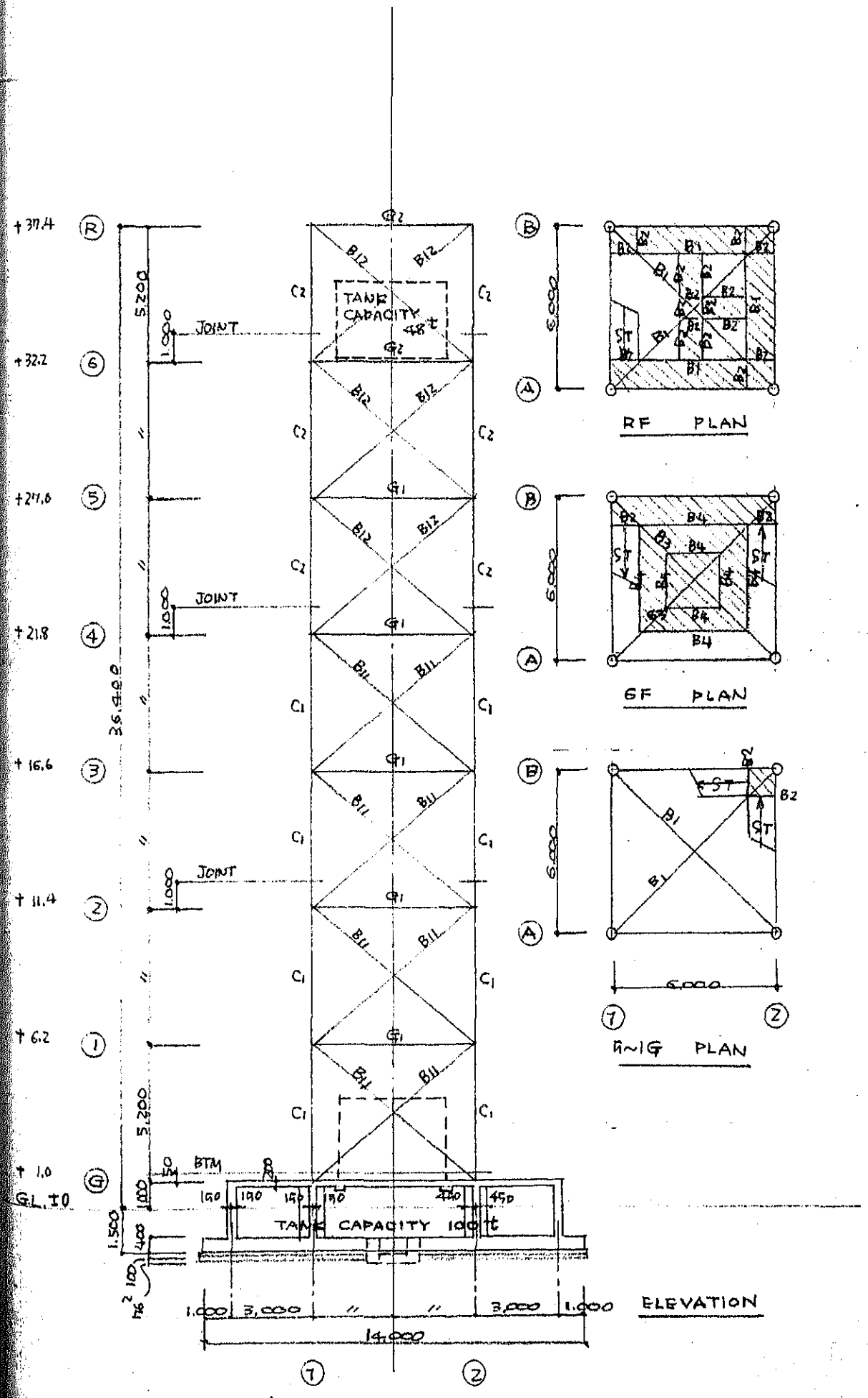
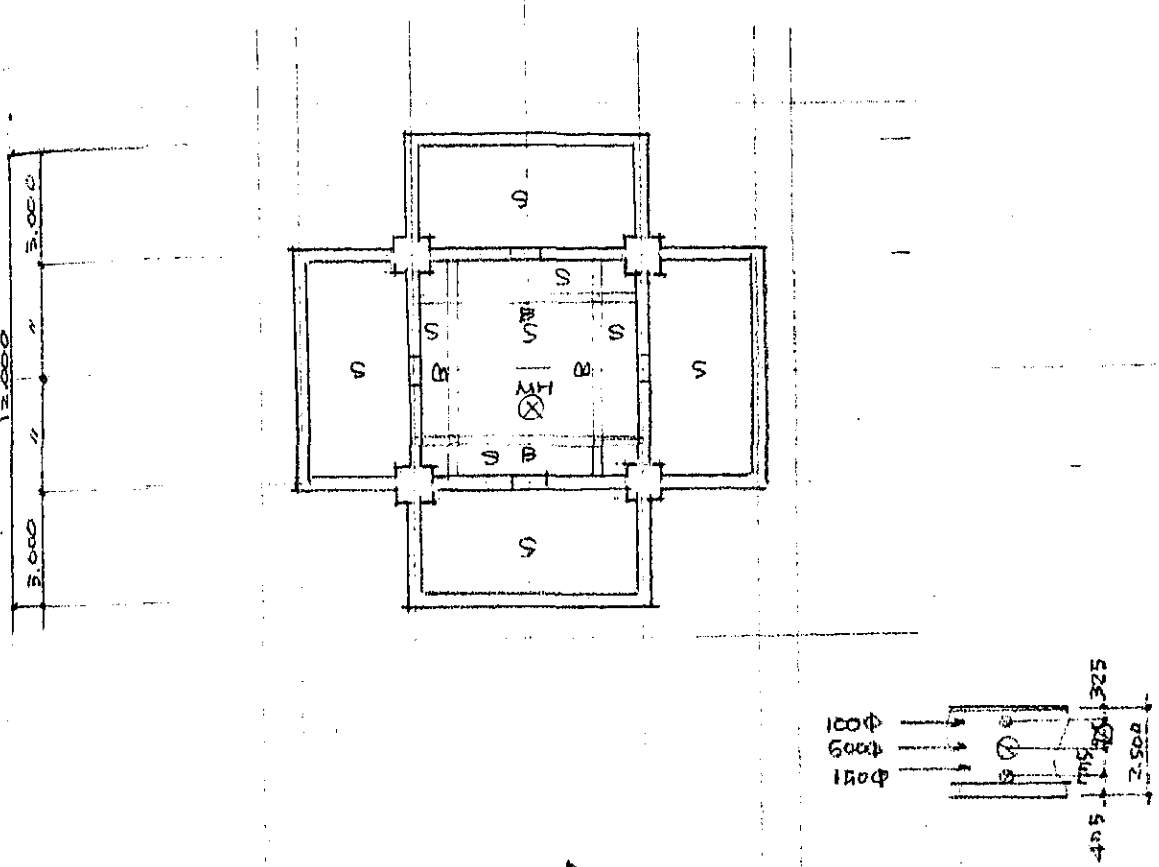
I6 WATER SUPPLY TOWER


+37.4
R
+32.2
6
+27.6
5
+21.8
4
+16.6
3
+11.4
2
+6.2
1
+1.0
G
G.L. ±0
5,200
JOINT
1,000
36,400
TANK CAPACITY 48 t
TANK CAPACITY 100 t
BTM
1,500
400
100
1,000
3,000
14,000
ELEVATION
RF PLAN
6F PLAN
1~1G PLAN
6,000
5,000


3,000
12,000
3,000
S
B
HW
100Φ
600Φ
150Φ
325
2,500
FS
FB
FCG
FG
PIT 500 H
1,000
3,000
14,000

Load

Tank W.L. 48.0 (0) + D.L. 2.0 (2.0) = 50.0 [t]

Top Floor L.L. 0.20 (0) + D.L. 0.10 = 0.30 (0.10) [t/m²]

Staircase L.L. 0.20 (0) + D.L. 0.10 = 0.30 (0.10) [t/m²]

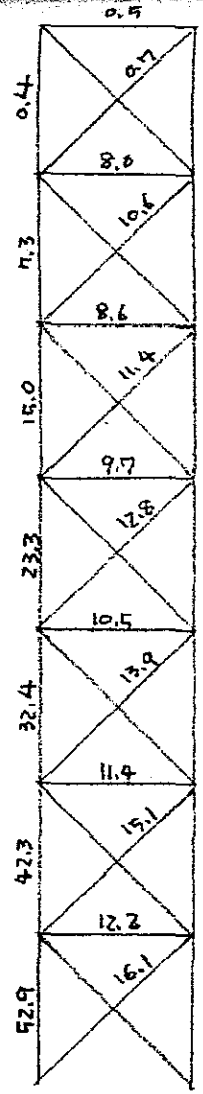
Column 0.15 [t/m] (Including Brace)

Beam 0.18 [t/m] (Including Subbeam)

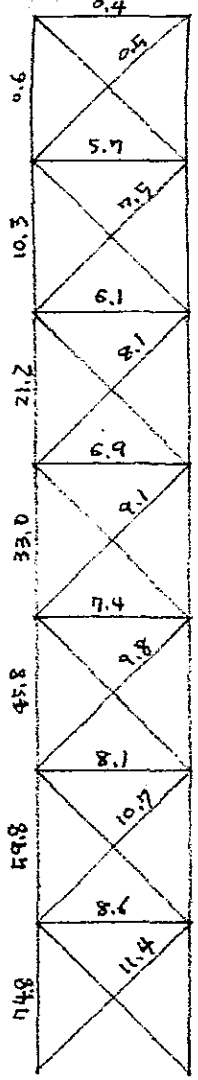
Wall 0.05 [t/m²]

Wal Force (At Bottom)

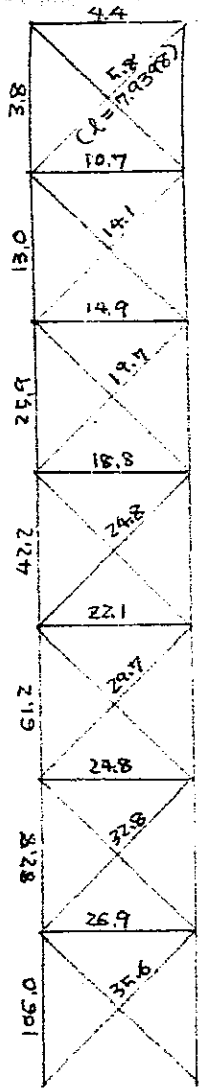
Max	Tank	50.0 / 4	12.5
	Top Floor	0.30 × 36.0 / 4	2.7
	Staircase	0.30 × 6.0 × 6/4	2.7
	Column	0.15 × 36.4	5.5
	Beam	0.15 × 6.0 × 7	6.3
	Wall	0.05 × 5.2 × 6	1.6
		Σ	31.3 [t]
Min	Tank	2.0 / 4	0.5
	Top Floor	0.10 × 36.0 / 4	0.9
	Staircase	0.10 × 6.0 × 6 / 4	0.9
	Column	5.5	5.4
	Beam	6.3	6.3
	Wall	1.6	1.6
		Σ	15.7 [t]



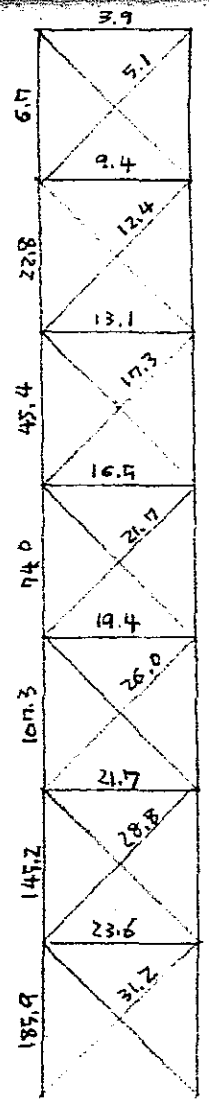
h		W	K	H	ΣH	ΔB	M	ΣM	Nc	NG	Nbr
37.4	1.6 3.6	5.2	0.2	1.0	1.0	5.2	5.2	5.2	0,4	0.5	0.7
32.2	50.0 10.8 0.9 V.1 3.6 6.2	74.6	//	14.9	15.9	4	82.7	87.9	7.3	8.0	10.6
27.0	1.8 3.1 3.6	8.5	//	1.7	17.6	//	94.5	179.4	15.0	8.6	11.4
21.8	1.8 3.1 3.6	//	//	//	19.3	//	100.4	279.8	23.3	9.7	12.8
16.6	1.8 3.1 3.6	//	//	//	21.0	//	109.2	389.0	32.4	10.5	13.9
11.4	1.8 3.1 3.6	//	//	//	22.7	//	118.0	507.0	42.3	11.4	15.1
6.2	1.8 3.1 3.6	//	//	//	24.4	//	126.9	633.9	52.9	12.2	16.1



R	W	K	H	ΣH	ΔR	M	ΣM	NC	NQ	NDF
37.4		0.2	1.0	1.0	5.2	5.2	5.2	0.6	0.4	0.5
32.2		〃	14.9	15.9	〃	82.7	87.9	10.3	5.7	7.5
27.0		〃	1.7	17.6	〃	91.5	179.4	21.2	6.1	8.1
21.8		〃	〃	19.3	〃	100.4	279.8	33.0	6.9	9.1
16.6		〃	〃	21.0	〃	109.2	389.0	45.8	7.4	9.8
11.4		〃	〃	22.7	〃	118.0	507.0	59.8	8.1	10.7
6.2		〃	〃	24.4	〃	126.9	633.9	74.8	8.6	11.4
Ratio for 0°			1.00	1.00		1.00	1.00	$\frac{\frac{1.00}{6\sqrt{2}}}{\frac{1.00}{6\times2}}$ $=1.414$	$\frac{\frac{0.5}{\sqrt{2}}}{0.5}$ $=0.707$	$=0.707$



P	q	C	A	H	ΣH	ΔP	M	ΣM	Nc	Nq	Nγ
37.4	0.37	1.4 (0.8+0.6)	16.7	8.7	8.7	5.2	45.2	45.2	3.8	4.4	5.8
32.2	0.34	1.4 2.5	16.7 5.5	7.9 4.7	21.3	〃	110.8	156.0	13.0	10.7	14.1
27.0	0.31	2.5	11.0	8.5	29.8	〃	155.0	311.0	25.9	14.9	19.7
21.8	0.28	〃	〃	7.7	37.5	〃	195.0	506.0	42.2	18.8	24.8
16.6	0.24	〃	〃	6.6	44.1	〃	229.3	735.3	61.2	22.1	29.7
11.4	0.20	〃	〃	5.5	49.6	〃	257.9	993.2	82.8	24.8	32.8
6.2	0.15	〃	〃	4.1	53.7	〃	279.2	1272.4	106.0	26.9	35.6



h	q	c	A	H	EH	ZH	M	ZM	NC	NG	NBY
37.4		1.7							6.7	3.9	5.1
32.2		1.7 3.1							22.8	9.4	12.4
27.0		3.1							45.4	13.1	17.3
21.8		〃							74.0	16.5	21.7
16.6		〃							104.3	19.4	26.0
11.4		〃							145.2	21.7	28.8
6.2		〃						1577.8	185.9	23.6	31.2
Ratio for 0°		3.1/25 = 1.24						1.24	$\frac{(1.24)}{(6\sqrt{12})}$ / $\frac{(1.00)}{(6\times2)}$ = 1.754	1.754/2 = 0.877	1.754/2 = 0.877

Design of Foundation

Force from Upper Structure

Vertical Force

Max 31.3 × 4 = 125.2 [t]
Min 15.7 × 4 = 62.8 [t]

Horizontal Force

Wind Force

0° Direction
- N = ± 106.0×2 [t]
- H = 53.17 [t]
- M = 1,272.4 [tm]

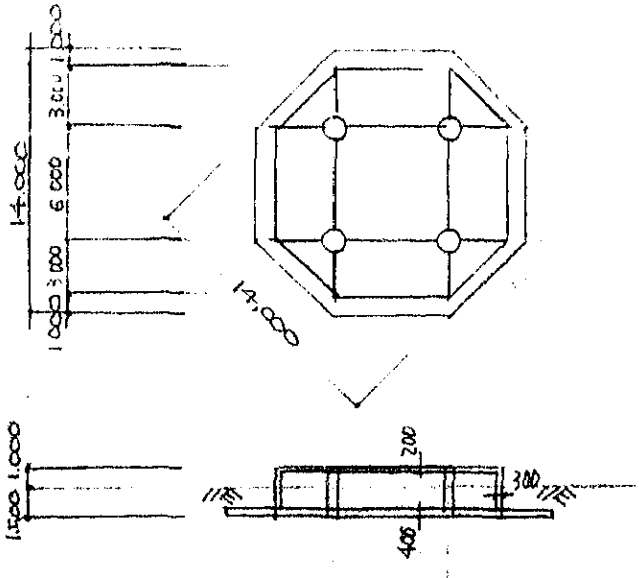
45° Direction
- N = ± 185.9×2 [t]
- H = 66.6 [t]
- M = 1,577.8 [tm]

Seismic Force
- N = ± 93.0×2 [t]
- H = 24.5 [t]
- M = 637.0 [tm]

Self Load

Pump Room [Roof (0.10+0.46)×4.0×4.0 = 9.0; Wall 0.46×2.35×4 = 4.3] 13.3

Soil	$(0.8284 \times 14.0^2 - 6.0^2 - 4\times6.3\times3.15)\times1.1\times1.6$	82.7	416.6	FULL 529.9 ~ EMPTY 429.9
Slab	$(6.0^2 + 4\times6.3\times3.15)\times(0.06+0.48)$	62.3		
Base	$0.8284\times14.0^2\times(0.06+0.96)$	165.6		
Wall	$(4\times3.9+4\times10.9)\times(0.19+1.35)$	89.9		
Column	$4\times1.9\times(0.18+1.94)$	16.1		
Water	100.0 ~ 0	100.0 ~ 0		



$A = 0.8284 \times 14.0^2 = 162.4$ [m²]
$Z = 0.1095 \times 14.0^3 = 448.5$ [m³]

45° Direction — Soil Reaction

$\Sigma N = (125.2 \sim 62.8) + (529.9 \sim 429.9) = 655.1 \sim 492.7$ [t]

$M = 1,577.8 + (66.6 \times 2.5) = 1,744.3$ [tm]

$\sigma_L = \dfrac{655.1 \sim 492.7}{162.4} = 4.03 \sim 3.03 <$ Lfe = 8.4 , $>$ W.L. max = 1.50

$\sigma_S = \dfrac{655.1 \sim 492.7}{162.4} \pm \dfrac{1,744.3}{448.5}$

$= (4.03 \sim 3.03) \pm 3.89$

$= 8.02 \sim -0.86$ $<$ sfe = 16.8 , $> \fallingdotseq 0$

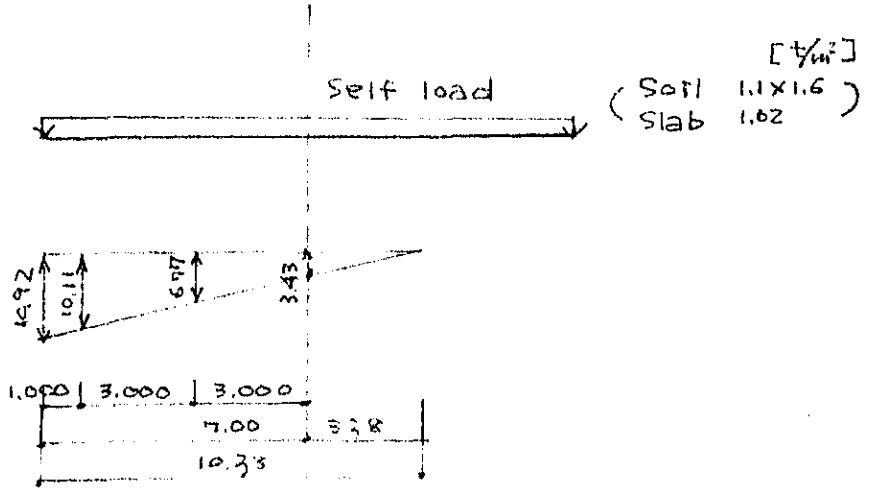
$e = \dfrac{1,744.3}{655.1 \sim 492.7} = 2.66 \sim 3.54$, $3\left(\dfrac{D}{2} - e\right) = \underset{10.38}{13.02}$ $(= x_n)$

$\dfrac{e}{\ell} = \dfrac{2.66 \sim 3.54}{14.0} = 0.19 \sim 0.25$

$\alpha = 2.6 \sim 3.6$

$\sigma_S = \dfrac{655.1 \sim 492.7}{162.4} \times 2.6 \sim 3.6$

$= 10.49 \sim 10.92$ $<$ sfe = 16.8



Foundation Beam

FB

$$q = \left\{\frac{10.92+10.11}{2} - (1.1\times1.6+1.02)\right\}\times 1.0 + \left\{\frac{10.11+(10.11+6.77)/2}{2} - 1.02\right\}\times 1.5$$

$$= 7.89 + 12.38$$

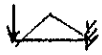
$$= 20.27 \quad [t/m]$$

$M_0 = 20.27 \times 6.0^2/8 = 93.5$ [tm] at 14.17 [cm²] >3−D25
$Q = \times 6.0/2 = 62.3$ [t] p 19.6 [cm]

b 30 D 250 j 211.75 QAS 57.2 [t]
α 2.0

FCG

P = from FB 62.3



$$W = \left\{\frac{11.01+6.77}{2} - (1.1\times1.6+1.02)\right\}\times 3.0\times 1.8/2$$

$$= 16.5$$

$C = 16.5\times 3.0 = 49.5$ [tm] 3−D25
$Q = 16.5$ [t]

FG

$$q = \left\{\frac{(10.11+6.77)/2+6.77}{2} - 1.02\right\}\times 1.5 + \left\{\frac{6.77+3.43}{2} - 1.02\right\}\times 3.0$$

$$= 9.88 + 12.24$$

$$= 22.12 \quad [t/m]$$

$C = 22.12\times 8^2/12 = 66.4$ [tm] >3−D25
$M_0 = /8 = 99.5$ [ ]
$Q = 6/2 = 66.4$ [t]

Opening Reinforcing $Q = \frac{Q_E}{2} = 33.2$ [t]

Φ600

$$\tau = \frac{33,200}{211.75\times 30} = 5.25 \ [kg/cm^2]$$

$$T = 5.25\times 30\times 30\sqrt{2} = 6.65 \ [t]$$

$$p_w = \frac{Q/2}{bj + 0.5\,\omega ft} + 0.002 = \frac{33.2/2}{30\,(95-8)\times\frac{\pi}{8}\times 1.5} + 0.002 = 0.0068$$

$a_s = 2.2$ [cm²] 2−D13
□ D13−@100

Foundation Slab D 40 j 28.9

Case 1. Cantilever $\ell = 0.85 \sim 1.80$

$w_{NET_S} = 11.22 - (1.1 \times 1.6 + 1.02) = 8.44$

M	$8.44 \times 1.8^2/2$	13.67	at 15.8
Q	$\times 1.8$	15.19	φ 35.0

Case 2. 2 Edge Fix $\ell = 1.8$

$w_S = 8.44$

M	$8.44 \times 1.8^2 \times 0.29$	7.93
Q	$\times 1.8$	15.19

Case 3. ℓ_x 3.0 ℓ_y 6.0 $\overline{w}_S = (11.01 + 6.77)/2 - 1.02 = 7.87$ λ 2

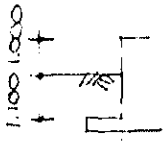
M	$7.87 \times 3.0^2 \times 0.083$	5.88
Q	$\times 3.0 \times 0.51$	12.04

Case 4. $\ell_x = \ell_y$ 6.0 λ 1 $w_L = 3.95 - 1.02 = 2.83$

M	$2.83 \times 6.0^2 \times 0.042$	5.30	at 6.1
Q	$\times 6.0 \times 0.44$	7.47	φ 17.2

FS { TOP D13 - @ 150 c.
BTM D19 - @ 150 c.

Soil Pressure for Outside Beam



$w_{max} = K_a \gamma (S + \beta)$
$= 0.5 \times 1.6 (0.3 + 1.1)$
$= 1.12$ [t/m²]

$Q = 1.12 \times 1.4/2 = 0.78$ [t/m] cφ 1.9 [cm]
$M = 1.12 \times 1.4^2/6 = 0.37$ [tm/m] σa 1.0 [cm²]

D 30 j 19.25 □ D 13 - @ 150

Upper Slab

L.L. 0.30
D.L. 0.06 Finish + 0.48 Slab = 0.54
T.L. 0.84

$l_x = l_y = 6.0$ $\lambda = 1$ D 20 j 14.4

M $0.84 \times 6^2 \times 0.052$ 1.57 at 5.5 D10 – @150 D.C.
Q $\times 6 \times 0.44$ 2.22 φ 7.3

Column

N $(31.3 \sim 15.7) \pm 185.9$ = MAX 217.2 [t]
MIN −170.2

$b = D = 90$ $\sigma t = 217{,}200/8{,}100$
$= 26.8 < fc = 100$ (Fc = 180)
[F/cm²]

$a_s = \frac{170.2}{3.0}$
$= 56.7$ 12 – D25

p_g 0.8
a_g 64.8 16 – D25
□ D13 @100

If Beam isn't considered,

N = 217.2 ~ −170.2 N/bD 26.8 ~ −21.0
Q = 26.9/2 = 13.5
M = 13.5 × (1.0 + 1.1) = 28.4 M/bD^2 3.9

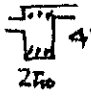
a_s 60.2 > 15.5 p_t 0.50
at 40.5
8 – D25

Total 28 – D25

Pump Roof

Roof D=150 D10 @ 200 D.C. ($M = 0.86 \times 4^2/16 = 0.56$ at 2.6)
Wall 〃 〃 D15 j 10.9

Beam



• D19 $W = 0.84 \times 6 \times 3/2 = 17.96$ D 45 j 35 b 25
$M = 7.56 \times 6 \times 0.104 = 4.8$ at 6.9 3 – D19
$Q = 7.56/2 = 3.78$ φ 5.1 a_L 6.1

Column

C1 (+1,000 Level) Φ 406.4 × 7.9

N = (31.3 ~ 15.7) ± 185.9 = 217.2 ~ −170.2

C = 0.17 , q = 0.28 , A = 0.4 c q A = 0.0784 [t/m²]

M_0 $0.0784 \times 4.8^2/8 = 0.226$ [tm]

A 98.9 , i 14.1 , ℓ_k 520 , λ 36.9 , fc 1.48 [t/cm²]

$$\frac{\sigma_c}{f} = \frac{217.2}{98.9 \times (1.48 \times 1.5)} = 0.99$$

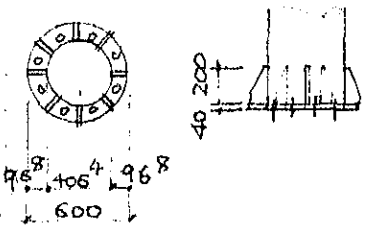
$$\frac{\sigma_t}{f} = \frac{170.2}{98.9 \times 2.4} = 0.72$$

$$1.00 \leq 1.00$$

z 1,150 $\frac{\sigma_b}{f} = \frac{22.6}{1,150 \times 2.4} = 0.01$

Joint N = (31.3 ~ 15.7) ± 107.3 = 138.6 ~ −91.6

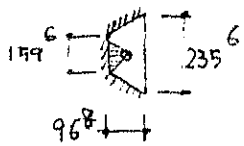
$$\sigma_c = \frac{107,300}{\frac{\pi}{4} \times 60^2} = 37.9 \text{ [kg/cm²]}$$



H.T.B. $\Delta T = \frac{91.6}{8} = 11.5$ [t]

< M24 R = 21.0

B.P.



BPL 40 × 600 □

8 Ribs PL 9 × 200

8 − M24

ℓ_x 9.7 ℓ_y 19.8 λ 2.0 w 37.9

M $37.9 \times 9.7^2 \times 0.28$ 998.5 [kg cm/cm]

Q $\times 9.7 \times 1.00$ 367.6 [kg/cm]

ΔT 11.5

M $(11.5 \times 9.7/2)/9.7$ 5.75 [tcm/cm]

Q $11.5/9.7$ 1.19 [t/cm]

mz $\frac{5.75}{2.4} = 2.36$

mt $\sqrt{6 \times 2.36} = 3.79 \rightarrow$ PL 40

∴ Welding

R = 0.79 × 2.4 = 1.90 [t/cm] > Q = 1.19

Rib PL

Q = 37.9 × 9.7² = 3,566.0 [kg]

M = 3,566.0 × 7.7 × 2/3 = 23,060.2 [kg cm]

$$nZ = \frac{23,060.2}{2,400} = 9.61$$

$$nt = \frac{6 \times 9.61}{20^2} = 0.14 \longrightarrow \text{PL } 9$$

Welding

$$Z = \frac{(0.7 \times 0.7 \times 2) \times 20^2}{6} = 65.3$$

$$A = 0.7 \times 0.7 \times 2 \times 20 = 19.6$$

$$\sigma_M = 23,060.2 / 65.3 = 353.1$$

$$\sigma_Q = 3,566.0 / 19.6 = 181.9$$

$$\sqrt{353.1^2 + 3 \times 181.9^2} = 473.2 < f = 1,200 \ [kg/cm^2]$$

Bottom $N = 217.2 \sim -170.2$, $Q = 11.8$

$$\sigma_c = \frac{217,200}{\frac{\pi}{4} \times 60^2} = 65.5 < f_c = 100 \ [kg/cm^2]$$

A.B. $\Delta T = \frac{170.2}{16} = 10.6$ [t]

$$A_n = \frac{10.6}{1.8} = 5.9$$

$$\phi_n = \sqrt{4 \times 5.9 / \pi} = 2.74 \longrightarrow 36\phi$$

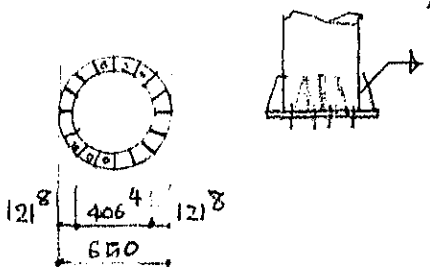
$$\tau = \frac{11.8 / 16}{\left(\frac{\pi \times 3.6^2}{4}\right)} = 0.017 < f_s = 1.35 \ [kg/cm^2]$$

$$f_{ts} = 1.4 f_{to} - 1.6\tau$$

$$= 1.4 \times 1.8 - 1.6 \times 0.017$$

$$= 2.41 \ [kg/cm^2] \longrightarrow f_{to} = 1.8$$

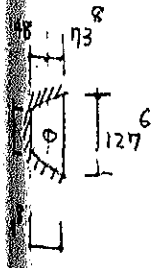
$$\frac{\sigma}{f} = \frac{10.6}{\left(\frac{\pi \times 3.6^2}{4}\right) \times 1.8} = 0.58 < 1.00$$



Bte 40 × 650 ϕ
8 Rib Pes 9 × 300
A.B. 16 − 36 ϕ

Anchoring $f_b = \frac{6 \times 1.5}{100} F_c = 13.5 \ [kg/cm^2]$

$$l_n = \frac{10,600}{\pi \times 3.6 \times 13.5} = 69.4 \longrightarrow 120 \ [cm]$$



Bte

ℓ_x 12.2 ℓ_y λ 1.0 w 65.5

M $65.5 \times 12.2^2 \times 0.085 = 828.7$ [kgcm/cm]

Q $\times 12.2 \times 0.5 = 399.6$ [kg /cm]

ΔT 10.6

M $(10.6 \times 4.8) / 11.98 = 6.38$ [tcm/cm]

Q $10.6 / 11.98 = 1.33$ [t/cm]

nZ $6.38 / 2.4 = 2.66$

nt $\sqrt{6 \times 2.66} = 3.99 \longrightarrow$ Pte 40

Welding

$R = 0.119 \times 2.4 = 1.90 \ [t/cm] > Q = 1.33$

Rib 共

$\sigma c = 65.5$ $\left(\sigma t = \frac{170,200}{\frac{\pi}{4}(65^2 - 40.64^2)} = 84.2 \right)$

$Q = 84.2 \times 12.2^2 = 12,532.3$ [kg]

$M = 12,532.3 \times 12.2 \times 2/3 = 101,929.6$ [kg cm]

$nz = \frac{101,929.6}{2,400} = 42.47$

$nt = \frac{6 \times 42.47}{20^2} = 0.64 \longrightarrow$ 共9

Welding

$Z = \frac{(0.7 \times 6.7 \times 2) \times 30^2}{6} = 147.0$

$A = 0.7 \times 0.7 \times 2 \times 25 = 29.4$

$\sigma_M = 101,929.6 / 147.0 = 693.4$

$\sigma_Q = 12,532.3 / 29.4 = 426.3$

$\sqrt{693.4^2 + 3 \times 426.3^2} = 1,012.9 < f = 1,200$ [kg/cm²]

C2 (+21,800 Level) Φ 406.4 × 6.4

$N \fallingdotseq (31.3 \sim 15.7) \pm 45.4 = 76.7 \sim -29.7$ (t)

$C = 0.17$, $\phi = 0.37$, $A = 0.4$ $C \phi A = 0.1036$ [t/cm]

M_0 $0.1036 \times 4.8^2/8 = 0.298$ [tm]

A 80.4, I 14.1, ϕ 520, λ 36.9, fc 1.48

$\frac{\sigma c}{f} = \frac{76.7}{80.4 \times (1.48 \times 1.5)} = 0.43$

$\frac{\sigma t}{f} = \frac{29.7}{80.4 \times 2.4} = 0.15$

& 967 $\frac{\sigma b}{f} = \frac{29.8}{967 \times 2.4} = 0.02$

$0.45 < 1.00$

Joint

$\sigma c = \frac{76,700}{\frac{\pi}{4} \times 60^2} = 27.1$

H.T.B,

$\Delta T = \frac{29.7}{8} = 3.7$

$<$ M20 $R = 14.6$

$M = (3.7 \times 9.7/2)/9.7 = 1.85$ [tcm/cm]

$nz = 1.85/2.4 = 0.77$

$nt = \sqrt{6 \times 0.77} = 2.15 \longrightarrow$ 共25

Rib 共 $8 \text{共} - 9 \times 200$

Beam

G1 H-400×200×8×13 (Y=16)

Nmax 26.9 [t]

Self Load 0.10 [t/m] Mo 0.10×5.6²/8 0.39 [tm]
Q ×5.6/2 0.28 [t]

Wind Force for Surface

C=2.0 q=0.31 A=0.2~0.4

C·q·A=0.124~0.248

Mo 0.124~0.248×5.6²/8 0.49~0.97
Q ×5.6/2 0.35 0.69

ℓk 560 iy 4.94 λk 123.3 fc 0.63 A 84.1
ℓb 560 ib 5.26 λb 106.5 η 8.09 C 1.00 fb 1.10 Zx 1,190 Zy 174

$$\frac{\sigma}{f} = \frac{26.9}{84.1\times(0.63\times1.5)} + \frac{39+49}{1,190\times(1.10\times1.5)} + \frac{9.7}{174\times(1.10\times1.5)}$$

$$= 0.34 + 0.04 + 0.34$$

$$= 0.72 < 1.00$$

$$\delta = \frac{5\times560^4}{384\times2,100}\sqrt{\left(\frac{0.001+0.00124}{23,700}\right)^2+\left(\frac{0.00248}{1,740}\right)^2}$$ Jx 23,700 Jy 1,740

$$= 0.87 \text{ [cm]}$$

$\delta/span = 0.87/560 = 1/644$

Joint 2HS 9×165×260 4-M22

G2 H-390×300×10×16 (Y=22)

Nmax 10.7 [t]

C=0.8 q=0.37 A=1.5~2.8 0.8×0.37×1.5~2.8=0.444~0.829

Mo 0.444~0.829 × 5.6²/8 1.74~3.25
Q ×5.6/2 1.24 2.32

ℓk 560 iy 7.28 λk 76.9 fc 1.13 A 136.0
ℓb 560 ib 8.10 λb 69.1 η 6.58 C 1.00 fb 1.60 Zx 1,980 Zy 481

$$\frac{\sigma}{f} = \frac{10.7}{136.0\times(1.13\times1.5)} + \frac{39+174}{1,980\times(1.6\times1.5)} + \frac{3.25}{481\times(1.6\times1.5)}$$

$$= 0.38 < 1.00$$

$$\delta = \frac{5\times560^4}{384\times2,100}\sqrt{\left(\frac{0.001+0.00444}{38,700}\right)^2+\left(\frac{0.00829}{7,210}\right)^2}$$

$$= 0.71 \text{ [cm]}$$

$\delta/span = 0.71/560 = 1/798$

Sub Beam

B1 ↓ D.L.

q 0.05 [t/m]

P $0.05 \times 7.9/2 = 0.20$ [t]

W.L.

C 2.0 q 0.31 A 0.2

q $2.0 \times 0.31 \times 0.2 = 0.124$ [t/m]

P $0.124 \times 7.9/2 = 0.49$ [t]

T.L.

q $0.05 + 0.124 = 0.174$ [t/m]

P $0.20 + 0.49 = 0.69$ [t]

M_o $0.174 \times 7.9^2/8 + 0.69 \times 7.9/4 = 2.72$ [tm]

Q $0.174 \times 7.9/2 + 0.69/2 = 1.03$ [t]

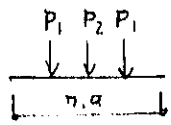
$Z_n = 272/2.4 = 113.3$ [cm³]

$$J_n = \frac{5 \times 0.00174 \times 790^3 \times 300}{384 \times 2{,}100} + \frac{0.69 \times 790^2 \times 300}{48 \times 2{,}100} = 2{,}877.4 \text{ [cm}^4\text{]}$$

H − 400 × 200 × 6.0 × 9.0 (r = 0) Zx 602, Jx 16,500

B2 H − 400 × 200 × 4.5 × 6.0 Zx 438, Jx 11,500

B3



$P_1 = P_2 = (0.10 \times 4.0) + 12.5 = 13.0$ (1st Tank)

$M_o = 13.0 \times 7.9/2 = 51.35$ [tm]

$Q = 13.0 \times 1.5 = 19.5$ [t]

$Z_n = 5{,}135/1.6 = 3{,}209.4$ [cm³]

$$J_n = \frac{19 \times 13.0 \times 740^2 \times 300}{384 \times 2{,}100} = 57{,}348.5 \text{ [cm}^4\text{]}$$

H − 400 × 400 × 13 × 21 Zx 3,030, Jx 66,600

B4 $P = (0.10 \times 4.0) + 12.5 = 13.6$

$Z_n = \frac{13.0 \times 4.0 \times 100}{4 \times 1.6} = 812.5$

$J_n = \frac{13.0 \times 400^2 \times 300}{48 \times 2{,}100} = 6{,}190.5$

H − 400 × 200 × 8 × 13 Zx 1,190, Jx 23,700

B5 $q = 0.30 \times 0.5 = 0.15$

$Z_n = 0.15 \times 4^2 \times 100/8 \times 1.6 = 18.8$

$J_n = 5 \times 0.0015 \times 400^3 \times 300/384 \times 2{,}100 = 178.6$

H − 400 × 200 × 4.5 × 6.0

Bracing

B11 　Φ 165.2 × 5.0 　(A 25.16, J 808, Z 97.3)

N max 35.6[t] 　HTB $35.6/17.1 = 3-M22$ (14.1) $3-M20$ 　$An = 35.6/2.4 = 14.8$ → PL12×200

Self Load 0.02[t/m] 　Mo $0.02 \times 7.6^2/8$ 0.08 [t·m]
Q $\times 7.6/2$ 0.06 [t]

Wind Force for Side Surface

C = 0.7 　q = 0.28 　A = 0.1652

CqA = 0.0324 [t/m]

P = $0.0324 \times 7.3/2 = 0.1182$ [t]

Mo $0.0324 \times 7.3^2/8 + 0.1182 \times 7.3/4 = 0.4315$ [t·m]
Q $\times 7.3/2 +$ $\times 1/2 = 0.1774$ [t]

$$\frac{\sigma}{f} = \frac{35.6}{25.16 \times 2.4} \pm \frac{(8.0 + 43.15)}{97.3 \times 2.4}$$

$= 0.59 + 0.22$

$= 0.81 < 1.00$

($V_{0.7 \times 0.7 \times 1.2} = 0.42$
$\ell = 35.6/0.42 \times 2$
$= 42.4 \rightarrow 25 \times 2$)

$$\delta = \frac{5 \times 0.000324 \times 730^4}{384 \times 2{,}100 \times 808} + \frac{0.1182 \times 730^3}{48 \times 2{,}100 \times 808}$$

$= 0.71 + 0.56$

$= 1.27$ [cm]

$\delta/span = 1.27/730 = 1/575$

B12 　Φ 139.8 × 4.5 　(A 19.13, J 438, Z 62.7)

N max 19.7 [t] 　HTB $19.7/17.1 = 2-M22$ (14.1) $2-M20$ 　$An = 19.7/2.4 = 8.2$ → PL9×150

D.L. 0.02 　Mo 0.08 　Q 0.06

CqA $0.7 \times 0.37 \times 0.1398 = 0.0362$

P $0.0362 \times 7.3/2 = 0.1322$

Mo $0.0362 \times 7.3^2/8 + 0.1322 \times 7.3/4 = 0.4824$
Q $\times 7.3/2 +$ $\times 1/2 = 0.1982$

$$\frac{\sigma}{f} = \frac{19.7}{19.13 \times 2.4} \pm \frac{8 + 48.2}{62.7 \times 2.4}$$

$= 0.43 + 0.37$

$= 0.80 < 1.00$

$$\delta = \frac{5 \times 0.00362 \times 730^4}{384 \times 2{,}100 \times 438} + \frac{0.1322 \times 730^3}{48 \times 2{,}100 \times 438}$$

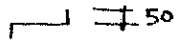
$= 1.46 + 1.16$

$= 2.62$ [cm]

$\delta/span = 2.62/730 = 1/279$

Stair Case

Step　C 共 4.5



ω　0.30 [t/m²]

↔ ℓ 30 [cm]

$$Zn = \frac{0.3 \times 0.3^2 \times 100}{8 \times 1.6} = 0.211$$

$$tn = \sqrt{6 \times 0.211 / 100} = 0.11$$

$$In = \frac{5 \times 0.003 \times 30^3 \times 300}{384 \times 2,100} = 0.151$$

$$tn = \sqrt[3]{12 \times 0.151 / 100} = 0.26$$

↕ ℓ 110 [cm]　　$q = 0.3 \times 0.15 = 0.045$

$$Zn = \frac{0.045 \times 0.11^2 \times 100}{8 \times 1.6} = 0.172$$

$$tn = 6 \times 0.172 / 5^2 = 0.04$$

$$In = \frac{5 \times 0.00045 \times 110^3 \times 300}{384 \times 2,100} = 0.287$$

$$tn = 12 \times 0.287 / 5^3 = 0.03$$

String　共 6

q　$0.3 \times 0.35 = 0.105$ [t/m]

$$Zn = \frac{0.105 \times 4^2 \times 100}{8 \times 1.6} = 13.125$$

$$tn = 6 \times 13.125 / 30^2 = 0.09$$

$$In = \frac{5 \times 0.00105 \times 400^3 \times 300}{384 \times 2,100} = 125.0$$

$$tn = 12 \times 125.0 / 30^3 = 0.06$$

Q　$0.105 \times 2 = 0.21$

Sub Beam　　Bs

H − 200×100×5.5×8

(END)

2. CALCULATION SHEET OF VENTILATION AND AIR CONDITIONING

C O N T E N T S

1 GENERAL

NAME OF CONSTRUCTION : THE SANITARY AND VENTILATION EQUIPING WORK IN BANGLADESH CAR REPAIR SHOP

TOTAL FLOOR AREA : 18,000 M²

LOCATION : DACCA, BANGLADESH

THE NORTH LATITUDE - 23°45'

THE EAST LONGITUDE - 90°15'

8 m ABOVE THE SEA LEVEL

2 DESIGN CONDITIONS

CLIMATIC CONDITIONS

THE DESINING OUTDOOR TEMPERATURE IN THE SUMMER SEASON (APR.)	: 37.2°C (D.B.)
AVERAGE HUMIDITY	: 78 %
DAILY TEMP. RANGE	: 10°C
THE DESIGNING OUTDOOR TEMPERATURE IN THE WINTER SEASON (FEB.)	: 10° C (D.B.)
THE HIGHEST OUTDOOR TEMP.	: 40.5°C (APR.)
THE LOWEST OUTDOOR TEMP.	: 6.6°C (FEB.)
ANNUAL RAINFALL	: 2012 MM/YEAR
THE MOST RAINFALL IN 24 HOURS	236 MM/DAY
THE RAINY SEASON	: APR. THROUGH OCT.
WIND	: 2.2 M/S

REFERENCE "THE CLIMATE OF ASIA"

AIR CONDITIONING

AIR CONDITIONING INSTLLATION ARE REQUIRED FOR THE FOLLOWING THREE ROOMS:

(1) "INJ. PUMP SHOP", HEAVY REPAIR FACTORY

(2) "GENERAL MANAGER ROOM", GENERAL OFFICE BLDG. (1F)

(3) "ADVISOR'S OFFICE ROOM", GENERAL OFFICE BLDG (2F)

THE STRUCTUR OF ROOM IS DIFFERENT AMONG (1), (2) AND (3).

(1) COOLING LOAD ESTIMATION ON "INJ. PUMP SHOP"

OUTDOOR 37.2°C (D.B.) 78%

INDOOR 26.0°C (D.B) 55%

HEAT TRANSMISSION COEFFICIENT (KCAL/M²hr°C)

EXTERNAL WALL	1.6	(UP TO 1.5 M ABOVE THE FLOOR)
	0.5	(OVER 1.5 M ABOVE THE FLOOR)
INTERNAL WALL	1.4	(UP TO 1.5 M ABOVE THE FLOOR)
	0.4	(OVER 1.5 M ABOVE THE FLOOR)
ROOF	1.0	
FLOOR	NOT ESTIMATED DUE TO ITS DEFINITE POSITION WITHIN THE SAFETY RANGE.	

TEMERATUR DIFFERENCE

EQUIVALET TEMP. DIFFERENCE I ON EXTERNAL WALL (°C)

	10:00	12:00
N	6.9	7.2
E	11.2	11.0

EQUIVALENT TEMP. DIFFERENCE II ON EXTERNAL WALL (°C)

	10:00	12:00
N	9.5	15.0
E	26.8	18.8

EQUIVALENT TEMP. DIFFERENCE ON ROOF (°C)

	10:00	12:00
H	34	42.5

TEMP. DIFFERENCE ON INTERAL WALL $37.2 - \frac{37.2 + 26.0}{2} = 5.6°C$

CALORIFIC VALUE GENERATED IN ROOM

LIGHTING 20 W/M²

NUMBER OF PERSONS 3 PERSONS 71 KCAL/HR·PERON S.H.G.

152 KCAL/HR·PERON L.H.G.

AIR INFILTRATION THROUGH TWO-SIDED DOOR 30 M³/HR·PERSON

(2) COOLING LOAD ESTIMATION ON "GENERAL MANAGER ROOM" & "ADVISOR'S OFFICE ROOM"

INDOOR 26.0°C (D.B.) 78%

OUTDOOR 37.2°C (D.B.) 55%

HEAT TRANSMISSION COEFFICIENT (KCAL/M²HR.°C)

EXTERNAL WALL	1.6
WINDOW	5.5
INTERNAL WALL	2.5
FLOOR	1.7
CEILING	1.2
ROOF	1.4

TEMPERATUR DIFFERENCE AND SOLAR RADIATION

EQUIVALENT TEMP DIFFERENCE ON EXTERNAL WALL (°C)

	16:00	18:00
N	5.7	6.2
S	8.8	9.6
W	9.3	13.1

SOLAR RADIATION THROUGH ORDINARY WINDOWS (KCAL/M² HR.)

	16:00	18:00
N	29	16
S	31	5
W	436	153

EQUIVALENT TEMP. DIFFERENCE ON ROOF (°C)

	16:00	18:00
H	20.8	22.8

TEMP. DIFFERENCE FROM NON-AIR CONDITIONED SECTION $37.2 - \frac{37.2 + 26.0}{2} = 5.6$

CALORIFIC VALUE GENERATED IN ROOM

LIGHTING 20 W/M²

NUMBER OF PERSON 1 PERSON 50 KCAL/HR·PERSON S.H.G

60 KCAL/HR·PERSON L.H.G

AIR INFILTRATION ROOM VOLUME X 0.7 N/HR.
(REFERENCE : AIR CONDITIONING HANDBOOK)

TOTAL UNIT : KCAL/HR

	S.H.G	L.H.G	TOTAL
INJ. PUMP SHOP	7,510	1,810	9,320
GENERAL MANAGER RM.	6,020	1,370	7,390
ADVISOR'S OFFICE RM.	7,840	1,570	9,410

REGARDING TO THE TYPE OF AIR CONDITIONING EQUIPMENTS, THE PACKAGE TYPE SHOULD BE CONSIDERED FOR "INJ. PUMP SHOP" DUE TO O.A. INSTALLATION AND A WINDOW TYPED COOLER FOR "GENERAL MANAGER ROOM" & "ADVISOR'S OFFICE RM."

4 VENTILATION

VENTILATION INSTALLATION IS REQUIRED FOR W.C. AND KETTLE ROOM THAT HAVE NO WINDOWS, AND KITCHEN, RELATED SECTIONS IN THE SHOP (PAINTING, WELDING, HEAT-GENERATING AND CEMENTING SECTIONS ETC.). A LIST ON THE FOLLOWING PAGE SHOWS THE VOLUME OF CHANGED AIR CALCULATED FROM NECESSARY NUMBERS OF AIR CHANGE.

EXAMPLE) NECESSARY NUMBERS OF AIR CHANGE
PAINTING WORKS : 30 - 60 N/HR. WELDING WORKS : 15 - 25 N/HR.
STORAGE : 5 N/HR.
KITCHEN : 40 - 80 N/HR. W.C. : 15 N/HR.

NAME OF BLDG.	FLOOR	NAME OF ROOM	RM. VOLUME M^3	NUMBER OF AIR CHANGE N/HR.	VOLUME OF CHANGED AIR (M^3/HR.) M^3/HR.
PARTS STORAGE	GF	PARTS ROOM	11,270	5	56,400
PAINT & BODY FACTORY	GF	PAINT SHOP	3,570	45	160,650
RETREADING & METAL CASTING FACTORY	GF	METAL CASTING SHOP	1,044	20	20,900
	GF	BOILER	379	30	11,400
	GF	HOT WATER SYSTEM	592	20	11,800
	GF	CEMENT ROOM	164	20	3,280
CHECH GATE	GF	KETTLE ROOM	12	7	84
CAFETERIA	GF	KITCHEN	467	60	28,020
	GF	TOILET	12	14	168
DORMITORY	GF	KITCHEN	139	60	8,340
GENERAL OFFICE BUILDING	GF	SANITARY CLOSET	24	—	360
	1F	KETTLE ROOM	15	—	360

THE FIRST CLASS VENTILATION IS REQUIRED ONLY FOR PARTS STORAGE, AND FOR OTHERS, THE THIRD CLASS VENTILATION SHALL BE APPLIED.

5 AIR CONDITIONING EQUIPMENTS

(1) "INJ PUMP SHOP"

EQUIPMENTS : 2 UNITS OF AIR COOLED SPLIT TYPED AIR CONDITIONER

S.H.G. 3,760 KCAL/HR.

L.H.G. 910 KCAL/HR.

O.A. AIR VOLUME 150 M³/2

O.A. LOAD 240 KCAL/HR.

SUPPLY AIR VOLUME (OUTLET TEMPERATURE 17°C)

$\frac{3,760}{0.29 \times 9}$ = 1,440 M³/HR.

24 M³/MIN.

SPECIFICATIONS OF EQUIPMENTS

REFERENCE EQUIPMENT : DP-34V1, MITSUBISHI HEAVY INDUSTRY CO.

COOLING CAPACITY : 7,100 KCAL/HR. (OUTDOOR TEMP. 37.2°C)

SUPPLY AIR VOLUME : 1,440 M³/HR.

REFRIGERANT : R-22

POWER CONSUMPTION : 3φ x 415 V x 50 HZ x 3.3 KW

(2) " GENERAL MANAGER ROOM"

EQUIPMENTS : 2 UNITS OF WINDOW TYPED AIR CONDITIONER

ROOM COOLING LOAD 7,390 KCAL/HR /2 = 3,700 KCAL/HR/UNIT

SPECIFICATIONS OF EQUIPMENTS

REFERENCE EQUIPMENT : CW-1711PS235T, NATIONAL

COOLING CAPACITY : 4,020 KCAL/HR. (OUTDOOR TEMP. 37.2°C)

VENTILATABLE TYPE

REFRIGERANT : R-22

POWER CONSUMPTION : $1\phi \times 240^{V} \times 50^{Hz} \times 2.4^{KW}$

(3) " ADVISOR'S OFFICE ROOM"

EQUIPMENTS : 2 UNITS OF WINDOW TYPED AIRCONDITIONER

ROOM COOLING LOAD : 9,410 KCAL/HR/2 = 4,710 KCAL/HR/UNIT

SPECIFICATIONS OF EQUIPMENTS

REFERENCE EQUIPMENT : CW-2411PS235T, NATIONAL

COOLING CAPACITY : 5,560 KCAL/HR. (OUTDOOR TEMP. 37.2°C)

VENTILATABLE TYPE

REFRIGERANT : R-22

POWER CONSUMPTION : $1\phi \times 240^{V} \times 50^{Hz} \times 3.4^{KW}$

6 VENTILATION EQUIPMENTS

1) DOUBLE SUCTION CENTRIFUGAL FAN

THIS FAN IS USED FOR SUPPLYING AIR TO PARTS STORAGE. FAN ROOMS SHALL BE PROVIDED IN ONE POSITION ON THE DECK AND AT TWO POSITIONS ON THE MONITOR ROOF.

SPECIFICATIONS OF EQUIPMENTS

a) FAN ROOM (DECK)

REFERENCE EQUIPMENTS	: DRM No.4, EBARA
SUPPLY AIR VOLUME	: 27,000 M^3/HR (450 $M^3/MIN.$)
STATIC PRESSURE	: 45 MM Aq
POWER CONSUMPTION	: $3\phi \times 415^{V} \times 50^{Hz} \times 7.5^{KW}$

b) FAN ROOM (2 POSITIONS ON THE MONITOR ROOF)

REFERENCE EQUIPMENTS	: 2 UNITS OF DRM No.3, EBARA
SUPPLY AIR VOLUME	16,200 M^3/HR (270 M^3/MIN)
STATIC PRESSURE	40 MM Aq
POWER CONSUMPTION	$3\phi \times 415^{V} \times 50^{Hz} \times 5.5^{KW}$

(2) TUBULAR ROOF FAN

THIS FAN IS USED FOR DIRECT EXHAUST FROM HOOD IN TWO KITCHENS.

SPECIFICATIONS OF EQUIPMENTS

a) CAFETERIA HOOD 3600 X 2400

REFERENCE EQUIPMENTS : RTFKV-75, ASAHI

EXHAUST AIR VOLUME : 15,000 M³/HR.

STATIC PRESSURE : 30 MM Aq

POWER CONSUMPTION : 3φ X 415 V X 50 Hz X 3.7 KW

b) CAFETERIA HOOD 2,800 X 2,400

REFERENCE EQUIPMENTS : RTFKV-75, ASAHI

EXHAUST AIR VOLUME : 13,000 M³/HR.

STATIC PRESSURE : 30 MM Aq

POWER CONSUMPTION 3φ X 415 V X 50 Hz X 3.7 KW

c) DORMITORY HOOD 2,000 X 1,400

REFERENCE EQUIPMENTS : RTFKV-70, ASAHI

EXHAUST AIR VOLUME : 8,400 M³/HR

STATIC PRESSURE : 30 MM Aq

POWER CONSUMPTION : 3φ X 415 V X 50 Hz X 2.2 KW

ALL OF THE ABOVE MODELS SHALL BE SPECIFIED AS HEAT-RESISTANT AND OIL-RESISTANT.

(3) ROOF FAN

THE FOLLOWING THREE KINDS OF ROOF FAN SHALL BE USED FOR EXHAUST IN SHOPS

SPECIFICATIONS OF EQUIPMENTS

a) PAINT SHOP

REFERENCE EQUIPMENT	: RF - 42 H, KAMAKURA
EXHAUST AIR VOLUME	: 37,200 M^3/HR
POWER CONSUMPTION	: $3\phi \times 415^V \times 50^{Hz} \times 2.2^{kW}$

b) METAL CASTING SHOP, BOILER, HOT WATER SYSTEM

REFERENCE EQUIPMENT	: RF - 24 H, KAMAKURA
EXHAUST AIR VOLUME	: 11,700 M^3/HR
POWER CONSUMPTION	: $3\phi \times 415^V \times 50^{Hz} \times 0.75^{kW}$

c) CEMENT ROOM

REFERENCE EQUIPMENT	: RF - 16 H, KAMAKURA
EXHAUST AIR VOLUME	: 2,580 M^3/HR
STATIC PRESSURE	: 10 MM Aq
POWER CONSUMPTION	: $3\phi \times 415^V \times 50^{Hz} \times 0.25^{kW}$

(4) CEILING TYPE VENTILATING FAN

THIS FAN IS USED FOR EXHAUST IN TOILET AND/OR KETTLE ROOM ETC WHICH DO NOT HAVE WINDOWS NOR FACE THE EXTERNAL WALL.

a) KETTLE ROOM : CHECK GATE

REFERENCE EQUIPMENTS . FV-14 BFT, NATIONAL

EXHAUST AIR VOLUME : 84 $M^3/HR.$

STATIC PRESSURE : 5 MM Aq (DUCT + VENT CAP)

POWER CONSUMPTION : $1\phi \times 240^{V} \times 50^{HZ} \times 0.023^{KW}$

b) TOILET ; CAFETERIA

REFERENCE EQUIPMENTS ; FV-18 BFT, NATIONAL

EXHAUST AIR VOLUME : 168 $M^3/HR.$

STATIC PRESSURE : 5 MM Aq. (DUCT + VENT CAP)

POWER CONSUMPTION : $1\phi \times 240^{V} \times 50^{HZ} \times 0.038^{KW}$

c) KETTLE ROOM, SANITARY CLOSET ; GENERAL OFFICE BLDG.

REFERENCE EQUIPMENTS : FV-20 BFT

EXHAUST AIR VOLUME : 360 $M^3/HR.$

STATIC PRESSURE : 5 MM Aq (DUCT + VENT CAP)

POWER CONSUMPTION : $1\phi \times 240^{V} \times 50^{HZ} \times 0.05^{KW}$

(5) FILTER AND THE LIKE

a) CA FILTER

FILTERS SHALL BE ATTACHED IN SUPPLYING AIR FROM LOUVRE . THE SPEED OF AIR PASSING THROUG THE FILTERS WAS SELECTED AT 2 M/S

SPECIFICATIONS OF FILTER

FILEDON UNIT TYPED AIR FILTER, MODEL VA-25
500 MM X 500 MM X 25 MM

FAN ROOM 1 (DECK)

$$\frac{27,000\ (M^3/HR)}{3600 \times 2^{(M/S)} \times 0.25^{(M^2)}} = 15\ (SHEETS)$$

3 STEPS 5 LINES

FAN ROOM 2, 3 (MONITOR ROOF)

$$\frac{16,200\ (M^3/HR)}{3600 \times 2 \times 0.25} = 9\ (SHEETS)$$

3 STEPS 3 LINES

b) GREASE FILTER

GREASE FILTERS SHALL BE ATTACHED TO THE HOOD OF KITCHENS. THE SPEED OF AIR PASSING THROUGH WAS SELECTED BETWEEN 1.5 MM/S AND 2 MM/S.

SPECIFICATIONS OF FILTER

FIRE FIGHTER FN2020, FN1625
FN 2020 500 MM X 500 MM X 45 MMt
FN 1625 400 MM X 630 MM X 45 MMt

HOOD 3600 X 2400
FN2020 X 12 SHEETS STATIC PRESSURE 21 MMAq

HOOD 2800 X 2400
FN 2020 X 10 SHEETS STATIC PRESSURE 22 MMAq

HOOD 2000 X 1400
FN1625 X 6 SHEETS STATIC PRESSURE 24 MMAq

ESTIMATING SHEET (B)

NO. 54T

		ROOM NAME	INJ. PUMP SHOP	ROOM AREA	W × L = A m² 87.5	ROOM VOLUME	A × H = V m³ 350	SYSTEM	

SENSIBLE HEAT LOAD				SUMMER				WINTER		
WALL & TRANS. GAIN THRU STRUCTURES				SUN TIME 12 H		SUN TIME 10 H		SENSIBLE HEAT LOSS		
	DIREC.	W × H	AREA	K	TEMP. DIFF.	HEAT GAIN	TEMP. DIFF.	HEAT GAIN	DIREC. FACTOR	TEMP. DIFF.	HEAT LOSS
		m × m	m²	Kcal/h·m²·℃	℃	Kcal/h	℃	Kcal/h		℃	Kcal/h
	N		16.0	1.6	7.2	180	6.9	180			
			55.0	0.5	15.0	410	9.5	260			
	E		12.5	1.6	11.0	220	11.2	220			
			43	0.5	18.8	400	26.8	580			
	ON		28.5	1.4	5.6	220	5.6	220			
			47.0	0.4	5.6	110	5.6	110			
			87.5	1.0	42.5	3720	34	2980			
SUB TOTAL (I)						5260		4550	SUB TOTAL		
WIN GAIN THRU GLASS			F		I_{GR}		I_{GR}				
									INFILTRATION		
									m³ ×		R/h × 0.288
									×		
SUB TOTAL (II)											
INTERNAL HEAT GAIN									TOTAL (SH)		
ELE. LIGHT		KW × 860							LATENT HEAT LOSS		
ELE. LIGHT		20W/m² × 87.5 ~~KW~~ × 1,000				1750			INFILTRATION		
									m³ ×		R/h × 715
									×		
PEOPLE		WALKING 3 × 51				210					
		SEATED ×							TOTAL (LH)		
INFILTRATION		90 m³ × R/h × 0.288			11.2	290			GRAND TOTAL		
SUB TOTAL (III)						2250					
TOTAL OF SENSIBLE HEAT LOAD (I + II + III)						7510					
LATENT HEAT LOAD											
PEOPLE		WALKING 3 × 152				460					
		SEATED ×									
INFILTRATION		90 m³ × R/h × 715			0.0326 0.0116	1350					
TOTAL OF LATENT HEAT LOAD (IV)						1810					
GRAND TOTAL OF HEAT GAIN						9320					
SENSIBLE HEAT FACTOR			%								
SUPPLY AIR QUANTITY			m³/h								
OUTDOOR AIR QUANTITY			m³/h								

REMARKS:

DESIGN CONDITION

(R) 26.0°C 55%

(O) 37.2°C 78%

ESTIMATING SHEET (B)

NO. 590

	ROOM NAME	GENERAL MANAGER Room	ROOM AREA	W × L = A m²	ROOM VOLUME	A × H = V m³	SYSTEM
				41.7		125	

SENSIBLE HEAT LOAD					SUMMER				WINTER		
EAR & TRANS. GAIN THRU STRUCTURES					SUN TIME 16 H		SUN TIME 18 H		SENSIBLE HEAT LOSS		
	DIREC.	W × H	AREA	K	TEMP. DIFF.	HEAT GAIN	TEMP. DIFF.	HEAT GAIN	DIREC. FACTOR	TEMP. DIFF.	HEAT LOSS
		m × m	m²	Kcal/h·m²·℃	℃	Kcal/h	℃	Kcal/h		℃	Kcal/h
	W		26.8	1.6	9.3	400	13.1	560			
	S		16.0	1.6	8.8	230	9.6	250			
	N		4.6	1.6	5.7	40	6.2	50			
S	W		5.8	5.5	11.2	360	11.2	360			
	S		5.8	5.5	11.2	360	11.2	360			
ION			25.5	2.5	5.6	360	5.6	360			
R			41.7	1.7	5.6	400	5.6	400			
SG											
	SUB TOTAL (I)					2150		2360	SUB TOTAL		
LAR GAIN THRU GLASS				F	I_{GR}		I_{GR}				
S									INFILTRATION		
	W		5.8 m²		486	2530	153	890	m³ ×	R/h × 0.288	
	S		5.8		31	180	5	30	×		
	SUB TOTAL (II)					2710		920			
ERNAL HEAT GAIN									TOTAL (SH)		
DE. LIGHT		KW × 860							LATENT HEAT LOSS		
RE. LIGHT	20 W/m² × 41.7	KW × 1,000				830			INFILTRATION		
									m³ ×	R/h × 715	
									×		
OPLE	WALKING	×									
	SEATED	1 × 50				50			TOTAL (LH)		
TRATION	125 m³ × 0.7	R/h × 0.288			11.2	280			GRAND TOTAL		
	SUB TOTAL (III)					1160			REMARKS:		
TAL OF SENSIBLE HEAT LOAD (I + II + III)						6020			DESIGN COND.		
ENT HEAT LOAD									26.0°C 55% (RH)		
OPLE	WALKING	×							33.2°C 78% (O.A.T)		
	SEATED	1 × 60				60					
TRATION	125 m³ × 0.7	R/h × 715			0.0326 0.0116	1310					
OF LATENT HEAT LOAD (IV)						1370					
TOTAL OF HEAT GAIN						7390					
E HEAT FACTOR		%									
AIR QUANTITY		m³/h									
R AIR QUANTITY		m³/h									
S:											

50. 11. 100×50

TIMATING SHEET (B)

NO.

	ROOM NAME	ADVISORS OFFICE ROOM	ROOM AREA	W × L = A m² 48.1	ROOM VOLUME	A × H = V m³ 144	SYSTEM	

SENSIBLE HEAT LOAD				SUMMER				WINTER		
AR & TRANS. GAIN THRU STRUCTURES				SUN TIME 16 H		SUN TIME 12 H		SENSIBLE HEAT LOSS		
DIREC.	W × H	AREA	K	TEMP. DIFF.	HEAT GAIN	TEMP. DIFF.	HEAT GAIN	DIREC. FACTOR	TEMP. DIFF.	HEAT LOSS
	m × m	m²	Kcal/h·m²·℃	℃	Kcal/h	℃	Kcal/h		℃	Kcal/h
W		26.8	1.6	9.3	400	13.1	560			
S		16.0	1.6	8.8	230	9.6	270			
N		16.0	1.6	5.7	150	6.2	160			
W		5.8	5.5	11.2	360	11.2	360			
S		5.8	5.5	11.2	360	11.2	360			
N		5.8	5.5	11.2	360	11.2	360			
ON		25.5	2.5	5.6	360	5.6	360			
		48.1	1.4	20.8	1400	22.8	1560			
SUB TOTAL (I)					3620		3950	SUB TOTAL		
AR GAIN THRU GLASS		m²	F	IGR		IGR				
								INFILTRATION		
W		5.8		436	2530	153	890	m³ ×		R/h×0.288
S		5.8		31	180	5	30	×		
N		5.8		29	170	6	90			
SUB TOTAL (II)					2880		1010			
ERNAL HEAT GAIN								TOTAL (SH)		
E. LIGHT	KW × 860							LATENT HEAT LOSS		
E. LIGHT	20W/m² × 48.1 ~~KW~~ × 1,000				960			INFILTRATION		
								m³ ×		R/h× 715
								×		
OPLE	WALKING ×									
	SEATED 1 × 50				50			TOTAL (LH)		
TRATION	144 m³ × 0.7 R/h×0.288			11.2	330			GRAND TOTAL		
SUB TOTAL (III)					1340			REMARKS:		
AL OF SENSIBLE HEAT LOAD (I + II + III)								DESIGN COND.		
ENT HEAT LOAD								26.0℃ 55% (ROOM)		
OPLE	WALKING ×							37.2℃ 78% (OUT)		
	SEATED 1 × 60				60					
TRATION	144 m³ × 0.7 R/h×715			0.032 0.014	1510					
OF LATENT HEAT LOAD (IV)					1570					
TOTAL OF HEAT GAIN					9410					
E HEAT FACTOR	%									
AIR QUANTITY	m³/h									
R AIR QUANTITY	m³/h									

3. CALCULATION SHEET OF WATER SUPPLY AND DRAINAGE

C O N T E N T S

1. OIL TANK

FUEL : C HEAVY OIL

FUEL USED QUANTITY OF BOILER : 200 kg/HR

TANK CAPACITY : 200 kg/HR × 8HR/DAY × 11 DAYS / 0.9 kg/M³ = 17500 ℓ

→ 1,800φ × 6,500ℓ EFFECTIVE CAPACITY 16.580ℓ

BRIQUETTE SYSTEM

2 OIL SERVICE TANK

(1) C HEAVY OIL SYSTEM

TANK CAPACITY

SHALL BE THE VOLUME THAT COVERS 1 HOUR.

200 kg / 0.9 = 220 ℓ

→ 750 × 750 × 850H FLOAT SWITCH WITH A STEAM HEATER.

(2) A HEAVY OIL SYSTEM

THIS SHOULD BE USED ONLY WHEN THE BOILER IS STARTED TO BE HEATED.

500 × 500 × 650H

3 OIL GEAR PUMP (C HEAVY OIL SYSTEM)

ASSUMING IT AS THREE TIMES AS MUCH AS FUEL USED QUANTITY OF BOILER,

200 kg/HR × 3 ÷ 60 ÷ 0.9 = 11 ℓ/MIN

→ REFERENCE MODEL NO.

GPE, EBARA 15φ × 10ℓ (MIN.) × 3 kg/cm² × 0.4 KW

4 DRAIN PUMP

4 — 1 DRAIN PUMP OF STEAM CLEANER SYSTEM IN A HEAVY REPAIR FACTORY

4-1-1 VOLUME OF WATER

THE SIZE OF THE WATER TANK SHALL BE 1500 (L) X 1.000 (W), AND THE DIFFERENCE OF THE WATER LEVEL BETWEEN ON AND OFF SHALL BE 600. THE ABOVE MENTIONED QUANTITY SHALL BE DRAINED IN 5 MINUTES.

$1.5 \times 1 \times 0.6 \times 1000 \div 5 = 180\,\ell/\text{MIN} \longrightarrow 250\,\ell/\text{MIN}.$
(STEAM CLEANER $1000\,\ell/\text{HR} \times 3 \div 60 = 80\,\ell/\text{MIN}$)

4-1-2 LIFT

REAL LIFT 1.4 M

PLUMBING, VALVING, ETC $\frac{2.0\,M}{3.4\,M} \longrightarrow 4\,MAq$

REFERENCE MODEL NO

50DSS 5.75, EBARA — UNDERWATER GENERAL DRAIN PUMP

50 ϕ X 250 ℓ/MIN. X 4 MAq X 0.75 KW X 2 UNITS

4 — 2 DRAIN PUMP FOR INSPECTION FACTORY & RETREADING

4-2-1 VOLUME OF WATER

SAME AS IN 1-1 (250 ℓ/MIN.)

4-2-2 LIFT

REAL LIFT 3.2 M

PLUMBING VALVING, ETC $\frac{2.0\,M}{5.2\,M} \longrightarrow 6\,MAq$

REFERENCE MODEL NO

50 DSS 5.75, EBARA — UNDERWATER GENERAL DRAIN PUMP

50 ϕ X 250 ℓ/MIN X 6 mAq X 0.75 KW X 2 UNITS X 2 SETS

5. COOLING TOWER FOR COMPRESSOR

40 ℓ/MIN. + 6 UNITS = 240 ℓ/MIN.

WATER TEMPERATURE : 50°C/40°C (IN/OUT)

OUTER AIR 35°C 90% W.B 33.5°C

REFERENCE MODEL NO SBC-20 0.4 KW.

6 COOLING WATER PUMP

VOLUME OF WATER 240 ℓ/MIN.

LIFT

REAL LIFT	2 MAq
CHECK VALVE	3
COMP.	6
PLUMBING ETC	3
	14 MAq

REFERENCE MODEL NO

50 LPB-515, EBARA — LINE PUMP

50 φ × 240 ℓ/MIN × 14 MAq × 1.5 KW

7 ELECTRIC BOILER FOR SHOWER USE IN HEAVY REPAIR FACTORY

1. TYPE OF BOILER

THERE IS ONLY ONE SHOWER PLACE WHICH IS SUPPLIED WITH HOT WATER IN THE WHOLE SHOP. THEREFORE, A CONTINUOUS AND SUCCESSIVE USE OF THE SHOWER PLACE IS FORECASTED ⟶ AN INSTANTANEOUS TYPE SHALL BE EMPLOYED

2. CAPACITY

THE BOILER SHALL BE CAPABLE TO HEAT 13 ℓ OF WATER FROM 15°C TO 45°C IN A MINUTE.

$$\text{OUTPUT} = 13\ell/\text{MIN} \times (45 - 15^{\circ}\text{C}) \times \frac{60}{860} \times \underset{(\text{LOSS})}{1.05} \fallingdotseq 28.6\ \text{KW}$$

REFERENCE MODEL NO

EI-30, NIHON ITOMIC 30 KW

1050 (W) × 1710 (H) × 190 (D)

INSTANTANEOUS AND DOUBLE TUBE TYPE

8. WATER SUPPLY

8-1 WATER SUPPLY QUANTITY FORECAST.

[CENTRAL WORK SHOP]

WATER FOR LIVING

DAILY SUPPLY FORECAST $950^{\text{PERSONS}} \times 10^{\ell/\text{D}\cdot\text{PERSONS}} = 95,000\ \ell/\text{D}$

HOURLY AVERAGE SUPPLY $95,000^{\ell/\text{D}} \div 8^{\text{HR}} = 11,875\ \ell/\text{HR}$

HOURLY MAXIMUM SUPPLY $11,875^{\ell/\text{D}} \times 2 = 23,750\ \ell/\text{HR}$

MOMENTARY MAX. SUPPLY $\dfrac{11,875^{\ell/\text{D}} \times 3}{60\ \text{MIN/HR}} = 594\ \ell/\text{MIN}$

WATER FOR CAR WASHING

DAILY SUPPLY FORECAST $30^{\text{UNITS/D}} \times 3,500^{\ell/\text{UNITS}} = 105,000\ \ell/\text{D}$

HOURLY AVERAGE SUPPLY $105,000^{\ell/\text{D}} \div 8^{\text{H/D}} = 13,125\ \ell/\text{D}$

HOURLY MAX. SUPPLY 〃

MOMENTARY MAX SUPPLY $13,125^{\ell/\text{H}} \div 60 = 219\ \ell/\text{MIN}$

WATER FOR FLOOR CLEANING

DAILY SUPPLY FORECAST $50^{\text{PCS}} \times 30^{\ell/\text{MIN}} \times 5^{\text{MIN}} = 7,500\ \ell/\text{D}$

HOURLY AVERAGE SUPPLY 〃

HOURLY MAX. SUPPLY 〃

MOMENTARY MAX. SUPPLY $7500^{\ell/\text{MIN}} \div 5\ \text{MIN} = 1,500\ \ell/\text{MIN}$

STEAM CLEANER

DAILY SUPPLY FORCAST $12^{\text{UNITS}} \times 10^{\ell/\text{MIN}} \times 60^{\text{MIN}} \times 8^{\text{HR}} = 57,600\ \ell/\text{D}$

HOURLY AVERAGE SUPPLY $57,600^{\ell/\text{D}} \div 8^{\text{HR}} = 7,200\ \ell/\text{HR}$

HOURLY MAX. SUPPLY 〃

MOMENTARY MAX SUPPLY $7,200^{\ell/\text{H}} \div 60^{\text{MIN/H}} = 120\ \ell/\text{MIN}$

RETREADING

DAILY SUPPLY FORECAST	2,500 ℓ/HR × 8 HR =	20,000 ℓ/D
HOURLY AVERAGE SUPPLY		2,500 ℓ/D
HOURY MAX SUPPLY		2,500 ℓ/D
MOMENTARY MAX SUPPLY	2,500 ℓ/HR ÷ 60 MIN =	42 ℓ/MIN

[TRAINING INSTITUTE]

WATER FOR LIVING

DAILY SUPPLY FORECAST	80 PERONS × 200 ℓ/D + 30 PERSONS × 100 ℓ/D =	19,000 ℓ/D
HOURLY AVERAGE SUPPLY	19,000 ℓ/D ÷ 8 HR. =	2,375 ℓ/H
HOURLY MAX. SUPPLY	2,375 ℓ/HR × 2 =	4,750 ℓ/H
MOMENTARY MAX SUPPLY	2,375 ℓ/HR × 3 ÷ 60 MIN/HR =	119 ℓ/H

WATER FOR CLEANING TRAINING RM

DAILY SUPPLY FORCAST	5 PCS × 30 ℓ/MIN × 5 MIN =	750 ℓ/D
HOURLY AVERAGE SUPPLY		〃
HOURLY MAX SUPPLY		〃
MOMENTARY MAX SUPPLY	750 ℓ/D ÷ 5 MIN/D =	150 ℓ/MIN

[TOTAL]

DAILY SUPPLY FORCAST	95,000 + 105,000 + 7,500 + 57,600 + 20,000 + 19,000 + 750 =	304,850 ℓ/D
HOURLY AVERAGE SUPPLY	11,875 + 13,125 + 7,500 + 7,200 + 2,500 + 2,375 + 750 =	45,325 ℓ/H
HOURLY MAX SUPPLY	23,750 + 13,125 + 7,500 + 7,200 + 2,500 + 4,750 + 750 =	59,575 ℓ/H
MOMENTARY MAX SUPPLY	574 + 219 + 1,500 + 120 + 42 + 119 + 150 =	2,744 ℓ/MIN

8-2 ELEVATED WATER TANK

CAPACITY $V_E = (Q_P - Q_{PU})T_3 + Q_{PU} \cdot T_4$

WHEREIN Q_P: MOMENTARY MAX. WATER SUPPLY (2,744 ℓ/MIN.)

Q_{PU}: PUMPING QUANTITY OF RAM (950 ℓ/MIN)

T_3: TIME OF CONTINUANCE OF MOMENTARY MAX. SUPPLY (20 MIN.)

T_4: THE SHORTEST OPERATING TIME OF RAM (15 MIN.)

$V_E = (2744 - 950) \times 20 + 950 \times 15 = 50,130$ ℓ

∴ THE CAPACITY OF ELEVATED WATER TANK SHALL BE 50 M³.

HEIGHT $H = H_1 + H_2 + H_3$

WHEREIN H_1: REAL LIFT (12.8 M)

H_2: WATER HEAD LOSS (9.0 M)

H_3: DISCHARGE WATER HEAD (10.0 M)

$H = 12.8 + 9.0 + 10.0 = 31.8$ M

8-3 THE WATER RECEIVING TANK SHALL HAVE A CAPACITY FOR 2 HOURS OF HOURLY AVERAGE SUPPLY.

$43,113 \times 2 = 86,226$ ℓ

∴ THE CAPACITY SHALL BE 100 M³.

8-4 RAM

LIFTING QUANTITY (950 ℓ/MIN.)

LIFT $H = (H_1 + H_2 + H_3) \times 1.1$

WHEREIN H_1: REAL LIFT (35.0 M)

H_2: WATER HEAD LOSS (2.0 M)

H_3: DISCHARGE WATER HEAD (3.0 M)

$H = (35.0 + 2.0 + 3.0) \times 1.1 = 44$ M

SPECIFICATIONS OF PUMP: 100 A × 4 STEPS × 950 ℓ/MIN × 44 M × 15 KW

2 UNITS OPERATED AUTOMATICALLY AND ALTERNATIVELY

8-5 WELL PUMP (UNDERWATER PUMP)

LIFTNG WATER QUANTITY: SHALL BE THE HOURLY AVERAGE SUPPLY.

$(45{,}325\ \ell/HR \div 60\ MIN) = 755\ \ell/MIN$

LIFT : THOUGH THE STATIC WATER LEVEL IS 6 M, THE LIFT SHALL BE 35 M TAKING INTO CONSIDERATION A LOWERING OF THE WATER LEVEL.

SPECIFICATIONS OF PUMP

$100^{\Lambda} \times 3\ STEPS \times 755\ \ell/MIN \times 35\ M \times 11\ KW$

4. CALCULATION SCHEDULE OF FLOOR AREA

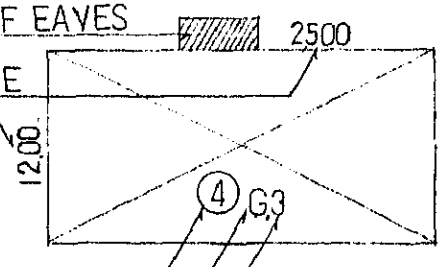
CALCULATION SCHEDULE OF FLOOR AREA

BUILDING		SCHEDULE OF FLOOR AREA (M^2)			
N.O	NAME	GROUND FLOOR	1ST FLOOR	2ST FLOOR	TOTAL
①	GENERAL OFFICE BLDG	473.94	461.29	461.29	1,396.52
②	CLASSROOM OFFICE BLDG	565.15	491.56		1,056.71
③	DORMITORY	590.24	287.55	287.55	1,161.34
④	CAFETERIA	754.95			754.95
⑤	TRAINING ROOM	1,161.38			1,161.38
⑥	CHECK GATE	129.92			129.92
⑦	AIR COMPRESSOR	88.94			88.94
⑧	PAINT GRESE OIL STORAGE	136.74			136.74
⑨	SUB STATION	117.50			117.50
⑩	HEAVY REPAIR FACTORY	4,003.62	192.39	87.45	4283.46
⑪	PARTS STORAGE	1.717.20			1,717.20
	WATER SUPPLY TOWER	16.00			16.00
	WELL HOUSE	5.41			5.41
⑫	INSPECTION FACTORY	636.00	53.00		689.00
⑬	PERIODICAL REPAIR FACTORY	2,003.40	121.90		2125.30
⑭	PAINT&BODY FACTORY	1,508.00	145 75		1,653.75
⑮	RETREADING&METAL CASTING FACTORY	1,311.75	141.30		1,453.05
TOTAL		15,220.14	1,894.74	836.29	17,951.17

NOTE :

SHADED PORTION INDICATES AREA OF EAVES

FIGURE INDICATES LENGTH OF A SIDE

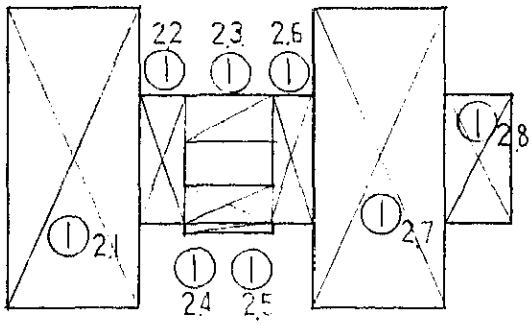


NUMBER IN ◯ INDICATES A BUILDING NUNBER

NUMBER OR ALPHERBET INDICATES STORY OF A BUILDING

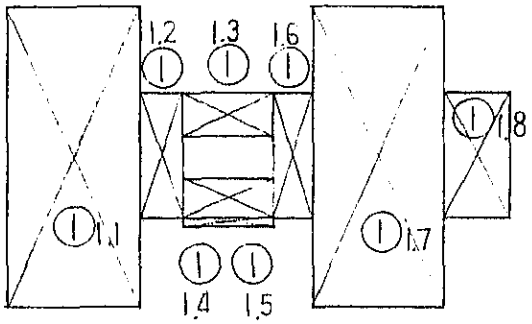
NUMBER INDICATES PART OF A BUILDING

① GENERAL OFFICE 1 : 500



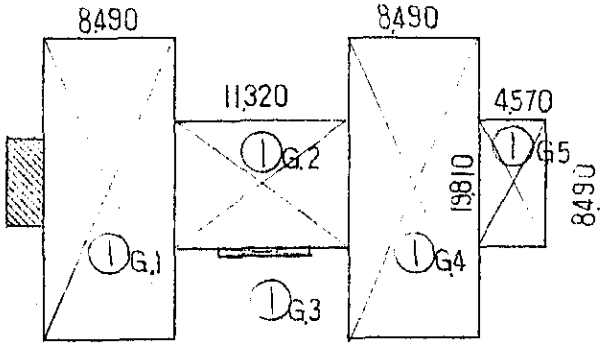
2 ND FLOOR PLAN

①2.1	19810 × 8490 = 168.1869
①2.2	8490 × 2830 = 24.0267
①2.3	2830 × 6550 = 18.5365
①2.4	3730 × 6550 = 24.4315
①2.5	470 × 5660 = 2.6602
①2.6	8490 × 1940 = 16.4706
①2.7	19810 × 8490 = 168.1869
①2.8	8490 × 4570 = 38.7993
	461.2986



1 ST FLOOR PLAN

①1.1	19810 × 8490 = 168.1869
①1.2	8490 × 2830 = 24.0267
①1.3	2830 × 6550 = 18.5365
①1.4	3730 × 6550 = 24.4315
①1.5	470 × 5660 = 2.6602
①1.6	8490 × 1940 = 16.4706
①1.7	19810 × 8490 = 168.1869
①1.8	8490 × 4570 = 38.7993
	461.2986

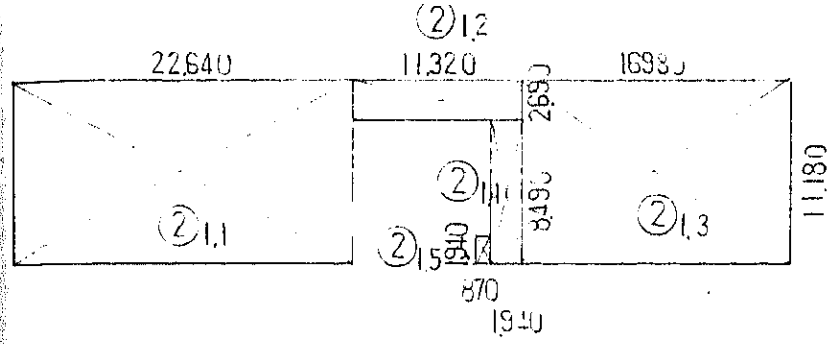


GROUND FLOOR PLAN

①G.1	19810 × 8490 = 168.1869
①G.2	8490 × 11320 = 96.1069
①G.3	470 × 5660 = 2.6602
①G.4	19810 × 8490 = 168.1869
①G.5	8490 × 4570 = 38.7993
	473.9402

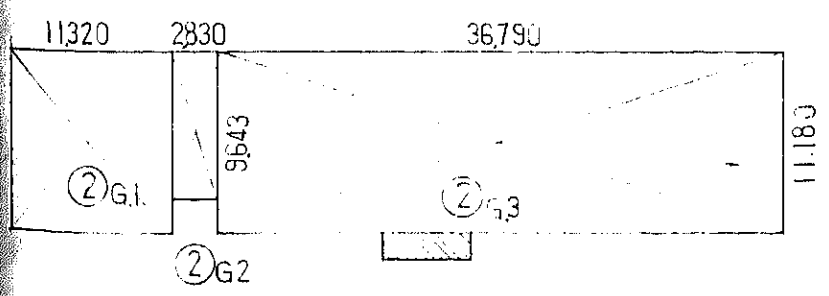
1396.52

② CLASS ROOM 1:100



1ST FLOOR PLAN

②1.1	11,190 × 22,640	= 253,1152
②1.2	2,690 × 11,320	= 30,4508
②1.3	11,1800 × 16,980	= 180,8364
②1.4	8,490 × 1,940	= 16,4706
②1.5	1,940 × 870	= 1,6878
		491,5608

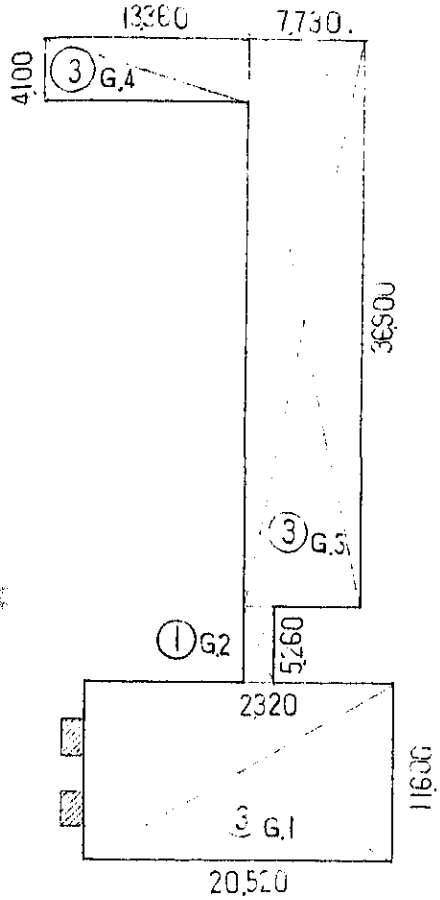


GROUD FLOOR PLAN

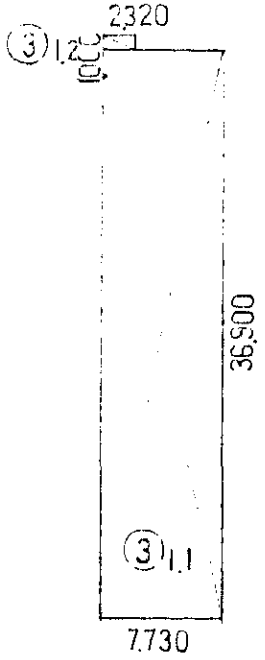
②G1	11,180 × 11,320	= 126,5576
②G2	9643 × 2830	= 27,2897
②G3	11,190 × 36,790	= 411,3122
		565,1595

105671

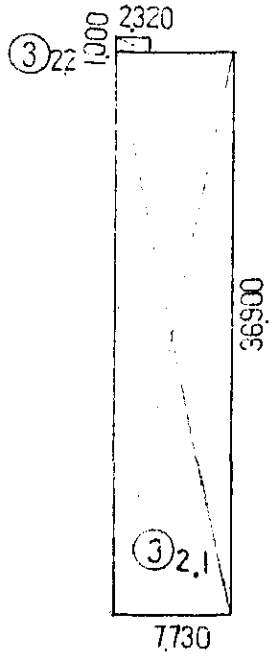
③ DOMITOR 1 : 500



GROUND FLOOR PLAN



1ST FLOOR PLAN

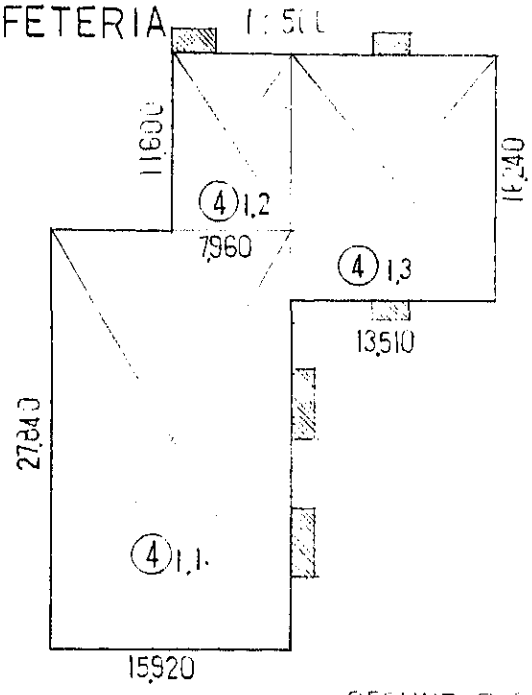


2ND FLOOR PLAN

③G1	11600 × 20520 = 238032 0						
③G2	2320 × 5260 = 12203 2						
③G3	36900 × 7730 = 285237 0	③1.1	36900 × 7730 = 285237 0	③2.1	36900 × 7730 = 285237 0		
③G4	4100 × 13360 = 54776 0	③1.2	1000 × 2320 = 2320 0	③2.2	1000 × 2320 = 2320 0		
	590282		287557 0		287557 0		

1165.34

④ CAFETERIA 1 : 500

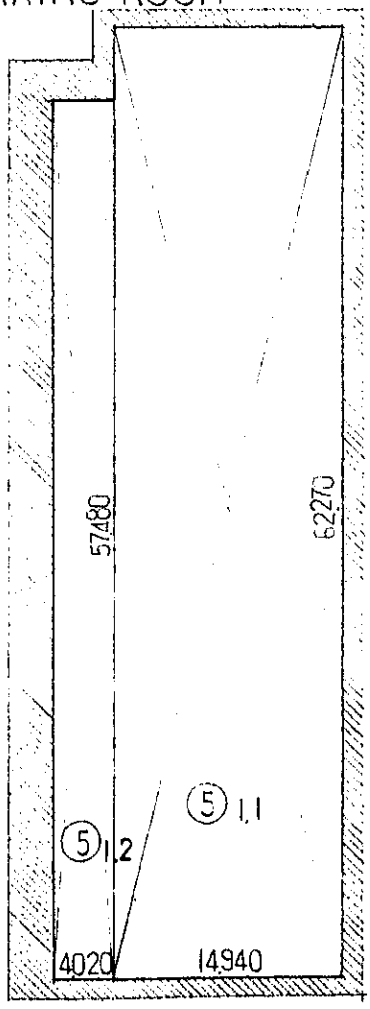


④13	16.240 × 13.510 =	219.4024
④12	11.600 × 7.960 =	92.3360
④11	27.840 × 15.920 =	443.2128
		754.9512

754.95

GROUND FLOOR PLAN

⑤ TRAING ROOM

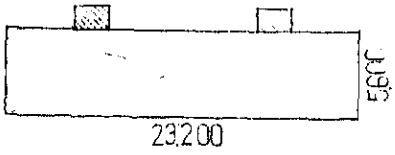


⑤12	4.020 × 57.480 =	231.0696
⑤11	14.940 × 62.270 =	930.3138
		1161.3834

1161.38

GROUND FLOOR PLAN

⑥ CHECK GATE 1:500

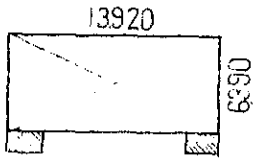


GROUND FLOOR PLAN

⑥ 5600 × 23200 = 129,9200

129.92

⑦ AIR COMPRESSOR HOUSE 1:500

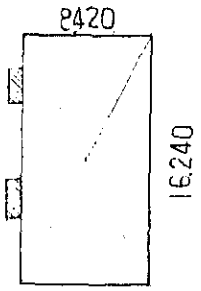


GROUND FLOOR PLAN

⑦ 6390 × 13920 = 88,9488

88.94

⑧ PAINT GREASE OIL STORAGE 1:500

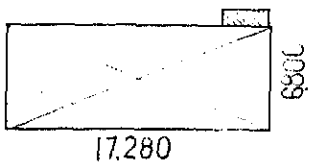


GROUND FLOOR PLAN

⑧ 16240 × 8420 = 136,7408

136.74

⑨ SUB STATION 1:500

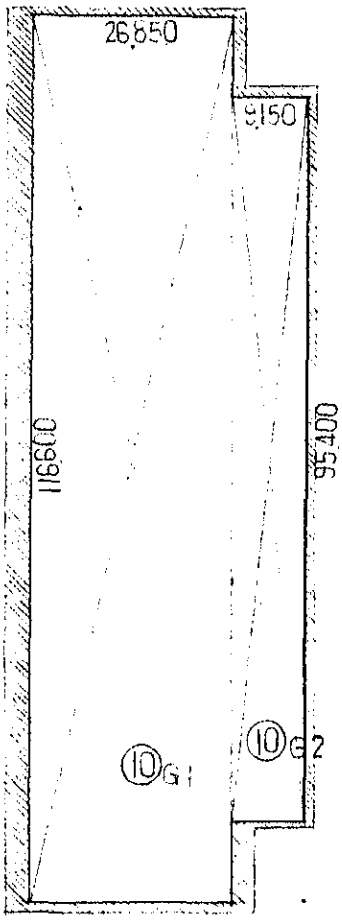


GROUND FLOOR PLAN

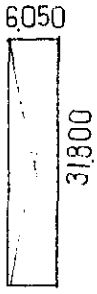
⑨ 6800 × 17280 = 117,5040

117.50

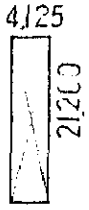
⑩ HEAVY REPAIR FACTORY 1:1000



GROUND FLOOR PLAN



1ST FLOOR PLAN



2ND FLOOR PLAN

⑩G.1 116,600×26,850=3,130.7100

⑩G.2 9540×9150= 872.9100

4003.6200

⑩1.1 31,800×6050=192.3900

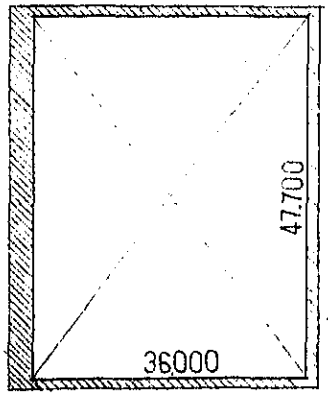
192.3900

⑩2.1 21,200×4125=87.4500

87.4500

4283.46

⑪ PARTS STORAGE 1:1000

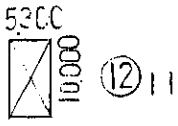


GROUND FLOOR PLAN

47,700 × 36,000 = 1,717.2000

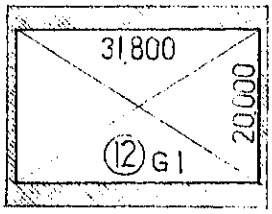
1,717.20

⑫ INSPECTION FACTORY 1:1000



1ST FLOOR PLAN

⑫11 10,000 × 5300 = 53,0000

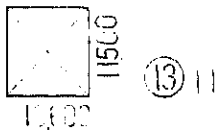


⑫G1 20,000 × 31,800 = 636,0000

689.00

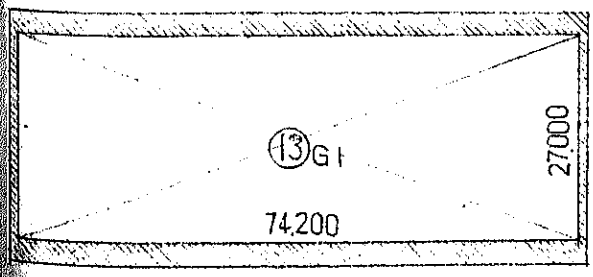
GROUND FLOOR PLAN

⑬ PERIODIC REPAIR FACTORY 1:1000



1ST FLOOR PLAN

⑬11 11,500 × 10,600 = 121,9000

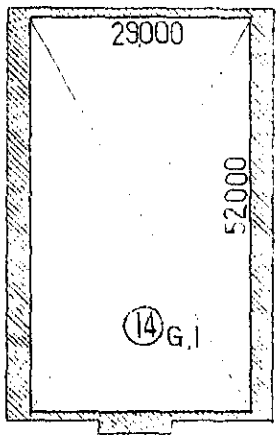


⑬G1 27,000 × 74,200 = 2,003,4000

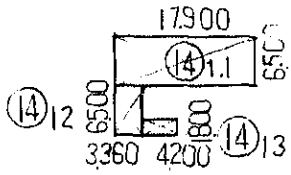
GROUND FLOOR PLAN

2125,30

(14) PAINT AND BODY FACTORY 1:1000



GROUND FLOOR PLAN



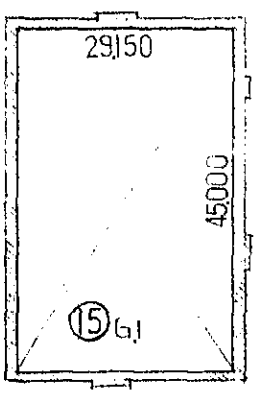
1ST FLOOR PLAN

(14)G.1 52000×29000=1508.0000
1,508.0000

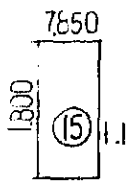
(14)1.1 17900×6500=116.3500
(14)1.2 6500×3360= 21.8400
(14)1.3 1,800×4200= 7.5600
145.7500

1,653.75

(15) RETREADING & METAL CASTING FACTORY 1:1000



GROUND FLOOR PLAN



1ST FLOOR PLAN

(15)G.1 29150×45000=1311.7500

(15)1.1 1800×7850=141.3000

1453.05

PUMP HOUSE (WATER SUPPLY TOWER) 1 : 500

4,000 X 4,000 = 16,0000

16,00

WELL HOUSE 1 : 500

2,032 X 2667 = 5,4190

5,4190

5,41