chain saw machine	2,800 mm	1	-	1
GG4	Circular saw machine	16 " dia.	1	1	-
GR1	Bench grinder	10 " dia.	7	-	7
GR2	Cutting grinder	10 " dia.	1	-	1
GR7	Electric handy grinder	180 mm	4	-	4
BR1	Upright drilling machine	500 x 1,000 mm	3	-	3
BR2	- ditto -	300 x 650 mm	1	1	-
PM1	Mechanical press	100 tons	1	-	1
LP1	Bending roller machine	15 t x 2,500 mm	1	-	1
C1	Air compressor	12 kgf/cm^2	2	-	2
C2	- ditto -	7 kgf/cm^2	1	-	1
T2	Jib crane	5 tons	1	-	1
BK	Working table		1	-	1
B15	Screw cutting lathe	1/4 " - 2 "	3	-	3
K	Planing machine	300 mm	1	-	1

Arrangement of Iron Workshop No.6

Area: 19 x 30 = 570 m²

Code	Description	Specifications	Q'ty	Existing	Procurement
L1	Arc welding machine	AC 400 A	2	-	2
L2	DC welding machine with generator	DC 40 - 350 A	1	-	1
	- ditto -	DC 20 - 470 A	1	-	1
L5	TIG welding machine	300 A	1	-	1
G2	Shearing machine	5 mm	1	-	1
P1	Punching machine	1 - 2 mm	1	-	1
GG1	Band saw machine	150 mm	2	-	2
GR1	Bench grinder	10 " dia.	2	-	2
GR2	Cutting grinder	10 " dia.	2	-	2
GR7	Electric handy grinder	180 mm	4	-	4
BR1	Upright drilling machine	500 x 1,000 mm	1	-	1
BR2	- ditto -	300 x 650 mm	1	-	1
C1	Air compressor	12 kgf/cm^2	1	-	1
C2	- ditto -	7 kgf/cm^2	1	-	1
T2	Jib crane	5 tons	1	-	1
BK	Working table		1	-	1
RP2	Bending roller machine	13 t x 1,270 mm	1	-	1
PM2	Mechanical press	125 kg	1	1	-
LP2	Bending roller machine	3 t x 1,000 mm	1	1	-

Scale 5 m

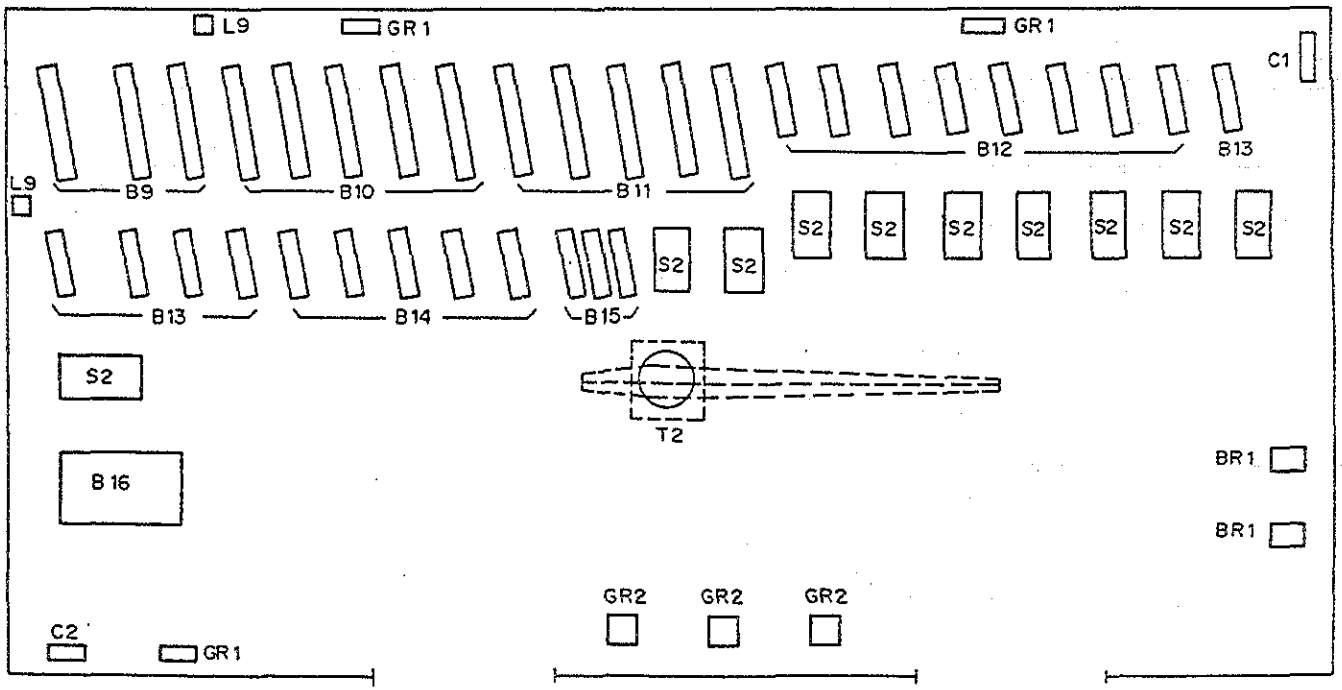


Drawing No. R-305 Arrangement of Machine Shop No.7 for Small Size Components

Scale: 1/250 Area: 18 x 36 = 648 m²

Code	Description	Specifications	Q'ty	Existing	Procurement
B9	Lathe	600 x 2,000 mm	3	2	1
B10	- ditto -	500 x 2,000 mm	5	2	3
B11	- ditto -	400 x 2,000 mm	5	-	5
B12	- ditto -	700 x 1,200 mm	8	3	5
B13	- ditto -	400 x 1,000 mm	5	3	2
B14	- ditto -	200 x 500 mm	5	-	5
B15	Screw cutting lathe	1/4" - 2"	3	-	3
B16	Face lathe	2,000 x 3,000 mm	1	-	1
S2	Shaper	500 x 850 mm	10	1	9

Code	Description	Specifications	Q'ty	Existing	Procurement
L9	Selectron welding machine	10 - 20 A	2	1	1
GR1	Bench grinder	10"	3	-	3
GR2	Cutting grinder	10"	3	-	3
GR7	Electric handy grinder	180 mm	1	-	1
BR1	Upright drilling machine	500 x 1,000 mm	2	-	2
C1	Air compressure	12 kgf/cm²	1	1	-
C2	- ditto -	7 kgf/cm²	1	-	1
T2	Jib crane	5 tons	1	-	1

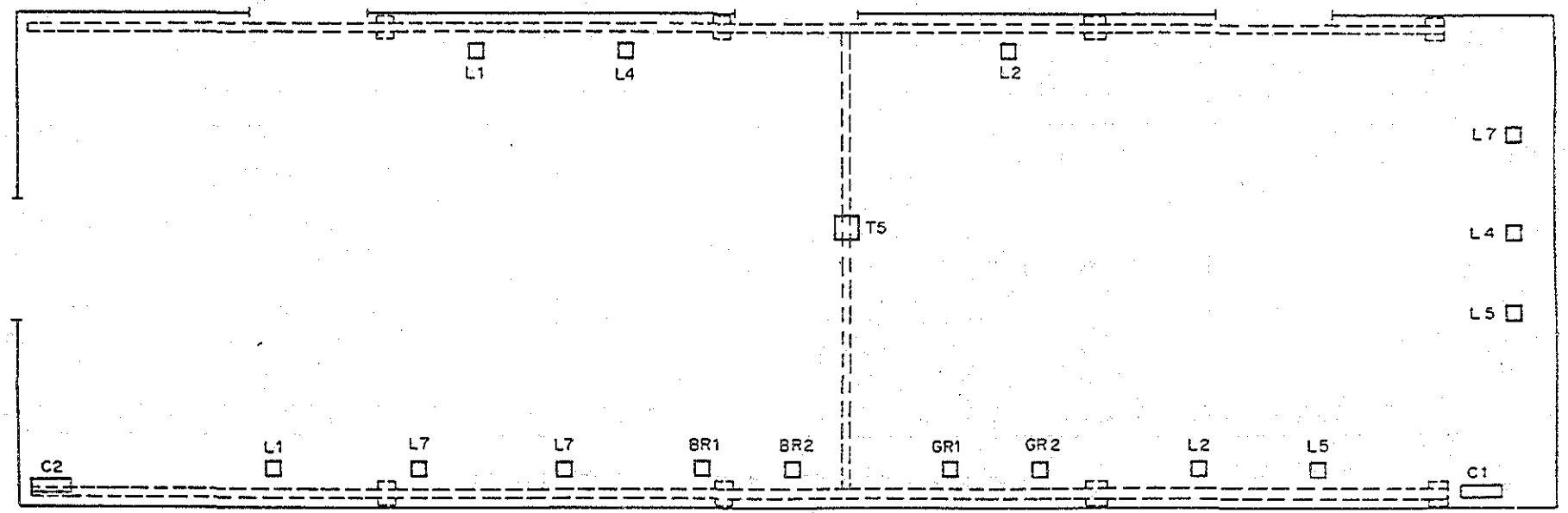


Drawing No. R-306 Arrangement of Assembling Shop No.8 for Large Size Components

Scale: 1/250 Area: 20 x 65 = 1,300 m²

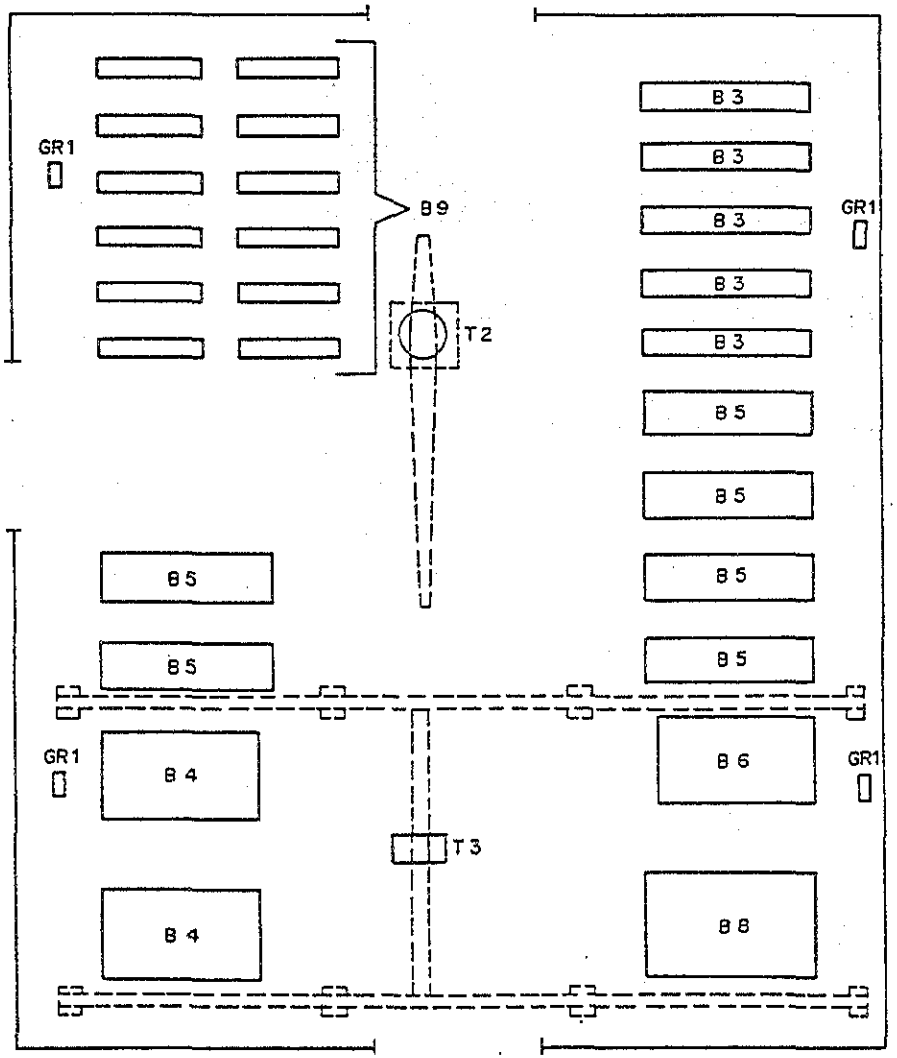
Code	Description	Specification	Q'ty	Exisitng	Procurement
L1	Arc welding machine	AC 400 A	2	2	-
L2	DC welding machine with generator	DC 10 - 295 A	1	1	-
	- ditto -	DC 3 - 470 A	1	1	-
L4	TIG Argon welding machine	57 A	2	-	2
L5	TIG welding machine	300 A	2	-	2
L7	Varioming welding machine	94 A	3	1	2
GR1	Bench grinder	10" dia.	1	-	1

Code	Description	Specification	Q'ty	Exisitng	Procurement
GR2	Cutting grinder	10" dia.	1	1	-
GR7	Electric handy grinder	180 mm	1	-	1
BR1	Upright drilling machine	500 x 1,000 mm	1	-	1
BR2	- ditto -	300 x 650 mm	1	1	-
C1	Air compressor	12 kgf/cm²	1	1	-
C2	- ditto -	7 kgf/cm²	1	1	-
T5	Overhead crane	50 tons	1	-	1



Drawing No. R-307 Arrangement of Machine Shop No.11 for Medium Size Components

Scale: 1/200 Area: 25 x 30 = 750 m²

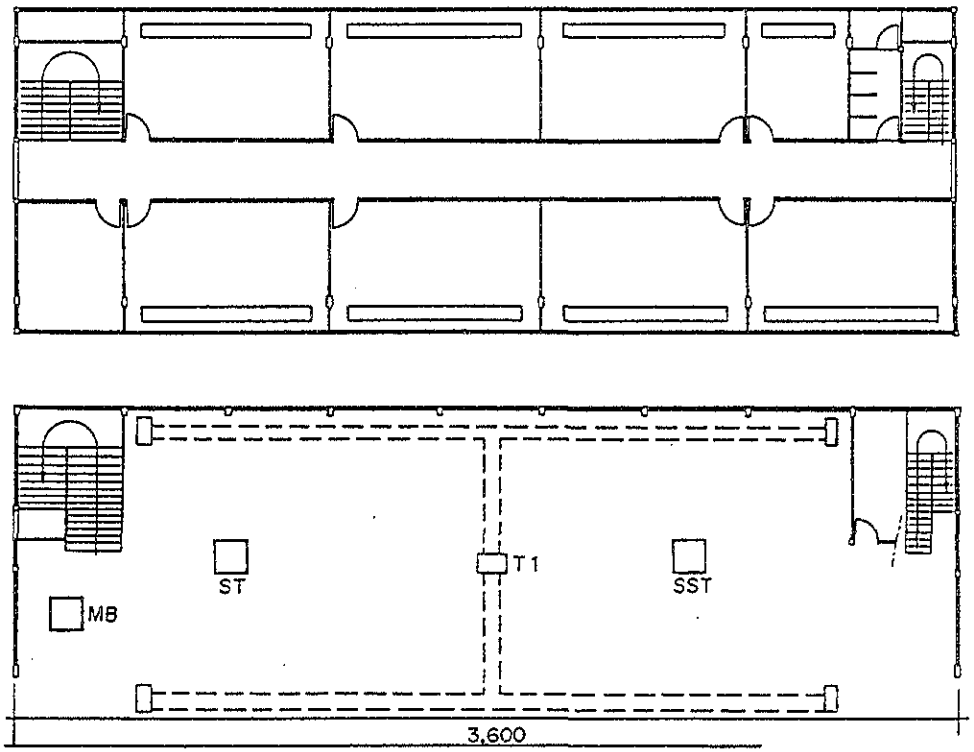


Code	Description	Specifications	Q'ty	Existing	Procurement
B3	Lathe for shaft	700 x 4,000 mm	5	1	4
B4	Heavy lathe	1,000 x 2,000 mm	2	-	2
B5	- ditto -	600 x 3,000 mm	6	-	6
B6	Face lathe	2,000 x 2,000 mm	1	-	1
B8	- ditto -	1,000 x 3,000 mm	1	-	1
B9	Heavy lathe	600 x 2,000 mm	12	-	12
GR1	Bench grinder	10" dia.	4	-	4
GR7	Electric handy grinder	180 mm	1	-	1
T3	Overhead crane	10 tons	1	-	1
T2	Jib crane	5 tons	1	-	1

Drawing No. R-308 Arrangement of Laboratory No.12

Scale: 1/100 Area: 10 x 36 = 360 m²

Code	Description	Specifications	Q'ty	Existing	Procurement
Tl	Electric hoist	l ton	l	-	l
ST	Shearing testing machine		l	-	l
SST	Stress testing machine		l	-	l
MB	Balancing machine		l	-	l
MT	Measuring tools		2	-	2



ANNEX

ANNEX - 1

TRANSFER OF ELECTRIC DIVISION TO KLENDER WORKSHOP

ANNEX-1

TRANSFER OF ELECTRIC DIVISION TO KLENDER WORKSHOP

Currently the Electrical Section of the Dayeuhkolot Workshop mainly conducts repair of transformers. It is now planned to set up an independent workshop at Klender to specialize the repair of transformers. This chapter analysis the present situation and future forecast of the transformer section.

1. Current Situations

(1) Concerning transformers, the drying work of transformer, 70/20 kV 3ø 30 MVA after winding assembly, and the winding work of the other transformer, 30/6 KV 3ø 630 kVA were being conducted at the time of the survey.

(2) Drying work was conducted with incandescent lamps. For winding work old coils were hanged on drum, untying it, stripping insulators, lapping the copper wire with cotton tapes, applying amber-colored varnish of room temperature drying onto them and finally winding them on insulation tube. The winding machine is just simple, self-made and manually operated.

(3) Disassembly and assembly of transformers were being conducted utilizing the part of small size machinery plant.

(4) Works are conducted almost without drawings just only to try the recovery into originals.

2. Consideration of Current Situations

(1) Drying temperature by incandescent lamps stands at around 45°C by hand-touching and extremely low compared with universal drying temperature of 80 to 100°C approximately. Accordingly, complete drying work was not yet attained while it takes very much time for drying.

Drying furnace is indispensable for repairs of transformers, and even in these situations of no furnace equipped there, it is recommendable to take some measures such as covering them by

sheets instead of the current method so that drying temperature may be raised for complete drying work and reduction of drying time.

(2) Painting of varnish during winding work makes difficult the replacement of internal air with oil, so that there may remain void, which may cause corona discharge and decrease of dielectric strength. Accordingly, non-processed kraft paper should be used for insulation of winding so that void and oil may easily be replaced each other.

(3) Adequate tension must be given to copper wire during winding work in order to make wire fit to coil size, so that winding machine must be electromotive to meet the tension and to make looseless coil.

(4) Adhered dusts on insulators are likely to decrease insulation performance, and especially metallic powders must be prevented absolutely from being mixed into them. Working space is so limited and narrow under the current situation that disassembly and assembly work in machinery plant can not be helped. However, it must be improved into further clean working environment in future.

(5) Copper wire is not annealed, and so remains old shape. As the result even if skillfully wound, it would make oil path smaller or outer dimensions larger, so that it must be accurately checked to what extent those results may influence on temperature rise and/or insulation performance.

3. Forecast for Repair Work Volume and Scope of Repair

(1) Number of transformers not less than 25 kV in whole Indonesia

About 600 units (C.F. Appendix 3-9)

Failure rate of transformers in Japan stood at 0.0457 case/unit/annum* on the annual average during 1978 to 1982.

Remarks: Marks * indicates reference data from Society of Electric Cooperative Research Vol. 41 No.5 "Special Committee for improving Reliability of Transforming Equipments".

Number of the failure decreased to 40%* compared to fiscal year 1971. Considering such factors as there are more accidents by thunderbolts in Indonesia than in Japan, the failure rate of Japan's fiscal year 1971 should be applied. In 1971 the rate was 0.114 case/unit/annum. Accordingly, the annual number of failure is as follows:

600 units x 0.114 = 68 cases/annum

(2) Classifying these units into two categories of not less than 150 kV and not more than 70 kV. The number of installation for the former is fewer and the protecting devices are full-equipped, its 80%* is occupied by the latter. So applying this rate, they are as shown below:

Group of not less than 150 kV	:	13	cases/annum
Group of not more than 70 kV	:	55	cases/annum

These figures include 28% failure rate for oil leakage, so excluding these figures, they are as shown below:

Group of not less than 150 kV	:	9	cases/annum
Group of not more than 70 kV	:	40	cases/annum

(3) As disclosed clearly by the following analysis work 3(5), there are many repair works able to be conducted at the installation sites among them. Accordingly, the number of repair works which may be conducted at the workshop is very few for over than 150 kV. Due to the large differences in all equipment and facilities including plant-house height, lifts and loads of cranes, etc. between below 70 kV and above 150 kV, above 150 kV should be considered out of object of repair in the workshop for less repair frequency.

(4) The above-mentioned matters are described for transformers for power plants and substations,. 20 kV transformers for power distribution mark a great number including 22,410 units in Java and 8,780 units out of Java (see C.F. Appendix 3-11), so the number of repair works of them will decide the scale of equipments and facilities.

The failure rate for distribution transformers in Indonesia stands at 0.048 case/annum (C.F. Appendix 3-11). Accordingly, the annual number of failures is as follows:

31,190 x 0,048 = 1,490 units/annum

As the failure rate of Indonesia is almost the same as of Japan, the analysis of contents of failure is made according to the data of the above-mentioned committee.

(5) The failures are broken down by the components, for a total number of 2,967 cases as follows:

Auxiliary equipment	:	645 cases or	22% of all failures
Cooling equipment	:	478 cases or	16% of all failures
Bushing	:	284 cases or	10% of all failures
Total	:		48%

The failures of above-mentioned 3 components can be repaired at sites without carrying them to workshops, so excluding these components, the number of failures for repair in workshop are as follows:

1,490 units x 0.52 = 755 units/annum

And then, the number of failures involve coil rewinding is as follows:

Inside transformer tanks	:	188 cases
Natural phenomenon	:	116 cases
Contact other substances	:	20 cases
Total	:	324 cases or 11% of all failure

Accordingly, the number of units of coil-rewinding can be forecasted as follows:

1,490 units x 0.11 = 160 units/annum

4. Necessity for Repair Equipment

(1) Coil winding machines and drying furnaces are necessary to conduct the repair works of transformers as described in the preceding paragraph 2, and in order to attain the further high quality the vacuum apparatus is inevitable, so that it may be required to have a plant equipped with the equipment and antidust measures as follows:

Vacuum tank, Vacuum pump, Oil purifier, Oil filter, Oil tank, Assembly base, Testing equipment

(2) There are not any equipment and facilities like them available now in the Dayeuhkolot Workshop, but only emergency repair works are taken. If repair works of transformers are required to be made continuously in future, it is desirable that the above-mentioned equipment and facilities be installed as soon as possible.

5. Selection of Repair Shop, Time of Transfer and Training of Personnel

(1) Transformers of above 25 kV shall be transported by trailer in many cases. Accordingly, desirable repair shops are required to be convenient for transportation, accessible to wide roads, and to have sufficient space for U-turn by trailers. In addition, as shown in attached drawings, 2,100 m^2 of workshop and about 600 m^2 for outdoor working space and tank yard are needed. Accordingly, the selection of Klender Workshop with reserve lot can be evaluated as appropriate.

(2) In regard with equipment, all of them shall be constructed from now on and the overlapped investments should be avoided. So the renovation program of Dayeuhkolot Workshop should not include repair of transformer this time and they shall be equipped in new place planned for. As described in the preceding paragraph, the current repair works are like emergency repair works, so this transfer plan should be conducted as soon as possible after receiving the education and training program of the following personnel.

(3) In order to start repair works of transformers, site technicians who have these experiences and the engineers of design, test and

management are needed. Particularly, the repair works to have to catch up defects correctly with optimum measurements for them will require rather broader technologies and skills than the works of new production.

(4) Accordingly, the transfer of workshops and construction of facilities shall be harmonized with learning of technologies and skills by the appropriate personnel. In order to attain this purpose, those personnel shall be trained for about one year and simultaneously the instructors shall be stationed regularly for transfer those technologies and skills for about 1 year.

6. Evaluation of In-house Repair Works

(1) A large scale of equipment and facilities are required for repair works of transformers as mentioned below. So in case of less frequency of occurrence of products to be repaired, it may be profitable to utilize the private speciality companies and/or to replace them with new products rather than to station workers there with necessary equipment and facilities.

(2) However, the analysis work as shown in Paragraph (3) discloses as many products for repairs forecasted as unable to be treated by limited number of personnel at this time, so that the repair shops may enhance, it is deemed, their merits sufficiently.

(3) In addition, small repair works will be good enough to meet the requirements in many cases depending upon damaged portions of transformers. When repair workshops are depending exclusively upon private companies including the above mentioned small repairs, it will become a problem in terms of delivery time and payability. It is desirable to construct new repair workshops from the viewpoint to meet quick emergency work and obtain high quality electric power.

(4) In addition, the necessity for repair workshops should be reconsidered from the viewpoint of maintenance and improvement of technologies applicable to high voltage instruments including transformers, etc. in PLN.

7. Scope and Layout of Equipment

(1) Considering again the above-mentioned matters as a whole, and concentrating repair works on 20 kV transformers for power distribution with their maximum voltage up to 70 kV, the size of repair workshop was reviewed as shown in attached drawing.

(2) In regard with the distribution of facilities in Klender Workshop, the building as the main of production should be constructed as near the administration office as possible. Accordingly, the attached drawing shows 2 drafts, one of which is to dismantle the galvanizing plant now almost not in operation and to build it on that position, and the other one is to build it on backward unoccupied lot. The outer walls of the current galvanizing plant are made of mortar on their lower portions and the upper portions are made with sheet zinc and the building itself is of simplified structure. Accordingly, its dismantlement is easy and the former draft is more desirable because it will be convenient to management and communication.

8. Equipment Plan

(1) Manufacturing Equipment

Unit: (¥1,000)

Drying furnace	Width 4 m, Depth 5.3 m Height 3.6 m (m a x 100°C)	1 unit	17,800
Drying furnace	Width 3 m, Depth 5.3 m Height 3.6 m (m a x 100°C)	1 unit	12,000
Winding machine	For Cylindrical coil, 1 unit For Disc Coil, 2 units	3 units	10,400
Vacuum tank	Oval type, bisected Inner dimensions: Long dia 4 m,Height 4.5 m Short dia 2 m	1 unit	47,500
Vacuum tank	Oval type, bisected Inner dimensions: Long dia 3 m, Height 3 m Short dia 2 m	1 unit	
Vacuum pump	3,000 lit/min (With mechanical booster)	2 units	
Oil purifier	4,000 lit/h	1 unit	5,000
Oil filter	200 lit/min	1 unit	1,600
Oil tank	Round type & vertical type (25,000 lit./32,000 lit.)	2 units	13,000
Dry air generator		1 unit	2,200
Oil characteristics testers	Electrical pressure, water vol. gas vol. gas analysis	1 set	14,800
Universal Winding Drum		1 set	7,000
Small machines (Shear, press, etc.)		1 set	8,000
Meters, valves, hose, etc.		1 set	6,000
Special tools		1 set	5,700
	Total		151,000

(2) Testing Equipment

Impulse equipment		1 unit	16,000
	Applied voltage 400 kV, Charging 800 kV 1 μF x 50 kV = 16 ps. Base machine, operation board, camera		
Transformer, for withstand voltage test		1 set	23,000
	Applied voltage 140 kV, Base machine 200/3 kV, 400 kVA (w/reactor transformer reg. control board)		
Transformer for characteristic measurement 40/20/3 kV, 1,000 kVA		1 unit	13,000
Power supply equipments	Synchronous generator 600 kVA - 6.6 kV - 8 P	1 unit	7,500
	Synchronous motor 400 kW - 8 P	1 unit	10,000
	D/C motor 100 kW - 220 V	1 unit	2,200
	Coupling base, connector, etc.	1 set	6,300
	Control board (synchronizing CB, etc.)	1 set	7,500
	DC power supply & control board	1 set	1,300
High frequency generator (layer test) 300 Hz, 200 kVA MG		1 set	25,000
P.T.	1 terminal grounding, double insulation, 4 each	8 ps.	4,800
Condenser	100 kV - 3.3 kV - 3ø	30 ps	3,000
Turn ratio tester	3ø	2 units	3,000
Operation board and withstand voltage tester		1 unit	4,000
Resistance meter, voltmeter and ammeter		1 set	2,700
Current transformer, earthing device, detector, etc.		1 set	7,000
Total			136,000

(3) Transportation Equipment

Crane	20/5 tons	2 units	36,000
Crane	1.5 tons	3 units	9,000
Fork lift	3 tons	11 unit	4,000
Total			49,000

(4) Power Transforming Equipment

There are many 6 kV-rated testing equipment, so 20 kV is transformed to 6 kV by 600 kVA transformer to be installed in non-utility transforming station to distribute power by 6 kV to the power operation room in plant.

Non-utility transforming station cubicle (including Tr.)	1 set	17,130
In-plant cubicle (including Tr.)	1 set	16,970
Total		34,100

(5) Working Site

Buildings Lift head 3.5 m portion
9 m x 70 m x 2

Lift head 8 m portion
12 m x 70 m x 1 Total 2,100 m

9. Personnel Plan

(1) The following personnels are necessary accommodating the above-mentioned equipment and facilities:

Test and design	7
Coil winding	4
Insulation process	5
Coil assembly	6
Total assembly	10
Total	32 prn.

(2) It is necessary for 1 design and testing engineer, each and 3 on-site technicians to attend the training course for learning special technologies and skills for one year.

(3) It is also necessary, in addition to the above training, for 1 design and testing engineer, each and 2 on-sites instructors totaling 4 persons to work for technology transfer for about 1 year.

10. Fund Requirement

Item	Q'ty	Unit price (Rp.000)	Unit price (¥000)	Amount (Rp.000)	Amount (¥000)
(1) New construction	m^2			929,000	
Structure	2,100	442.4		929,000	
(2) Machinery	unit				370,100
Equipment expense					
Mfg. equipment	26				200,000
Test equipment	1 set				170,100
(3) Overhead				322,300	210,000
a) Packaging	550		20		11,000
b) Transportation					
1) Ocean	550		8		4,400
2) In-land	550	10		5,500	
c) Port handling charge	550	20		11,000	
d) Insurance					3,300
e) Installing works				48,000	7,500
f) Training				144,000	113,100
g) Engineering fee					18,000
h) Contingency				113,800	52,700
Grand Total				1,251,300	580,100

11. Transformer Repair Section is planned to be transferred to Klender as a new investment. Therefore the evaluation is conducted independently of the mechanical section's renovation.

(1) A Joint Venture with a French company is current producing the transformers. The repair of the transformers is possible, but the interruption of production amounts to a higher cost. The repair at the private workshops are also possible although the quality and reliability are question.

For the purpose of economic analysis, the repair costs at private workshops are used as a conservative measure of costs saved.

The type of transformers dealt by the Project is 20 kV, 30 kV and 70 kV.

The repair prices at private workshops in Indonesia are estimated as follows:

Rp x 1,000

	Major	Minor
20 kV	6,000	750
30 kV	21,000	2,500
70 kV	87,000	10,100

(2) Material cost

The material costs are assumed as follows:

Rp x 1,000

	Major	Minor
20 kV	3,000	300
30 kV	13,000	1,300
70 kV	59,000	5,900

The production is envisaged to increase gradually as the learning process takes place, reaching a full capacity in 4 years, as follows:

Year 1	Year 2	Year 3	Year 4
0.3	0.6	0.8	1

(3) Investment

In accordance to investment plan, the initial finance requirement is assumed as shown in Table 1.

(4) Wage and Salary

The wage levels adopted in the evaluation of mechanical section's renovation plan are applied to the manpower plan for transformer repair section. The resultant payment is shown in Table 2.

(5) Other Expenses

Other expenses for manufacturing and administration follow the same assumptions adopted in the renovation plan evaluation.

(6) Evaluation

Under the above assumptions the cash flow for the project is derived as shown in Table 3.

The Internal Rate of Return is 5.0%.

TABLE 1 TRANSFORMER INVESTMENT PLAN

	F. C. ¥ x000	L. C Rp x000
MACHINERY	370,100	
(MACHINERY VOLUME m3)		(550)
PACKAGING	11,000	
TRANSPORTATION	4,400	
INSURANCE	3,300	
PORT HANDLING CHARGE		11,000
INLAND TRANSPORTATION		5,500
INSTALLATION COST	7,500	48,000
SUB TOTAL	396,300	64,500
LAND RECLAMATION		0
BUILDING		929,000
ENGINEERING FEE	18,000	
CONTINGENCY	41,430	99,350
TOTAL	455,730	1,092,850
Rp Equivalent	6,534,000	

TABLE 2 TRANSFORMER SEC. WAGE PAYMENT

PERSONNEL		PAYMENT Rp X 000
MANAGER	1	6698
DEPUTY MANAGER	1	5100
SECTION CHIEF	3	12120
FOREMAN	6	21347
GENERAL WORKER	40	101550
DAILY WORKER	10	12165
TOTAL	61	158980
DIRECT LABOR	48	114752
INDIRECT LABOR	13	44228

TABLE 3 TRANSFORMER REPAIR SECTION CASH FLOW

UNIT Rp Million

YEAR	1	2	3	4	5	6	7	8	9	10
CASH INFLOW										
20KV TRANSFORMER		288	576	768	960	960	960	960	960	960
30KV TRANSFORMER		13	25	34	42	42	42	42	42	42
70KV TRANSFORMER		104	209	278	348	348	348	348	348	348
OTHER REPAIR WORK		182	365	486	608	608	608	608	608	608
TOTAL INFLOW		587	1,175	1,566	1,958	1,958	1,958	1,958	1,958	1,958
CASH OUTFLOW										
INVESTMENT	6,534									
OPERATION COST		556	864	1,089	1,322	1,322	1,322	1,322	1,322	1,322
MATERIAL		303	607	809	1,011	1,011	1,011	1,011	1,011	1,011
DIRECT LABOR		115	115	115	115	115	115	115	115	115
OTHER MANUFACTURING COST		78	68	81	101	101	101	101	101	101
ADMINISTRATION SALARY		44	44	44	44	44	44	44	44	44
OTHER INDIRECT EXPENCES		15	30	40	51	51	51	51	51	51
NET CASH FLOW	-6,534	-373	310	477	636	636	636	636	636	636

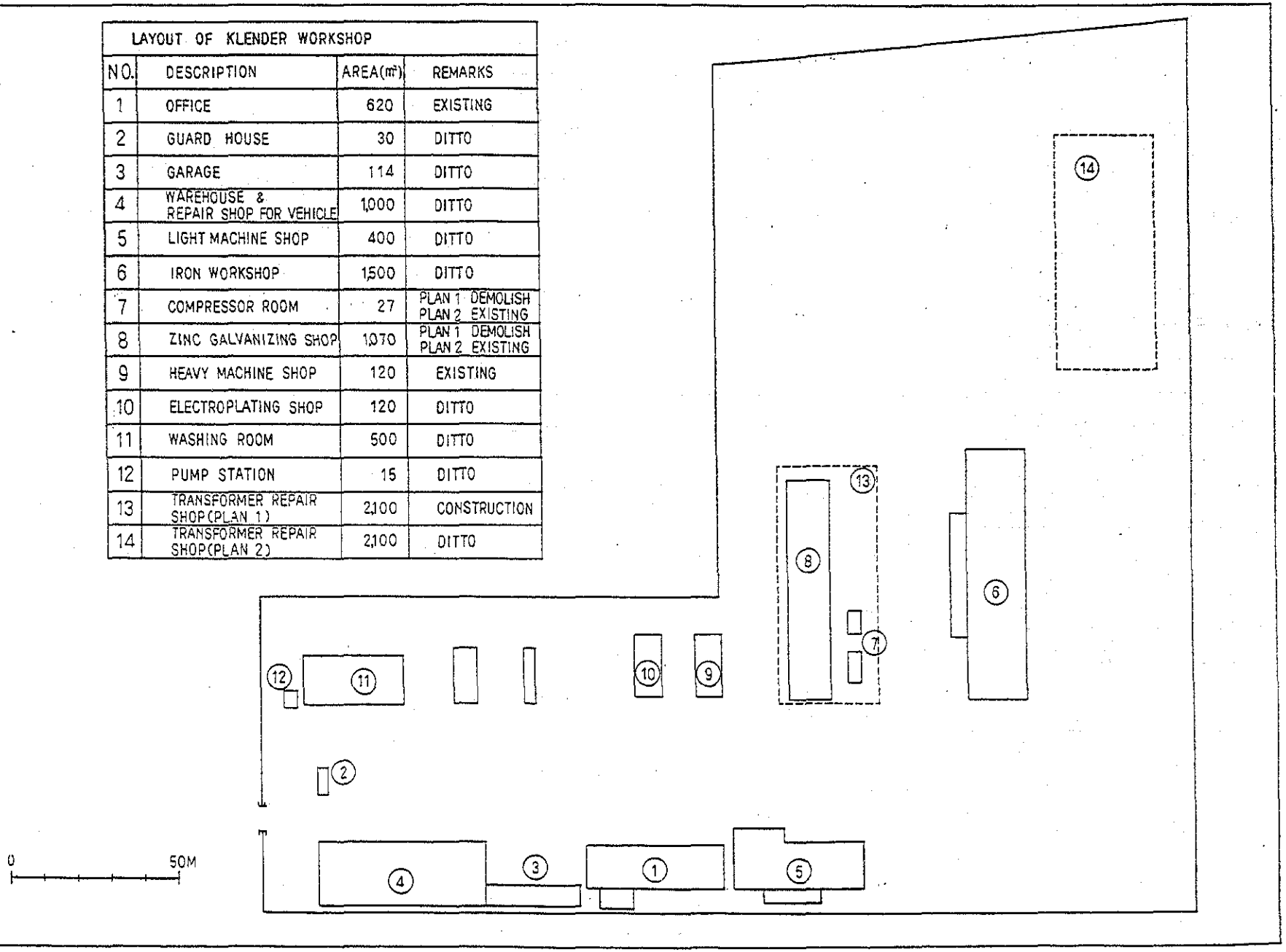
IRR= 5.0%

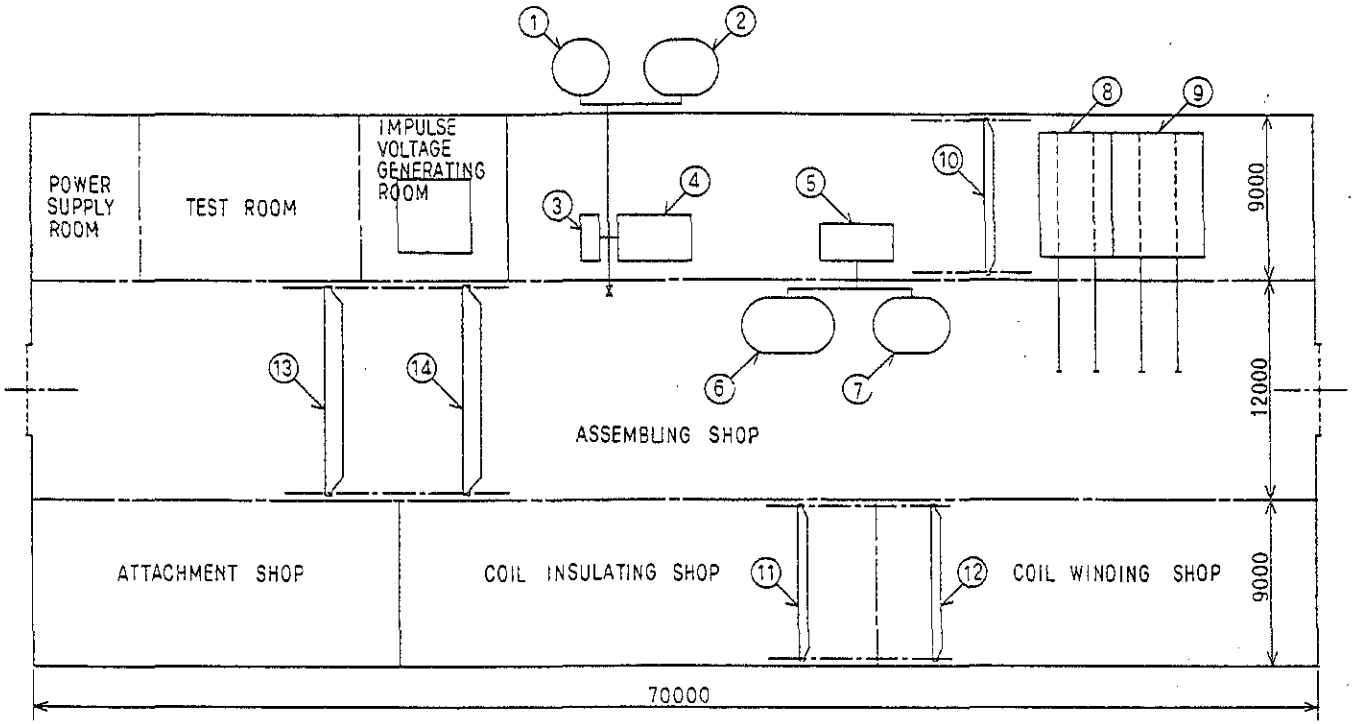
UNIT Rp Million

11	12	13	14	15	16	17	18	19	20	21
960	960	960	960	960	960	960	960	960	960	960
42	42	42	42	42	42	42	42	42	42	42
348	348	348	348	348	348	348	348	348	348	348
608	608	608	608	608	608	608	608	608	608	608
1,958	1,958	1,958	1,958	1,958	1,958	1,958	1,958	1,958	1,958	1,958
1,322	1,322	1,322	1,322	1,322	1,322	1,322	1,322	1,322	1,322	1,322
1,011	1,011	1,011	1,011	1,011	1,011	1,011	1,011	1,011	1,011	1,011
115	115	115	115	115	115	115	115	115	115	115
101	101	101	101	101	101	101	101	101	101	101
44	44	44	44	44	44	44	44	44	44	44
51	51	51	51	51	51	51	51	51	51	51
636	636	636	636	636	636	636	636	636	636	636

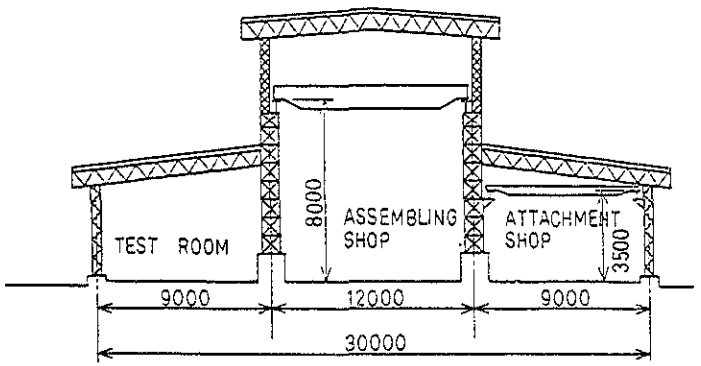
LAYOUT OF KLENDER WORKSHOP

NO.	DESCRIPTION	AREA(m²)	REMARKS
1	OFFICE	620	EXISTING
2	GUARD HOUSE	30	DITTO
3	GARAGE	114	DITTO
4	WAREHOUSE & REPAIR SHOP FOR VEHICLE	1,000	DITTO
5	LIGHT MACHINE SHOP	400	DITTO
6	IRON WORKSHOP	1,500	DITTO
7	COMPRESSOR ROOM	27	PLAN 1 DEMOLISH PLAN 2 EXISTING
8	ZINC GALVANIZING SHOP	1,070	PLAN 1 DEMOLISH PLAN 2 EXISTING
9	HEAVY MACHINE SHOP	120	EXISTING
10	ELECTROPLATING SHOP	120	DITTO
11	WASHING ROOM	500	DITTO
12	PUMP STATION	15	DITTO
13	TRANSFORMER REPAIR SHOP(PLAN 1)	2,100	CONSTRUCTION
14	TRANSFORMER REPAIR SHOP(PLAN 2)	2,100	DITTO





SKELETON PLAN OF TRANSFORMER REPAIR SHOP	
NO.	DESCRIPTION
①	OIL TANK
②	OIL TANK
③	OIL FILTER
④	OIL PURIFIRE
⑤	EVACUATING EQUIPMENT
⑥	VACCUUM TANK
⑦	VACCUUM TANK
⑧	DRYING FURNACE
⑨	DRYING FURNACE
⑩	1.5 TON CRANE
⑪	1.5 TON CRANE
⑫	1.5 TON CRANE
⑬	20/5 TON CRANE
⑭	20/5 TON CRANE



ANNEX - 2

GENERATOR REPAIR SHOP

ANNEX-2

GENERATOR REPAIR SHOP

1. Reasons for Recommendation

(1) Rewinding works of generator coils are not now conducted in Dayeuhkolot Workshop and there is no private company making specially of the rewinding works.

(2) On the other hand, many generators now installed have become deteriorated as follows:

33 sets	Over 50 years
13 sets	Over 40 years
20 sets	Over 30 years
12 sets	Over 20 years

(3) Generally speaking, the lives of generator coils are considered about 30 years and any generators which have worked over these years are likely to be in danger into dielectric breakdown even by such an impulse as slight thunderbolt, etc.

(4) The dielectric breakdown of coils during operation not only cause the damage of coils, but also cause a great damage to other portions than coils like melting of iron core or burn-out of a whole generator, etc.

(5) Accordingly, though it is presumed that the followings are already conducted in Indonesia, in Japanese electric power companies coil-rewinding works are conducted according to their programs within 30 years of service to increase the reliability of insulation.

(6) Accidental sudden stop of operation of generator by dielectric breakdown results in spilling of water. If the stoppage is conducted according to the established plan making use of dry seasons and/or alternative stoppage of generators, the spilling of water may be minimized.

(7) If coils of old generators are wound with new insulating materials, the increase of output will be expected generally by about 10% to

20% by the innovation of materials. If such manufacturing works are not ordered outside but conducted by PLN itself, the optimum output can be planned with overall consideration of water volume, output of turbines, etc. at each power generating station.

(8) Around 15 years ago, the insulation of high voltage coils had to be processed with vacuum drying and vacuum impregnation of resin or compound, which required large scale equipments and facilities with complicate processes. Recently due to the innovation of insulating resin the insulation performance with high reliability can be obtained with simpler equipment and uncomplicated process. So the insulation of high voltage coils are accordingly able to be easily accessible.

(9) Considering the above-mentioned matters, it is recommended that the rewinding equipments of generator coils shall be installed in the Dayeuhkolot Workshop, and that coils of old, obsolete generators be renewed by turns to increase reliability of insulation.

(10) If the coil-rewinding technology and skills are established firmly, repair works can be possibly made not only for generator coils but also auxiliary high voltage motor coils of thermal power generating stations. With the deterioration of thermal power generating equipments, moderate volume of demands may be expected.

(11) When coils, the most important part of generator, are able to be manufactured, the new whole generator can easily be manufactured in future, adding the production of iron cores and frames.

(12) By exchanging old cores with new one having high performance, larger output can be expected than the case of only exchanging coils.

(13) According to the circumstances of damaged coils, it may not be needed to exchange entire coils, but exchange only the troubled portion or only separate it occasionally. If the coil insulation

technology is established firmly, however these applied works can be practised and contribute also to rationalization in this aspect.

2. Coil Manufacturing Process

(1) It shall be established to be able to manufacture both stator and rotor coils.

(2) The life of generators is longer than turbine's one. Accordingly, if the generator coils to be manufactured are limited to more than 20 years from the start of running, they shall not exceed 7K volts and 10 MVA. However, the manufacturing process for the higher voltage or capacity is not different from them, so it can be possible to apply to the ones with higher voltage or capacity than the current ones if the technology has once been established. But the generator of Saguling P/S is considered out of the problem because its voltage is 16.5K volts and vacuum impregnation process is needed.

(3) Coils for both stator and rotor shall be manufactured in Dayeuhkolot Workshop and their exchanges shall be made at the site of the power generating stations. However, at the power generating stations where the frame of stator and the spider of rotor can be easily moved in or out, these machines shall be able to be moved into Dayeuhkolot Workshop to conduct the repair works.

(4) Stator coils shall be wound in pig (cucumber) type, formed to hexagon with pull-out machine, insulated between layers and against ground with resin-rich mica-tape, pressed on their straight portions with molding machine, and then dried at high temperature for finishing.

(5) In case of so-called wound-type rotor coil with rectangular copper wire, winding shall be made on bobbin applied by specified insulation and then it shall be finished with epoxy resin. Coils of flat-belt type copper wire shall be wound with layer insulation of glass tape and impregnated with resin for finishing. In case of flat-belt type coils, existing wire shall be used to them and only insulator may be replaced in many cases.

(6) The above-mentioned matters are described for generator, and in case of motor, stator coils shall be processed in the same way as generator. As for rotor coils, as the voltage of wound type rotor is low and the cage type rotor has less possibility of deterioration, the rotor coils of motor shall be outside the demand estimate of repair.

3. Materials to be used

Rectangular copper wire	Import
Circular wire (covered with special enamel)	Import
Resin-treated mica tapes	Import
Glass tapes, glass strings	Import
Silicon tapes	Import
Epoxy resin	Import
Varnish	Import
Slot wedges, pluggings	Local
Connecting goods, solder, etc.	Local
Binder, fixing materials	Local
Articles of consumption	Local

4. Demand Estimate

Demand estimate shall be made for winding works in terms of generators of hydraulic power generating stations and auxiliary motors of thermal power generating stations.

(1) Hydraulic Power

Number of all generator units except Saguling as object : 118 units

Total output of all generators except Saguling as object : 659,313 kVA

Accordingly, the average output per unit : 5,587 kVA = 5,500 kVA

Assuming the rewinding cycle as 25 years,
number of rewinding units per year 118/25 = 4.72 = 5 sets

Accordingly, for hydraulic power, 5 generators per annum of averaged 5,500 kVA are estimated to be rewound.

(2) Generally speaking, as for thermal power, more than 30 units of auxiliary high voltage motors from around 100 kW to 2,000 kW/unit are equipped.

Water-supply pump	3 units
Sea water pump	2 units
Condenser pump	3 units
Circulating water pump	3 units
Induced draft fan	2 units
Forced draft fan	2 units
Gas recirculating pump	2 units
Cooling water pump	2 units
Utility compressor	3 units
High pressure oil pump	2 units
Fuel concerns	4 units
Others	4 - 5 units
Total	32 - 33 Units

Limiting to Java because of concentration of thermal power generating stations there, the number of those units stands at 20 units, and accordingly, the number of auxiliary high voltage motor stands at 600 units, 30 units x 20.

As motors have no chance to meet with thunderbolt, assuming the rewinding cycle as 30 years.

600 units ÷ 30 = 20 units

That is, 20 units of motors approximately per annum are estimated for rewinding demand.

In addition, auxiliary high voltage motors of gas power and geothermal power generating stations will be also estimated further for those demands in future as well as thermal power.

5. Personnel Arrangement

(1) The following man-power is required for coil manufacture:

Design, survey and tests:	4	engineers
Stator coil winding and pull-out:	2	technicians
Stator coil insulation:	6	technicians
Stator coil reformation and mold-drying:	3	technicians
Rotor coil winding and resin processing:	4	technicians
Stator/rotor coil finish and assembly:	4	technicians
Total:	23	persons

(2) As the above-mentioned personnel are all specialists, 2 design and testing engineers and 3 shop-technicians are required to attend the education and training course for about one year to learn their respective technologies and technical craftmanship.

(3) In addition, about 1-year technology transfer program is required with 2 design and testing instructors and 2 technical craftman.

(4) The man-days required for rewinding 5,500 kVA generator coils are as follows:

	Man-days
Stator coil manufacturing	405
Stator coil replacement	85
Stator coil design and testing	48
Rotor coil manufacturing	105
Rotor coil replacement	35
Rotor coil design and testing	12
Total	690

(5) Assuming the averaged motor output as 250 kW, the man-day required for rewinding of its coils are as follows:

Stator coil manufacturing	75
Stator coil replacement	32
Stator coil design and testing	8
Total	115

6. Equipment Plan

(1) Manufacturing Equipment

(¥ x 1,000)

Pull-out machine	1 unit	7,500
Mold machines	2 sets	14,000
Taping machine (for earth insulation)	1 unit	16,500
Taping machine (for layer insulation)	1 unit	11,000
Winding drum settings	2 sets	1,000
Drying furnaces, high temperature and low temperature	2 units	13,000
Vacuum dryer	1 set	9,000
Press, 400 tons	1 unit	19,500
Winding machine	2 units	4,600
Cold storage box	1 unit	1,000
Others and special tools	1 set	4,900
Total		102,000

(2) Testing Equipment

(¥ x 1,000)

Tr. for testing 100 kV - 100 kVA	1 unit	1,740
Tr. for testing 30 kV - 30 kVA	1 unit	3,000
PT 33 kv/22 kV/11 kV/110 V	2 units	1,380
Shelling bridge, positive	1 unit	2,300
Shelling bridge, negative	1 set	1,070
Standard condenser	1 set	1,000
Reactor (air-core, 100 A)	1 unit	790
Tr. for testing 30 kV - 3 kVA	1 unit	430
Tr. for testing 15 kV - 5 kVA	1 unit	520
Meters	1 set	1,000
Others	1 set	1,770
Total		15,000

(3) Transportation Equipment

Portal crane, 10 tons	15,000
total	15,000

(4) Working Site

Building 20 m x 30 m = 600 m^2

The location of the generator plant in the Dayeuhkolot Workshop and the layout diagram of instruments in working site are shown in attached drawings.

7. Fund Requirement

Item	Q'ty	Unit price (Rp.x1,000)	Unit price (¥x1,000)	Amount (Rp.x1,000)	Amount (¥x1,000)
(1) New construction	m^2			189,600	
Structure	600	316		189,600	
(2) Machinery	unit				132,000
Equipment expense					
Mfg. equipment	15				117,000
Test equipment	1 set				15,000
(3) Overhead				230,200	166,000
a) Packaging	$200m^3$		20		4,000
b) Transportation					
1) Ocean	$200m^3$		8		1,600
2) In-land	$200m^3$	40		8,000	
c) Port handling charge	$200m^3$	20		4,000	
d) Insurance					1,200
e) Installing works				36,000	5,000
f) Training				144,000	113,100
g) Engineering fee					14,000
h) Contingency				38,200	27,100
Grand Total				419,800	298,000

8. Economic Analysis

Generator and motor section is distinctly a new investment plan, therefore the evaluation is conducted independently of the mechanical section's renovation.

(1) Benefit

The repair of generators and motors of the size envisaged in this Project is currently conducted not in Indonesia but overseas. The repair of sufficient quality can be expected in Singapore. The benefit for the Project is defined as the cost saving made by eliminating the repair service import. The price of benefit is C.I.F. value of the repair for a typical generator and motor. It is computed as follows:

	Rp x 1,000/piece
Generator	
Stator	147,000
Rotor	56,000
Motor	32,000

The production is envisaged to increase gradually as the learning process takes place, reaching a full capacity in 4 years, as follows:

Year 1	Year 2	Year 3	Year 4
0.3	0.6	0.8	1

(2) Investment

In accordance to investment plan, the initial finance requirement is assumed as shown in Table 1.

(3) Material Cost

The material costs for the repair are assumed as follows:

	Rp x 1,000/piece
Generator	
Stator	88,000
Rotor	34,000
Motor	19,000

(4) Wage and Salary

The wage levels adopted in the evaluation mechanical section's renovation plan are applied to the man power plan for the generator and motor repair section. The resultant payment is shown in Table 2.

(5) Other Expenses

Other expenses for manufacturing and administration follow the same assumptions adopted in the renovation plan evaluation.

(6) Evaluation

Under the above assumptions the cash flow for the project is derived as shown in Table 3.

The Internal Rate of Return is 11.7%.

T A B L E 1 GENERATOR/MOTOR SECTION INVESTMENT PLAN

	F. C. ¥ X 000	L. C Rp X 000
MACHINERY	132,000	
(MACHINERY VOLUME m3)		(200)
*PACKAGING	4,000	0
TRANSPORTATION	1,600	0
INSURANCE	1,200	
PORT HANDLING CHARGE		4,000
INLAND TRANSPORTATION		8,000
INSTALLATION COST	5,000	36,000
SUB TOTAL	143,800	48,000
LAND RECLAMATION		0
BULDING		189,600
CONTINGENCY	15,780	24,000
ENGINEERING FEE	14,000	0
TOTAL	173,580	261,600
Rp Equivalent	2,334,000	

T A B L E 2 GENERATOR/MOTOR SEC. WAGE PAYMENT

PERSONNEL		PAYMENT Rp '000
MANAGER	0	0
DEPUTY MANAGER	1	5100
SECTION CHIEF	3	12120
FOREMAN	6	21347
GENERAL WORKER	27	68546
DAILY WORKER	18	21898
TOTAL	55	129011
DIRECT LABOR	45	111791
INDIRECT LABOR	10	17220

TABLE 3 GENERATOR/MOTOR SEC. CASH FLOW UNIT Rp Million

YEAR	1	2	3	4	5	6	7	8	9
CASH INFLOW									
GENERATOR		305	609	812	1,015	1,015	1,015	1,015	1,015
MOTOR RECOILING		192	384	512	640	640	640	640	640
TOTAL INFLOW		497	993	1,324	1,655	1,655	1,655	1,655	1,655
CASH OUTFLOW									
INVESTMENT	2,334								
OPERATION COST		493	817	1,045	1,273	1,273	1,273	1,273	1,273
MATERIAL		297	594	792	990	990	990	990	990
DIRECT LABOR		117	117	117	117	117	117	117	117
OTHER MANUFACTURING COST		47	59	79	99	99	99	99	99
ADMINISTRATION SALARY		17	17	17	17	17	17	17	17
OTHER INDIRECT EXPENCES		15	30	40	50	50	50	50	50
NET CASH FLOW	-2,334	3	176	279	383	383	383	383	383

IRR= 11.7%

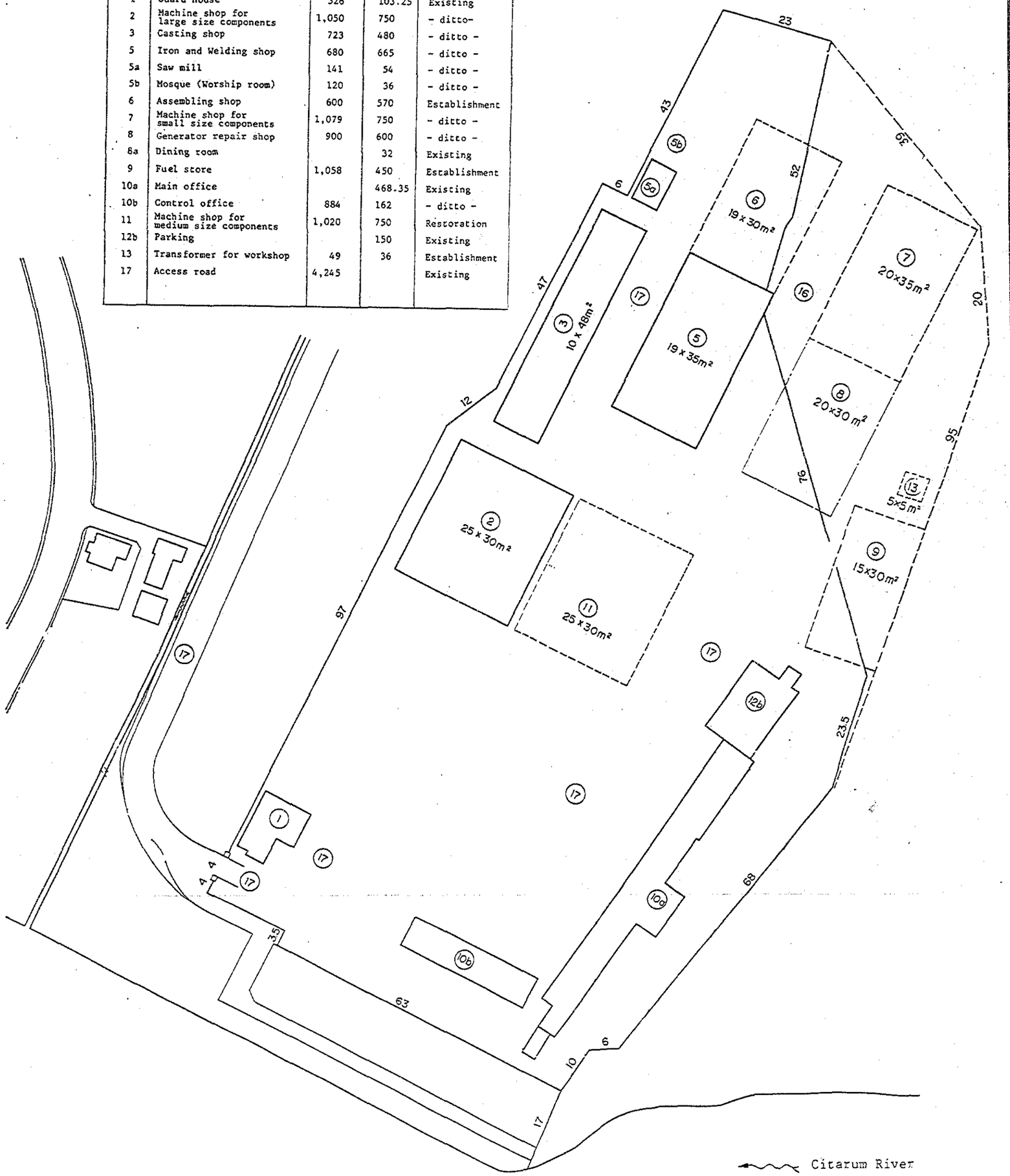
UNIT Rp Million

10	11	12	13	14	15	16	17	18	19	20	21
1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015
640	640	640	640	640	640	640	640	640	640	640	640
1,655	1,655	1,655	1,655	1,655	1,655	1,655	1,655	1,655	1,655	1,655	1,655
1,273	1,273	1,273	1,273	1,273	1,273	1,273	1,273	1,273	1,273	1,273	1,273
990	990	990	990	990	990	990	990	990	990	990	990
117	117	117	117	117	117	117	117	117	117	117	117
99	99	99	99	99	99	99	99	99	99	99	99
17	17	17	17	17	17	17	17	17	17	17	17
50	50	50	50	50	50	50	50	50	50	50	50
383	383	383	383	383	383	383	383	383	383	383	383

Drawing No. R-200 General Arrangement of Workshop PLAN-2 and PLAN-3

Scale: 1/500

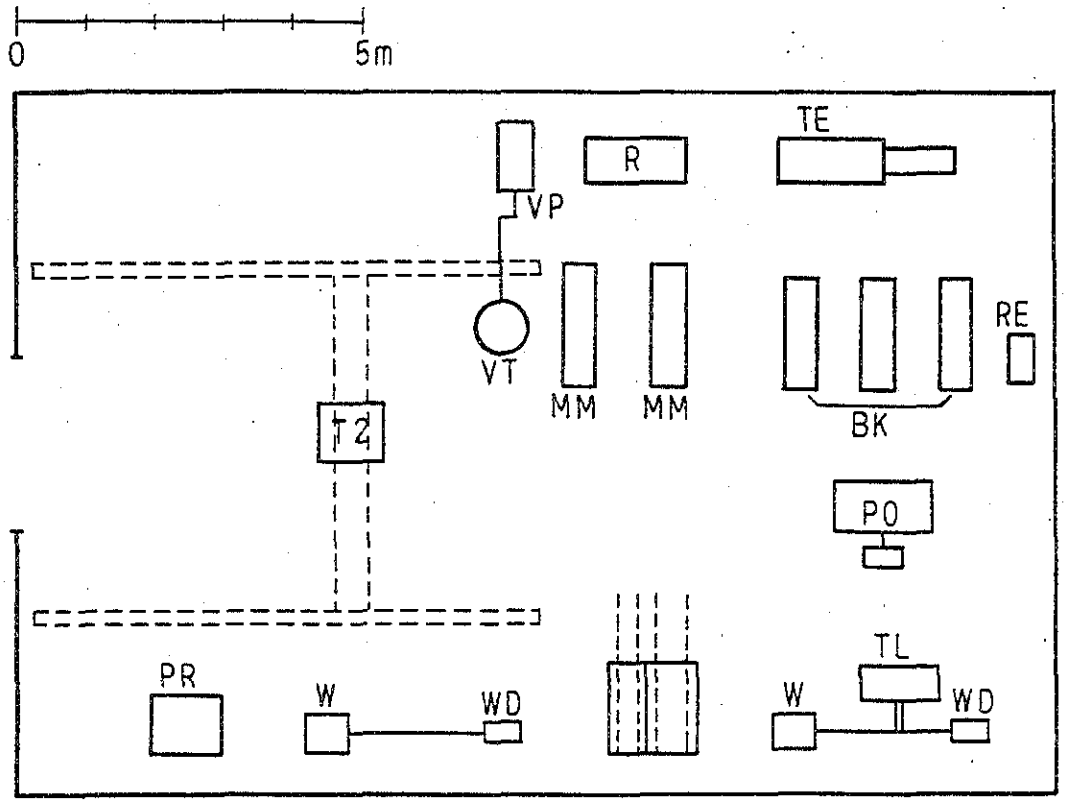
Shop No.	Description	Area m²		Remarks
		Plottage	Floor	
1	Guard house	326	103.25	Existing
2	Machine shop for large size components	1,050	750	- ditto-
3	Casting shop	723	480	- ditto -
5	Iron and Welding shop	680	665	- ditto -
5a	Saw mill	141	54	- ditto -
5b	Mosque (Worship room)	120	36	- ditto -
6	Assembling shop	600	570	Establishment
7	Machine shop for small size components	1,079	750	- ditto -
8	Generator repair shop	900	600	- ditto -
8a	Dining room		32	Existing
9	Fuel store	1,058	450	Establishment
10a	Main office		468.35	Existing
10b	Control office	884	162	- ditto -
11	Machine shop for medium size components	1,020	750	Restoration
12b	Parking		150	Existing
13	Transformer for workshop	49	36	Establishment
17	Access road	4,245		Existing



NO.8 GENERATOR REPAIR SHOP

SCALE : 1 / 200

AREA : 20X30 = 600m²



REGD	DESCRIPTION	QUANTITY (SETS)
TE	TAPING MACHINE (FOR EARTH INSULATION)	1
TL	TAPING MACHINE (FOR LAYER INSULATION)	1
PO	PULL-OUT MACHINE	1
W	WINDING MACHINE	2
RE	COLD STRAGE BOX	1
MM	COIL MOULDING MACHINE	2
R	COIL REFORMING TABLE	1
D1	DRYING FURNACE (LOW TEMPERATURE)	1
D2	DRYING FURNACE (HIGH TEMPERATURE)	1
PR	OIL PRESS	1
T2	GANTRY CRANE	1
VT	VACUUM TANK	1
VP	VACUUM PUMP	1

ANNEX - 3

QUALITY CONTROL

ANNEX-3

QUALITY CONTROL

1. General

(1) Purpose

Quality control shall be defined as control activity to produce good products and services economically. Quality assurance shall also be defined as the manufacturer's activity to make up the quality to be required by customers.

(2) Organization and Structure

1) The appropriate organization and structure shall be established.

2) The flow and function shall be defined on works from order-taking, engineering design, manufacture to shipment.

(3) Responsibility System for Quality Assurance

1) Responsibility and assignments shall be established on quality assurance of products.

Example:
Responsibility system shall be established by manufacturing process, and the contents of process shall also be ascertained.

2) Quality assurance organization shall be established as an independent section.

(4) Responsibility and Authority

The scope and authority of each organization shall be defined.

(5) Committees, Conferences, etc.

Committees shall be established in order to promote the quality control and quality assurance. And, the purpose, the members, the

opening procedures, the responsible persons, etc. of the committee shall be defined.

(6) Audit and Check System

A system (including the quality audit committee, etc.) shall be established to check whether the quality assurance functions will be smoothly enhanced or not, and the operation thereof shall be defined concretely.

Example:
The quality audit committee members shall check the condition of activities of quality assurance functions once or twice a year and give the instructions for improvement and so on.

(7) Maintenance of QC Documents

1) Preparation of Table of Production Control Process

Example:
The table of production control process shall be prepared to manage the process control, schedule control, cost control, delivery control, manpower and personnel control, etc. for the entire production management.

2) Preparation of Table of QC Process

Example:
The table of QC process shall be prepared in accordance with the table of production control process as mentioned in paragraph 1) above including the check items of important points (whether the products according to the specifications will meet necessary dimensions, numbers, and functions at the step of product inspection) and check columns by model, product and work by manufacturing process.

3) Preparation of Table of Manufacturing Procedures and Manufacturing Standards

Example:
Table of manufacturing procedures and manufacturing standards shall be prepared defining the manufacturing

procedures and courses on important points in accordance with the table of QC process as mentioned in paragraph 2) above.

4) Preparation of Check Lists

Example:

Check lists shall be prepared in accordance with the table of manufacturing procedures and manufacturing standards as mentioned in paragraph 3) above, by necessary check point, and also prepared by manufacturing work including the following items:

Check items, check contents, check columns, date, and other necessary items.

(8) Matters concerning Education and Training

The method of the education and training shall be defined by *trainees' level and by contents.*

a. Trainees' level shall be classified into engineering designer, manufacturing personnel, assembly personnel, etc.

b. The theme shall be so defined to be suitable for trainees by process.

Example:

Engineering designer: Whether the contents of specifications are reflected on engineering designs, and whether the check method is good.

Manufacturing personnel: The method to check whether products are made to meet the drawings.

Assembly personnel: How they can assemble precisely at the site according to drawings.

c. The time, period of education and training shall be defined.

2. Management of Engineering Design

(1) General Quality Assurance

1) The contents of management in the field of engineering design (technology) shall be provided to meet the requirements of the specifications.

2) Measures for revision of engineering design shall be defined.

(2) Functions

1) The functions in the field of engineering design (technology) shall be defined (how cheap and good quality products can be made).

2) The management, revision and maintenance method of standards and codes available in engineering design shall be provided concretely.

(3) Measures prior to Commencement

1) The time and method shall be defined on the advanced consultations and reviews prior to commencement of the engineering design.

Example:
Contents of meetings, members, check items, etc. shall be made clear.

(4) Preparation of Site Sketches

The condition of the work site shall be collected on the products including the mounting dimensions, angles, spaces, working sites, incoming and outgoing routes, traffic routes between sites and plants, etc., and so confirmed that engineering design may not be prevented.

Particularly, it shall be provided to measure actually at site the mounting dimensions, positions of mounting holes, angles, etc. on portions where the current installations and the newly constructed installations will be put together.

(5) Management under Engineering Design and upon Completion

The management under engineering design and upon completion shall be defined clearly.

Example:
The management items shall be provided until submitting drawings including inspections of drawings, confirmation of contents of the specifications, confirmation of functions, etc. by the respective working steps.

(6) Manufacturing Instructions, procedures and management. These matters shall be defined clearly in accordance with the drawings and the specifications.

Example:
Instruction concerning special matters including manufacturing procedures, working procedures, heat treatment, etc.

(7) The strict enforcement method shall be provided for the instructions on distribution and collection of information including supersedure of the specifications and the drawing in case of revision.

3. Management of Documents

(1) General

1) The methods of preparation, issue, receipt, storage of documents and records concerning quality control and quality assurance including their flows among each department shall be defined.

2) The handling method of them for amendment and revision shall be also defined similarly as mentioned in paragraph 1) above.

(2) Preparation and Issue of Documents and Records

The rules for preparation, issue, inspection, approval, dispatch, distribution and receipt of documents concerning quality control and quality assurance shall be defined in a tabular form.

(3) Storage and Destruction of Files

1) The storage method and effective period of documents and files shall be defined.

2) The copies of documents distributed to customers and/or outside the firm shall be also defined as mentioned in paragraph 1) above.

(4) Quality Control Records

1) The management method of records shall be defined concerning quality control including the inspection reports.

Example:
Those documents shall be classified as the completion inspection reports by independent delivered customer.

2) Records issued to outside firms shall be also defined as well.

(5) Treatment on Amendment and Revision

1) Responsible personnel shall be appointed for drafting and obtaining approval for amendment and revision of the specifications, drawings and various instructions.

2) Treatment of old documents regarding amendment and revision shall be defined.

Example:
Procedures on collection and destruction, etc. shall be decided.

4. Management of Sbucontract and Procurement

(1) General

The management method shall be defined on subcontract and procurement from vendors.

Example:

a. The basic agreement on transaction and the agreement on quality assurance shall be made.

b. The obligation for submission of the inspection report and the joint inspection system (interim and final inspections), etc. shall be defined.

(2) Management on Order Issue

The issue of the specifications, confirmations method of vendors and confirmation method of delivery for order-issue on purchasing goods and subcontractions shall be defined.

(3) Communications and Guidance

1) The concrete procedures shall be defined on the manufacturing guidance, amendment of specifications and necessary communications to subcontractors (vendors), etc.

2) The concrete procedures shall be defined on the vendor-site inspection system, if applicable.

(4) Acceptance and Inspection of Products

The method of acceptance and inspection of subcontracted (purchased) products shall be defined concretely.

Example:
Total inspection, sampling inspection, joint inspection, inspection time, judgement criteria for pass, etc.

(5) Unsatisfied Products

The treatment procedure shall be defined concretely on unsatisfied products found in the acceptance inspection.

Example:
The criteria for unsatisfied products shall be established to decide a level for returning all back.

5. Management of Manufacturing Process

(1) General

1) The management of works, jigs tools, equipment, etc. on the manufacturing process shall be defined.

Example:

For the working procedures and the handling procedures of jigs and tools, the management shall be conducted in accordance with them.

2) The qualifications and skills of workers shall be defined as necessary.

Example:

Welding qualifications, heavy load handling qualifications, etc.

(2) Manufacturing Plan

1) The working procedures shall be provided for the contents of works from the manufacturing plan to conduct thereof by model and by work in order to define the work-flows.

2) The documents necessary for arrangement of works and the procedures on modification of plans shall be defined.

(3) Management of Raw Materials and Parts

The concrete definitions shall be made on the confirmation method and the prevention measures for careless use by mistake of unsatisfied products including identification of materials on the manufacturing line and records of materials and parts.

Examples:

a. The identification marks by color paint of each material shall be applied to raw materials like metallic materials.

b. Materials on the manufacturing line shall be tagged, and unsatisfied products shall be put in the designated storage boxes for the appropriate classification and so on.

(4) Work Management for Manufacture (Utilization of Table of QC Process)

In order to conduct the work management on the manufacturing process, the check sheet shall be prepared for the respective

works, and the utilization method of the check sheet, handling procedure at the time of change of works, recording method during works, etc. shall be defined

Example:

_____ working procedure, _____ work change instruction form, etc. shall be prepared, and the check list (dimensions, quantity) and inspection result recording sheet shall be utilized at any time when required.

(5) Interim Process Inspection

The method of execution of interim inspection to be conducted in the interim process (upon completion of temporary assembly) shall be defined.

Example:

Inspection time (at every transition of process), inspection method, inspection items, judgement criteria, etc.

(6) Management of Special Process

Materials, equipment, working method, etc. to be used on important process during the working course shall be defined.

Example:

Conduct of heat treatment after welding, conduct of transportation work of heavy loads, etc.

(7) Working Environments and Safety Measure

1) The concrete management method shall be defined on the maintenance of working environments and safety measures for works.

Example:

Steel plates and bars shall be classified and arranged by thickness and size and stored on shelves.

2) Management method shall be provided for moisture-proof, rust-proof and dust-proof.

Example:

Products required for dust-proof shall be stored in covered cotainers.

3) Paths shall be kept for safety works.

(8) Management of Equipment, Jigs and tools

1) Management method of manufacturing equipment, jigs and tools to be used on the manufacturing line shall be provided.

Example:

Responsible personnel shall be appointed for management of *machine tools to conduct inspection once a half year.*

2) Procedures on daily inspection, periodical inspection, maintenance, repair, replacement, etc. shall be provided.

Example:

Check lists on electric tools for periodical inspection (insulation resistance and confirmation for soundness) and register books shall be prepared for historical record control.

(9) Education and Technical Training of Workers

1) Education and training of workers shall be provided.

Example:

Standard working procedures shall be prepared, and the working methods shall be instructed periodically.

2) Fostering procedures for workers required for special technical skills shall be provided.

Example:

Welding works, operation of cranes, assembling of precise equipment (run-out finding, centering), handling of heavy loads.

6. Inspection Management

(1) General

Functional contents of inspection or test shall be defined.

Example:
Inspection items, inspection methods, reading of numerical values on inspection results, judgement of criteria, etc. shall be provided, and management method of equipment and measuring instruments to be used for these functions shall be also provided.

(2) Inspection Plan

Time, method, schedule, etc. necessary for tests and inspections shall be provided definitely.

(3) Product Inspection

1) The type of inspection (total inspection, sampling inspection), inspection items, inspecting equipment, inspection method, judgement criteria, records and treatment procedures on products shall be provided.

2) *Inspection procedures, inspection standard, inspection result* report, etc. shall be prepared concerning individual product, and the methods shall be provided for to check them for a certainty.

(4) Management of *Inspection Equipment and Instruments.*

Management criteria shall be clearly provided for equipment and measuring instruments available for inspections and tests. Periodical inspection method, repair, destruction, and indication method for serviceability of individual measuring instrument (indication of effective date) shall be provided.

(5) Training and Authorization of Inspectors.

1) Concrete contents and schedule shall be planned concerning the education and training of prospective inspectors.

Example:

Education and training shall be conducted once a half year on the handling method of vernier calipers and micrometers, and the judgement method of numerical values on measurement results.

2) Authorization and registration system of special inspection personnel shall be provided.

Example:

Authorization and registration of welders and operators of magnetic particle testing equipment.

7. Transportation Plan and Management

(1) Storage, Packing, Transportation Management

Management method shall be provided on storage, packing, transportation, etc. in order to prevent quality deterioration of finished products and damages by accidents.

Example:

Wooden craters, packing methods, piling methods, loading methods, and transportation methods shall be provided for in case of transporting products larger than a certain size.

(2) Delivery and Transportation Plan

Concrete plans shall be provided for concerning responsible organizations for transportation and packing, time of dispatching craters, transportation methods, transportation routes, delivery routes.

(3) Packing

1) Packing specifications prior to packing shall be provided for including verification of products to the specifications, packing method, packing materials, etc.

2) Rust-proof treatment shall be provided to prevent deterioration of instruments, corrosions and so on, and vinyl covers shall be put on them.

3) Indications shall be made outside of craters including contents, quantity, prohibition of lateral loading, prohibition of piling, weight, handling caution, etc. in order to indicate conditions of products.

(4) Transportation

1) Concrete transportation method shall be provided on transportation by trucks, freight trains, etc.

2) Appearance of loads, loading methods, water-proof measures against rain-fall, vibration-proof measures, roping on loads shall be specified in order to prevent packages from damages by traffic accidents.

3) Unloading methods (by crane and/or fork lift), transportation routes, movement in sites, delivery routes, etc. shall be specified.

ANNEX - 4

SAFETY CONTROL AND ENVIRONMENT PRESERVATION

ANNEX-4

SAFETY CONTROL AND ENVIRONMENT PRESERVATION

I. Safety Control

1. Proper Arrangement and Good Order

(1) Tools, materials, etc. in the workshops shall be classified into necessary and unnecessary goods. Disused articles shall be disposed, and necessary goods shall be arranged on their designated places in good order so that they may be found and picked up easily.

(2) Tools shall be always arranged in good order for proper use even during working period.

(3) The workshops shall be cleaned up after every working process has been finished, and mill scales, dusts and wastes shall be disposed in the designated place.

(4) The workshops shall be always kept clean to protect the workers from slipping and stumbling.

2. Inspection and Maintenance

(1) Machines and tools shall be periodically inspected and also inspected prior to use of them.

(2) Electric instruments and devices shall be used after confirmation of sufficient insulation level thereof.

3. Clothes

(1) All workers shall wear neat clothes with long sleeves and trousers and keep the ends of sleeves and coats from being loosened so that they may not be caught in turning machines.

(2) Safety helmets shall be used right during working period to protect heads.

(3) Shoes with hard soles shall be used to protect the instep from mill scales, shaped iron wastes, etc.

(4) No cloth glove shall be used for drilling and chambering works by using machine-tools with turning bites.

4. Access Paths in Workshop

(1) Width of the access paths in workshops shall be of more than 80 cm and no goods shall be put on and/or protruded in the access path area.

(2) No cargo and goods shall be piled up high near the access paths.

(3) Access paths shall be kept clean so that no slipping, stumbling and treading may happen on there.

5. Protectors

(1) Dust-proof masks and glasses shall be used for dusting works such as grinding and arc welding works and both light-shield glasses and leather gloves together for arc welding works.

(2) Ear-plug shall be used for noisy works.

(3) Protecting masks, gloves and hand-cream shall be used to protect human body from organic chemical agents like thinner, benzene, etc. or their solvents and asbestos, coal tar, etc., and lead like solder.

(4) Protective equipment and tools shall be used for electric work and/or work to closely hot-line jobs and those protective tools shall have been proven by withstand voltage test.

6. Machinery Equipment

(1) Turning portions of machines shall be enclosed with protective fences or covers to prevent catching in.

(2) Safety devices shall be inspected periodically and confirmed for normal and right operation.

(3) Processing materials shall be covered and/or enclosed so that they may not be scattered out during processing works.

(4) When machines are suspended to operate for lubrication, cleaning, inspection and/or repair, they shall be so locked that they may not start up easily indicating "Under Maintenance".

(5) Machine tools such as press and shearing machines shall be enclosed with protective fence or mounted with safety devices to protect from danger.

7. Electric Concerns

(1) Main power supply and power distribution boards shall be operated by authorized persons in charge.

(2) Main power supply equipment and power distribution boards shall be of hermetic type or enclosed with fence.

(3) Inspection, repair and maintenance works for electrical equipment shall be done according to the instructions of authorized persons in charge.

(4) *Confirmation for insulation shall be performed periodically* for motors and other machines.

(5) Electric equipment and devices shall be grounded and mounted with earth leakage breakers. Earth leakage breakers shall be subject to their operation tests prior to use.

8. Handling and Transportation of Goods

(1) All goods shall be handled carefully and not be thrown away for piling or pulled down.

(2) Cargos and freights shall be piled as low as possible and applied with supports or fastened so that they may not crumble and fall away.

(3) Heavy goods shall be put underneath and light goods upwards.

(4) Transporting tools shall be always inspected and well maintained.

(5) Freights shall not be overloaded and loaded ununiformly.

(6) Long freight shall be moved laying down laterally and manually by more than 2 persons without fail.

9. Handling of Dangerous Goods

(1) In case of handling inflammable or combustible goods such as thinner, alcohol, varnish, oil, etc., it shall be prohibited to use fire near them.

(2) Pressure vessels for oxygen gas, acetylene gas, propane gas, etc. shall be carefully handled and covered with permeable sheets so that the temperature of vessel may not increase over 40°C with direct sun-shine heat.

(3) In case of use of inflammable gas vessels of oxygen gas, acetylene gas, etc. nearing each other, they shall be isolated by nonflammable materials (thin iron plate, zinc plate, slate, etc.) on the cap of vessels.

(4) Extinguishers shall be mounted on the position where they will be used immediately onto a dangerous goods handling place indicating the mounting place with a mark and all workers shall be thoroughly informed of the mounting place of extinguisher with the handling instructions.

(5) Acetylene gas vessels shall not be laid down laterally in any case of storage, transportation and use.

(6) When gases remain a little in pressure vessels and can not be used, their main valves shall be fully opened for discharge of all of remaining gases. However in case of discharging poison gases and inflammable gases, prior notice shall be given for thorough protection of workers to be taken from hazards and fire accident by inflammation.

10. Indication of Marks

(1) Marks such as danger, charging, turning, off-limits, watch your head, watch your step, etc. shall be indicated on necessary places for calling attention to all workers and strict enforcement.

(2) Marks indicating responsible personnel in charge of electric power and machines shall be filled with their names of such personnel to prohibit other people from handling them.

(3) Appropriate marks shall be indicated telling, "Don't switch on during inspection and repair work." prohibiting unauthorized persons from operation.

(4) Annual or monthly safety objectives shall be bulletined for enhancement of a sense of safety and promotion of safety activities.

(5) In order to promote the labor accident prevention, the annual safety basic principles and safety activating matters shall be itemized and shown on the bulletin boards in working sites for strict enforcement.

11. Working Procedures

(1) Working procedures shall be developed by each product and strictly observed.

(2) For unplanned works, the work guidance sheet shall be prepared from time to time.

(3) Working procedure shall include the opinions and suggestions of workers and the check points by working process in terms of technical aspect and safety aspect for enforcement of them.

(4) Working procedure shall be reviewed and improved as necessary to meet the current situation.

12. Daily Works

(1) Calisthenics shall be practiced prior to starting jogs.

(2) Prior to starting jobs, the group meeting shall be held to discuss the schedule and assignments of jobs of the day. In the meeting, the dangerous factors relevant to the works shall be pointed out and the preventive measures to be taken against them. In addition, this method (prediction of dangers) shall be conducted by each working process.

(3) Own working positions shall be kept in good order and well-arranged, cleaned and cleared.

(4) Works and jobs shall be conducted in accordance with working procedures and shall not be omitted or conducted at own discretion.

(5) Workers shall call attention to each other and prevent dangers.

(6) Used instruments and devices shall be maintained, tools shall be turned into the appropriate positions, and working sites shall be cleaned up and well-arranged in good order at the closing time of works.

II. Environment Preservation

1. Workshops

(1) Power receiving equipment shall be of enough capacity for the maximum electric power energy, the careful inspection and maintenance shall be conducted on transformers, and noise and temperature rise shall be prevented.

(2) Hazardous, dangerous goods and poisons shall be stored and isolated at designated places respectively, so that they may be administered to be prevented from affection to human body due to leakage or inflammation and explosion. Particularly, gas pressure vessels shall be installed so that they may not rise their temperature over 40°C.

(3) Noise-making works shall be shielded or workpieces covered by sponge-mattress, etc. so that acoustic wave may not go outside trying to decrease noise.

(4) Vibration-generating works shall be improved by fixing and working methods of such generating instruments and devices to try to decrease vibration.

(5) Soil water produced during works and entrained water of chemical agents shall be discharged to rivers after purified in workshop.

(6) Pressure vessel of compressor, etc. shall be used always under the specified pressure and the confirmation of operation of pressure regulator shall be inspected periodically for normal operation.

(7) Smoke collector and smell collector shall be installed for works generating dust, smoke and stinky smell to prevent them.

(8) Wastes generated from works shall be disposed of at the designated place which is provided for such wastes.

2. Working Environment

(1) Work site shall be ventilated uniformly by opening and closing windows and/or by ventilator in order to keep clean air always.

(2) Forced ventilation shall be made with central or local exhausts at the working place handling hazardous goods.

(3) Illuminance for normal and precision works shall be more than 150 luxes and 300 luxes, respectively.

(4) Arc welding works shall be conducted by cutting out arc light by screen, etc. to protect other workers from its influence.

(5) Rest shall be taken at the designated place and smoking shall be authorized at the rest room provided with ash-trays.