

The image features a dark navy blue background. In the center is a rectangle with a thin, light gold border. Inside this rectangle, the text "EEE 414" is positioned above the word "Project". Both are in a light gold, sans-serif font. Radiating from the central rectangle are several thin, light gold lines that extend towards the edges of the frame, creating a starburst or network-like effect. Some lines are straight, while others form small, open geometric shapes like triangles and polygons.

EEE 414 Project

Project Members

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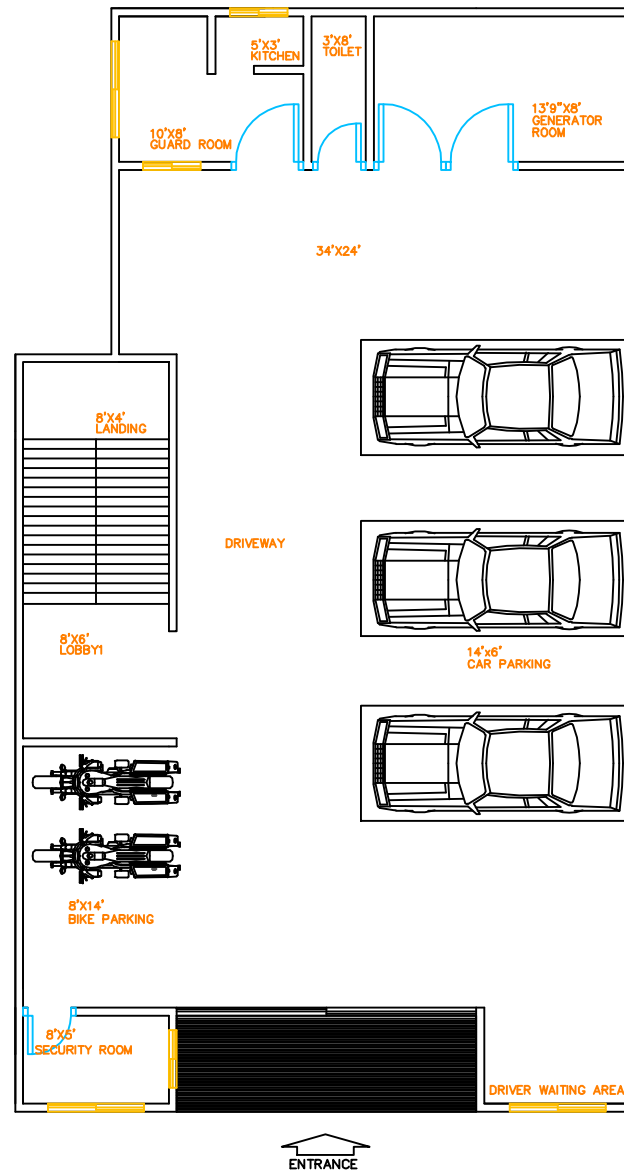
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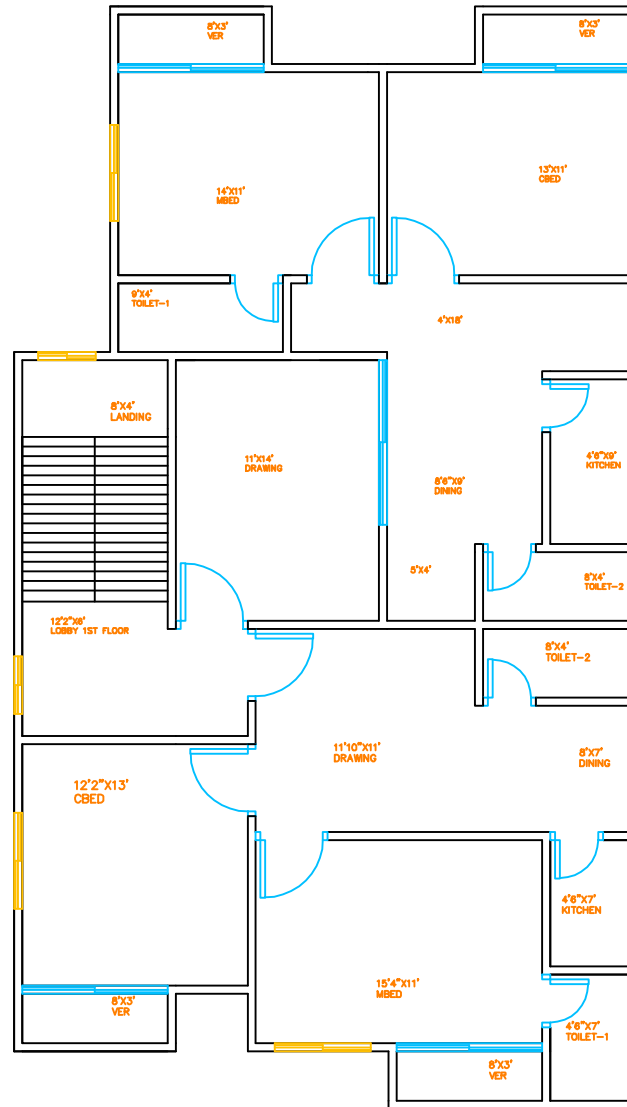
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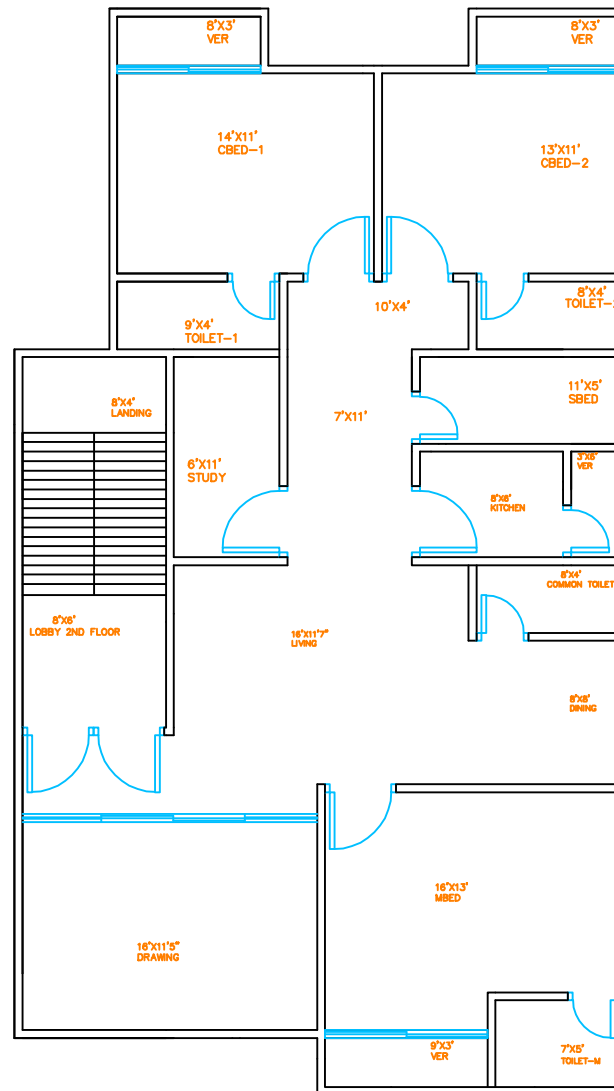
Floor Plan



GROUND FLOOR



1ST FLOOR



2ND FLOOR

Calculations for Light Bulbs (LB) & Fans (F):

$$\text{Formula for Room Index} = \frac{\text{Length} * \text{Width}}{\text{Mounting Height} * (\text{Length} + \text{Width})}$$

$$\text{Formula for Light Bulbs, E} = \frac{n * N * F * UF * LLF}{A} ; \text{ here, A is in square meter unit}$$

Light Loss Factor, LLF = 0.9

Mounting Height = 2 m

Reflectance, Ceiling = 0.3, Walls = 0.5, Floor = 0.2

For every 100 square feet, one ceiling fan is needed.

$$\text{Number of Ceiling Fans} = \frac{A}{100} ; \text{ here, A is in square feet unit}$$

Chart for calculating Utilization Factor:

Utilization factor											
Room Reflectance			Room Index								
Ceiling	Wall	Floor	0.75	1	1.25	1.5	2	2.5	3	4	5
0.7	0.5	0.2	0.43	0.49	0.55	0.6	0.66	0.71	0.75	0.8	0.83
0.7	0.3	0.2	0.35	0.41	0.47	0.52	0.59	0.65	0.69	0.75	0.78
0.7	0.1	0.2	0.29	0.35	0.41	0.46	0.53	0.59	0.63	0.7	0.74
0.5	0.5	0.2	0.38	0.44	0.49	0.53	0.59	0.63	0.66	0.7	0.73
0.5	0.3	0.2	0.31	0.37	0.42	0.46	0.53	0.58	0.61	0.66	0.7
0.5	0.1	0.2	0.27	0.32	0.37	0.41	0.48	0.53	0.57	0.62	0.66
0.3	0.5	0.2	0.3	0.37	0.41	0.45	0.52	0.57	0.6	0.65	0.69
0.3	0.3	0.2	0.28	0.33	0.38	0.41	0.47	0.51	0.54	0.59	0.62
0.3	0.1	0.2	0.24	0.29	0.34	0.37	0.43	0.48	0.51	0.56	0.59
0	0	0	0.19	0.23	0.27	0.3	0.35	0.39	0.42	0.46	0.48

Ground Floor:

Guard Room:

Length=10'=3.048m

Width=8'=2.43m

Area, $A=7.4 \text{ m}^2$

Room Index= .631

UF=.18

Illuminance, $E = 100 \text{ lumen/m}^2$

Flux, $F = 1800 \text{ lumen (20 W fluorescent tubelight \& light bulbs)}$

Calculating from above formula, $N = 1.4$

So, we will install 1 tube light.

Number of fans = 0.78

So, we will install 1 fan.

Generator Room:

Length=13'9"= 4.191m

Width=8'=2.43m

Area, $A=10.18 \text{ m}^2$

Room Index= 0.879

UF=0.35

Illuminance, $E = 100 \text{ lumen/m}^2$

Flux, $F = 1800 \text{ lumen (20 W fluorescent tubelight \& light bulbs)}$

Calculating from above formula, $N = 2.4$

So, we will install 2 tube lights.

Security room:

Length = 8' = 2.44 m

Width = 5' = 1.52 m

Area, A = 3.709 m²

Room Index = 0.468

UF = 0.168

Illuminance, E = 100 lumen/m²

Flux, F = 1800 lumen (20 W fluorescent tubelight & light bulbs)

Calculating from above formula, N = 1.36

So, we will install 1 light bulb. But as security guard has to do some paper work, we will install one more ceiling light.

Number of fans = 0.4

So, we will install 1 fan.

Lobby ground floor:

Length = 8' = 2.43 m

Width = 6' = 1.83 m

Area, A = 4.46 m²

Room Index = 0.522

UF = 0.156

Illuminance, E = 80 lumen/m²

Flux, F = 1800 lumen (20 W fluorescent tubelight & ceiling light bulbs)

Calculating from above formula, N = 1.41

So, we will install 1 light bulb.

Garage area:

Length = 24' = 7.31 m

Width = 43' = 13.106 m

Area, A = 95.403 m²

Room Index = 2.34

UF = 0.557

Illuminance, E = 80 lumen/m²

Flux, F = 1800 lumen (20 W fluorescent tubelight & ceiling light bulbs)

Calculating from above formula, N = 8.52

So, we will install 9 ceiling lights.

1st Floor Lower Flat:**For Bedroom 1:**

Length = 15'4" = 4.67 m

Width = 11' = 3.35 m

Area, A = 15.64 m²

Room Index = 0.9753

UF = 0.3608

Illuminance, E = 100 lumen/m²

Flux, F = 1800 lumen (20 W fluorescent tube light & light bulbs)

Calculating from above formula, N = 2.67

So, we will install 1 tube light & 2 light bulbs.

Number of fans = 1.68

So, we will install 2 fans.

For Bedroom 2:

Length = 12'2" = 3.71 m

Width = 13' = 3.96 m

Area, A = 14.69 m²

Room Index = 0.9577

UF = 0.354

Illuminance, E = 100 lumen/m²

Flux, F = 1800 lumen (20 W fluorescent tubelight & light bulbs)

Calculating from above formula, N = 2.56

So, we will install 1 tube light & 2 light bulbs.

Number of fans = 1.58

So, we will install 2 fans.

So, we will install 2 fans.

For Drawing :

Length = 11'10" = 3.61 m

Width = 11' = 3.35 m

Area, A = 12.09 m²

Room Index = 0.8687

UF = 0.321

Illuminance, E = 150 lumen/m²

Flux, F = 1800 lumen (20 W fluorescent tube light & light bulbs)

Calculating from above formula, N = 3.48

So, we will install 2 tubelight & 1 light bulbs.

Number of fans = 1.301

So, we will install 1 fan.

For Dining:

Length = 8' = 2.43902439 m

Width = 7' = 2.134146341m

Area, A = 5.205 m²

Room Index = 0.5686

UF = 0.227

Illuminance, E = 150 lumen/m²

Flux, F = 1800 lumen (20 W fluorescent tubelight & light bulbs)

Calculating from above formula, N = 2.12

So, we will install 1 tube light & 1 light bulb.

Number of fans = 0.5675

So, we will install 1 fan.

1st Floor Upper Flat

For Bedroom 1:

Length = 14' = 4.27 m

Width = 11' = 3.35 m

Area, A = 14.31 m²

Room Index = 0.9386

UF = 0.3472

Illuminance, E = 100 lumen/m²

Flux, F = 1800 lumen (20 W fluorescent tube light & light bulbs)

Calculating from above formula, N = 2.54

So, we will install 1 tube light & 2 light bulbs.

Number of fans = 1.54

So, we will install 2 fans.

For Bedroom 2:

Length = 13' = 3.96 m

Width = 11' = 3.35 m

Area, A = 13.29 m²

Room Index = 0.907

UF = 0.3355

Illuminance, E = 100 lumen/m²

Flux, F = 1800 lumen (20 W fluorescent tubelight & light bulbs)

Calculating from above formula, N = 2.44

So, we will install 1 tube light & 1 light bulb.

Number of fans = 1.43

So, we will install 1 fan.

For Drawing :

Length = 11' = 3.35 m

Width = 14' = 4.27 m

Area, A = 14.32 m²

Room Index = 0.9386

UF = 0.347

Illuminance, E = 150 lumen/m²

Flux, F = 1800 lumen (20 W fluorescent tube light & light bulbs)

Calculating from above formula, N = 3.82

So, we will install 2 tubelight & 2 light bulbs.

Number of fans = 1.54

So, we will install 2 fans.

For Dining:

Length = 8'6" = 2.59 m

Width = 9' = 2.74 m

Area, A = 7.11 m²

Room Index = 0.665

UF = 0.266

Illuminance, E = 150 lumen/m²

Flux, F = 1800 lumen (20 W fluorescent tubelight & light bulbs)

Calculating from above formula, N = 2.47

So, we will install 1 tube light & 1 light bulb.

Number of fans = 0.765

So, we will install 1 fan.

Lobby 1st Floor:

Length = 12' 2" = 3.71 m

Width = 6' = 1.83 m

Area, A = 6.785 m²

Room Index = 0.612

UF = 0.183

Illuminance, E = 80 lumen/m²

Flux, F = 1800 lumen (20 W fluorescent tubelight & light bulbs)

Calculating from above formula, N = 1.83

So, we will install 1 tube light and 1 ceiling light

2nd Floor Flat

For Bedroom 1:

Length = 16' = 4.87 m

Width = 13' = 3.96 m

Area, A = 19.33 m²

Room Index = 1.09

UF = 0.4038

Illuminance, E = 100 lumen/m²

Flux, F = 1800 lumen (20 W fluorescent tube light & light bulbs)

Calculating from above formula, N = 2.95

So, we will install 1 tube light & 2 light bulbs.

Number of fans = 2.08

So, we will install 2 fans.

For Bedroom 2:

Length = 14' = 4.27 m

Width = 11' = 3.35 m

Area, A = 14.31 m²

Room Index = 0.9386

UF = 0.3472

Illuminance, E = 100 lumen/m²

Flux, F = 1800 lumen (20 W fluorescent tube light & light bulbs)

Calculating from above formula, N = 2.54

So, we will install 1 tube light & 2 light bulbs.

Number of fans = 1.54

So, we will install 2 fans.

For Bedroom 3:

Length = 13' = 3.96 m

Width = 11' = 3.35 m

Area, A = 13.29 m²

Room Index = 0.907

UF = 0.3355

Illuminance, E = 100 lumen/m²

Flux, F = 1800 lumen (20 W fluorescent tubelight & light bulbs)

Calculating from above formula, N = 2.44

So, we will install 1 tube light & 1 light bulb.

Number of fans = 1.43

So, we will install 1 fan.

For Drawing :

Length = 16' = 4.87 m

Width = 11'5" = 3.48 m

Area, A = 16.97 m²

Room Index = 1.01

UF = 0.3737

Illuminance, E = 150 lumen/m²

Flux, F = 1800 lumen (20 W fluorescent tube light & light bulbs)

Calculating from above formula, N = 4.20

So, we will install 2 tubelight & 2 light bulbs.

Number of fans = 1.82

So, we will install 2 fans.

For Dining:

Length = 8' = 2.44 m

Width = 8' = 2.44 m

Area, A = 5.95 m²

Room Index = 0.61

UF = 0.183

Illuminance, E = 150 lumen/m²

Flux, F = 1800 lumen (20 W fluorescent tubelight & light bulbs)

Calculating from above formula, N = 3.01

So, we will install 1 tube light & 2 light bulbs.

Number of fans = 0.64

So, we will install 1 fan.

For Living:

Length = 16' = 4.87 m

Width = 11' 7" = 3.53 m

Area, A = 17.226 m²

Room Index = 1.02

UF = 0.3786

Illuminance, E = 150 lumen/m²

Flux, F = 1800 lumen (20 W fluorescent tubelight & light bulbs)

Calculating from above formula, $N = 4.21$

So, we will install 2 tube lights & 2 light bulbs.

Number of fans = 1.85

So, we will install 2 fans.

For Study room:

Length = $6' = 1.83 \text{ m}$

Width = $11' = 3.35 \text{ m}$

Area, $A = 6.134 \text{ m}^2$

Room Index = 0.597

UF = 0.1791

Illuminance, $E = 100 \text{ lumen/m}^2$

Flux, $F = 1800 \text{ lumen (20 W fluorescent tubelight \& light bulbs)}$

Calculating from above formula, $N = 2.11$

So, we will install 1 tube light & 1 light bulb.

Number of fans = 0.66

So, we will install 1 fan.

Lobby 2nd Floor:

Length = $8' = 2.43 \text{ m}$

Width = $6' = 1.83 \text{ m}$

Area, $A = 4.46 \text{ m}^2$

Room Index = 0.522

UF = 0.156












Illuminance, $E = 80 \text{ lumen/m}^2$

Flux, $F = 1800 \text{ lumen (20 W fluorescent tubelight \& light bulbs)}$

Calculating from above formula, $N = 1.41$

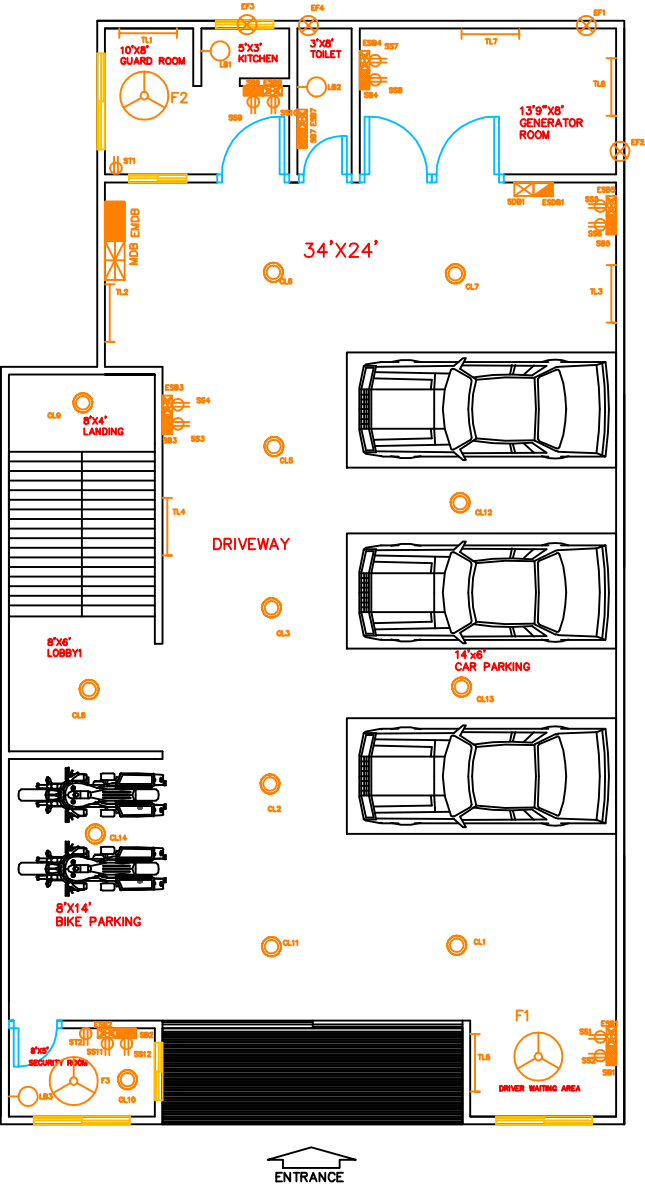
So, we will install 1 light bulb.

Fixture

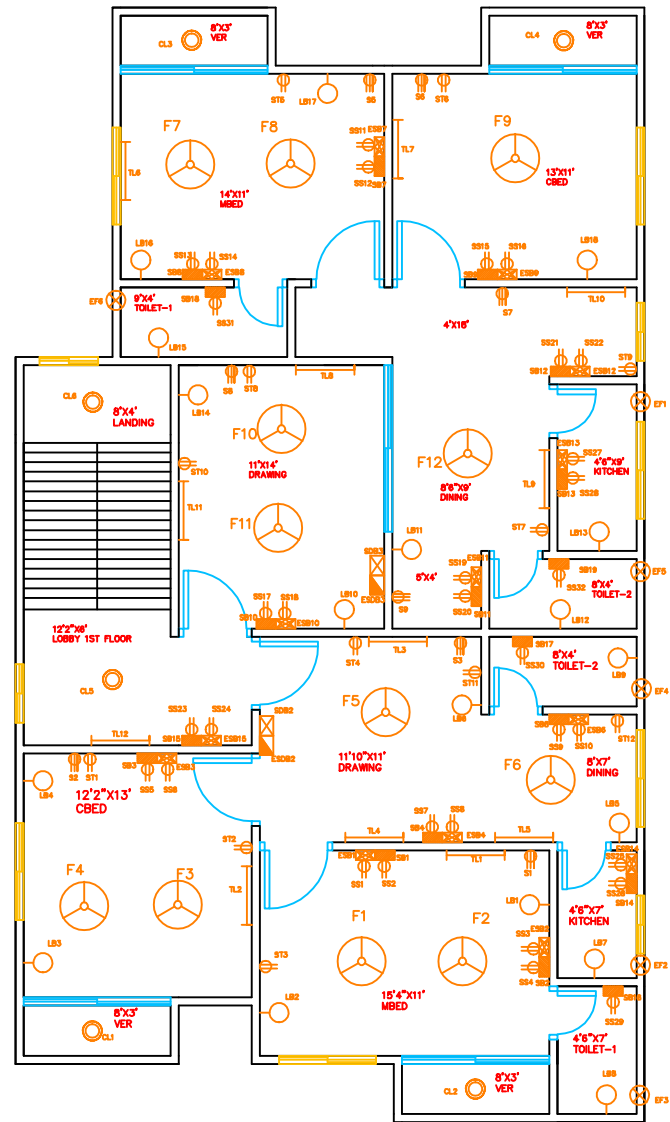
Symbol	Component Name
	Fan
	Florescent Bulb
	Tube Light
	Ceiling Light
	Exhaust Fan
	Power Socket 15A
	Power Socket 20A
	Switch board with Sockets
	Switch board + Emergency Switch board without Sockets
	Switch board + Emergency Switch board with Sockets
	Sub-Distribution Board + Emergency Sub-Distribution Board
	Main Distribution Board + Emergency Main Distribution Board

Fixture

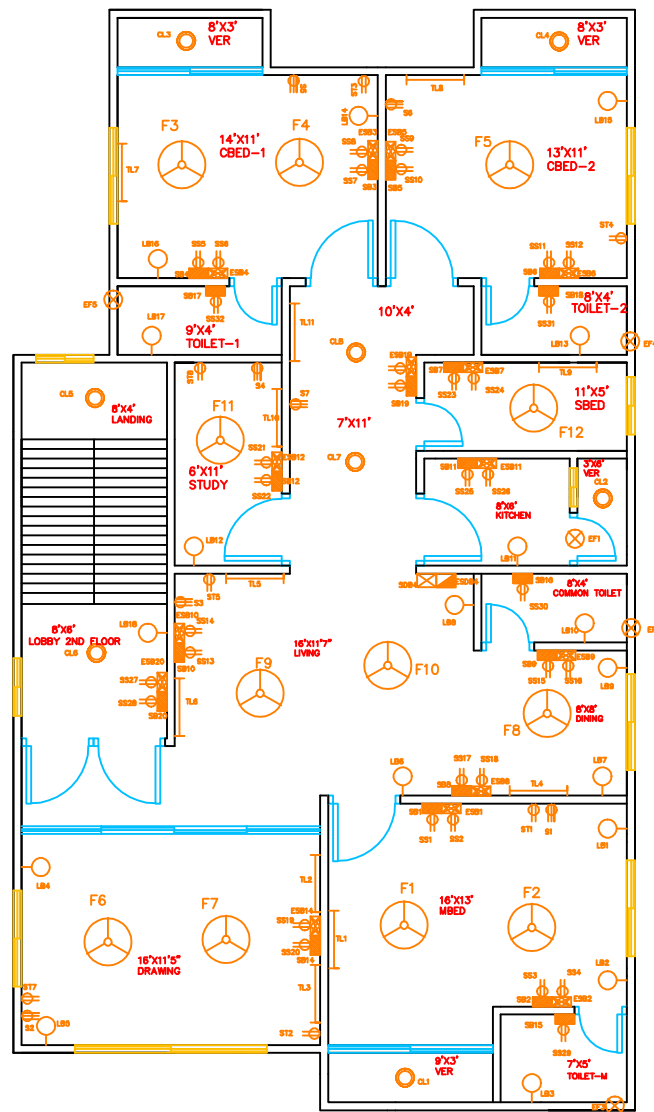
Fittings



GROUND FLOOR

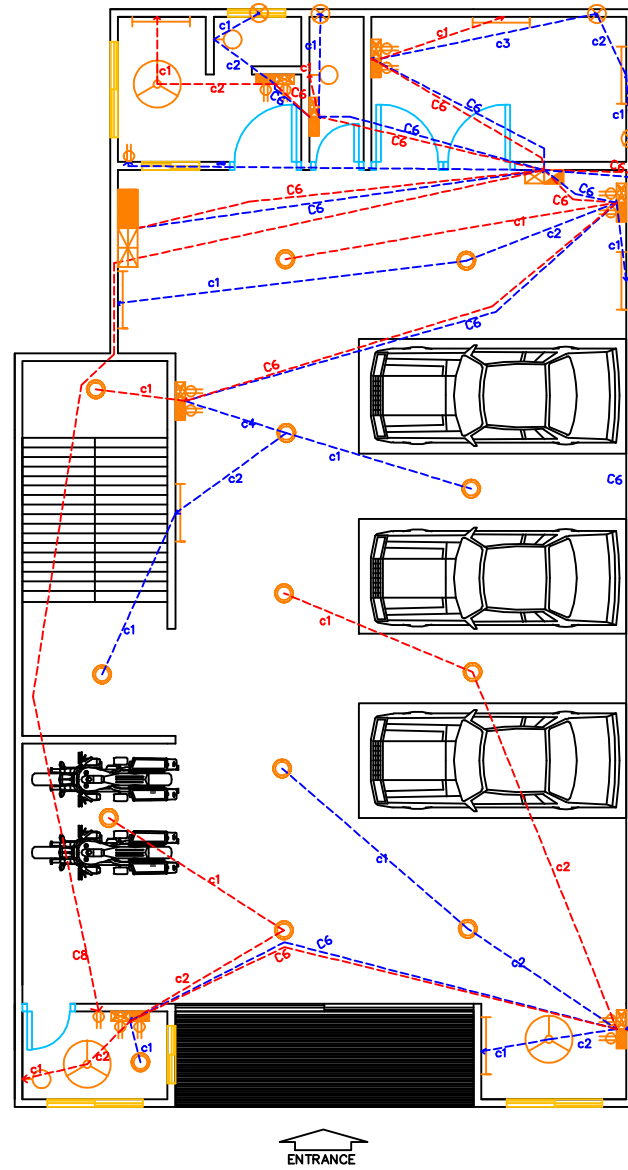


1ST FLOOR

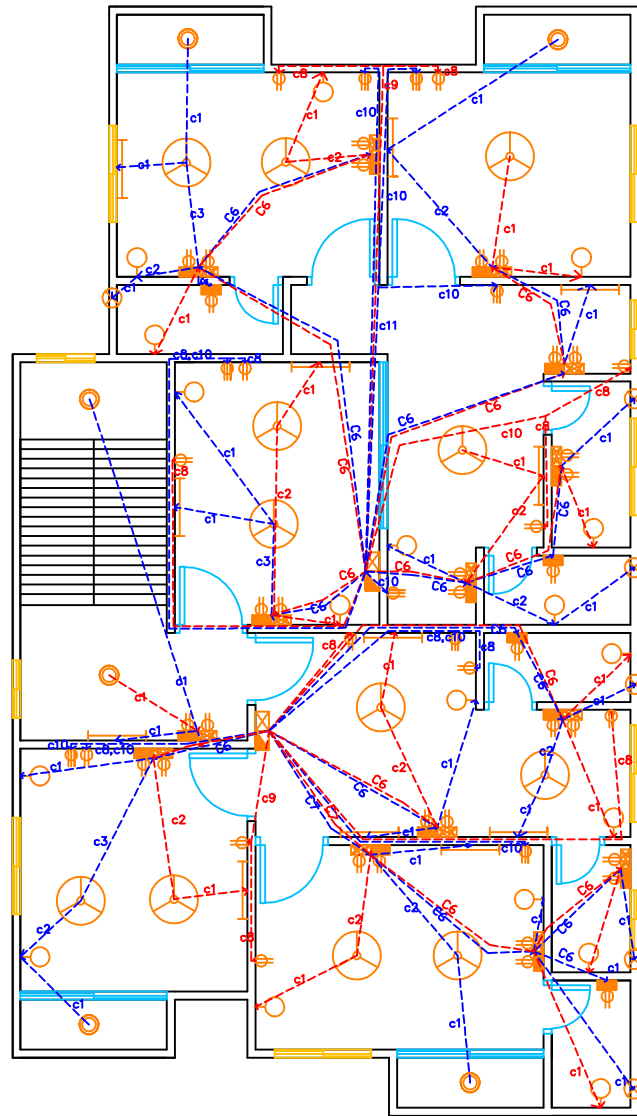


2ND FLOOR

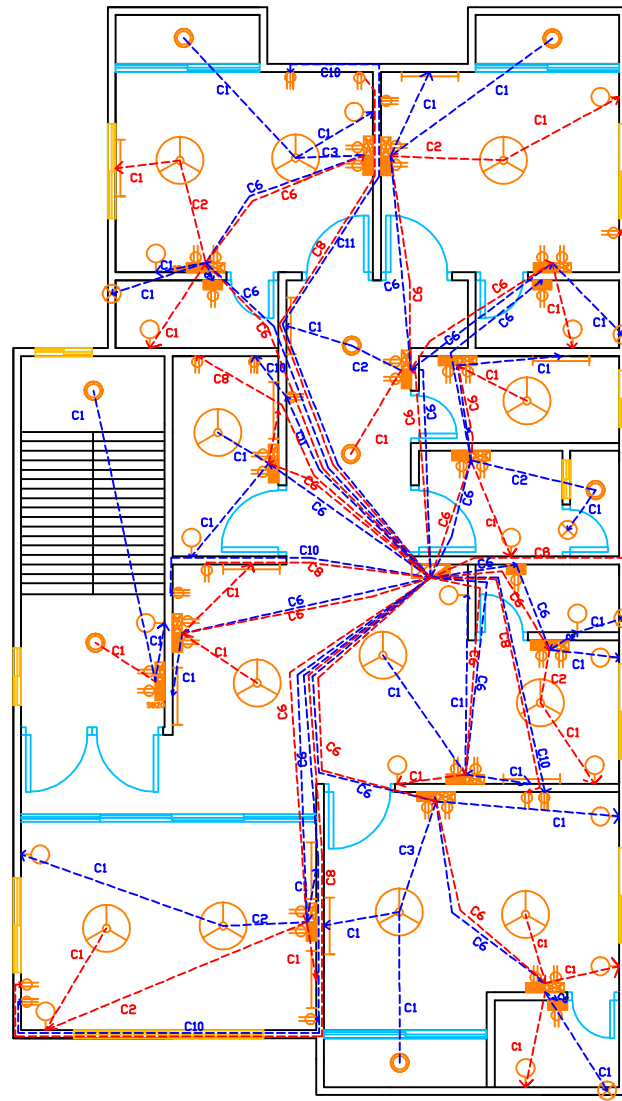
Conduit Layout



GROUND FLOOR



1ST FLOOR



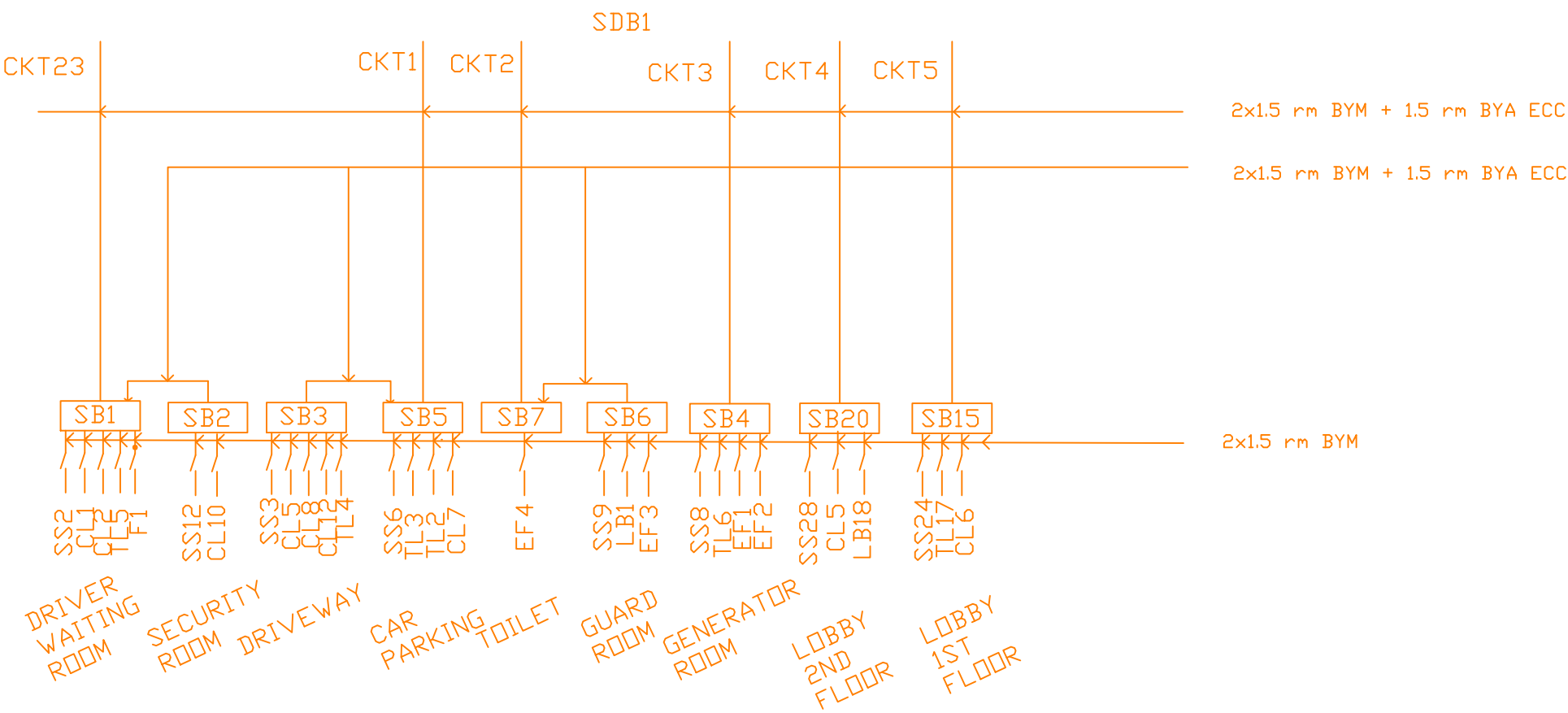
2ND FLOOR

SCHEDULE OF CONDUIT

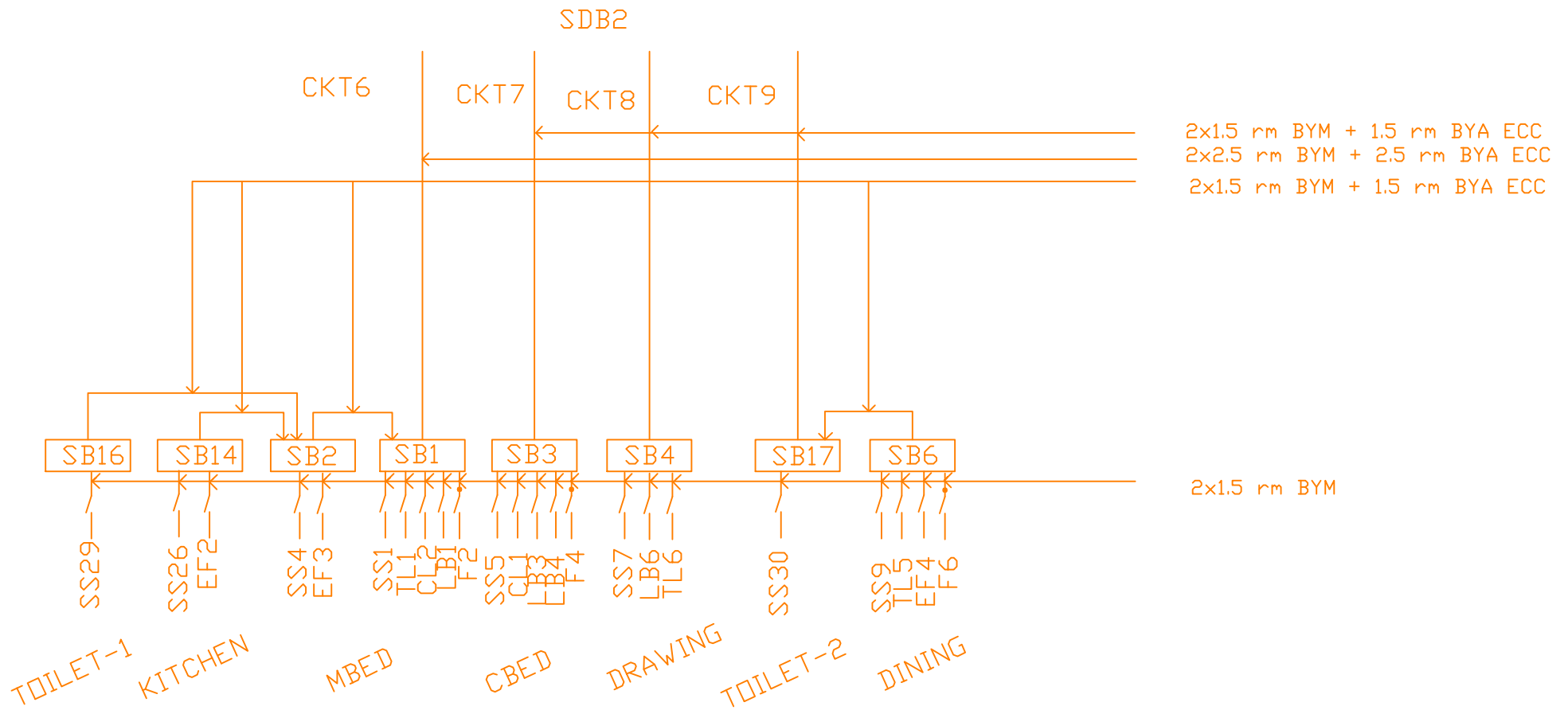
SYMBOL	CONTAINING POWER CABLE+ECC	CONDUIT SIZE
C1	2×1.5 rm BYM	16 mm
C2	4×1.5 rm BYM	20 mm
C3	6×1.5 rm BYM	25 mm
C4	8×1.5 rm BYM	30 mm
C5	10×1.5 rm BYM	30 mm
C6	2×1.5 rm BYM+1.5 rm BYA ECC	16 mm
C7	2×2.5 rm BYM+2.5 rm BYA ECC	16 mm
C8	2×4 rm BYM+4 rm BYA ECC	20 mm
C9	4×4 rm BYM+4 rm BYA ECC	25 mm
C10	2×6 rm BYM+6 rm BYA ECC	25 mm
C11	4×6 rm BYM+6 rm BYA ECC	30 mm
C12	2×10 rm BYM+10 rm BYA ECC	25 mm
C13	2×16 rm BYM+16 rm BYA ECC	30 mm
C14	2×25 rm BYM+25 rm BYA ECC	40 mm
C15	2×35 rm BYM+16 rm BYA ECC	40 mm
C16	4×35 rm BYM+16 rm BYA ECC	50 mm
C17	2×50 rm BYM+25 rm BYA ECC	50 mm

Switch Board Diagram

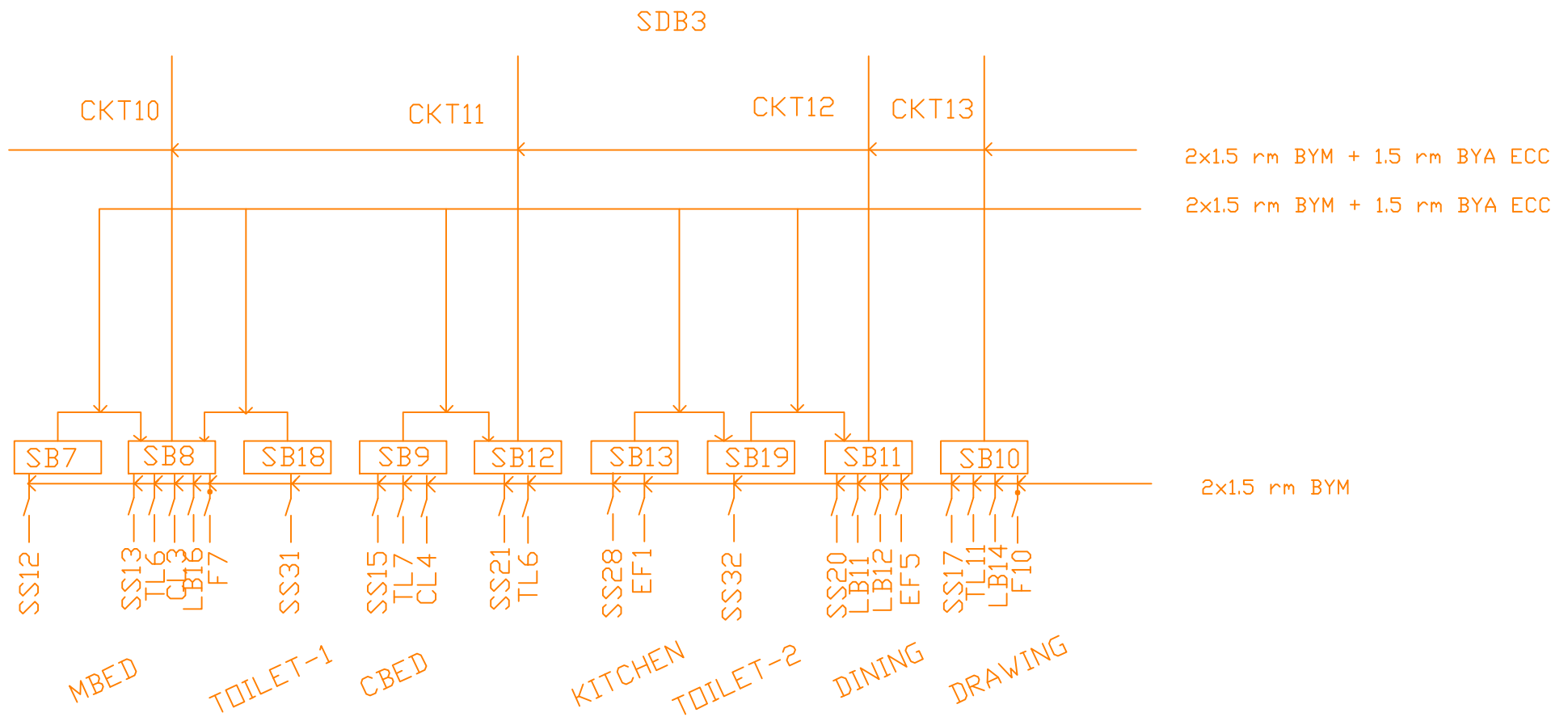
Ground floor
Switch board diagram



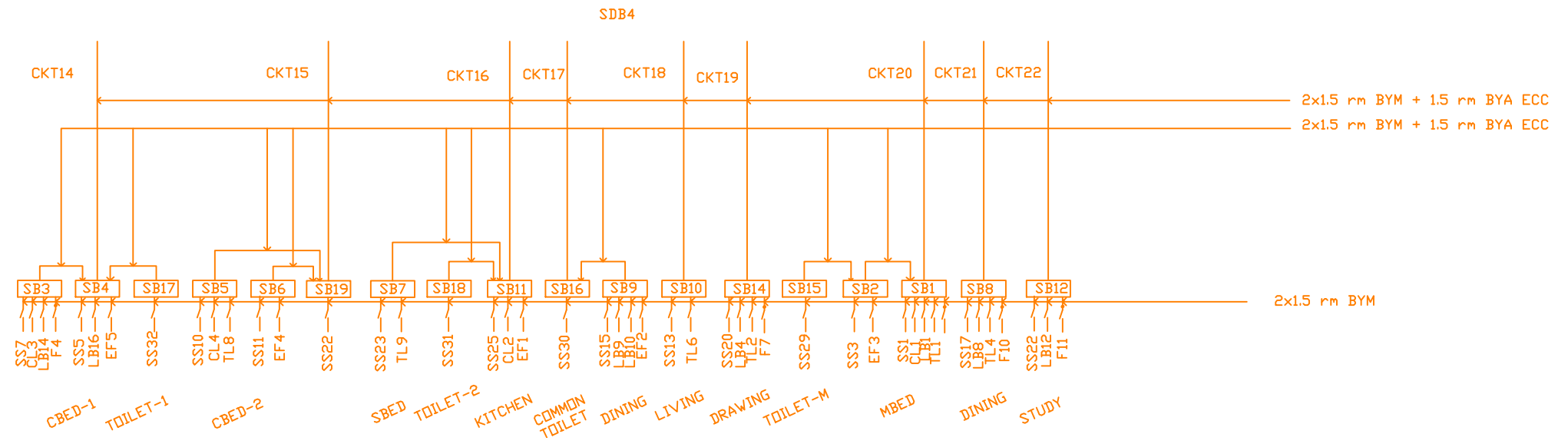
First floor Lower
Switch board diagram



First floor Upper
Switch board diagram



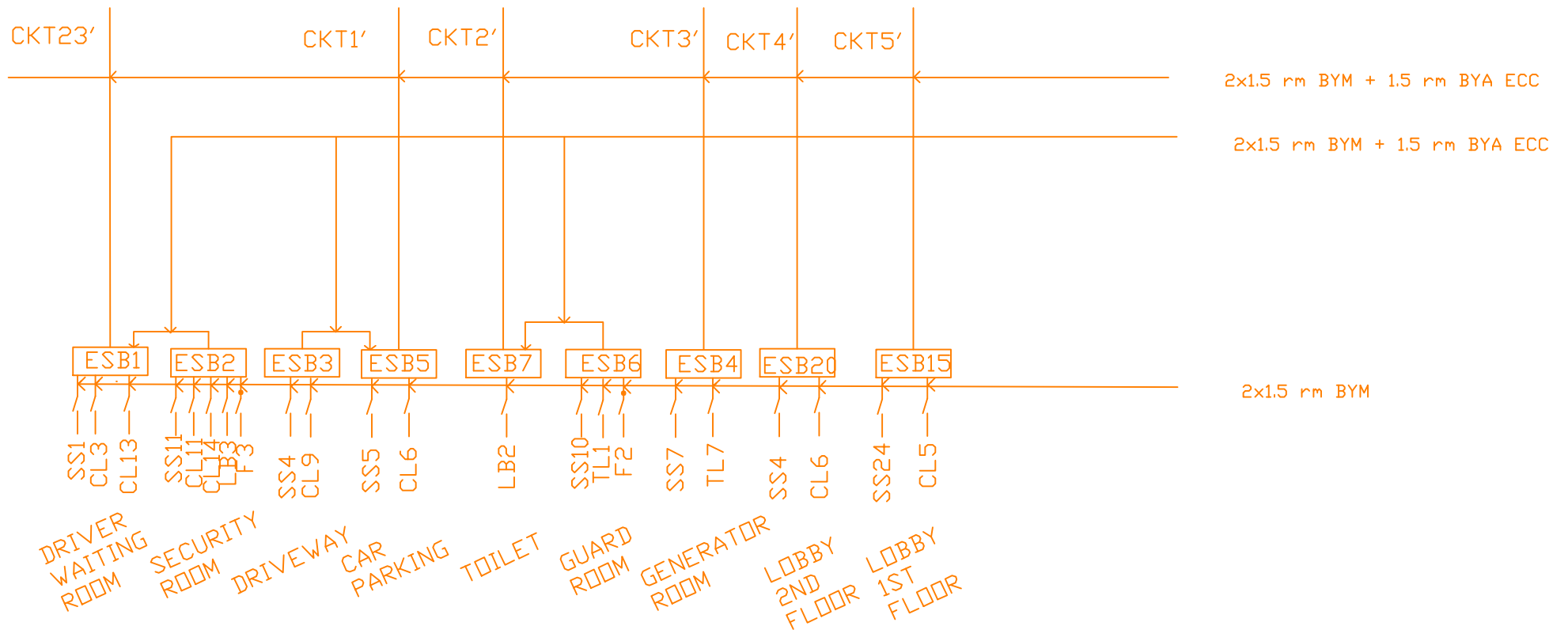
Second floor
Switch board diagram



Emergency Switch Board Diagram

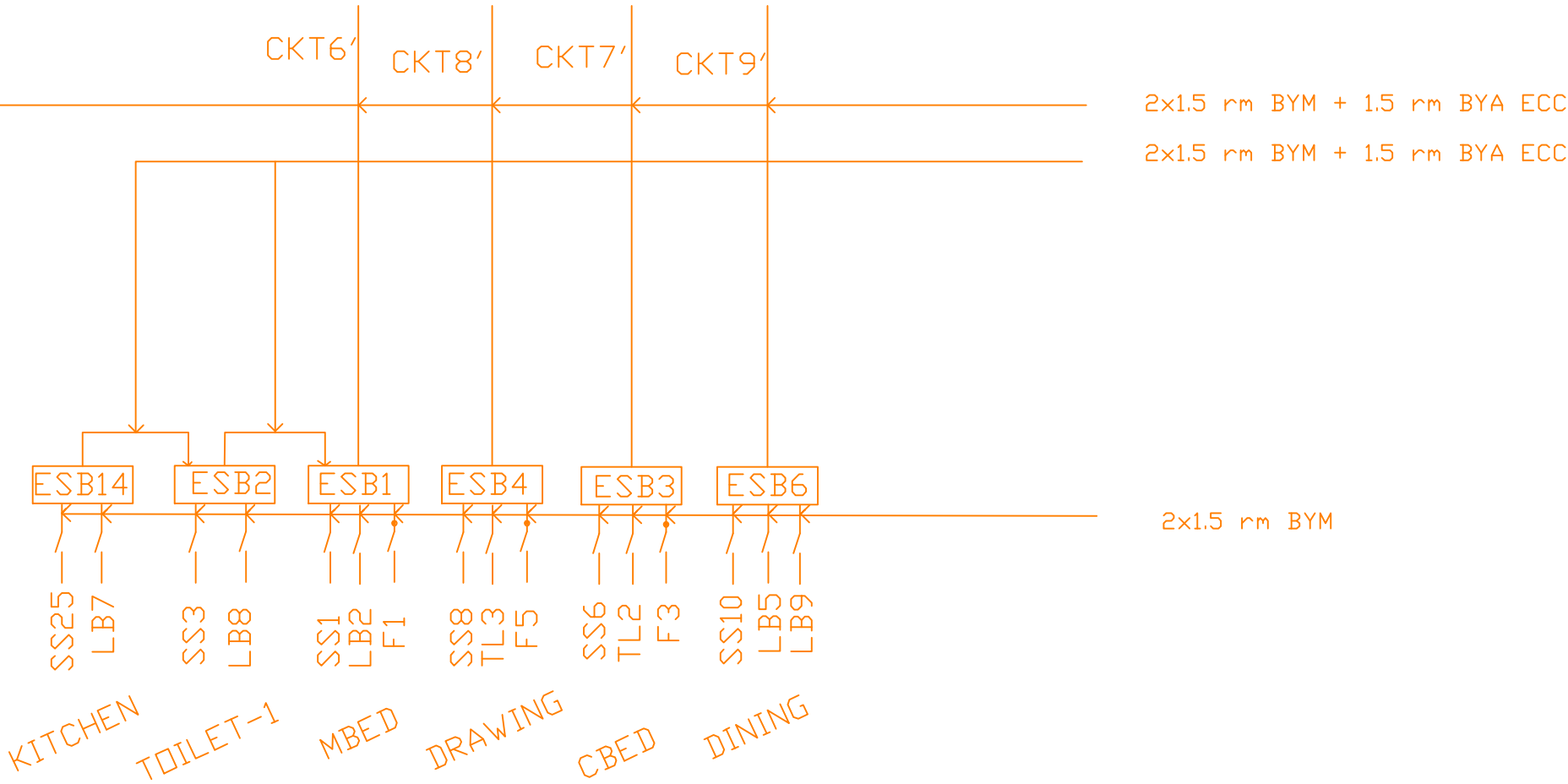
Ground floor
Emergency switch
board diagram

ESDB1



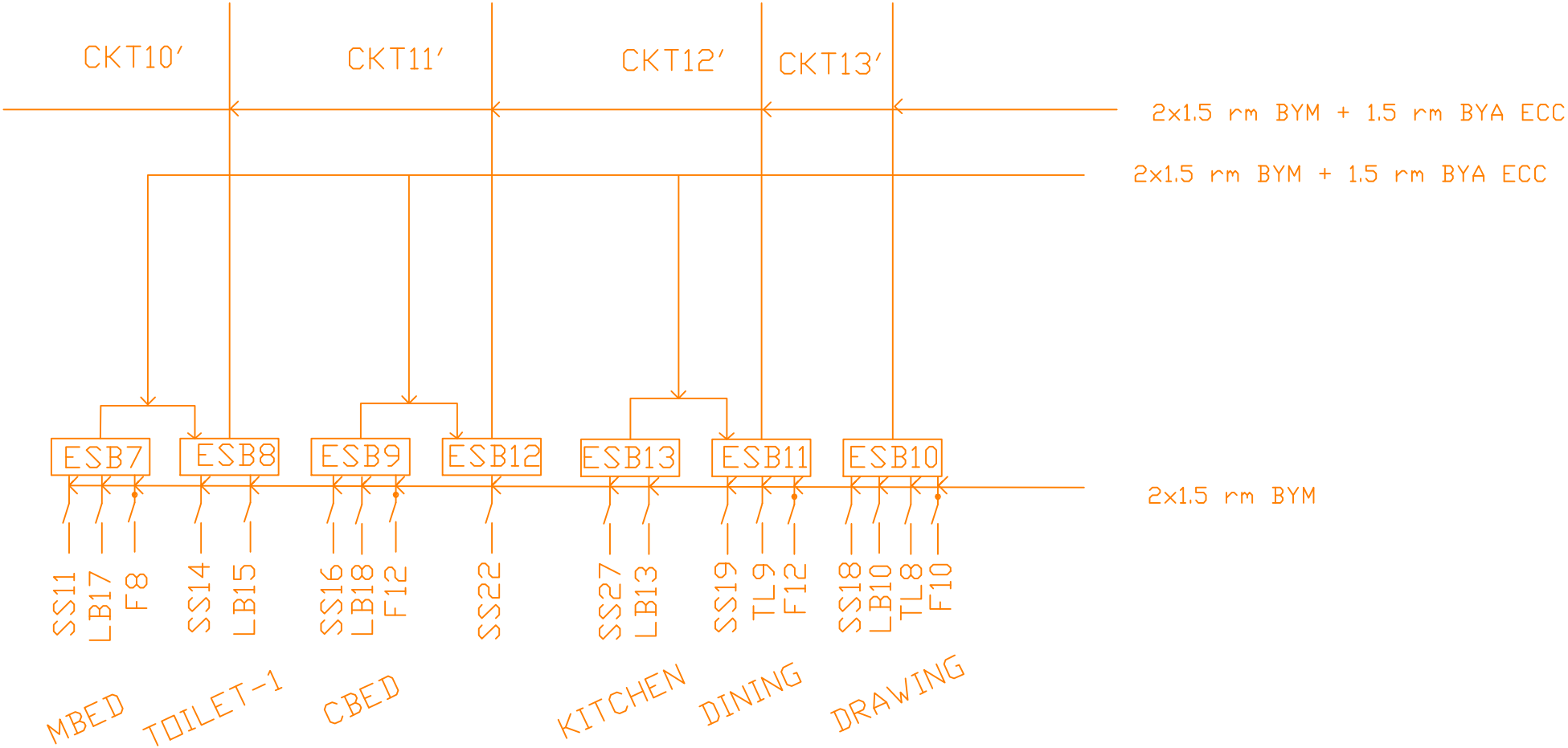
First floor lower
Emergency switch
board diagram

ESDB2



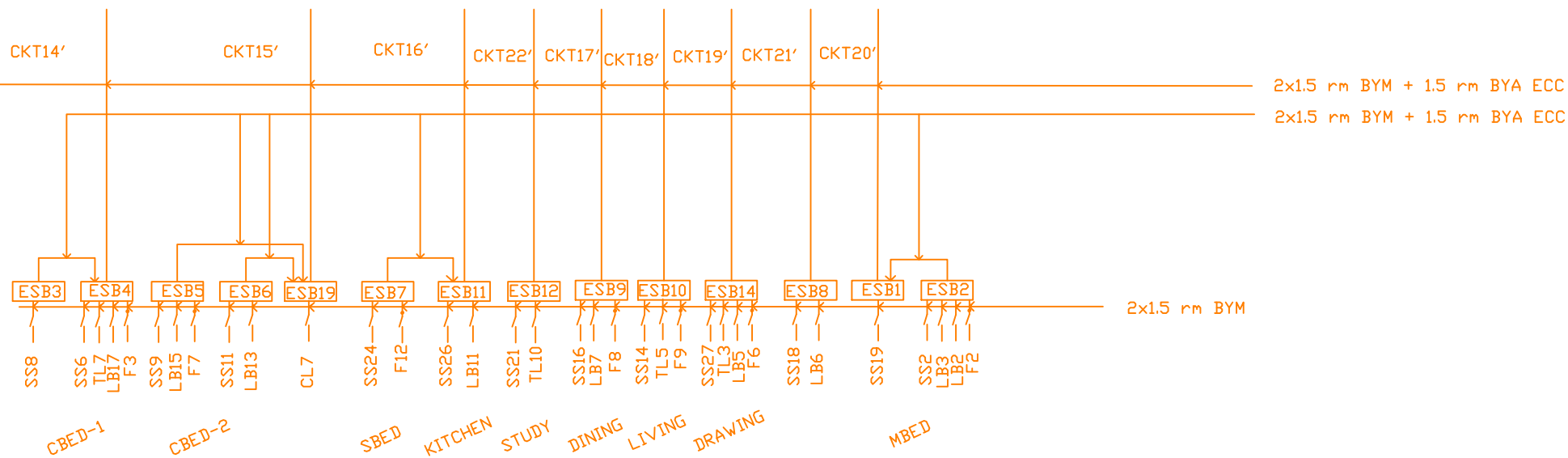
First floor Upper
Emergency switch
board diagram

ESDB3



Second floor
Emergency
Switch board diagram

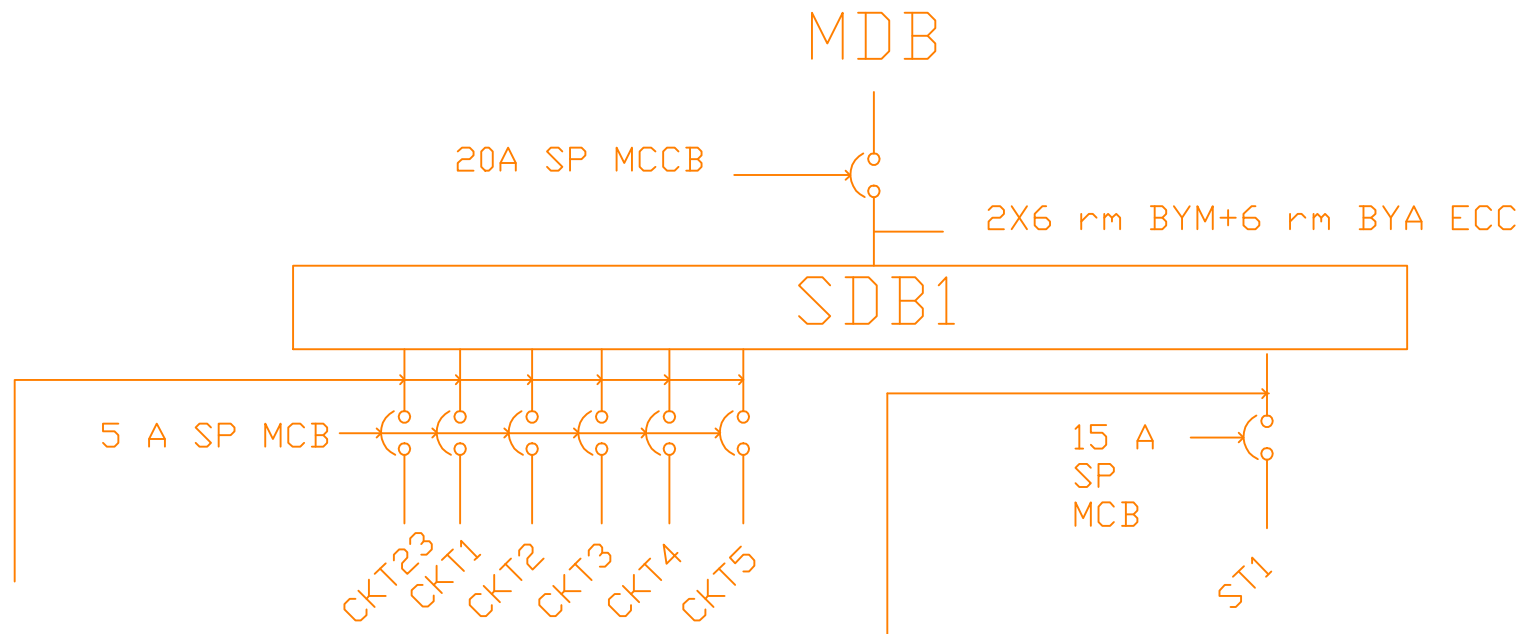
ESDB4



Sub Distribution Board Diagram

Sub distribution board diagram

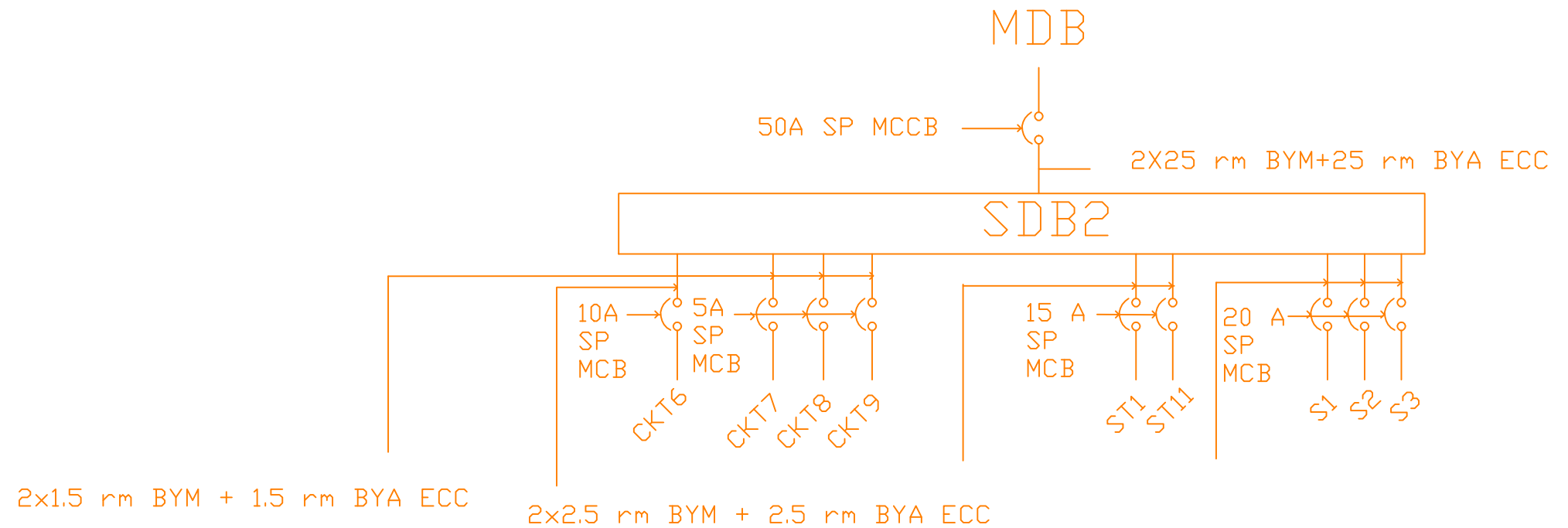
GROUND FLOOR



2x1.5 mm² BYM + 1.5 mm² BYA ECC

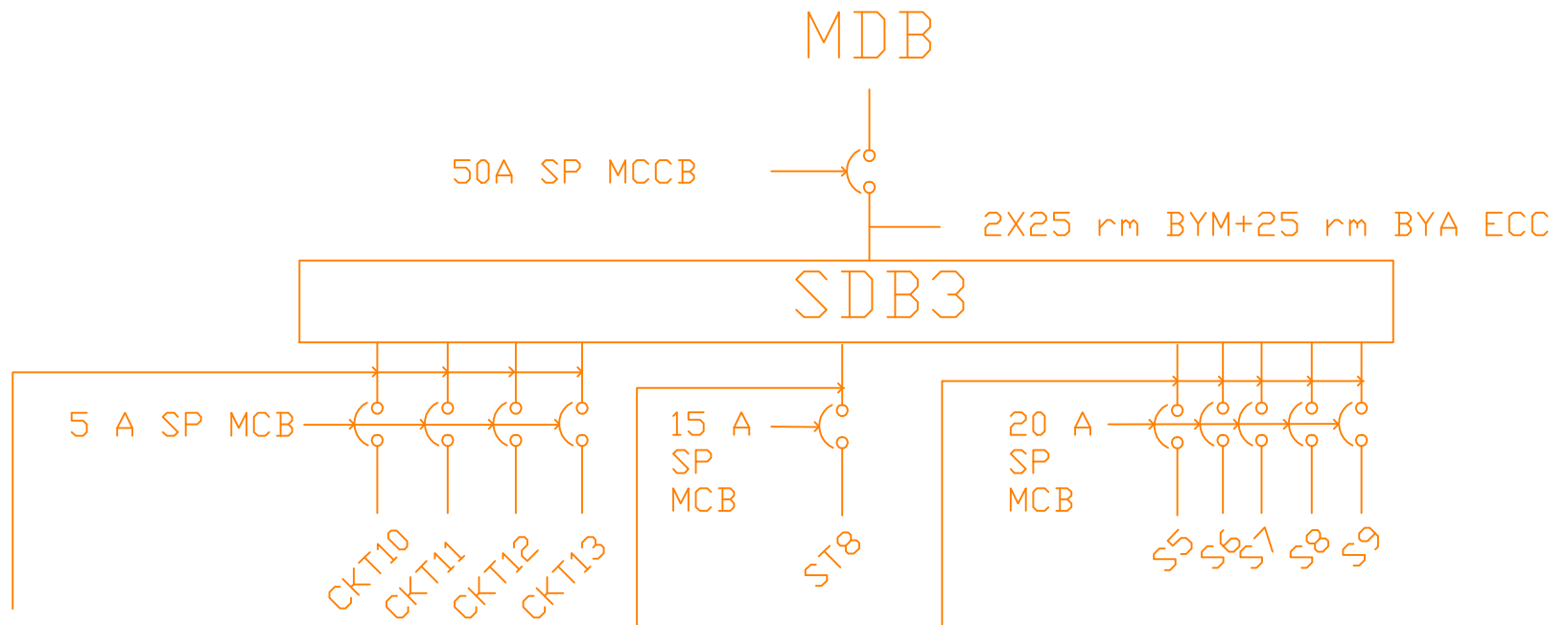
Sub distribution board diagram

1ST FLOOR (LOWER)



Sub distribution board diagram

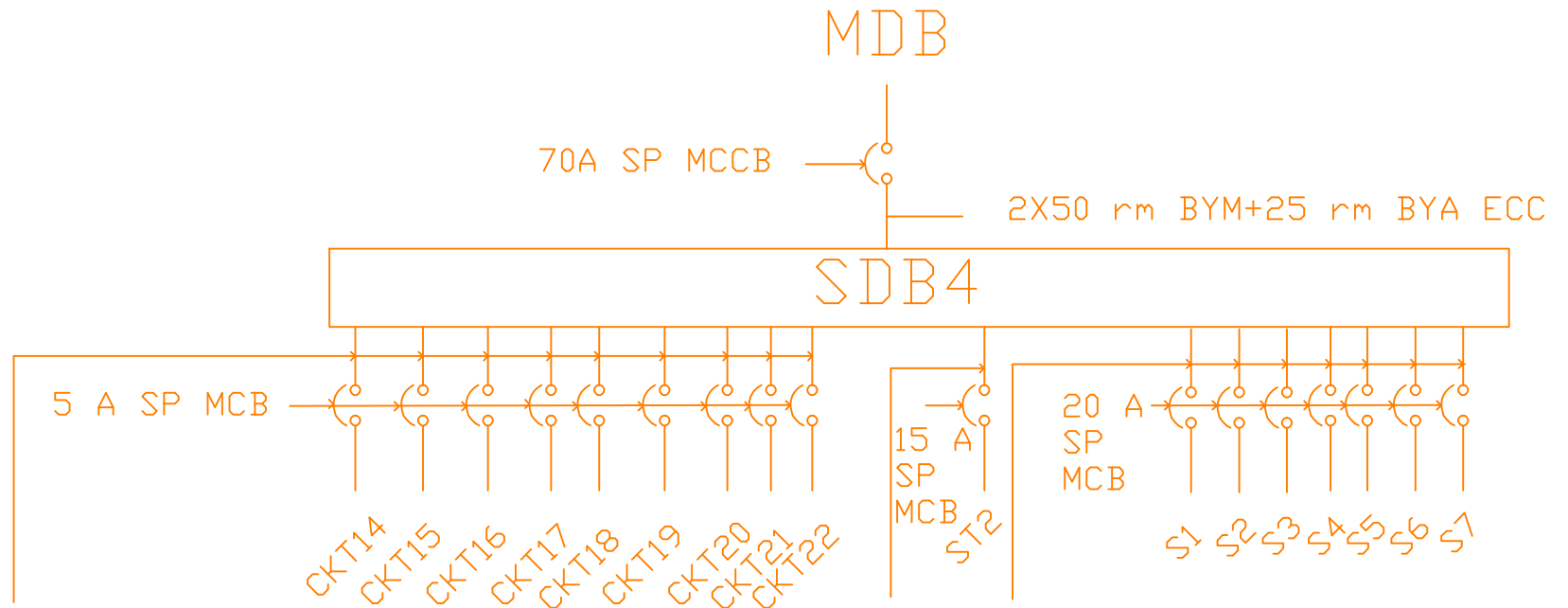
1ST FLOOR (UPPER)



2x1.5 mm² BYM + 1.5 mm² BYA ECC

Sub distribution board diagram

SECOND FLOOR

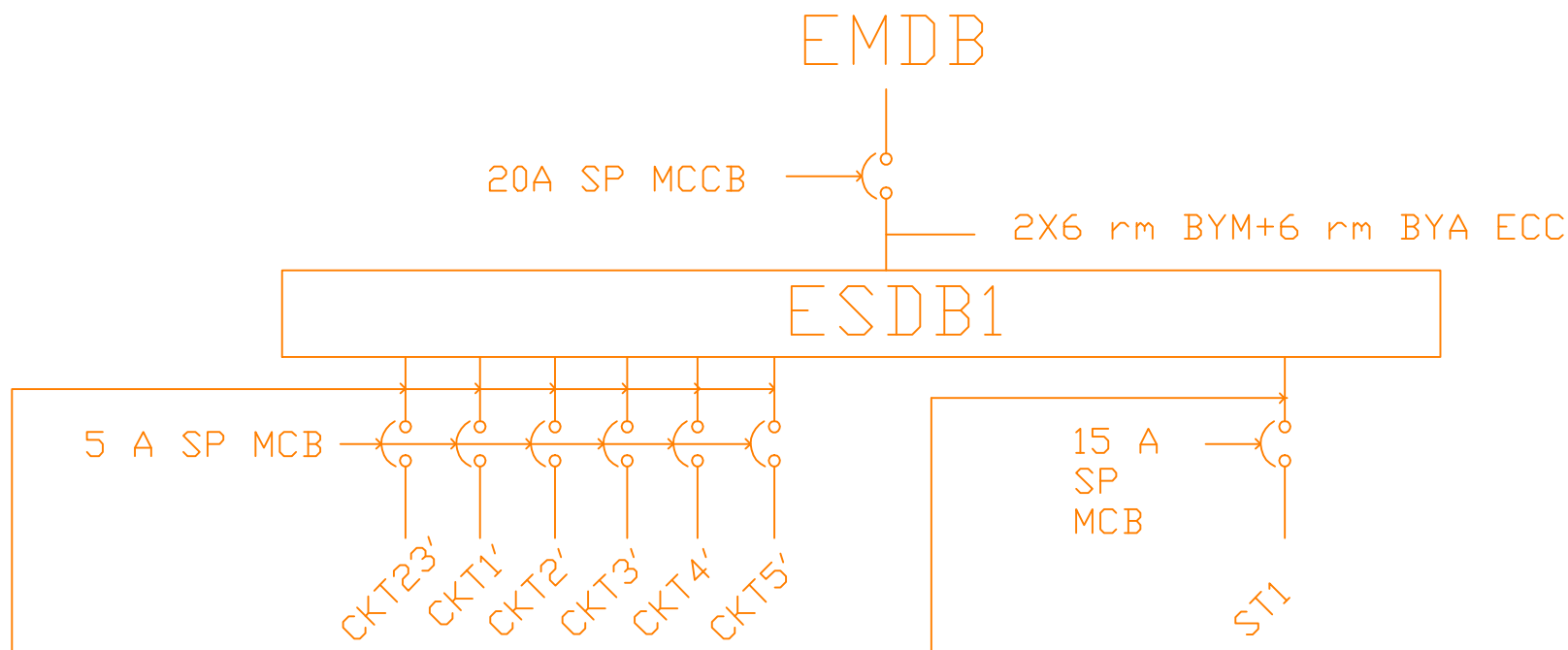


2x1.5 mm BYM + 1.5 mm BYA ECC

Emergency Sub Distribution Diagram

Emergency Sub distribution
board diagram

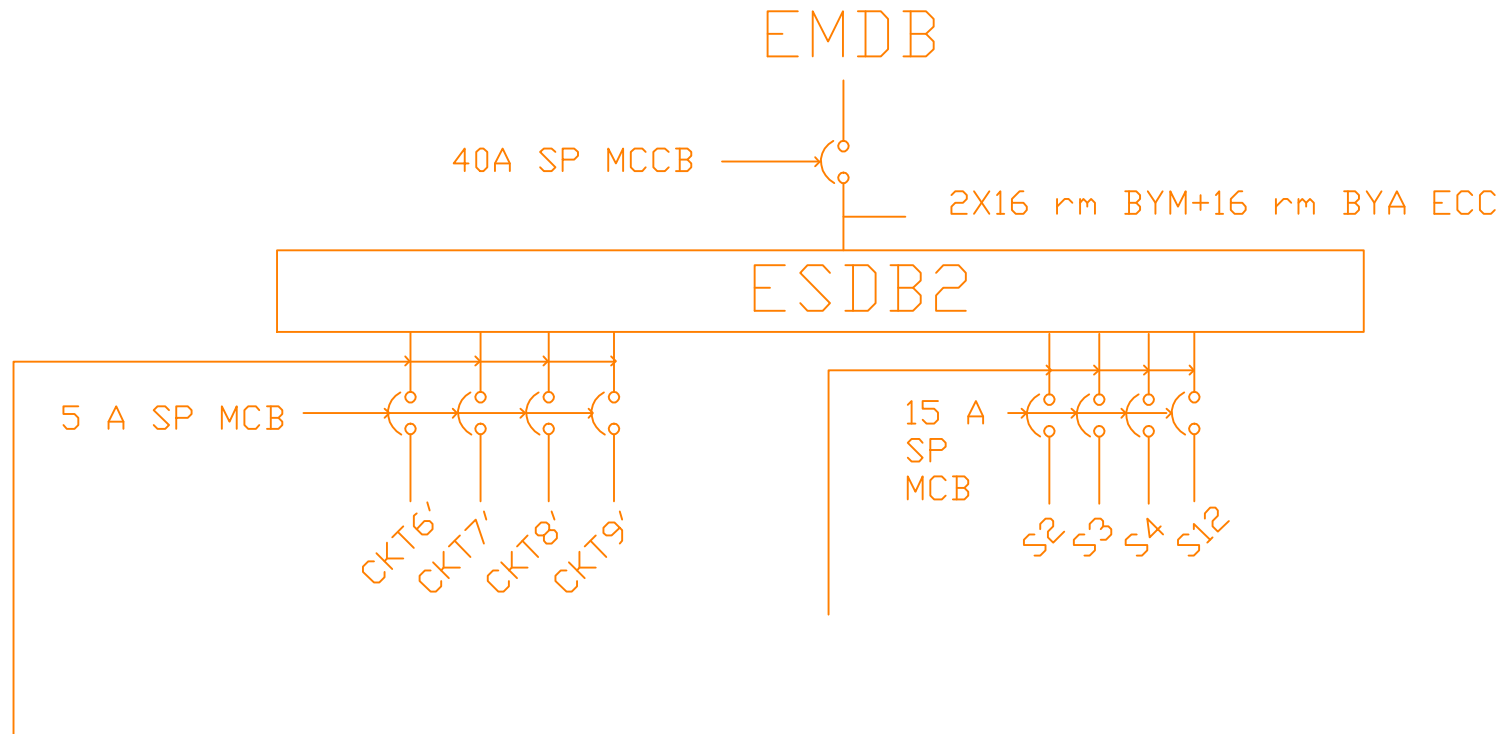
GROUND FLOOR



2x1.5 rm BYM + 1.5 rm BYA ECC

Emergency Sub distribution board diagram

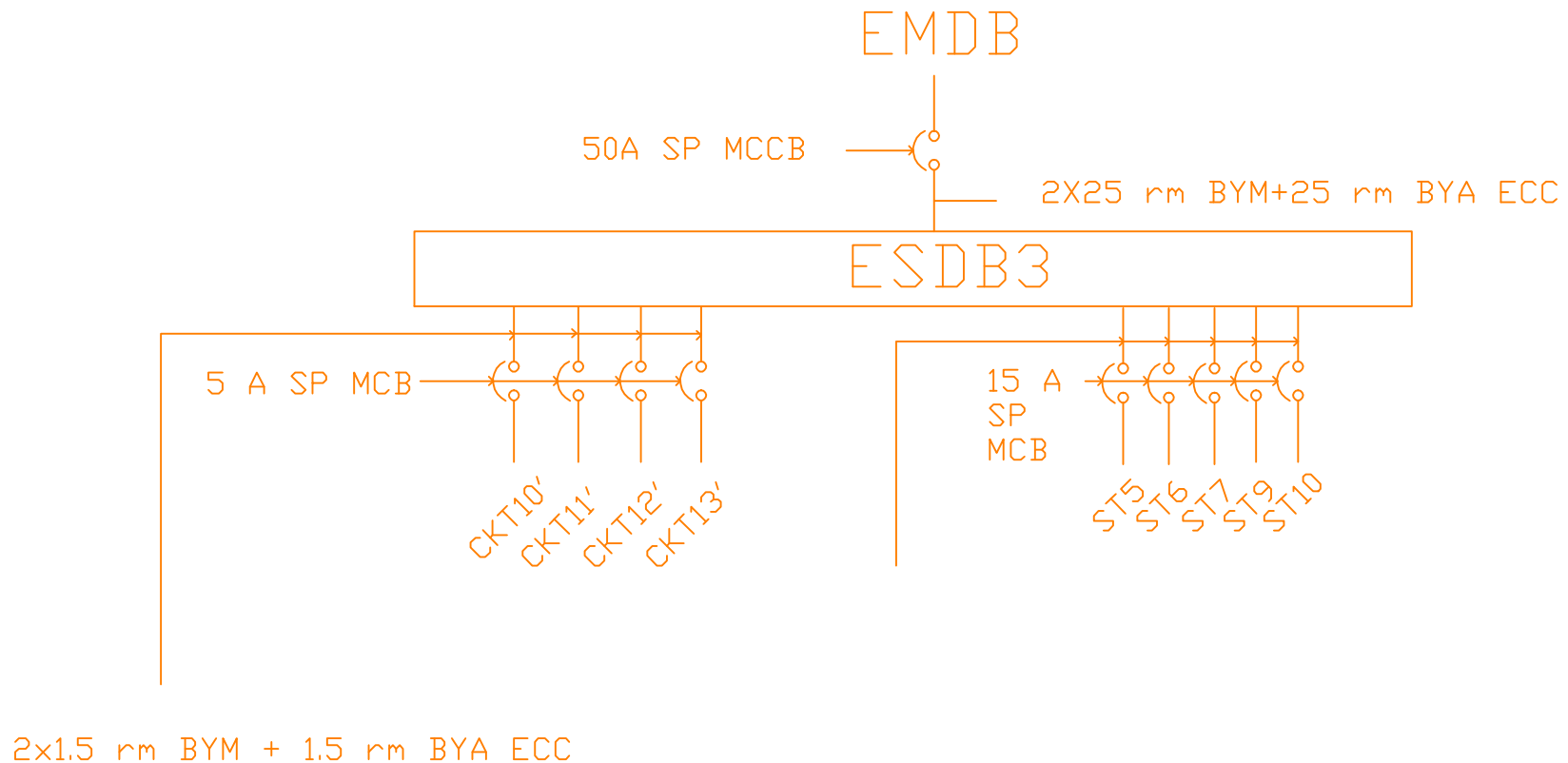
1ST FLOOR
(LOWER)



2x1.5 mm² BYM + 1.5 mm² BYA ECC

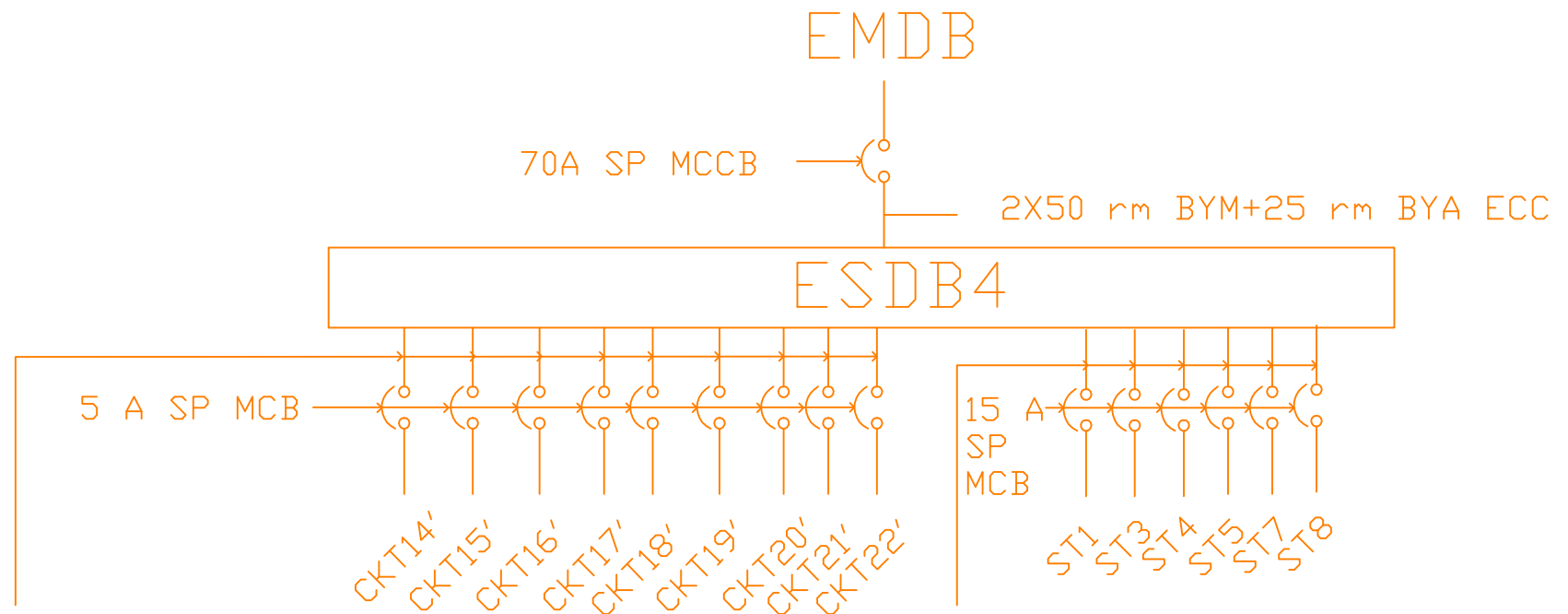
Emergency Sub distribution board diagram

1ST FLOOR
(UPPER)

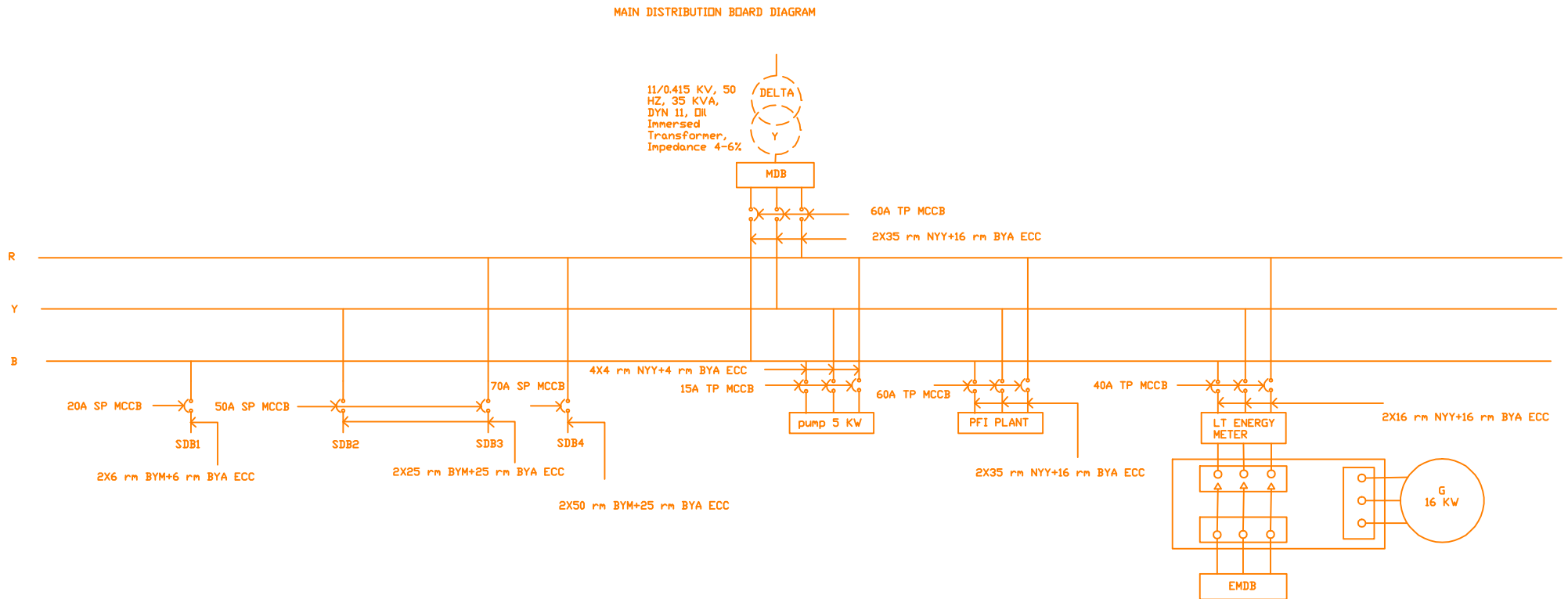


Emergency Sub distribution board diagram

SECOND FLOOR

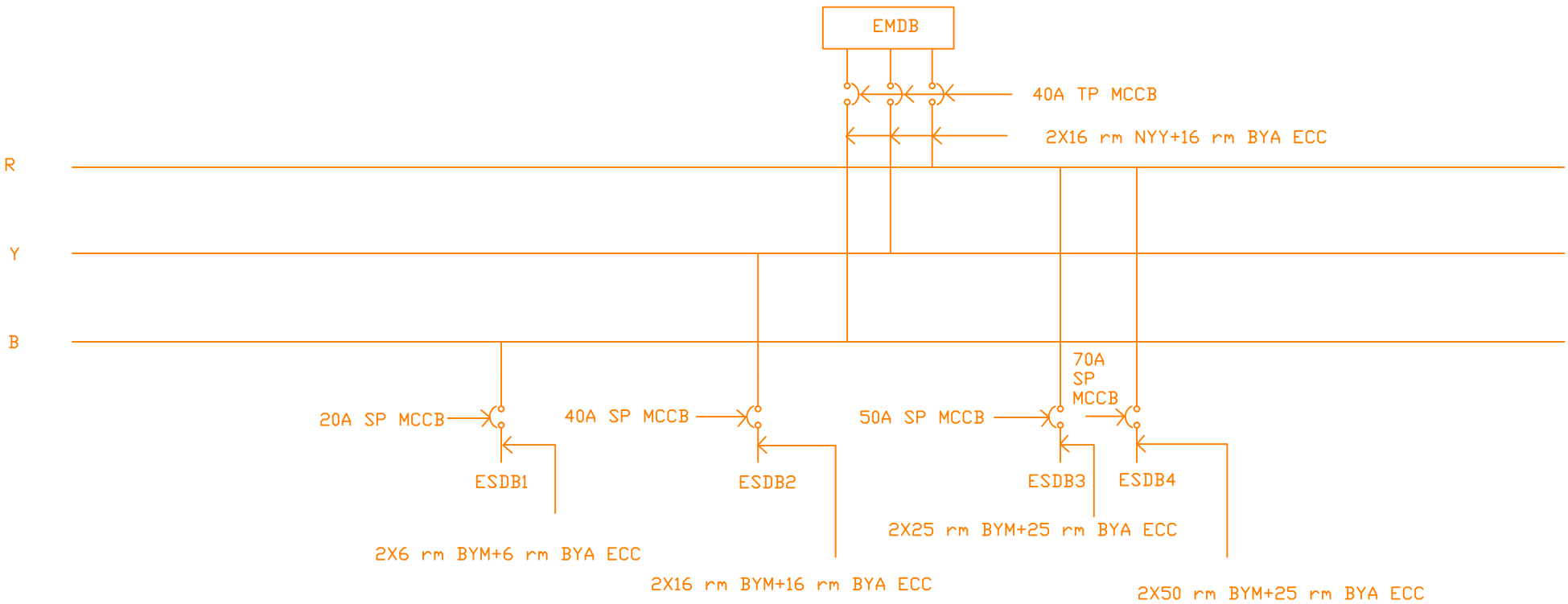


Main Distribution Board Diagram



Emergency Main Distribution Board Diagram

CONNECCTION DIAGRAM OF EMDB



Calculations for Conduits

Formula for Ampere Rating, $I = \frac{P}{V * pf}$ (A)

Pf = 0.7 is considered on an average

Fan = 100 W

Ceiling Light = 24 W

Tubelight = 45 W

Light Bulb = 20 W

Exhaust Fan = 50 W

Switch Board Socket = 100 W

Power Socket 1 (ST) = 2000 W

Power Socket 2 (S) = 3000 W

All internal wires are below 5 A rating so 2 X 1.5 rm BYM is used in all internal wiring.

To Sub Distribution Board (SDB)

● Ground Floor

CKT1 Rating:

$$I = \frac{(3*24)+45+100+24+(2*45)+100}{220 * 0.7} = 2.799 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT2 Rating:

$$I = \frac{50+20+50+100}{220 * 0.7} = 1.429 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT3 Rating:

$$I = \frac{45 + (2 \times 50) + 100}{220 \times 0.7} = 1.591 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT4 Rating:

$$I = \frac{24 + 20 + 100}{220 \times 0.7} = 0.935 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT5 Rating:

$$I = \frac{24 + 45 + 100}{220 \times 0.7} = 1.097 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT23 Rating:

$$I = \frac{24 + 100 + 100 + (2 \times 24) + 45 + 100}{220 \times 0.7} = 2.708 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

- **First Floor (Lower)**

CKT6 Rating:

$$I = \frac{100 + 24 + 45 + 100 + 20 + 50 + 100 + 100 + 50 + 100}{220 \times 0.7} = 4.474 \text{ A}$$

So, 2 X 2.5 rm BYM + 2.5 BYA ECC are used.

CKT7 Rating:

$$I = \frac{100+24+(2*20)+100}{220 * 0.7} = 1.714 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT8 Rating:

$$I = \frac{45+20+100}{220 * 0.7} = 1.071 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT9 Rating:

$$I = \frac{100+100+45+50+100}{220 * 0.7} = 2.565 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

- **First Floor (Upper)**

CKT10 Rating:

$$I = \frac{100+100+24+45+20+50+100+100}{220 * 0.7} = 3.500 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT11 Rating:

$$I = \frac{24+45+100+45+100}{220 * 0.7} = 2.039 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT12 Rating:

$$I = \frac{50+100+100+(2*20)+50+100}{220 * 0.7} = 2.857 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT13 Rating:

$$I = \frac{100+45+20+100}{220 * 0.7} = 1.721 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

- **Top Floor**

CKT14 Rating:

$$I = \frac{100+24+20+100+20+50+100+100}{220 * 0.7} = 3.338 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT15 Rating:

$$I = \frac{24+45+100+50+100+24+100}{220 * 0.7} = 2.877 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT16 Rating:

$$I = \frac{45+100+24+50+100+100}{220 * 0.7} = 2.721 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT17 Rating:

$$I = \frac{100 + (2 \times 20) + 50 + 100}{220 \times 0.7} = 1.883 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT18 Rating:

$$I = \frac{45 + 100}{220 \times 0.7} = 0.942 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT19 Rating:

$$I = \frac{100 + 45 + 20 + 100}{220 \times 0.7} = 1.721 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT20 Rating:

$$I = \frac{100 + 24 + 45 + 20 + 100 + 50 + 100 + 100}{220 \times 0.7} = 3.500 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT21 Rating:

$$I = \frac{100 + 45 + 20 + 100}{220 \times 0.7} = 1.721 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT22 Rating:

$$I = \frac{100+20+100}{220 * 0.7} = 1.428 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

To Emergency Sub Distribution Board (ESDB)

- **Ground Floor**

CKT1' Rating:

$$I = \frac{24+100+24+100}{220 * 0.7} = 1.610 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT2' Rating:

$$I = \frac{20+100+45+100}{220 * 0.7} = 1.721 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT3' Rating:

$$I = \frac{45+100}{220 * 0.7} = 0.942 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT4' Rating:

$$I = \frac{24+100}{220 * 0.7} = 0.805 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT5' Rating:

$$I = \frac{24+100}{220 * 0.7} = 0.805 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT23' Rating:

$$I = \frac{100+(2*24)+20+100+(2*24)+100}{220 * 0.7} = 2.701 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

- **First Floor (Lower)**

CKT6' Rating:

$$I = \frac{100+20+100+20+100+20+100}{220 * 0.7} = 2.987 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT7' Rating:

$$I = \frac{100+45+100}{220 * 0.7} = 1.591 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT8' Rating:

$$I = \frac{100+45+100}{220 * 0.7} = 1.591 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT9' Rating:

$$I = \frac{(2*20)+100}{220 * 0.7} = 0.909 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

- **First Floor (Upper)**

CKT10' Rating:

$$I = \frac{100+20+100+20+100}{220 * 0.7} = 2.208 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT11' Rating:

$$I = \frac{100+20+100+100}{220 * 0.7} = 2.078 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT12' Rating:

$$I = \frac{20+100+100+45+100}{220 * 0.7} = 2.370 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT13' Rating:

$$I = \frac{100+45+20+100}{220 * 0.7} = 1.721 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

- **Top Floor**

CKT14' Rating:

$$I = \frac{100+100+45+20+100}{220 * 0.7} = 2.370 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT15' Rating:

$$I = \frac{100+20+100+20+100+24+100}{220 * 0.7} = 3.013 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT16' Rating:

$$I = \frac{100+100+20+100}{220 * 0.7} = 2.078 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT17' Rating:

$$I = \frac{100+20+100}{220 * 0.7} = 1.429 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT18' Rating:

$$I = \frac{100+45+100}{220 * 0.7} = 1.591 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT19' Rating:

$$I = \frac{100+45+20+100}{220 * 0.7} = 1.721 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT20' Rating:

$$I = \frac{100+100+(2*20)+100}{220 * 0.7} = 2.987 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT21' Rating:

$$I = \frac{20+100}{220 * 0.7} = 0.779 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

CKT22' Rating:

$$I = \frac{45+100}{220 * 0.7} = 0.942 \text{ A}$$

So, 2 X 1.5 rm BYM + 1.5 BYA ECC are used.

Calculations for SDB

$$\text{SDB Load} = \text{Total load} * 0.7 + \text{Total ST socket} * 0.5 + \text{Total S socket} * 0.25$$

$$\text{SDB Current} = \frac{\text{SDB load}}{\text{Voltage} * \text{pf}}$$

$$\text{ST load} = 2000 \text{ W}$$

$$\text{S load} = 3000 \text{ W}$$

$$\text{Voltage} = 220 \text{ V}$$

$$\text{Power Factor, pf} = 0.7$$

● Ground Floor

$$\text{Total Load} = \text{CKT1 load} + \text{CKT2 load} + \text{CKT3 load} + \text{CKT4 load} + \text{CKT5 load} + \text{CKT23 load}$$

$$\text{Total Load} = 1626 \text{ W}$$

$$\text{SDB Load} = 1626 * 0.7 + 1 * 2000 * 0.5 = 2138.2 \text{ W}$$

$$\text{SDB Current} = \frac{2138.2}{220 * 0.7} = 13.884 \text{ A}$$

So, 20A SP MCCB is needed from SDB to MDB.

● First Floor (Lower)

$$\text{Total Load} = \text{CKT6 load} + \text{CKT7 load} + \text{CKT8 load} + \text{CKT9 load}$$

$$\text{Total Load} = 1513 \text{ W}$$

$$\text{SDB Load} = 1513 * 0.7 + 2 * 2000 * 0.5 + 3 * 3000 * 0.25 = 5309.1 \text{ W}$$

$$\text{SDB Current} = \frac{5309.1}{220 * 0.7} = 34.475 \text{ A}$$

So, 50A SP MCCB is needed from SDB to MDB.

● First Floor (Upper)

$$\text{Total Load} = \text{CKT10 load} + \text{CKT11 load} + \text{CKT12 load} + \text{CKT13 load}$$

$$\text{Total Load} = 1558 \text{ W}$$

$$\text{SDB Load} = 1558 * 0.7 + 1 * 2000 * 0.5 + 5 * 3000 * 0.25 = 5840.6 \text{ W}$$

$$\text{SDB Current} = \frac{5840.6}{220 * 0.7} = 37.926 \text{ A}$$

So, 50A SP MCCB is needed from SDB to MDB.

- **Top Floor**

Total Load = CKT14 load + CKT15 load + CKT16 load + CKT17 load + CKT18 load + CKT19 load + CKT20 load + CKT21 load

Total Load = 3100 W

SDB Load = $3100 * 0.7 + 1 * 2000 * 0.5 + 7 * 3000 * 0.25 = 8420 \text{ W}$

SDB Current = $\frac{8420}{220 * 0.7} = 54.675 \text{ A}$

So, 70A SP MCCB is needed from SDB to MDB.

Calculations for ESDB

SDB Load = Total load * 0.7 + Total ST socket * 0.5 + Total S socket * 0.25

SDB Current = $\frac{SDB \text{ load}}{Voltage * pf}$

ST load = 2000 W

S load = 3000 W

Voltage = 220 V

Power Factor, pf = 0.7

- **Ground Floor**

Total Load = CKT1' load + CKT2' load + CKT3' load + CKT4' load + CKT5' load + CKT22' load

Total Load = 1322 W

SDB Load = $1322 * 0.7 + 1 * 2000 * 0.5 = 1925.4 \text{ W}$

SDB Current = $\frac{1925.4}{220 * 0.7} = 12.503 \text{ A}$

So, 20A SP MCCB is needed from SDB to MDB.

- **First Floor (Lower)**

Total Load = CKT6' load + CKT7' load + CKT8' load + CKT9' load

Total Load = 1090W

SDB Load = $1090 * 0.7 + 4 * 2000 * 0.5 = 4763 \text{ W}$

SDB Current = $\frac{4763}{220 * 0.7} = 30.929 \text{ A}$

So, 40A SP MCCB is needed from SDB to MDB.

- **First Floor (Upper)**

Total Load = CKT10' load + CKT11' load + CKT12' load + CKT13' load

Total Load = 1290 W

SDB Load = $1290 * 0.7 + 5 * 2000 * 0.5 = 5903 \text{ W}$

SDB Current = $\frac{5840.6}{220 * 0.7} = 38.331 \text{ A}$

So, 50A SP MCCB is needed from SDB to MDB.

- **Top Floor**

Total Load = CKT14' load + CKT15' load + CKT16' load + CKT17' load +
CKT18' load + CKT19' load + CKT20' load + CKT21' load

Total Load = 2484 W

SDB Load = $2484 * 0.7 + 6 * 2000 * 0.5 = 7738.8 \text{ W}$

SDB Current = $\frac{7738.8}{220 * 0.7} = 50.252 \text{ A}$

So, 70A SP MCCB is needed from SDB to MDB.

Calculations for EMDB

$$\text{EMDB Load} = \text{Total ESDB Load} * 0.7$$

$$\text{Total ESDB Load} = 20330.2 \text{ W}$$

$$\text{EMDB Load} = 20330.2 * 0.7 = 14231.12 \text{ W}$$

$$\begin{aligned}\text{EMDB Current} &= \frac{\text{EMDB Load}}{\sqrt{3} * \text{Line Voltage} * pf} \\ &= \frac{14231.12}{\sqrt{3} * \sqrt{3} * 220 * 0.7} \\ &= 30.803 \text{ A}\end{aligned}$$

So, 40A TP MCCB is needed from EMDB to MDB.

A 16 KW Generator is used to supply the EMDB Load through an ATS.

Calculations for MDB

$$\text{MDB Load} = \text{Total SDB Load} * 0.7 + (\text{EMDB Load} + \text{Pump Load}) * 0.7$$

$$\text{Total SDB Load} = 21707.9 \text{ W}$$

$$\text{EMDB Load} = 14231.12 \text{ W}$$

$$\text{Pump Load} = 5000 \text{ W}$$

$$\text{Power Factor, pf} = 0.95 \text{ (Due to PFI plant)}$$

$$\text{MDB Load} = 21707.9 * 0.7 + (14231.12 + 5000) * 0.7 = 28657.328 \text{ W}$$

$$\begin{aligned}\text{MDB Current} &= \frac{\text{MDB Load}}{\sqrt{3} * \text{Line Voltage} * pf} \\ &= \frac{28657.328}{\sqrt{3} * \sqrt{3} * 220 * 0.95} \\ &= 45.705 \text{ A}\end{aligned}$$

So, 60A TP MCCB is needed from MDB to Main Line.

Calculations of PFI Plant

$$\cos x = 0.70$$

$$\sin x = \sqrt{1 - (\cos x)^2}$$
$$= 0.714$$

$$\tan x = \frac{\sin x}{\cos x} = 1.020$$

$$Q = P * \tan x = 29236.332$$

After pf improvement, $\sin x = 1$

$$I = \frac{Q}{3 * V * \sin x} = 44.297 \text{ A}$$

So, 60A TP MCCB is needed from PFI to MDB

Calculations for Transformer

$$S = 3VI = 3 * 220 * 45.705 = 30165.608 \text{ KVA}$$

So, 11/0.415 KV, 50 Hz, 35 KVA, DYN 11, Oil Immersed Transformer with 4-6% Impedance is needed.