ISLAMIC UNIVERSITY OF TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

REPORT ON PROJECT

Course Code: EEE 4418

Course Title: Electrical Service Design Lab

Submitted To	**Submitted By**
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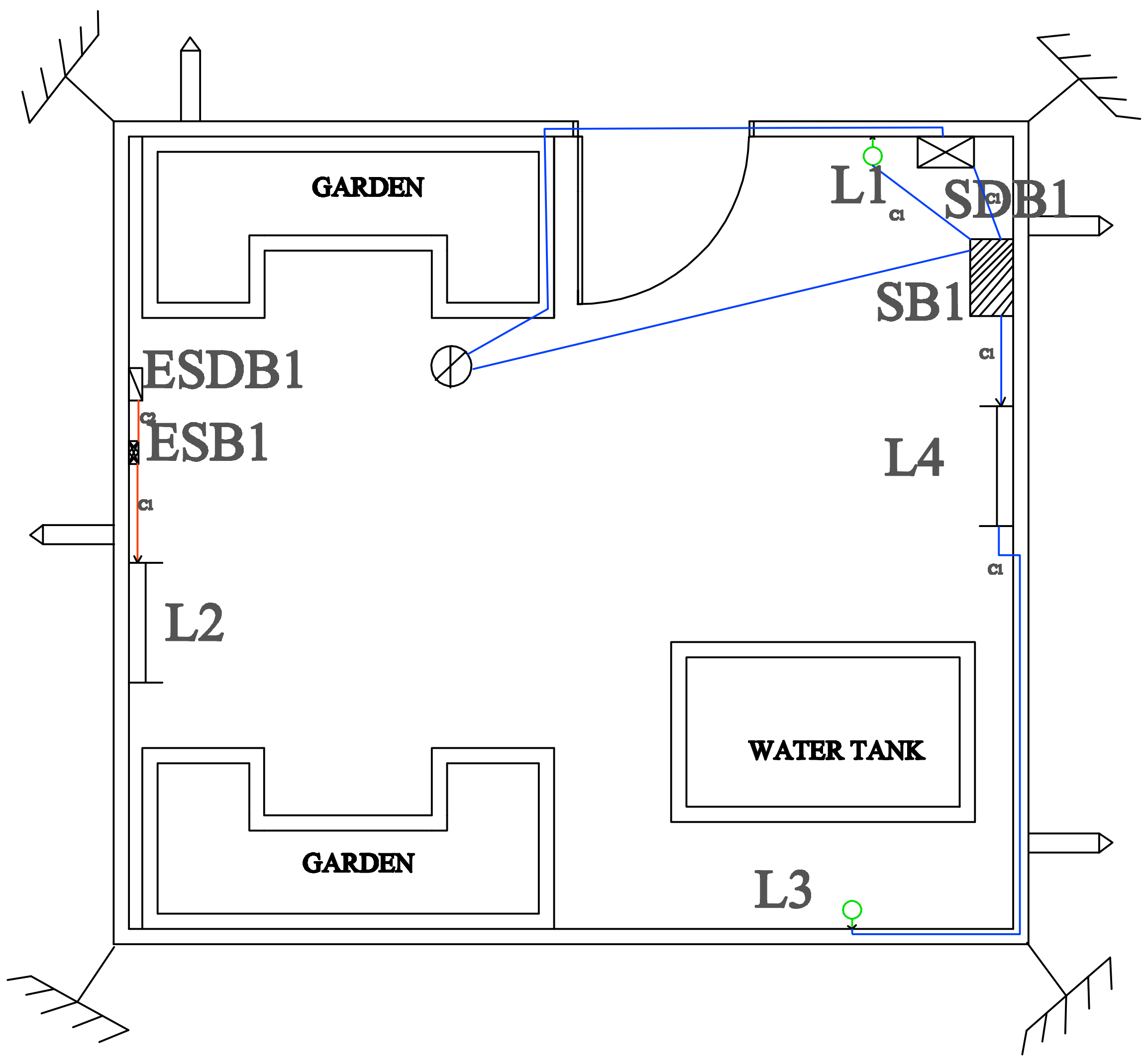
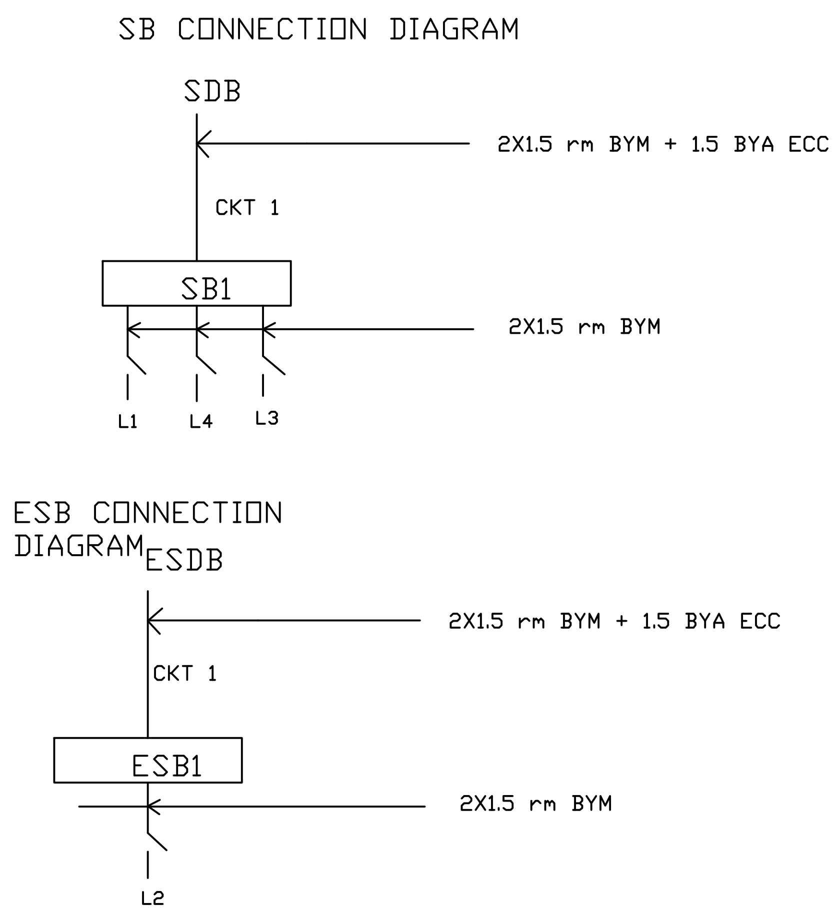
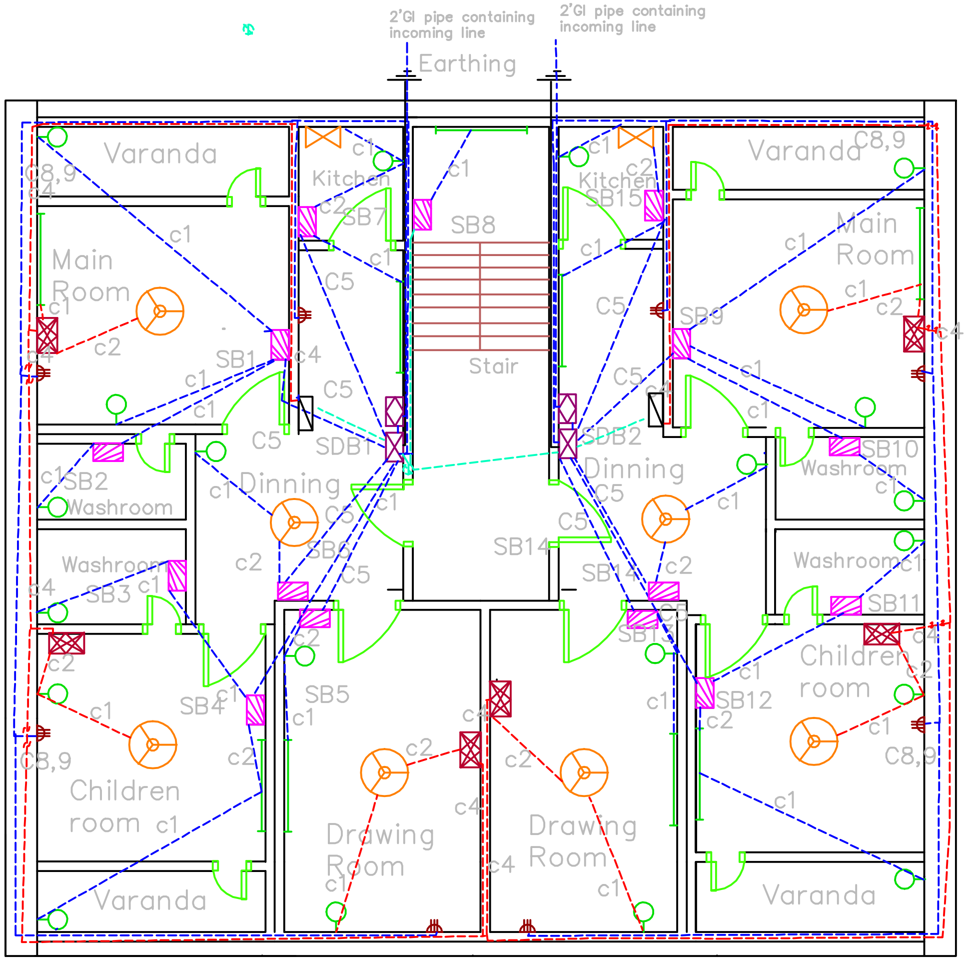
ROOFTOP


GARDEN
L1
SDB1
SB1
ESDB1
ESB1
L4
L2
WATER TANK
GARDEN
L3

ROOFTOP

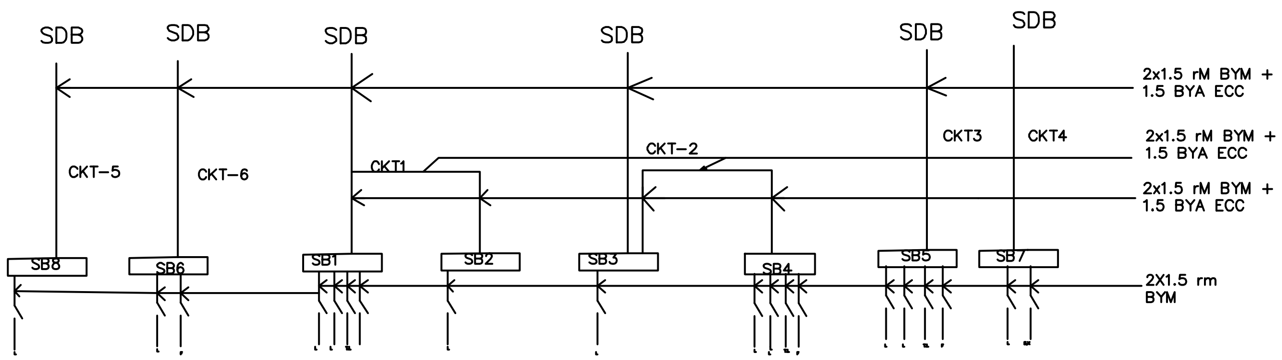

SB CONNECTION DIAGRAM
SDB
2X1.5 rm BYM + 1.5 BYA ECC
CKT 1
SB1
2X1.5 rm BYM
L1
L4
L3
ESB CONNECTION DIAGRAM
ESDB
2X1.5 rm BYM + 1.5 BYA ECC
CKT 1
ESB1
2X1.5 rm BYM
L2

Typical

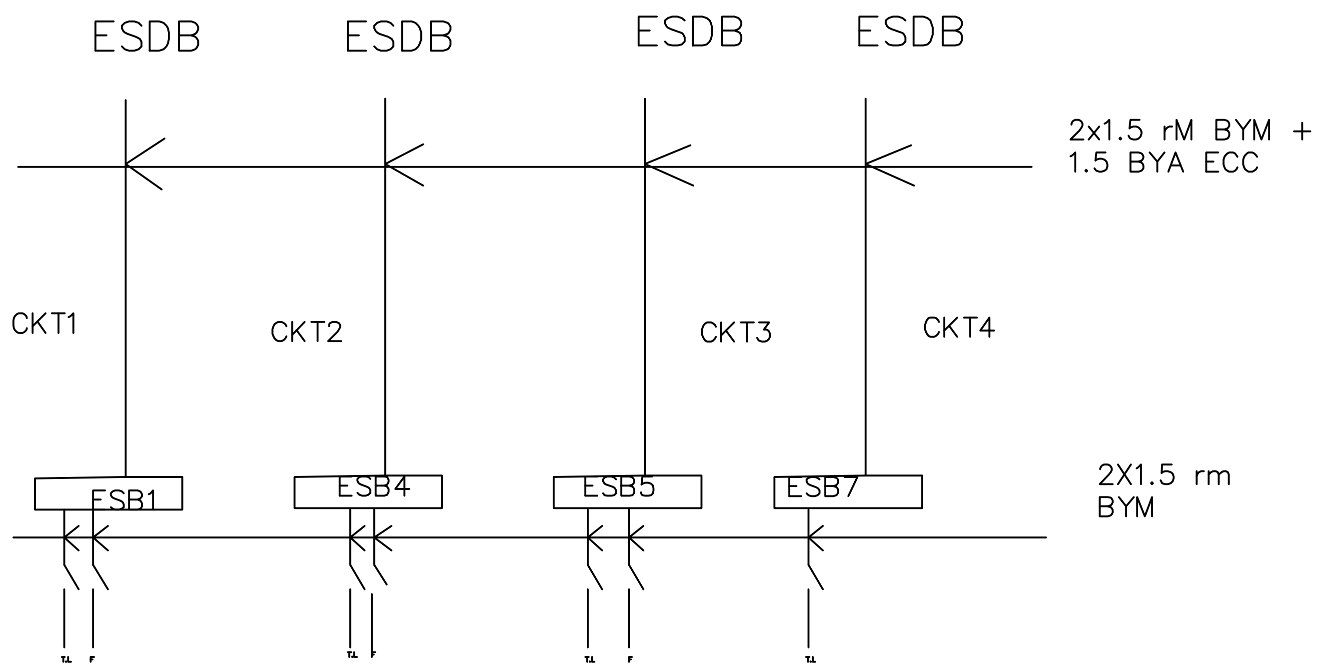


2'GI pipe containing incoming line
2'GI pipe containing incoming line
Earthing
Varanda
Kitchen
SB8
Kitchen
Varanda
Main Room
SB1
Stair
SDB1
SDB2
Main Room
SB2
Washroom
Dinning
Dinning
SB10
Washroom
Washroom
SB3
SB14
Washroom
SB11
SB4
SB5
SB12
Children room
Children room
Drawing Room
Drawing Room
Varanda
Varanda

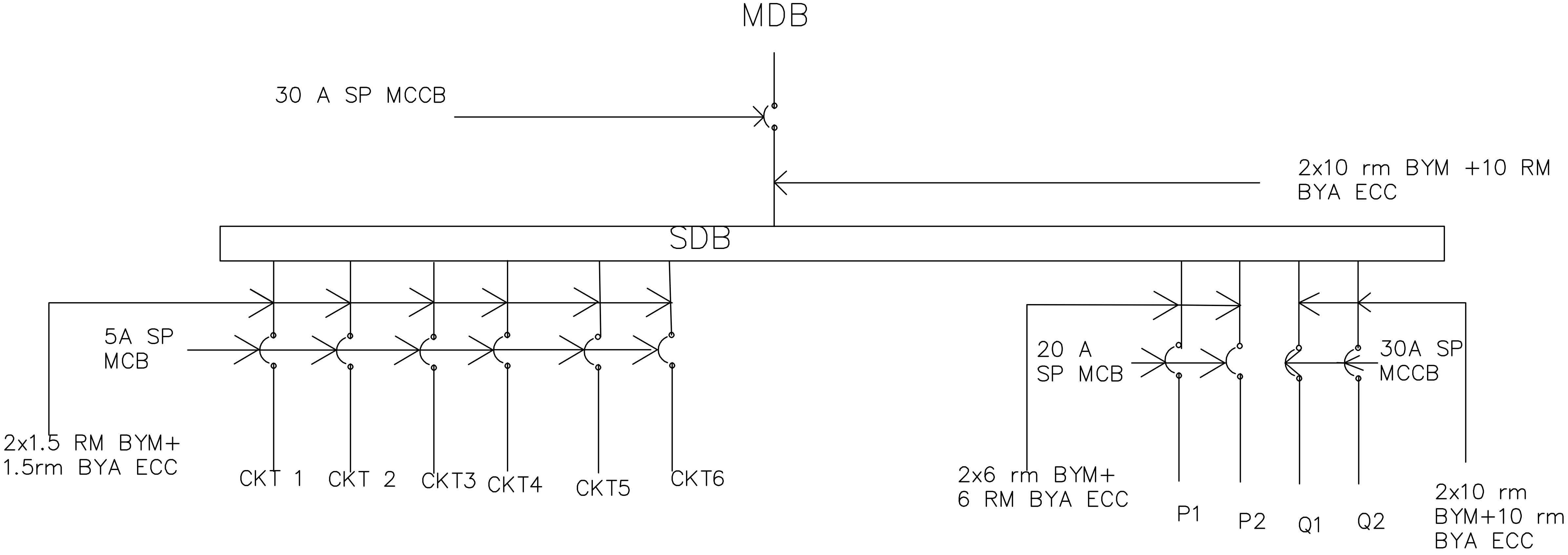
SB DIAGRAM (Typical)



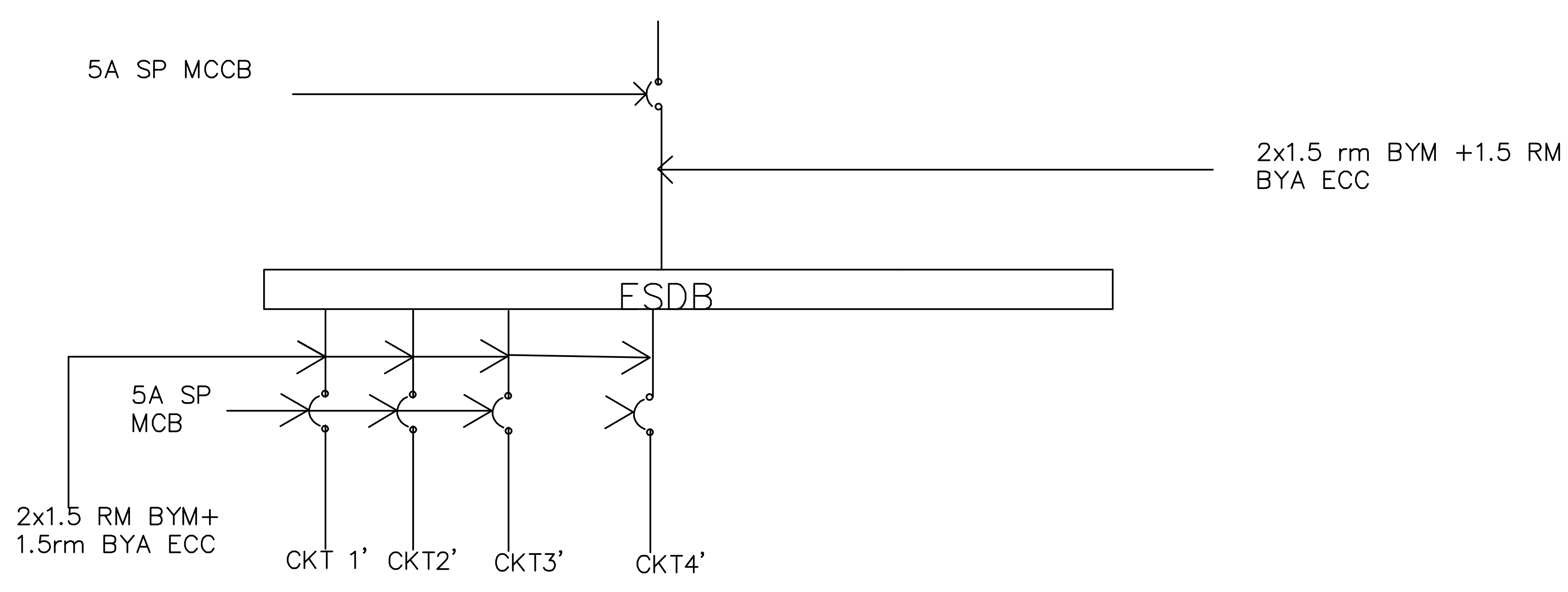
ESB DIAGRAM (Typical)



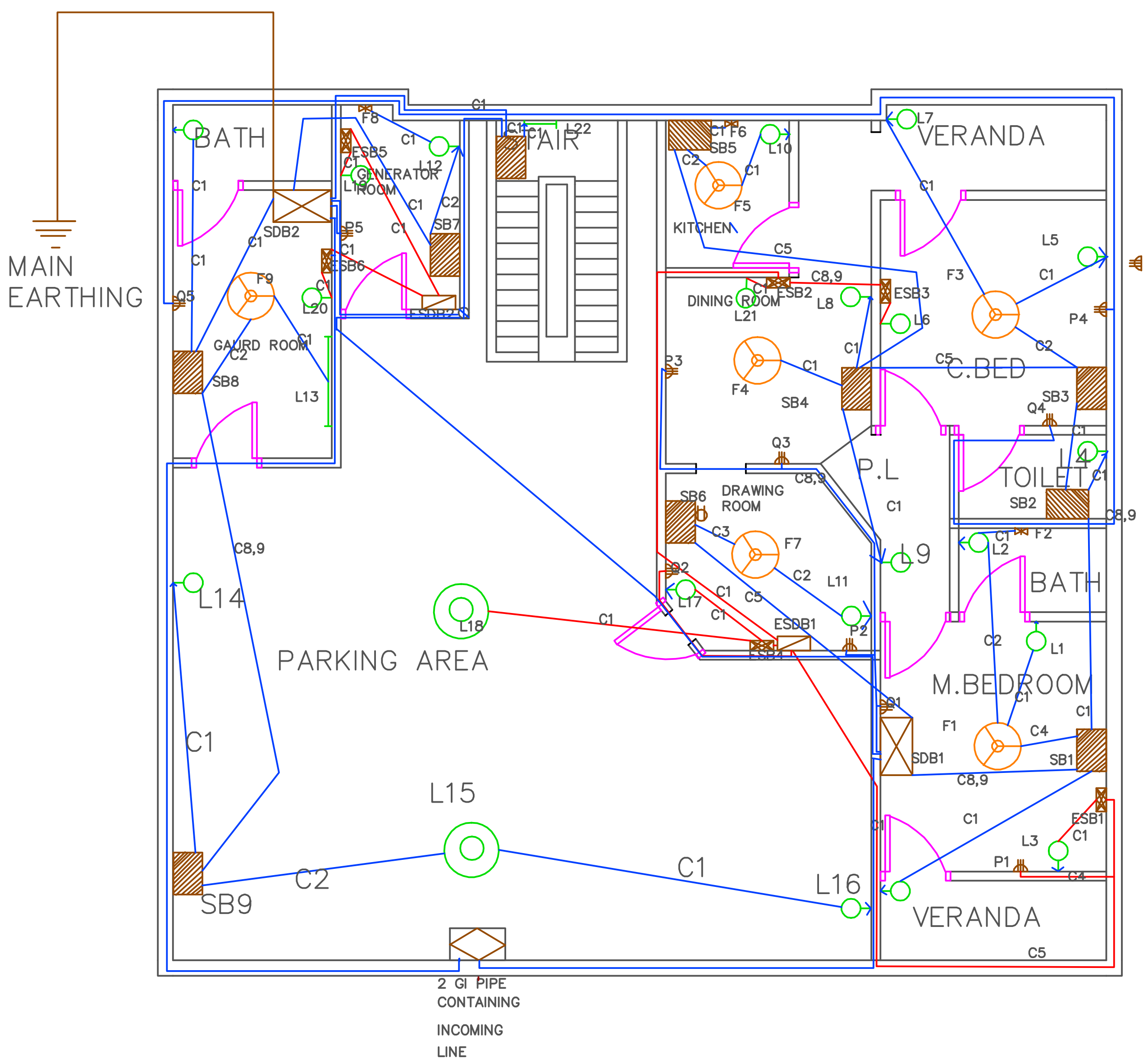
SDB DIAGRAM (Typical)



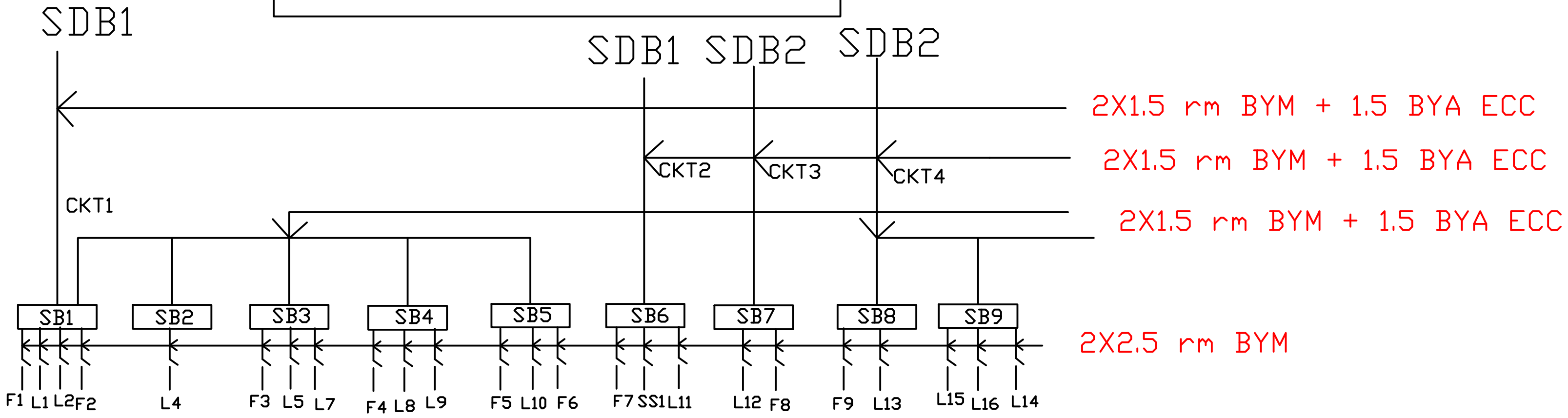
ESDB DIAGRAM (Typical)

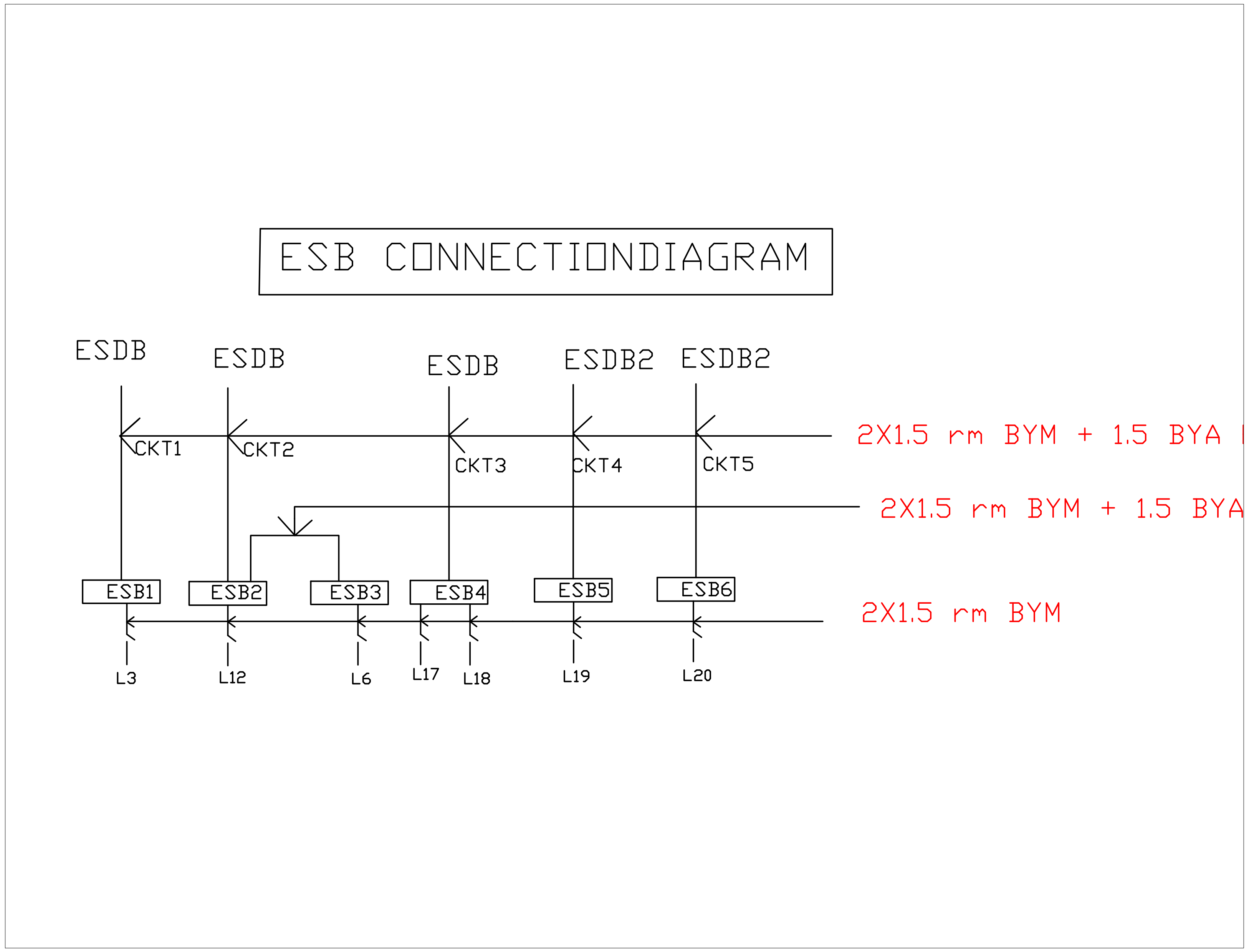


GROUND FLOOR

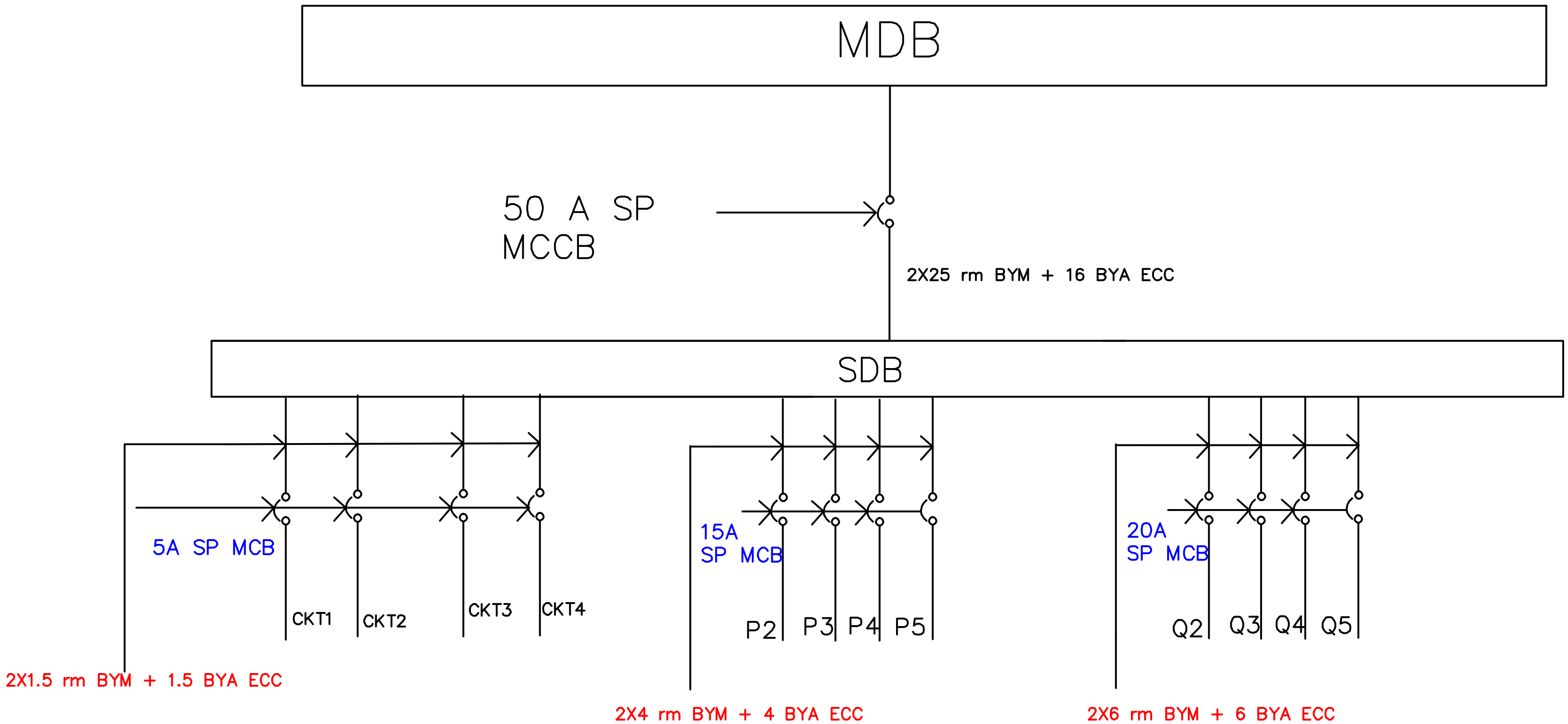

MAIN
EARTHING
BATH
GENERATOR
ROOM
STAIR
KITCHEN
VERANDA
DINING ROOM
C.BED
GAURD ROOM
P.L
TOILET
DRAWING
ROOM
BATH
PARKING AREA
M.BEDROOM
L15
L16
SB9
VERANDA
2 GI PIPE
CONTAINING
INCOMING
LINE

SB CONNECTION DIAGRAM

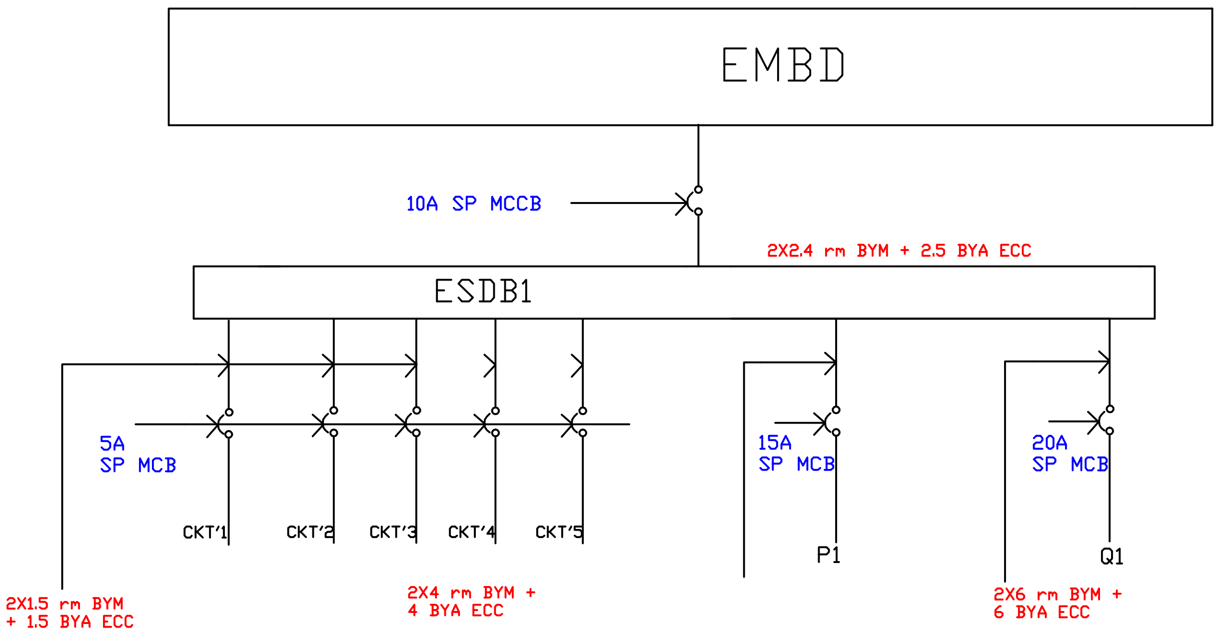


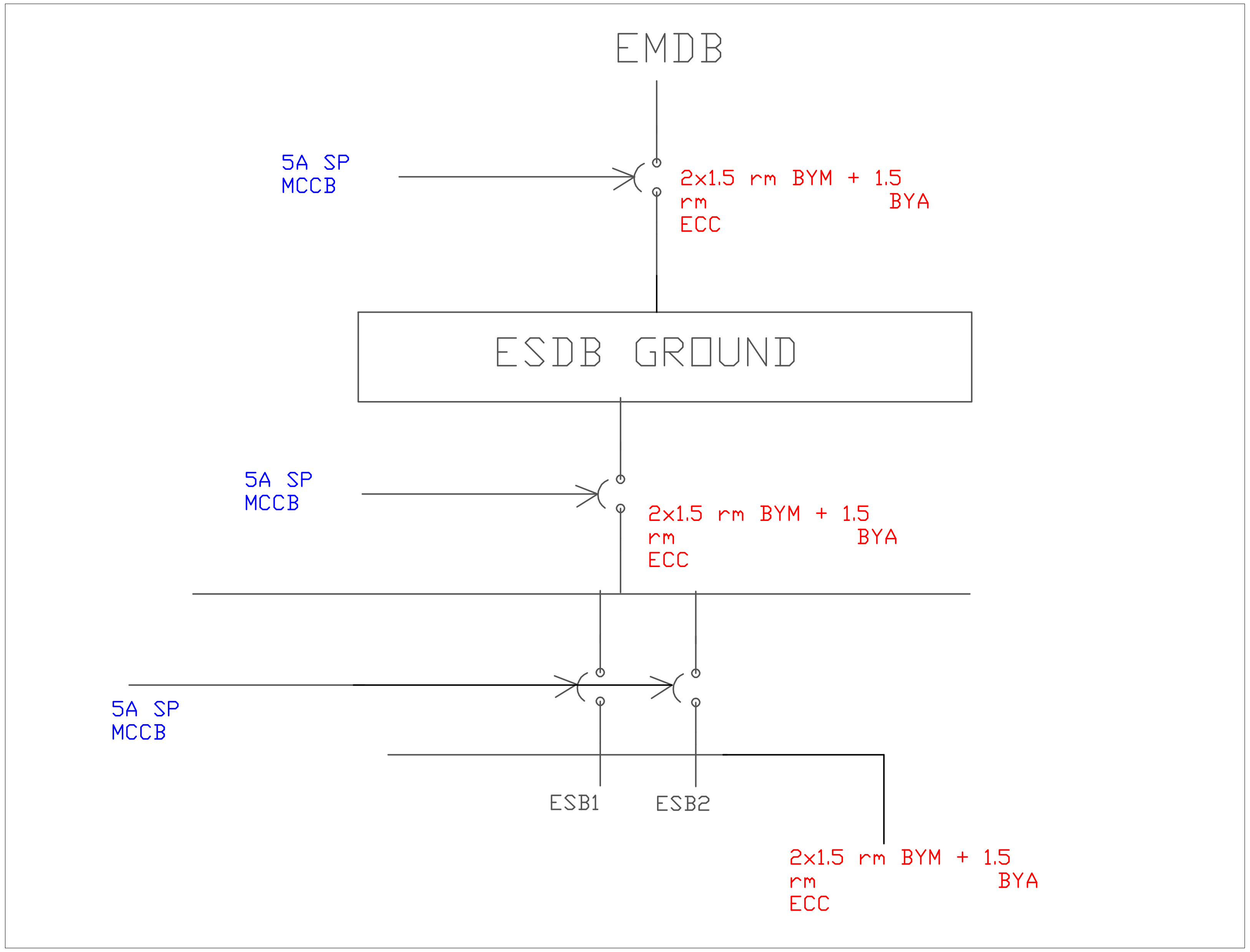

ESB CONNECTIONDIAGRAM
ESDB
ESDB
ESDB
ESDB2
ESDB2
CKT1
CKT2
CKT3
CKT4
CKT5
2X1.5 rm BYM + 1.5 BYA
2X1.5 rm BYM + 1.5 BYA
ESB1
ESB2
ESB3
ESB4
ESB5
ESB6
2X1.5 rm BYM
L3
L12
L6
L17
L18
L19
L20

SDB CONNECTION DIAGRAM

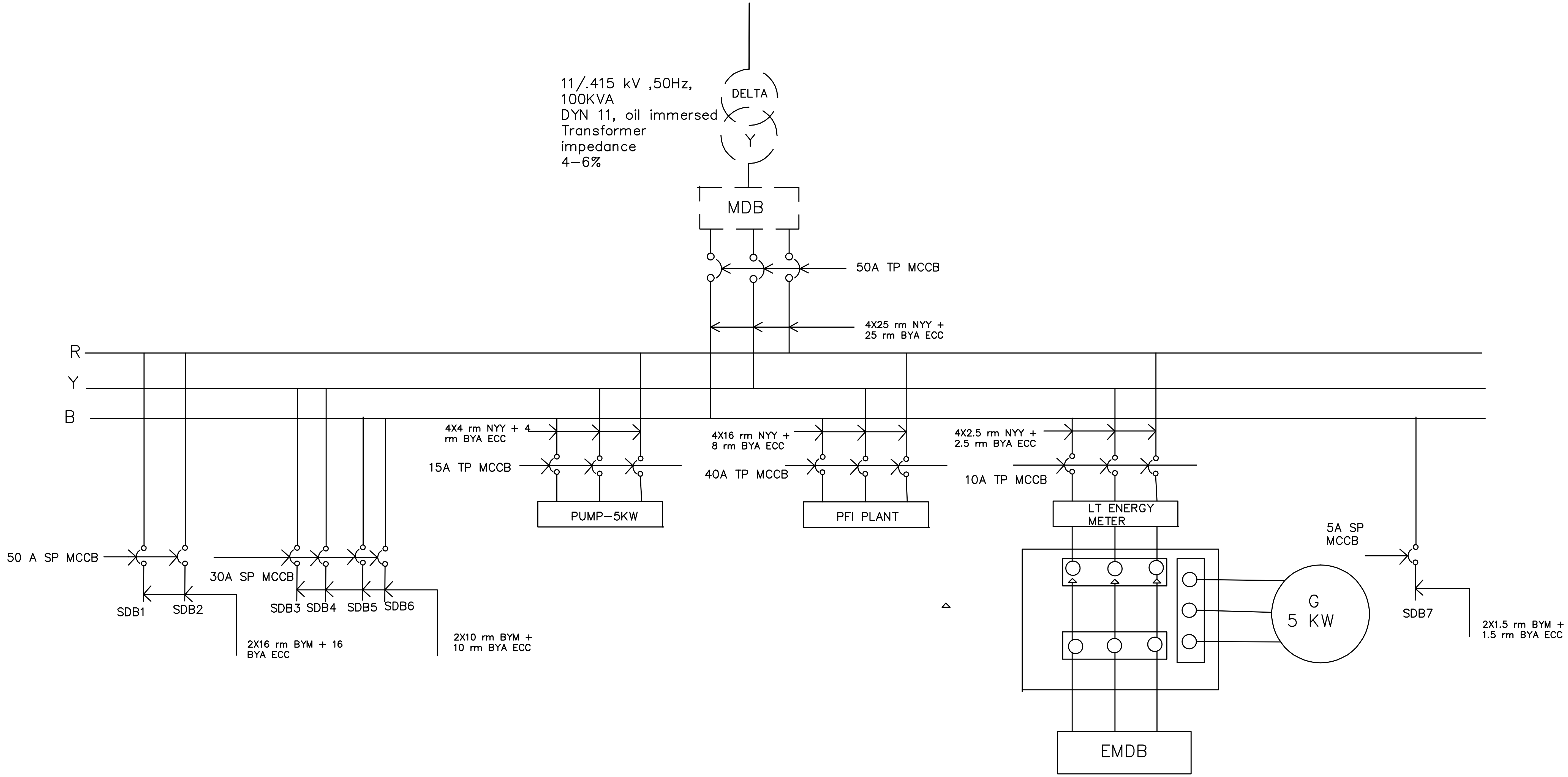


ESDB CONNECTION
DIAGRAM

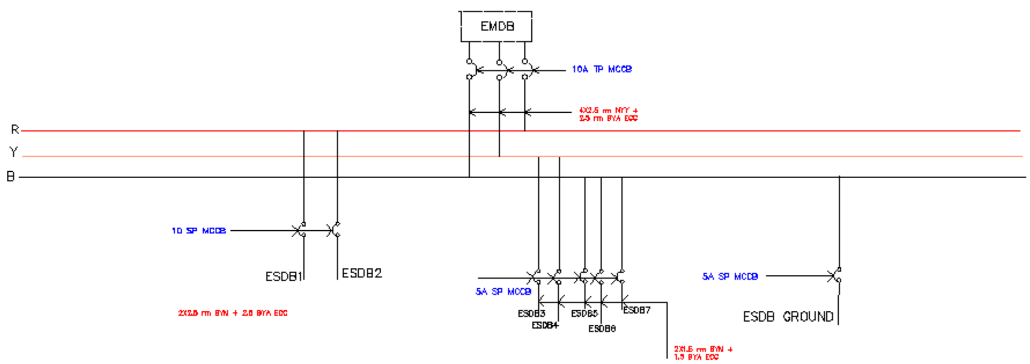



EMDB
5A SP
MCCB
2x1.5 rm BYM + 1.5 rm BYA ECC
ESDB GROUND
5A SP
MCCB
2x1.5 rm BYM + 1.5 rm BYA ECC
5A SP
MCCB
ESB1
ESB2
2x1.5 rm BYM + 1.5 rm BYA ECC

MAIN DISTRIBUTION BOARD DIAGRAM



EMDB CONNECTION DIAGRAM



CALCULATIONS

CALCULATIONS FOR CONDUITS

Calculations for Conduits

Formula for Ampere Rating, I=P/V*Pf

Pf= 0.7 is considered on an average.

Energy Saving Bulb 20 W

Tube Light 20 W

Ceiling Fan 100 W

Switchboard Socket (max)=100 W

Ceiling Light 20 W

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

SB CALCULATIONS

Formula for light Bulbs:

$$E = \frac{n * N * F * UF * LLF}{A(m^2)}$$

Formula for No. of fans:

$$No.of\ Fans = \frac{A(sqft)}{100}$$

TYPICAL FLOOR:

M Bedroom

Area=13.75*12.5 sqft = 171.875 sqft =15.968 m^2

Illuminance, E=100 Lumen/m^2

Light loss factor and utilization Factor ,LLF*UF =0.7

No of lights per Illuminare, n=1

Flux = 1250 Lumen

No of lights N= 1.82 =~ 2

1 light bulb and 1 Tube light

No of Fans = $\frac{171.875}{100} = 1\ fan$

1 fan is needed

C Bedroom:

Area=12.5*12.5 sqft = 156.25 sqft =14.5161 m^2

Illuminance, E=100 Lumen/m^2

Light loss factor and utilization Factor ,LLF*UF =0.7

No of lights per Illuminare, n=1

Flux = 1250 Lumen

No of lights N= 1.65 =~ 2

1 light bulb and 1 Tube light

No of Fans = $\frac{156.25}{100} = 1\ fan$

1 fan is needed

Drawing Room:

Area=10.833*13.75 sqft = 148.96 sqft =13.84 m^2

Illuminance, E=100 Lumen/m^2

Light loss factor and utilization Factor ,LLF*UF =0.7

No of lights per Illuminare, n=1

Flux = 1250 Lumen

No of lights N= 1.58 =~ 2

1 light bulb and 1 Tube light

No of Fans = $\frac{148.96}{100} = 1\ fan$

1 fan is needed

Dining Room:

Area=10.833*13.75 sqft = 148.96 sqft =13.84 m^2

Illuminance, E=100 Lumen/m^2

Light loss factor and utilization Factor ,LLF*UF =0.7

No of lights per Illuminare, n=1

Flux = 1250 Lumen

No of lights N= 1.58 =~ 2

1 light bulb and 1 Tube light

No of Fans = $\frac{148.96}{100} = 1\ fan$

1 fan is needed

Kitchen:

Area=7*6 sqft = 42 sqft =3.6 m^2

Illuminance, E=100 Lumen/m^2

Light loss factor and utilization Factor ,LLF*UF =0.7

No of lights per Illuminare, n=1

Flux = 1250 Lumen

No of lights N= 1

1 light bulb is needed

No of Fans = $\frac{42}{100} = 1\ fan$

1 Exhaust fan is needed

Toilet:

Area=5*8 sqft = 40 sqft =3.92m^2

Illuminance, E=100 Lumen/m^2

Light loss factor and utilization Factor ,LLF*UF =0.7

No of lights per Illuminare, n=1

Flux = 1250 Lumen

No of lights N =~ 1 **1 light bulb is needed**

Bathroom

Area=5*8 sqft = 40 sqft =3.92m^2

Illuminance, E=100 Lumen/m^2

Light loss factor and utilization Factor ,LLF*UF =0.7

No of lights per Illuminare, n=1

Flux = 1250 Lumen

No of lights N =~ 1 **1 light bulb is needed**

Ground floor:

M BED

A=13.34 X12.5

=166.675 for

M. Bed: Area = 13’-4" x 12’-6" = 4.064 X 3.81

=15.47241 m^2

illuminance; E=100 Lumen m^2

LLF X UF=0.7

Number of lights rer illuminaire, n=1

flux = 1250 Lumen

E- nx N x F x UF x LLF (A m^2)/A

=> Number of Bulbs = 2

Number of fans = A /100

=1

C BED

A = 12.5X12.5 = 156.25 ft^2

A = 3.81X3.81 = 14-5161m^2

E- nx N x F x UF x LLF (A m^2)/A

Light = 1

Number of fans = A /100

=1

DRAWING ROOM

A= 3.302 X 4.191 = 13.838 m^2

A = 10.834 X 13.75=148.9675 ft^2

Light = 1

fan = 1

Dining Room

A = 10x 13.9167 = 139.167 ft^2.

A = 3.048 × 4.2418 = 12.929 m^2

Light = 1

Fan=1

Kitchen

A = 2.7178×2.413 = 6.558 m^2

A = 7.91667 X 8.91667 =70.59 ft^2

Light=1

fan= A/100

=1

Veranda-1

A= 1.27 X1.271 = 1.5483 m^2

A = 4.167 X 4 = 16,668ft^2

Light = 1

Veranda-2

A= 1.27 X1.271 = 1.5483 m^2

A = 4.167 X 4 = 16,668ft^2

Light = 1

Generator room (Ground floor)

Area=10*7 sqft = 70 sqft =6.5m^2

Illuminance, E=100 Lumen/m^2

Light loss factor and utilization Factor ,LLF*UF =0.7

No of lights per Illuminare, n=1

Flux = 1250 Lumen

No of lights N =~ 2 **2 light bulbs are needed**

No of Fans = $\frac{70}{100} = 1\ fan$

1 Exhaust fan is needed

Guard room (Ground floor)

Area=15*9 sqft = 135 sqft =12.54m^2

Illuminance, E=100 Lumen/m^2

Light loss factor and utilization Factor ,LLF*UF =0.7

No of lights per Illuminare, n=1

Flux = 1250 Lumen

No of lights N = 1.433 =~ 2

One light bulb and one tube bulb are needed

No of Fans = $\frac{135}{100} = 1\ fan$

1 fan is needed

Bathroom (Guardroom)

Area=4.7*8.6 sqft = 40.42 sqft =3.755m^2

Illuminance, E=100 Lumen/m^2

Light loss factor and utilization Factor ,LLF*UF =0.7

No of lights per Illuminare, n=1

Flux = 1250 Lumen

No of lights N =~ 1 **1 light bulb is needed**

ROOFTOP:

A= 50x45 =562.5 ft^2

A = 15.24/2 × 13.716/2 = 52.2579m²

Light = 5

CALCULATIONS FOR CONDUITS

GROUNDFLOOR

Calculations for Switchboard Connection Diagram:

Power of different equipments:

Fan=100W

Exhaust Fan=60W

Light/Tube Light=20W

Switch board socket = 100W

Power Socket (P type) =3000W

Power Socket (Q type) =4000W

Calculations for Circuit 1:

$$\boldsymbol{I = \frac{Total\ load\ connected\ to\ CKT}{220 * 0.7}}$$

I=$\frac{(20*8)+(100*4)+(60)}{220*0.7}$ =$\frac{620}{220*0.7}$ = 4.026A

I<5A so 2*1.5 r.m BYM+1.5 r.m BYA need to be used

Calculations for Circuit 2:

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

I<5A so 2*1.5 r.m BYM+1.5 r.m BYA need to be used

Calculations for Circuit 3:

I=$\frac{20+60}{220*0.7}$ = 0.519A

I<5A so 2*1.5 r.m BYM+1.5 r.m BYA need to be used

Calculations for Circuit 4:

I=$\frac{(4*20)+100}{220*0.7}$ =$\frac{180}{220*0.7}$ = 1.688A

I<5A so 2*1.5 r.m BYM+1.5 r.m BYA need to be used

Calculations for Emergency Switchboard Connection Diagram:

Calculations for CKT' 1:

I=$\frac{20}{220*0.7}$ = 0.13A

I<5A so 2*1.5 r.m BYM+1.5 r.m BYA need to be used

Calculations for CKT' 2:

I=$\frac{20+20}{220*0.7}$ = 0.26A

I<5A so 2*1.5 r.m BYM+1.5 r.m BYA need to be used

Calculations for CKT' 3:

I=$\frac{20+20}{220*0.7}$ = 0.26A

I<5A so 2*1.5 r.m BYM+1.5 r.m BYA need to be used

Calculations for CKT’ 4:

I=$\frac{20}{220*0.7}$ = 0.13A

I<5A so 2*1.5 r.m BYM+1.5 r.m BYA need to be used

Calculations for CKT’ 5:

I=$\frac{20}{220*0.7}$ = 0.13A

I<5A so 2*1.5 r.m BYM+1.5 r.m BYA need to be used

CALCULATIONS FOR SDB

P socket load: 3000W

Q socket load: 4000W

P socket load factor: 0.2

Q socket load factor: 0.2

Total load factor: 0.7

Voltage : 220V

CKT 1 load : (100*5) + (8*20) = 620W

CKT 2 load : (100)+(20)+(100) = 220W

CKT 3 load : (20)+(60) = 80W

CKT 4 load : (100)+(4*20) = 180W

Total load = 1100W

SDB load = 1100*0.7 + 4*3000*0.2 + 4*4000*0.2 = 6370W

SDB Current I= $\frac{6370}{220*0.7}$ = 41.3636 A

We can closely use 50A SP MCCB from SDB to MDB

CALCULATIONS FOR ESDB

CKT’ 1 load : (20) = 20W

CKT’ 2 load : (20+20) = 40W

CKT' 3 load : (20+20) = 40W

CKT' 4 load : (20) = 20W

CKT' 5 load : (20) = 20W

Total load = 140W

ESDB load = 140*0.7 + 3000*0.2 + 4000*0.2 = 1498W

ESDB Current $I=\frac{1498}{220*0.7}$ = 9.7273 A

10A SP MCCB will be used from ESDB to EMDB

Calculations for minimum load density

According to Rajuk for air conditioned dwelling abodes 100w/m^2 should be unit load

In our Apartment load density is $\frac{Total\ load}{\text{Apartment size in } m^2} = \frac{6370 + 1498}{209.03}$ = 37.64 W/m^2

<u>TYPICAL FLOOR</u>

Calculations for Circuit 1:

$$I = \frac{Total\ load\ connected\ to\ CKT}{220 * 0.7}$$

$I=\frac{(20+20+20+100)+20}{220*0.7} = \frac{180}{220*0.7}$ = 1.17A

I<5A so 2*1.5 r.m BYM+1.5 r.m BYA need to be used

Calculations for Circuit 2:

$I=\frac{(20+20+20+100)+20}{220*0.7} = \frac{180}{220*0.7}$ = 1.17A

I<5A so 2*1.5 r.m BYM+1.5 r.m BYA need to be used

Calculations for Circuit 3:

$I=\frac{20+20+100+20}{220*0.7}$ = 1.04A

I<5A so 2*1.5 r.m BYM+1.5 r.m BYA need to be used

Calculations for Circuit 4:

I=$\frac{20+60}{220*0.7}$ =$\frac{80}{220*0.7}$ = 0.52A

I<5A so 2*1.5 r.m BYM+1.5 r.m BYA need to be used

Calculations for Circuit 5:

I=$\frac{20}{220*0.7}$ =$\frac{20}{220*0.7}$ = 0.13A

I<5A so 2*1.5 r.m BYM+1.5 r.m BYA need to be used

Calculations for Circuit 6:

I=$\frac{20+100}{220*0.7}$ =$\frac{120}{220*0.7}$ = 0.78A

I<5A so 2*1.5 r.m BYM+1.5 r.m BYA need to be used

Calculations for Emergency Switchboard Connection Diagram:

Calculations for Circuit 1:

$$\boldsymbol{I = \frac{Total\ load\ connected\ to\ CKT}{220 * 0.7}}$$

I=$\frac{(20+100)}{220*0.7}$ =$\frac{120}{220*0.7}$ = 0.78A

I<5A so 2*1.5 r.m BYM+1.5 r.m BYA need to be used

Calculations for Circuit 2:

I=$\frac{(20+100)}{220*0.7}$ =$\frac{120}{220*0.7}$ = 0.78A

I<5A so 2*1.5 r.m BYM+1.5 r.m BYA need to be used

Calculations for Circuit 3:

$I = \frac{100+20}{220*0.7} = 0.78A$

I<5A so 2*1.5 r.m BYM+1.5 r.m BYA need to be used

Calculations for Circuit 4:

$I = \frac{100}{220*0.7} = 0.65A$

I<5A so 2*1.5 r.m BYM+1.5 r.m BYA need to be used

Calculations for Sub Distribution Board Diagram:

P socket load:3000W

Q socket load:4000W

P socket load factor:0.2

Q socket load factor:0.2

Total load factor:0.7

Total load:740 W

$I = \frac{(740*0.7)+(3000*2*0.2)+(4000*2*0.2)}{220*0.7} = \frac{3318}{220*0.7} = 21.54A$

I>20A so 2*10 r.m BYM+10 r.m BYA need to be used

30 A SP MCCB need to be used as circuit breaker

For P socket:

$I = \frac{3000}{220*0.7} = 19.48A$

I<20A so 2*6 r.m BYM+6 r.m BYA need to be used

20 A SP MCCB need to be used as circuit breaker

For Q socket:

$I = \frac{4000}{220*0.7} = 25.97A$

I>20A so 2*10 r.m BYM+10 r.m BYA need to be used

30 A SP MCCB need to be used as circuit breaker

Calculations for Emergency Sub Distribution Board Diagram:

Calculation for ESDB Ground:

$I=\frac{120*0.7}{220*0.7} = .545A$

5 A SP need to be used from ESDB Ground to EMDB

EMDB CALCULATIONS

Phase voltage = 220V

Line Voltage = $\sqrt{3}$*220V = 381.05V

Power factor = 0.7

EMDB load = total ESDB + P socket + Q socket

ESDB load = total ESBD ground + total ESDB (other floors)

TOTAL LOAD = 140*0.7 + 3000*0.2 + 4000*0.2 + (460*4*0.7) + 20*0.7 = 2,800W

A 5 kw Generator is used to supply the EMDB load through ATS

EMDB CURRENT $I = \frac{2800}{220*0.7*3} = 6.06$ A

So 10A TP MCCB is needed from EMDB to MDB

MDB CALCULATIONS

MDB LOAD = total SDB + P sockets + Q sockets + PUMP load + EMDB load

SDB(1,2) GROUND = (1100*0.7)+(4*3000*0.2)+(4*4000*0.2) = 6370W

SDB(3,4,5,6) (2,3 FLOOR) = (4740*4*0.7) = 13272 W

SDB (7) ROOF = (60*0.7) = 42W

TOTAL SDB = 6370 + 13272 + 42 = 19684 W

PUMP Load = 5000*0.7 = 3500 W

EMDB Load = 2800 W

MDB LOAD = 19684 + 3500 + 2926 = 26110 W

Phase Voltage = 220V

Line Voltage = 381.05 V

Power Factor pf = 0.95 (Due to PFI Plant)

MDB CURRENT I = $\frac{26110}{220*0.95*3}$ = 41.64A

So 50A TP MCCB is needed from MDB to Main line

Calculations for PFI plant

cosØ = 0.7, sinØ = $\sqrt{1-(cosØ)^2}$ = 0.714

Q = 3VIsinØ = P.tanØ = 26110 * $\frac{0.714}{0.7}$ = 26632.2 VAR

After Power Factor improvement sinØ = 1

I = $\frac{Q}{3Vsin Ø}$ = $\frac{26632.2}{3*220*1}$ = 40.354A

40 TP MCCB is needed from PFI to MDB

Calculations for transformer

S = 3VI

= 3*220*40.354

= 26.633 KVA

So 11/0.415 KV , 50 Hz , 30KVA, DYN 11, Oil Immersed Transformer with 4-6% impedence is needed

CALCULATIONS FOR ROOFTOP

ROOFTOP :

To Sub Distribution Board (SDB)

CKT1 Rating

I=((3X20)/(220*0.7)=0.3896A

So, 2 x 1.5 rm BYM + 1.5 BYA ECC are used

To Emergency Sub Distribution Board (ESDB)

CKT1 Rating

I=(20)/(220*0.7)=0.129A

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

Calculations for Air terminal

Total Circumference = 2x50+2x45 = 190 feet = 57.912 meters

Air Terminal should be placed at 20 meter distance

Air Terminal Number = 57.912/20 = 2.89 (Approx 3)

So, 3 Air terminals.