BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY

Course Number: EEE 414

Report on
Project of Electrical Design of a Seven-storeyed Building

Department: EEE

Section: B
Group :

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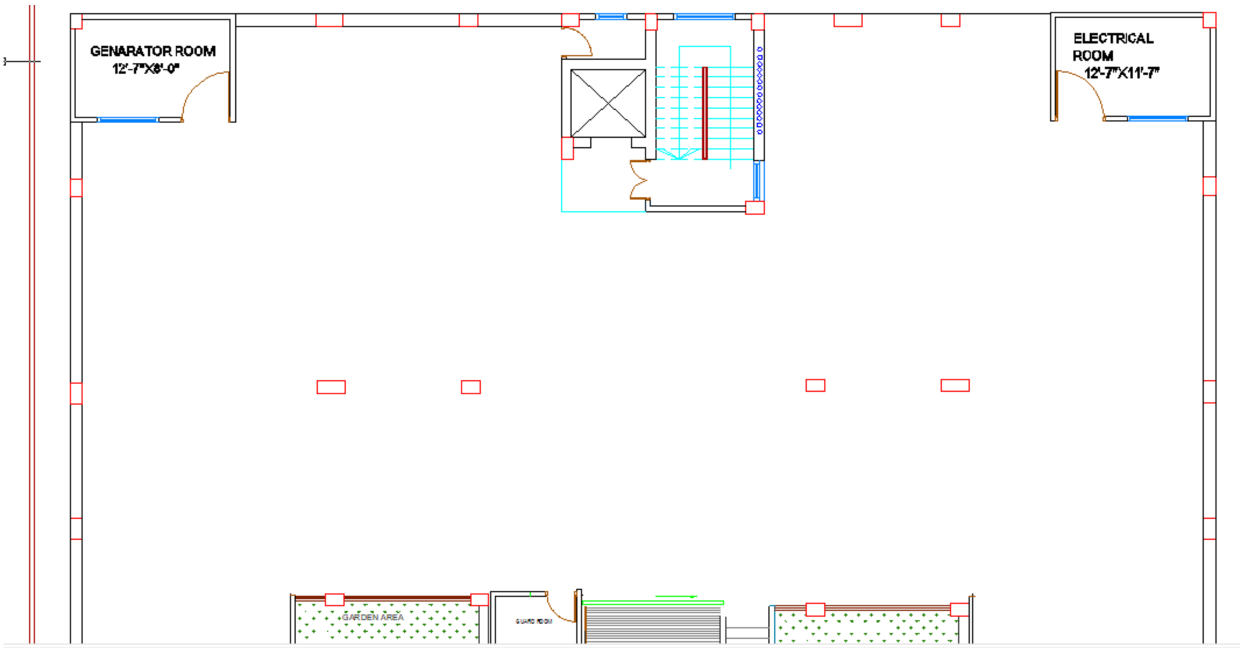
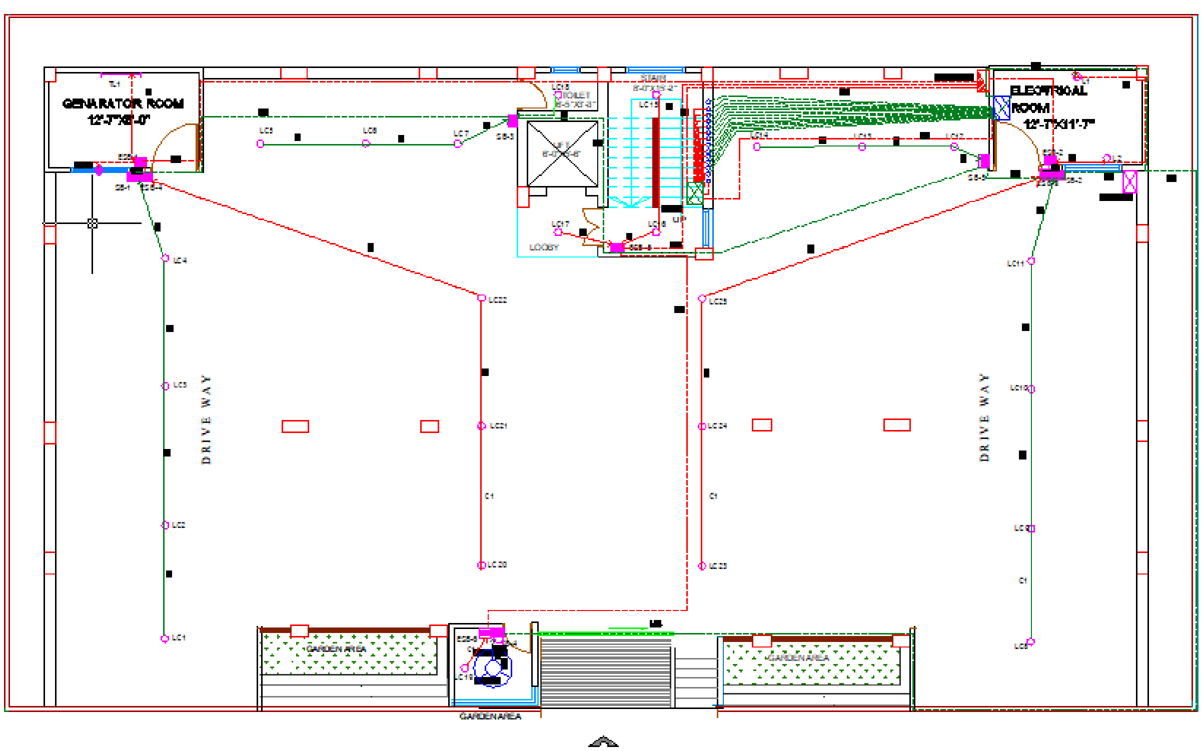
Legends


CONDUIT FOR EMERGENCY LINE
CONDUIT FOR MAIN LINE
DOWN CONDUCTOR
CROSSED LNK CONDUCTOR
GEYSAR
SDB
ESDB
EXHAUST FAN(EXF)
SWITCHBOARD SB
THAI GLASS
Main Distribution Board (MDB)
Emergency Main Distribution Board (EMDB)
CEILING FAN (F)
LED TUBELIGHT AT LINTEL LEVEL(L)
CONCEALED CEILING LIGHT (CL)
LED LIGHT AT LINTEL LEVEL (L)
DOOR
AIR CONDITIONER
POWER SOCKET FOR AC (Q)
POWER SOCKET (P)
2 PIN 5 A SOCKET FOR SWITCHBOARD LEVEL (SS)
2 PIN 5 A SOCKET FOR TV AT SKIRTING LEVEL (ST)

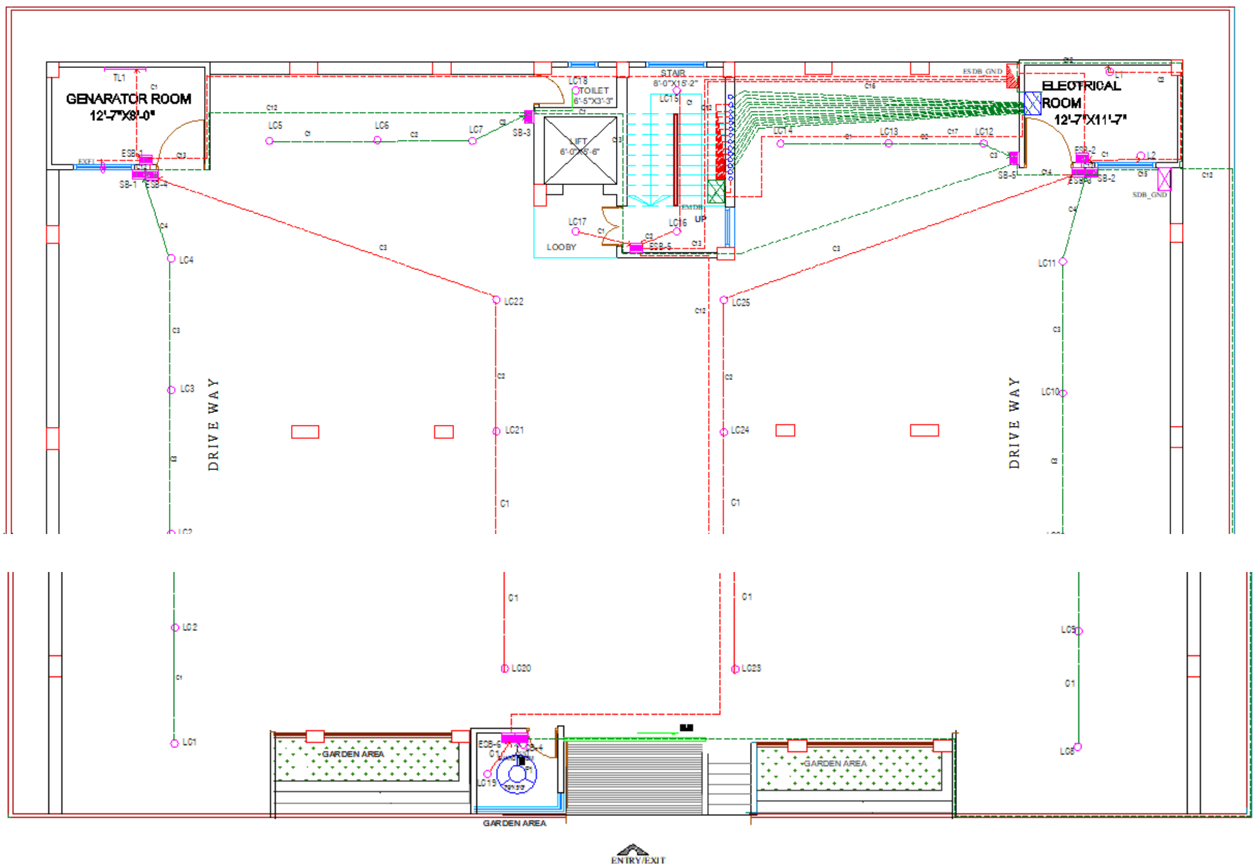
Ground floor Layout



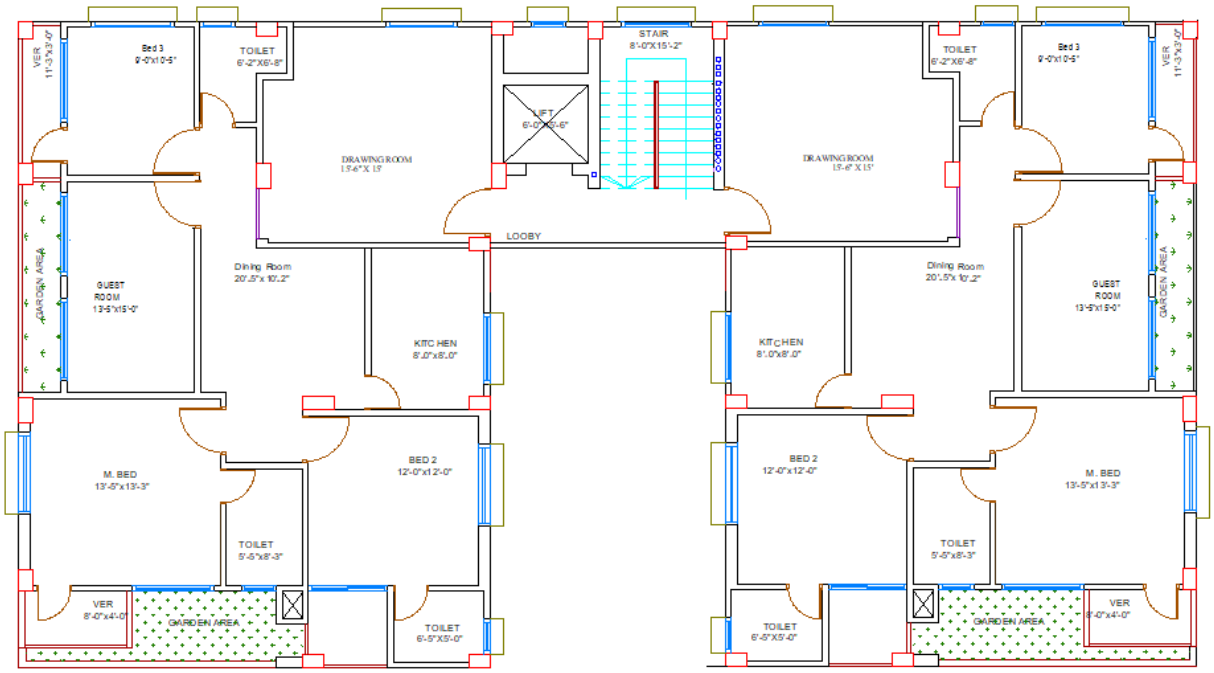
Ground floor with fittings and conduit



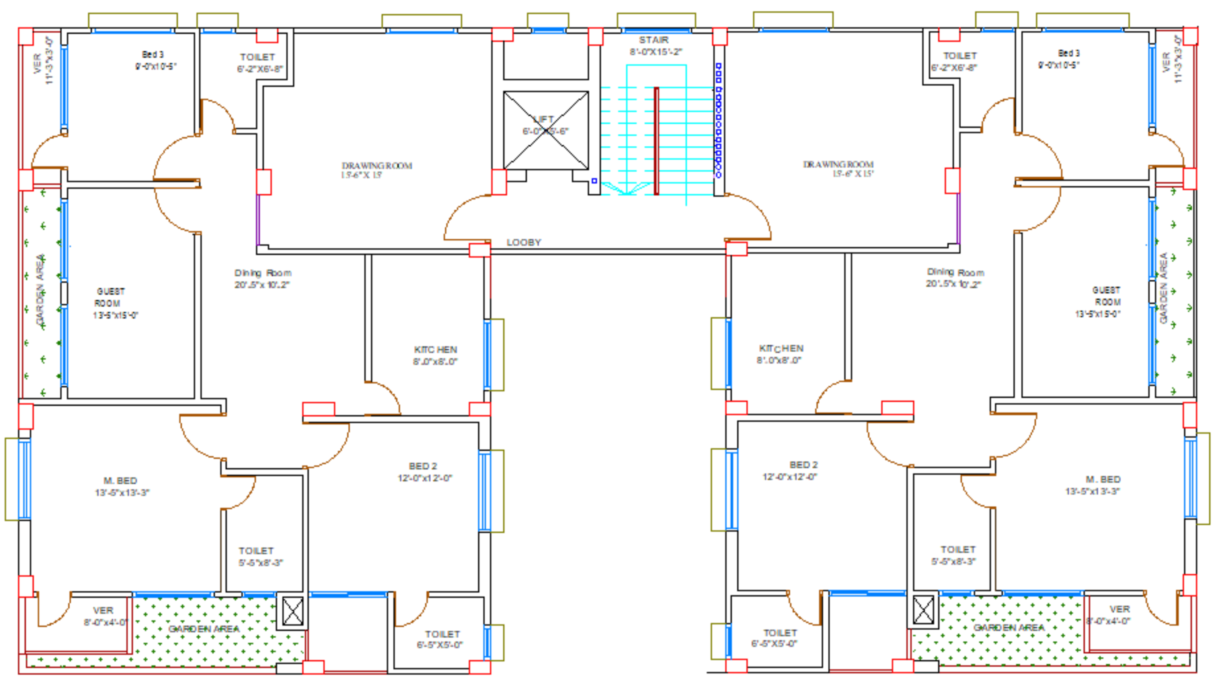
Ground floor with fittings and conduit (zoomed view)



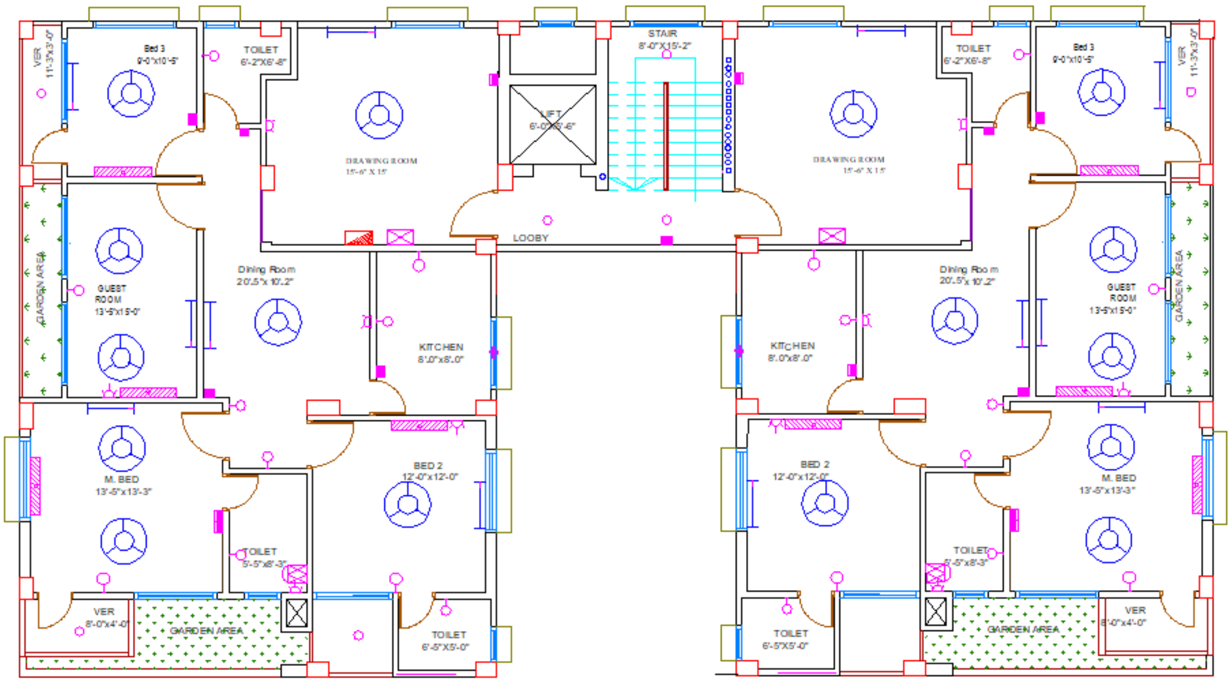
Typical 1st floor Layout



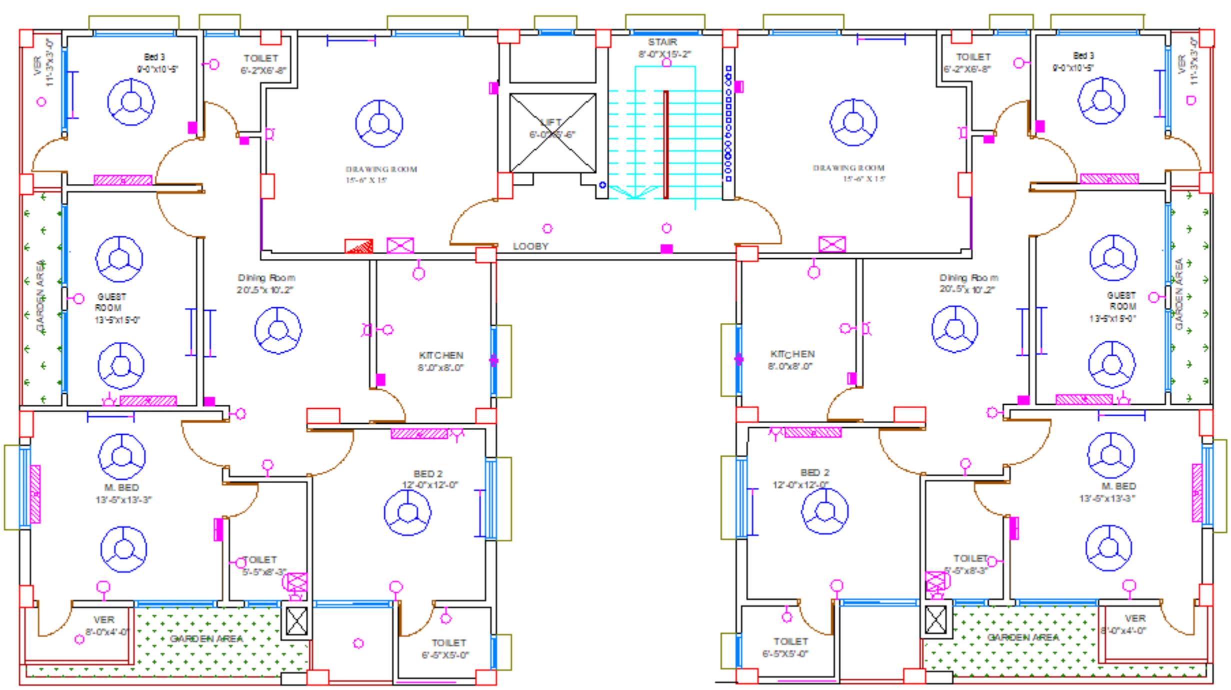
Typical 2nd floor Layout



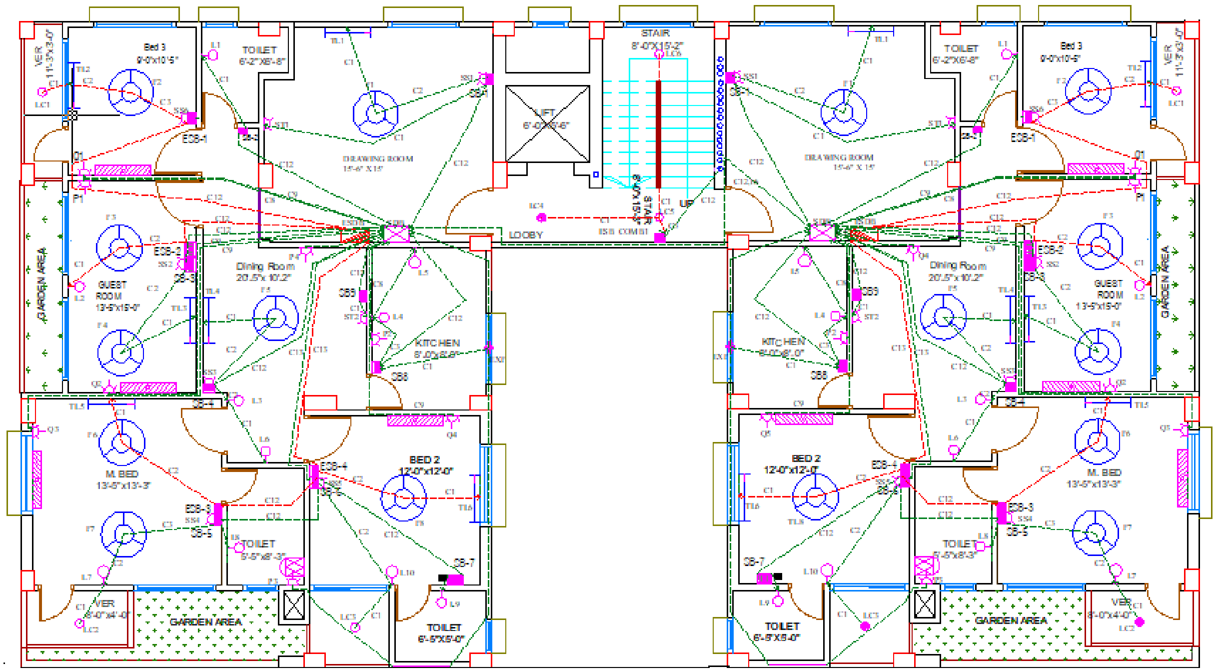
Typical 1st floor with Fittings



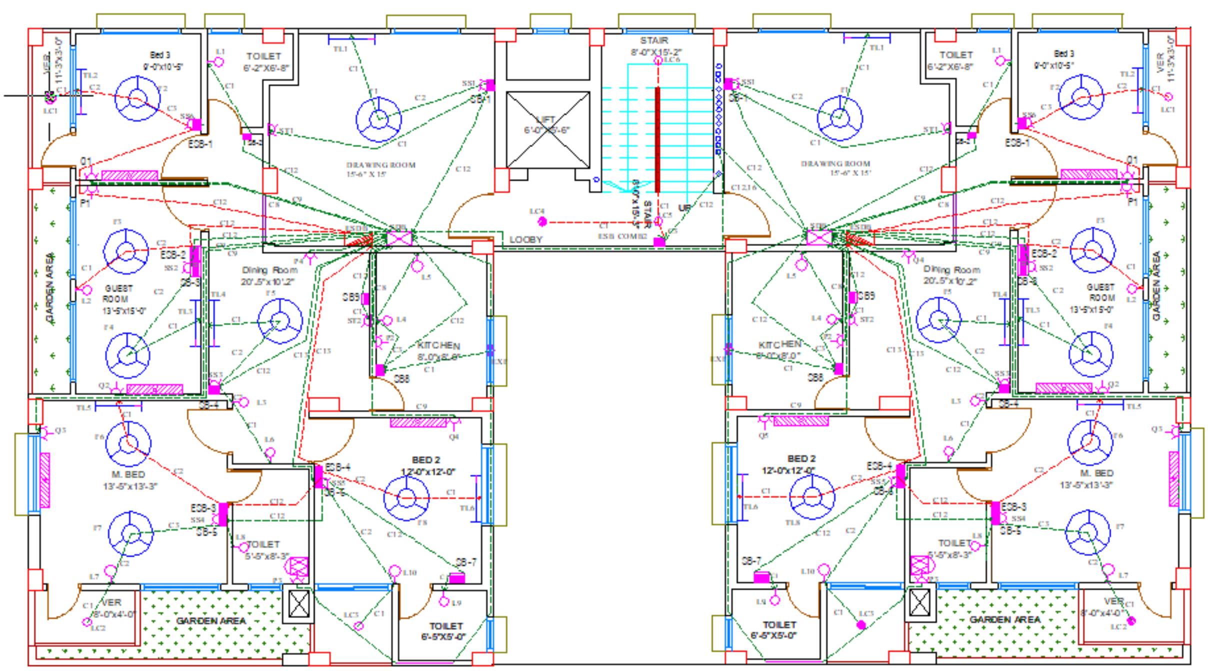
Typical 2nd floor with Fittings



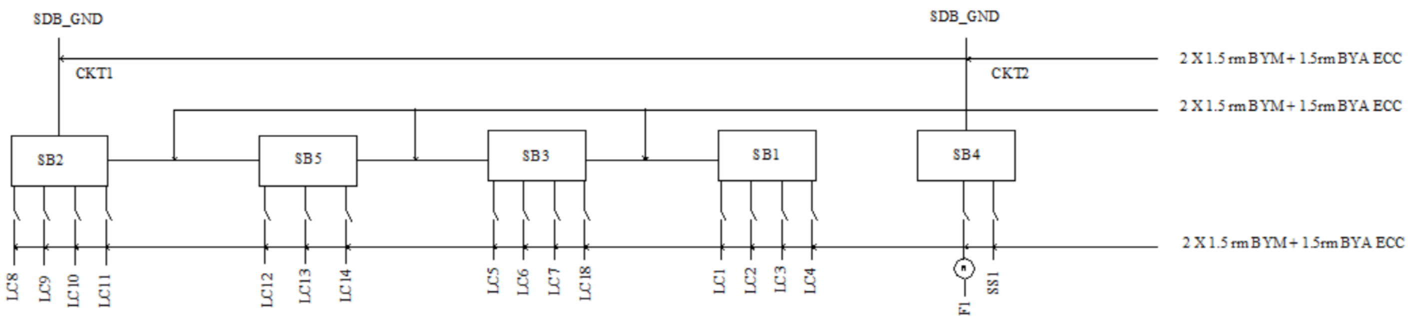
Typical 1st floor with Conduits



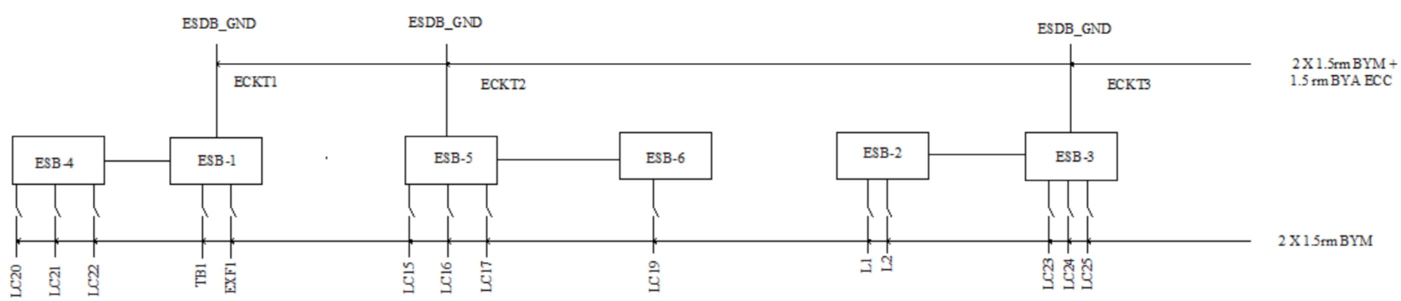
Typical 2nd floor with Conduits



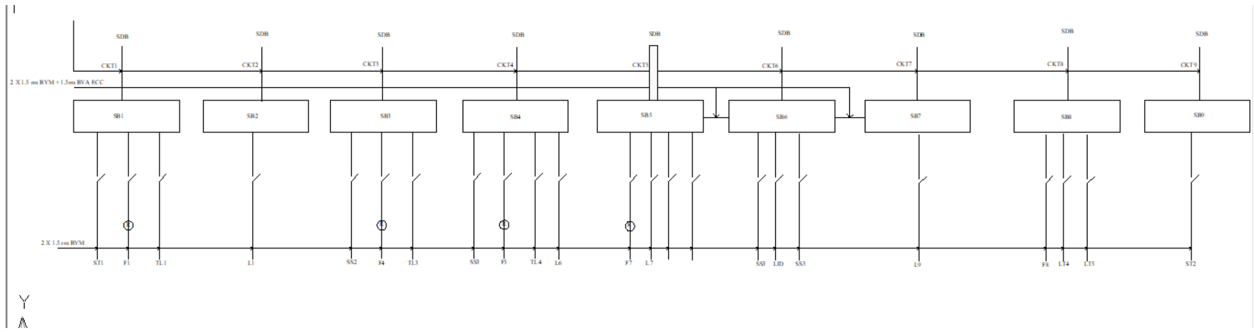
Ground floor Switchboard Diagram



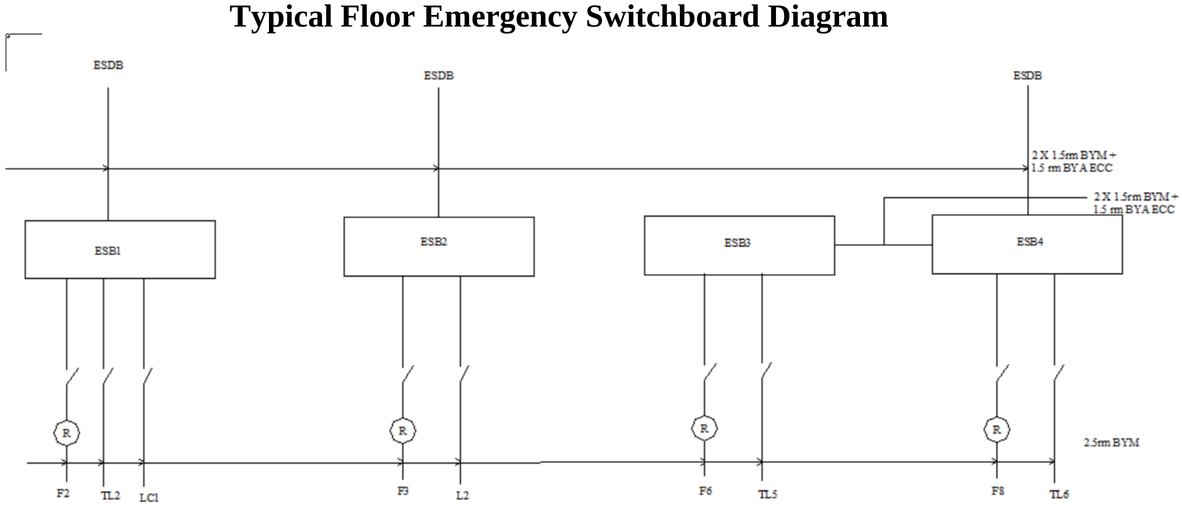
Ground floor Emergency Switchboard Diagram



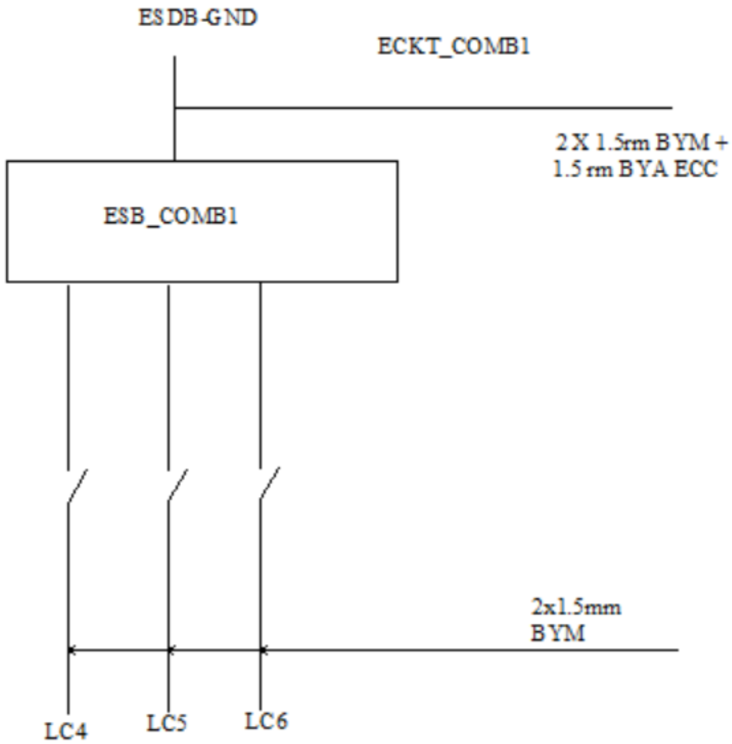
Typical Floor Switchboard Diagram



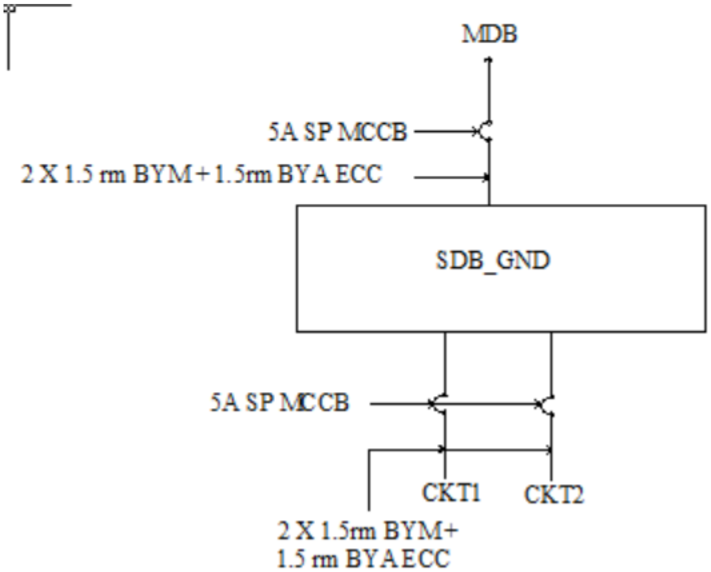
Typical Floor Emergency Switchboard Diagram



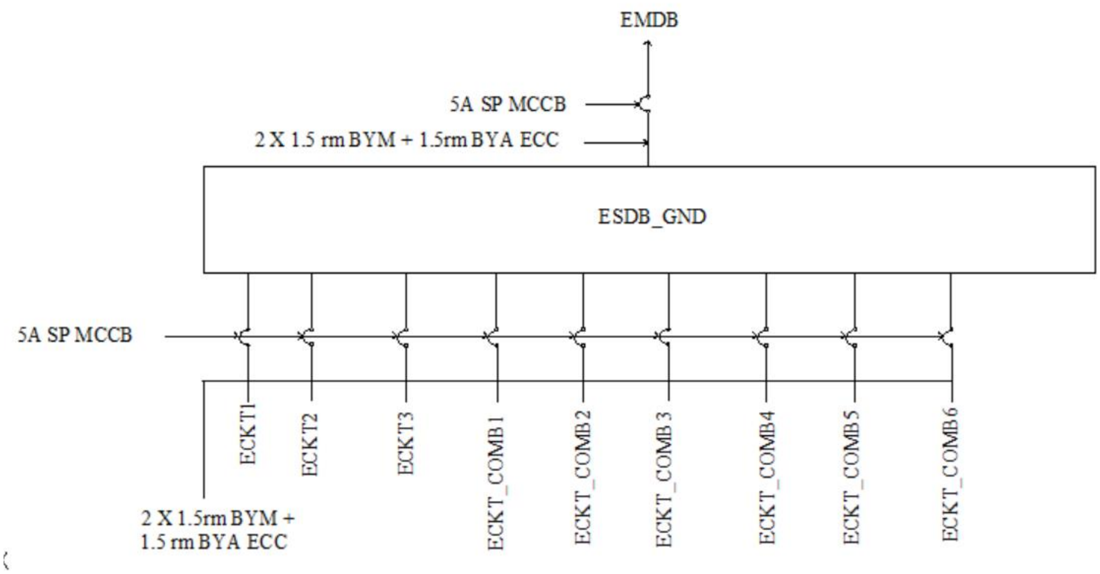
Lobby Emergency Switchboard Diagram



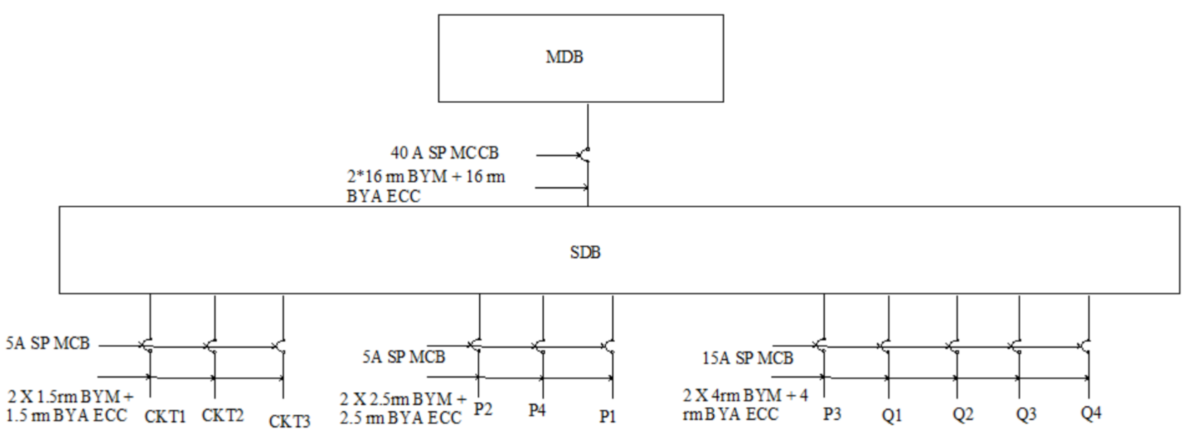
Ground Floor Sub distribution Board Diagram



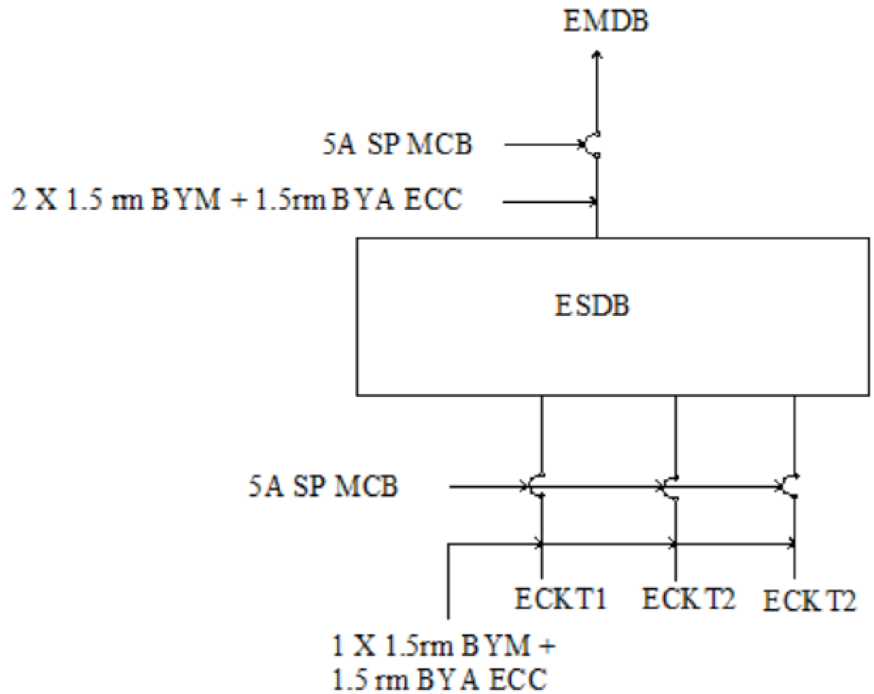
Ground Floor Emergency Subdistribution Board Diagram



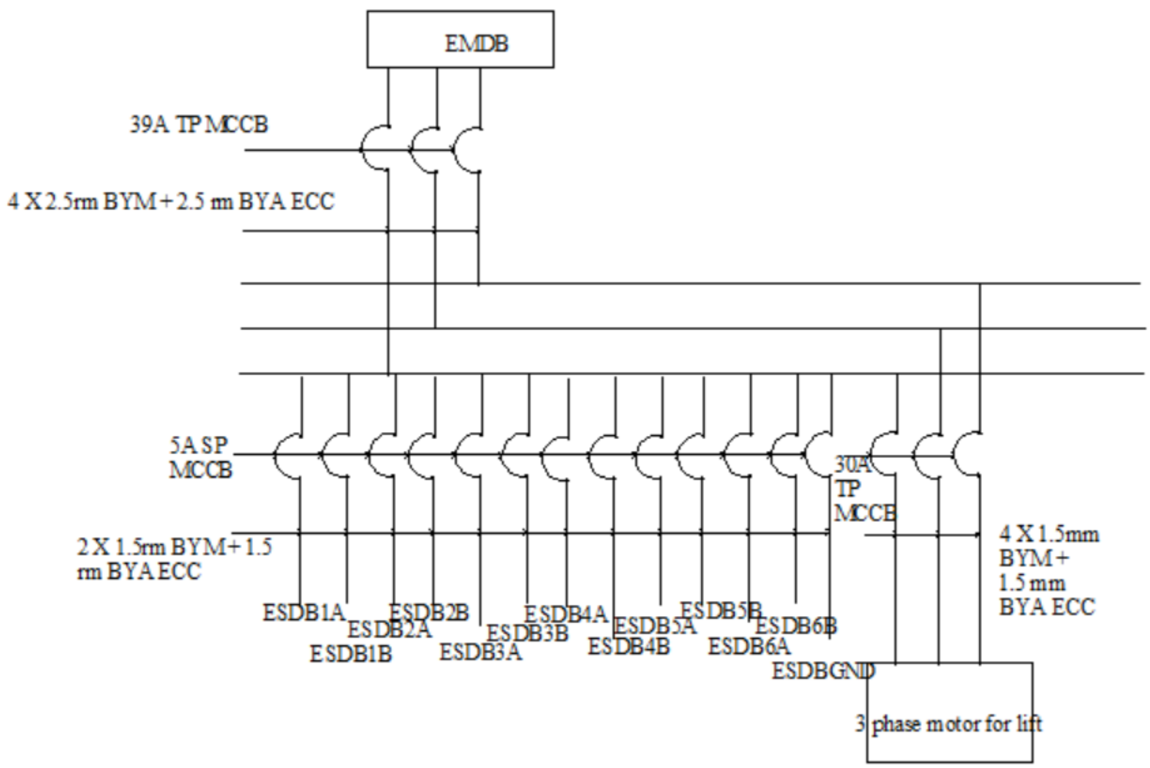
Typical Floor Sub distribution Board Diagram



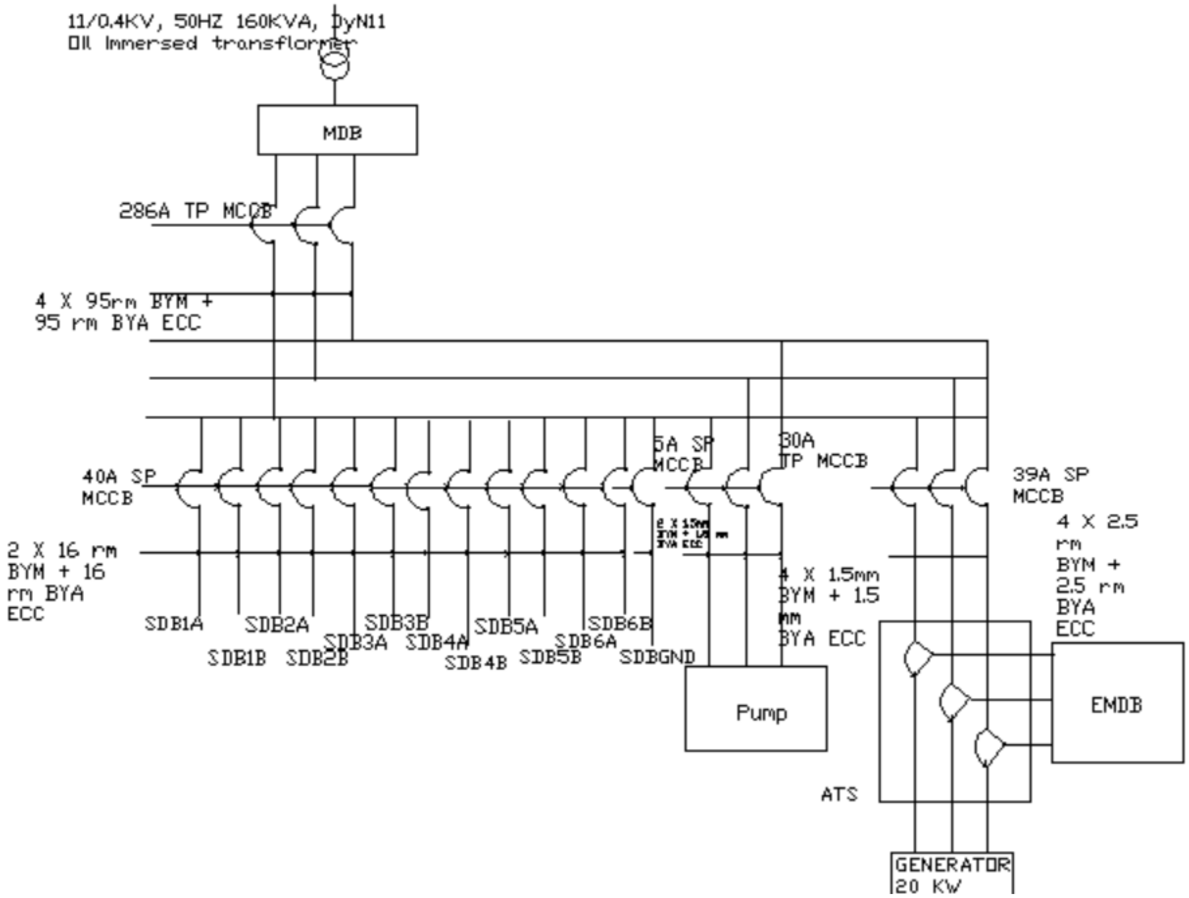
Typical Floor Emergency Sub distribution Board Diagram



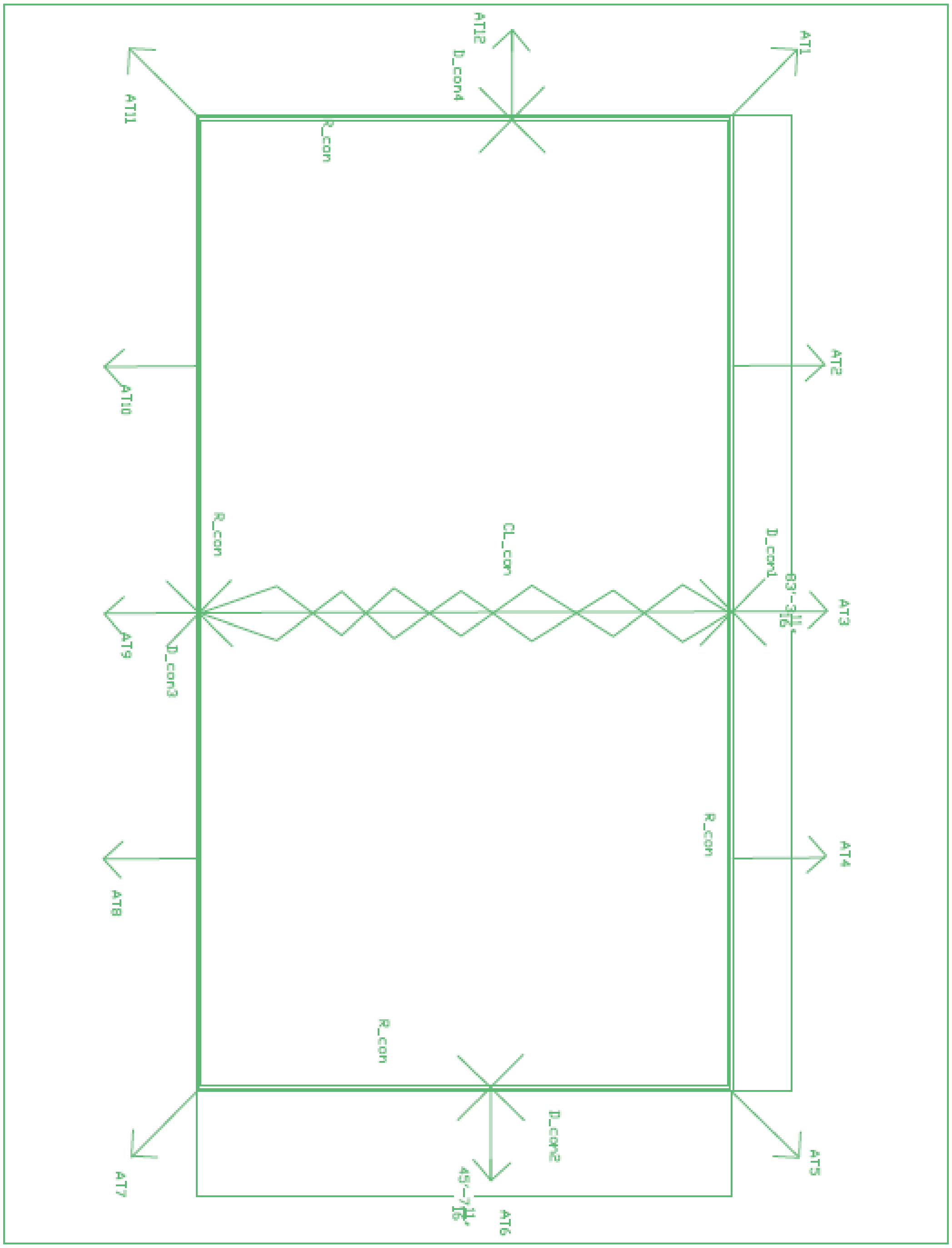
Emergency Main Distribution Board Diagram



Main Distribution Board Diagram



Lightening System Protection (LPS)



Legends for conduit:

Label	Wire size	Wire current rating
C1	2*1.5 rm BYM	5A
C2	4*1.5 rm BYM	5A
C3	6*1.5 rm BYM	5A
C4	8*1.5 rm BYM	5A
C8	2*2.5 rm BYM + 2.5 rm BYA ECC	10A
C9	2*4 rm BYM + 4 rm BYA ECC	15A
C12	2*1.5 rm BYM + 1.5 rm BYA ECC	5A
C13	4*1.5 rm BYM + 2*1.5 rm BYA ECC	5A
C14	6*1.5 rm BYM + 3*1.5 rm BYA ECC	5A
C15	8*1.5 rm BYM + 3*1.5 rm BYA ECC	5A
C16	2*16 rm BYM + 16 rm BYA ECC	40A
C17	4*2.5 rm NYY + 2.5 rm BYA ECC	39 A

Ground Floor Light Fan Calculation:

Guard Room:

Area= 7’9” x 5’ =38.75 sq. ft = (78.5 x 0.092903) m^2 =3.6 m^2
Illuminance, E= 100 lux
Light Loss Factor and Utilization Factor, LLF x UF = 0.8
Number of lights per luminaire, n=1
Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)
Number of Lights, N= 0.36
So, 1 Light Bulb is required.
Number of fans = 0.3875
So, 1 fan is required.

Stairs:

Area= 8’ x 15’3” = 122 sq. ft = (65.625 x 0.092903) m^2 =11.33 m^2
Illuminance, E= 70 lux
Light Loss Factor and Utilization Factor, LLF x UF = 0.6
Number of lights per luminaire, n=1
Flux= 750 Lumen (16 W Energy Saving Bulb and Fluorescent Tube Light)
Number of Lights, N= 1.76
So, 2 Ceiling mounted Light Bulb is required.

Lobby:

Area= 15’8” x 3’10” = 60.06 sq. ft = (60.06 x 0.092903) m^2 =5.58 m^2
Illuminance, E= 70 lux

Light Loss Factor and Utilization Factor, LLF x UF = 0.6
Number of lights per luminaire, n=1
Flux= 750 Lumen (16 W Energy Saving Bulb and Fluorescent Tube Light)
Number of Lights, N= 0.868
So, 1 Ceiling mounted Light Bulb is required.

Generator Room:
Area= 12’7”x8’ =100.67 sq. ft = (100.67 x 0.092903) m^2 =9.35 m^2
Illuminance, E= 100 lux
Light Loss Factor and Utilization Factor, LLF x UF = 0.5
Number of lights per luminaire, n=1
Flux= 3200 Lumen (40W Fluorescent Lamps)
Number of Lights, N= 0.58
So, 1 tube light is required.

Toilet:
Area= 6’5” x 3’3” = 20.85 sq. ft = (10.5 x 0.092903) m^2 =1.937 m^2
Illuminance, E= 100 lux
Light Loss Factor and Utilization Factor, LLF x UF = 0.5
Number of lights per luminaire, n=1

Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)

Number of Lights, N= 0.31

So, 1 Light Bulb is required.

Space between garage & doorway:
Area= 30’8” x 19’10” = 608.22 sq. ft = (608.22 x 0.092903) m^2 = 56.5 m^2
Illuminance, E= 70 lux
Light Loss Factor and Utilization Factor, LLF x UF = 0.7
Number of lights per luminaire, n=1
Flux= 950 Lumen (16 W Energy Saving Bulb and Fluorescent Tube Light)
Number of Lights, N=5.95
So, 6 Ceiling Mounted Light Bulbs are required.

Garage:
Area= 37’10” x 20’ (vertical – 5 cars) + 19’10” x 11’9” (Horizontal – 3 cars /bikes) = 989.71 sq. ft = (989.71 x 0.092903) m^2 = 91.94 m^2
Illuminance, E= 70 lux
Light Loss Factor and Utilization Factor, LLF x UF = 0.7
Number of lights per luminaire, n=1
Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)
Number of Lights, N= 7.355
So, 7 Ceiling Mounted Light Bulbs (4 vertical & 3 horizontal) are required.

First Floor Light Fan Calculation:

Master Bedroom:

Master Bed:

Area= 13’5” x 13’3” =177.77 sq. ft = (177.77 x 0.092903) m^2 =16.515 m^2

Illuminance, E= 100 lux

Light Loss Factor and Utilization Factor, LLF x UF = 0.7

Number of lights per luminaire, n=1

Flux= 3200 Lumen (40W Energy Saving Bulb and Fluorescent Tube Light)

Number of Lights, N= 0.737

So, 1 Tube Light is required.

Number of Fans= 1.77

So, 2 Fan is required.

Veranda:

Area= 8’ x 4’ =32 sq. ft = (32 x 0.092903) m^2 =2.973 m^2

Illuminance, E= 70 lux

Light Loss Factor and Utilization Factor, LLF x UF = 0.6

Number of lights per luminaire, n=1

Flux= 950 Lumen (16W Energy Saving Bulb and Fluorescent Tube Light)

Number of Lights, N= 0.365

So, 1 Ceiling Mounted Light bulb is required.

Bathroom:
Area= 5’5” x 8’3” = 44.6875 sq. ft = (44.6875 x 0.092903) m^2 = 4.15 m^2
Illuminance, E= 100 lux
Light Loss Factor and Utilization Factor, LLF x UF = 0.5
Number of lights per luminaire, n=1
Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)
Number of Lights, N= 0.66
So, 1 Light bulb is required

<u>Bedroom-2:</u>
Bedroom:
Area= 12’ x 12’ =144 sq. ft = (138 x 0.092903) m^2 =13.37 m^2
Illuminance, E= 100 lux
Light Loss Factor and Utilization Factor, LLF x UF = 0.7
Number of lights per luminaire, n=1
Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)
Number of Lights, N= 1.53
So, 1 Light bulb and 1 Tube Light are required.
The number of Fans= 1.44
So, 1 Fan is required.

Veranda:
Area= 6’ x 5’5” =32.5 sq. ft = (32.5 x 0.092903) m^2 = 3.02 m^2
Illuminance, E= 70 lux

Light Loss Factor and Utilization Factor, LLF x UF = 0.7
Number of lights per luminaire, n=1
Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)

Number of Lights, N= 0.24
So, 1 Ceiling Mounted Light bulb is required.

Bathroom:
Area= 6’5” x 5’ = 32.083 sq. ft = (44.6875 x 0.092903) m^2 = 2.98 m^2
Illuminance, E= 100 lux
Light Loss Factor and Utilization Factor, LLF x UF = 0.5
Number of lights per luminaire, n=1
Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)
Number of Lights, N= 0.477
So, 1 Light Bulb is required.

<u>Bedroom-3:</u>
Bedroom:
Area= 9’ x 10’5” =93.75 sq. ft = (138 x 0.092903) m^2 =8.71 m^2
Illuminance, E= 100 lux
Light Loss Factor and Utilization Factor, LLF x UF = 0.7
Number of lights per luminaire, n=1
Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)
Number of Lights, N= 0.995
So, 1 Tube Light is required.
The number of Fans= 0.9375
So, 1 Fan is required.

Veranda:
Area= 11’3” x 3’ =33.75 sq. ft = (32 x 0.092903) m^2 = 3.135 m^2
Illuminance, E= 70 lux

Number of lights per luminaire, n=1
Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)
Number of Lights, N= 0.66
So, 1 Light Bulb is required**.**

Bathroom:
Area= 6'2" x 6'8" = 41.11 sq. ft = (41.11 x 0.092903) m^2 = 3.82 m^2
Illuminance, E= 100 lux
Light Loss Factor and Utilization Factor, LLF x UF = 0.5
Number of lights per luminaire, n=1
Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)
Number of Lights, N= 0.611
So, 1 Light Bulb is required.

Guest room:
Area= 13'5" x 15' =201.25 sq. ft = (201.25 x 0.092903) m^2 = 18.7 m^2
Illuminance, E= 100 lux
Light Loss Factor and Utilization Factor, LLF x UF = 0.7
Number of lights per luminaire, n=1
Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)
Number of Lights, N= 2.14

So, 1 Light bulb and 1 Tube Light are required.
The number of Fans= 2.0125
So, 2 Fan is required.

Drawing Room:
Area= 15’6” x 15’ = 232.5 sq. ft = (95 x 0.092903) m^2 = 21.6 m^2
Illuminance, E= 100 lux
Light Loss Factor and Utilization Factor, LLF x UF = 0.7
Number of lights per luminaire, n=1
Flux= 3200 Lumen (40W Energy Saving Bulb and Fluorescent Tube Light)
Number of Lights, N= 0.96
So, 1 Tube light is required
The number of Fans= 0.23
So, 1 Fan is required.

Kitchen:
Area= 8’ x 8’ = 64 sq. ft = (111.625 x 0.092903) m^2 = 5.946 m^2
Illuminance, E= 200 lux
Light Loss Factor and Utilization Factor, LLF x UF = 0.8
Number of lights per luminaire, n=1
Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)
Number of Lights, N= 1.19
So, 1 Light bulb is required.
The number of Fans= 0.64
1 Exhaust Fan is required.

Dining Space:
Area= 7’8” x 10’7” = 81.14 sq. ft = (81.14 x 0.092903) m^2 = 7.538 m^2
Illuminance, E= 100 lux
Light Loss Factor and Utilization Factor, LLF x UF = 0.7
Number of lights per luminaire, n=1
Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)
Number of Lights, N= 0.86
So, 1 tube light is required.
The number of Fans= 0.81
1 Fan is required.

Common Toilet:
Area= 3’ x 3’6” = 10.5 sq. ft = (10.5 x 0.092903) m^2 =0.975 m^2
Illuminance, E= 100 lux
Light Loss Factor and Utilization Factor, LLF x UF = 0.5
Number of lights per luminaire, n=1

Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)
Number of Lights, N= 0.156
So, 1 Light Bulb is required.

Stairs:
Area= 8’ x 15’3” = 122 sq. ft = (65.625 x 0.092903) m^2 =11.33 m^2
Illuminance, E= 70 lux
Light Loss Factor and Utilization Factor, LLF x UF = 0.6
Number of lights per luminaire, n=1

Flux= 750 Lumen (16 W Energy Saving Bulb and Fluorescent Tube Light)
Number of Lights, N= 1.76
So, 2 Ceiling mounted Light Bulb is required.

Lobby:

Area= 15’8” x 3’10” = 60.06 sq. ft = (60.06 x 0.092903) m^2 =5.58 m^2
Illuminance, E= 70 lux
Light Loss Factor and Utilization Factor, LLF x UF = 0.6
Number of lights per luminaire, n=1
Flux= 750 Lumen (16 W Energy Saving Bulb and Fluorescent Tube Light)
Number of Lights, N= 0.868
So, 1 Ceiling mounted Light Bulb is required.

Calculation of current rating:

Current rating of fittings and fixtures:

LED bulb:

The power rating of each LED bulb is 10W. Current flow through the light bulb,
$I = \frac{P}{V*pf} = \frac{10}{220*0.9}$ = 0.05 A < 5A, so 2 X 1.5 rm BYM wire is needed.

LED tube light:

The power rating of each LED tube light is 10W (130 lm per watt, so 1250 lm is almost 10W). Current flow through tube light,

$I = \frac{P}{V*pf} = \frac{10}{220*0.9}$ = 0.05 A < 5A, so 2 X 1.5 rm BYM wire is needed.

Concealed ceiling light (CCL):

The power rating of each CCL is 10W. Current flow through CCL.

$I = \frac{P}{V*pf} = \frac{10}{220*0.9}$ = 0.05 A < 5A, so 2 X 1.5 rm BYM wire is needed.

Ceiling Fan:

The power rating of each 48-inch wing ceiling fan is 75W. Current flow through ceiling fan,

$I = \frac{P}{V*pf} = \frac{75}{220*0.8}$ = 0.42 A<5A, so 2X1.5 rm BYM wire is needed.

Exhaust fan (EF):

The power rating of each exhaust fan is 20W (5W-35W). Current flow through EF,

$I = \frac{P}{V*pf} = \frac{20}{220*0.8}$ =0.113A<5A, so 2X1.5 rm BYM wire is needed.

2 pin 5A socket at switchboard level (SS):

This is for charging a mobile (2-W)) or laptop(20-50W) or desktop computer (200W). So maximum current flow through SS,

$I = \frac{P}{V*pf} = \frac{200}{220*0.75}$ =1.21 A<5A, so 2X1.5 rm BYM wire is needed.

2 pin sockets for TV (ST):

Power consumption for TV (55-inch LED TV) = 80 W, current flow through it,

$I = \frac{P}{V*pf} = \frac{80}{220*0.75}$ =0.48 A<5A, so 2X1.5 rm BYM wire is needed.

Power Sockets:

P1: This is redundant power socket for washing machine, iron, or other high-power accessories, let standard SP MCB rating = 10A, so 2X2.5 rm BYM + 2.5 rm BYA ECC wire is needed.

P2: This is for microwave oven, having power consumption 1200W, or blending machine, having power consumption 1000W Current flow through P2,

$I = \frac{P}{V*pf} = \frac{1000}{220*0.8}$= 5.68<10$A$, so SP MCB rating = 10A, so 2X2.5 rm BYM + 2.5 rm BYA ECC wire is needed

P3: This is for geyser having power consumption 2000W (500W – 5000W). Current flow through P3,

$I = \frac{P}{V*pf} = \frac{2000}{220*0.8}$=11.36 A<15A, so 15A SP MCB and 2X4rm BYM + 4 rm BYA ECC wire is needed.

P4: This is for refrigerator, having power consumption 600W (home refrigerator 350W-780W), Current flow through P4, $I = \frac{P}{V*pf} = \frac{600}{220*0.75}$ = 3.63 <5A, So 5A SP MCB and 2X1.5 rm BYM + 1.5 rm BYA ECC wire is needed to connect.

Q1,Q2,Q3,Q4 for Air conditioner: Power rating of each 1.5 ton AC is 1500W. Current flow through AC,
$I = \frac{P}{V*pf} = \frac{1500}{220*0.9}$= 7.57$A$ <10A , so SP MCB rating = 10A, so 2X2.5 rm BYM + 2.5 rm BYA ECC wire is needed.

Current rating for Switchboards of ground floor (SB):

SB1:

Total current for SB2 = $Power\ consumption\ by\ \frac{LC1+LC2+LC3+LC4}{V*pf} = \frac{4*10}{220*0.9}$ = 0.2 A < 5A

So 5A SP MCB and 2X1.5 rm BYM + 1.5 rm BYA ECC wire is needed to connect **SB1 with SDB_gnd.**

SB2:

Total current for SB2 = $Power\ consumption\ by\ \frac{LC8+LC9+LC10+LC11}{V*pf} = \frac{4*10}{220*0.9}$ = 0.2 A < 5A

So 5A SP MCB and 2X1.5 rm BYM + 1.5 rm BYA ECC wire is needed to connect **SB2 with SDB_gnd.**

SB3:

Total current for SB2 = $Power\ consumption\ by\ \frac{LC5+LC6+LC7+LC18}{V*pf} = \frac{4*10}{220*0.9}$ = 0.2 A < 5A

So 5A SP MCB and 2X1.5 rm BYM + 1.5 rm BYA ECC wire is needed to connect **SB3 with SDB_gnd.**

SB4:

Total current for SB4 = = $Power\ consumption\ by\ \frac{F1+SS1}{V*pf} = \frac{75+200}{220*0.9}$ = 1.38 A < 5A

So 5A SP MCB and 2X1.5 rm BYM + 1.5 rm BYA ECC wire is needed to connect **SB4 with SDB_gnd.**

SB5:

Total current for SB8 = $Power\ consumption\ by\ \frac{L12+L13+L14}{V*pf} = \frac{3*10}{220*0.9}$ = 0.15 A < 5A

So 5A SP MCB and 2X1.5 rm BYM + 1.5 rm BYA ECC wire is needed to connect **SB5 with SDB_gnd.**

Current rating for Emergency Switchboards of ground floor (ESB):

ESB1:

Total current for ESB1 = $Power\ consumption\ by\ \frac{EXF1+TB1}{V*pf} = \frac{20+10}{220*0.9}$ = 0.15 A < 5A

So 5A SP MCB and 2X1.5 rm BYM + 1.5 rm BYA ECC wire is needed to connect **ESB1 with ESDB_gnd.**

ESB2:

Total current for ESB5 = $Power\ consumption\ by\ \frac{L1+L2}{V*pf} = \frac{2*10}{220*0.9}$ = 0.1 A < 5A

So 5A SP MCB and 2X1.5 rm BYM + 1.5 rm BYA ECC wire is needed to connect **ESB2 with ESDB_gnd.**

ESB3:

Total current for ESB3 = $Power\ consumption\ by\ \frac{LC23+LC24+LC25}{V*pf} = \frac{3*10}{220*0.9}$ = 0.15 A < 5A

So 5A SP MCB and 2X1.5 rm BYM + 1.5 rm BYA ECC wire is needed to connect **ESB3 with ESDB_gnd.**

ESB4:

Total current for ESB4 = $Power\ consumption\ by\ \frac{LC20+LC21+LC22}{V*pf} = \frac{3*10}{220*0.9}$ = 0.15 A < 5A

So 5A SP MCB and 2X1.5 rm BYM + 1.5 rm BYA ECC wire is needed to connect **ESB4 with ESDB_gnd.**

ESB5:

Total current for ESB5 = $Power\ consumption\ by\ \frac{LC15+LC16+LC17}{V*pf} = \frac{3*10}{220*0.9}$ = 0.15 A < 5A

So 5A SP MCB and 2X1.5 rm BYM + 1.5 rm BYA ECC wire is needed to connect **ESB5 with ESDB_gnd.**

ESB6:

Total current for ESB4 = $Power\ consumption\ by\ \frac{LC19}{V*pf} = \frac{10}{220*0.9}$ = 0.05 A < 5A

So 5A SP MCB and 2X1.5 rm BYM + 1.5 rm BYA ECC wire is needed to connect **ESB6 with ESDB_gnd.**

Current rating for Switchboards of a typical flat (SB):

SB1 :

Total current for SB1 = $Power\ consumption\ by\ \frac{F1+ST1+TL1+SS1}{V*pf} = \frac{75+80+10+200}{220*0.9}$ = 1.84 A < 5A

So 5A SP MCB and 2X1.5 rm BYM + 1.5 rm BYA ECC wire is needed to connect **SB1 with SDB.**

SB2 :

Total current for SB2 = $Power\ consumption\ by\ \frac{L1}{V*pf} = \frac{10}{220*0.9}$ $= 0.05$ A $<$ 5A

So 5A SP MCB and 2X1.5 rm BYM + 1.5 rm BYA ECC wire is needed to connect **SB2 with SDB.**

SB3:

Total current for SB3 = $Power\ consumption\ by\ \frac{SS2+F4+TL3}{V*pf} = \frac{200+75+10}{220*0.9} = 1.44$ A $<$ 5A

So 5A SP MCB and 2X1.5 rm BYM + 1.5 rm BYA ECC wire is needed to connect **SB3 with SDB.**

SB4:

Total current for SB4 = $Power\ consumption\ by\ \frac{SS3+F5+L3+L6+TL4}{V*pf} = \frac{200+75+3*10}{220*0.9} = 1.54$ A $<$ 5A

So 5A SP MCB and 2X1.5 rm BYM + 1.5 rm BYA ECC wire is needed to connect **SB4 with SDB.**

SB5:

Total current for SB5 = $Power\ consumption\ by\ \frac{F7+L7+L8+SS4+LC2}{V*pf} = \frac{75+3*10+200}{220*0.9} = 1.54$ A $<$ 5A

So 5A SP MCB and 2X1.5 rm BYM + 1.5 rm BYA ECC wire is needed to connect **SB5 with SB6.**

SB6 :

Total current for SB6 = $Power\ consumption\ by\ \frac{SS5+L10+LC3}{V*pf} = \frac{200+2*10}{220*0.9}$ = 1.22 A < 5A

So 5A SP MCB and 2X1.5 rm BYM + 1.5 rm BYA ECC wire is needed to connect **SB6 with SDB.**

SB7 :

Total current for SB7 = $Power\ consumption\ by\ \frac{L9}{V*pf} = \frac{10}{220*0.9}$ = 0.05 A < 5A

So 5A SP MCB and 2X1.5 rm BYM + 1.5 rm BYA ECC wire is needed to connect **SB7 with SB6.**

SB8 :

Total current for SB8 = $Power\ consumption\ by\ \frac{L4+L5+EXF}{V*pf} = \frac{10*2+20}{220*0.9}$ = 0.2 A < 5A

So 5A SP MCB and 2X1.5 rm BYM + 1.5 rm BYA ECC wire is needed to connect **SB8 with SDB.**

SB9 :

Total current for SB8 = $Power\ consumption\ by\ \frac{ST2}{V*pf} = \frac{80}{220*0.9}$ = 0.4 A < 5A

So 5A SP MCB and 2X1.5 rm BYM + 1.5 rm BYA ECC wire is needed to connect **SB9 with SDB.**

Current rating for Emergency Switchboards of a typical flat (ESB):

ESB1:

Total current for ESB1 = $Power\ consumption\ by\ \frac{F2+LC1+TL2}{V*pf} = \frac{75+2*10}{220*0.9} = 0.48\text{ A} < 5\text{A}$

So 5A SP MCB and 2X1.5 rm BYM + 1.5 rm BYA ECC wire is needed to connect **ESB1 with ESDB.**

ESB2:

Total current for ESB2 = $Power\ consumption\ by\ \frac{F3+L2}{V*pf} = \frac{75+10}{220*0.9} = 0.43\text{ A} < 5\text{A}$

So 5A SP MCB and 2X1.5 rm BYM + 1.5 rm BYA ECC wire is needed to connect **ESB2 with ESDB.**

ESB3:

Total current for ESB3 = $Power\ consumption\ by\ \frac{F6+TL5}{V*pf} = \frac{75+10}{220*0.9} = 0.43\text{ A} < 5\text{A}$

So 5A SP MCB and 2X1.5 rm BYM + 1.5 rm BYA ECC wire is needed to connect **ESB3 with ESB4.**

ESB4:

Total current for ESB4 = $Power\ consumption\ by\ \frac{F8+TL6}{V*pf} = \frac{75+10}{220*0.9} = 0.43\text{ A} < 5\text{A}$

So 5A SP MCB and 2X1.5 rm BYM + 1.5 rm BYA ECC wire is needed to connect **ESB4 with ESDB.**

Current rating of Sub Distribution Board of a typical flat (SDB):

SDB load = Total normal load + (Total P socket load + Total Q socket load) * 0.5

SB1 load = $75 + 80 + 10 + 200 * 0.3$ = 225W

SB2 load = 10W

SB3 load = $200 * 0.3 + 75 + 10$ = 145W

SB4 load = $200 * 0.3 + 75 + 3 * 10$= 165W

SB5 load = $75 + 3 * 10 + 200 * 0.3 =$ 165W

SB6 load = $200 * 0.3 + 2 * 10$= 80W

SB7 load = 10W

SB8 load = 10*2+20 = 40W

SB9 load = 80W

So, total normal load = 225+10+145+165+165+80+10+40+80 = 920W

Total P load = P1+P2+P3+P4 load = 1000+1200+2000+600 = 4800W

Total Q load = Q1+Q2+Q3 load = 1500*4 = 6000W

SDB load = 920 + (4800+6000) *0.5 = 6320 W

Current rating for SDB = $\frac{Power\ Consumption\ by\ SDB}{V * pf} = \frac{6320}{220 * 0.8} =$ 35.9 A

So, 40 A SP MCCB and 2*16 rm BYM + 16 rm BYA ECC wire is needed to connect SDB with MDB.

Current rating of Sub Distribution Board of ground floor (SDB_gnd):

SDB_gnd load = Total normal load in the ground floor.

SB1 load = 10*4 = 40W

SB2 load = 10*4 = 40W

SB3 load = 10*4 = 40W

SB4 load = $75 + 200$= 275W

SB5 load = $3 * 10$ = 30W

So, total SDB_gnd load = 3*40+275+30 = 425W

Current rating for SDB_gnd = $\frac{Power\ Consumption\ by\ SDB\_gnd}{V*pf} = \frac{425}{220*0.8}$ = 2.41 A

So, 5 A SP MCCB and 2*1.5 rm BYM + 1.5 rm BYA ECC wire is needed to connect **SDB_gnd with MDB.**

Current rating of Emergency Sub Distribution Board of a typical flat (ESDB):

ESDB load = Total emergency load connected to the ESBs
ESB1 load = 75+2*10 = 95W
ESB2 load = 10+75= 85W
ESB3 load = 75+10= 85W
ESB4 load = 75+10 =85W

So, total normal load = 95 + 3* 85 = 350 W

ESDB load = 350 W

Current rating for ESDB = $\frac{Power\ Consumption\ by\ ESDB}{V*pf} = \frac{350}{220*0.8}$
= 1.98 A

So, 5 A SP MCCB and 2*1.5 rm BYM + 1.5 rm BYA ECC wire is needed to connect **ESDB with EMDB.**

Current rating of Emergency Sub Distribution Board of ground floor (ESDB_gnd):
ESDB_gnd load = Total emergency load in the ground floor + Total ESB loads of the lobby of 1st to 6th floor.

ESB1 load = 10+20 = 30W
ESB2 load = 2*10 = 20 W
ESB3 load = 10*3 = 30W
ESB4 load = 3*10 = 30W
ESB5 load = 3*10 = 30W
ESB6 load = 10 = 10W
So, total emergency load in the ground floor = 4*30+20+10 = 150W
Total ESB loads of the lobby of 1st to 6th floor = 6*10*3 = 180W
So, total ESDB_gnd load = 180+150 = 330W
Current rating for ESDB_gnd = $\frac{Power\ Consumption\ by\ ESDB\_gnd}{V*pf}$ = $\frac{330}{220*0.8}$ = 1.875 A
So, 5 A SP MCCB and 2*1.5 rm BYM + 1.5 rm BYA ECC wire is needed to connect **ESDB_gnd with EMDB.**

Current rating of Emergency Main Distribution Board (EMDB):
Total EMDB load = Total ESDB load of all typical flats + ESDB load of ground floor + Lift load
Total ESDB load = 4*6*ESDB load = 24*350 W = 8400 W

Lift load ≈ power consumption of motor that run the 1 lift
= (Total weight of passengers that one lift can carry + weight of one lift) * average velocity of lift
= (80*12+100) *9.8*0.9
≈ 9350 W
So, Total EMDB load = 8400 + 330 + 9350W = 18080W
So, generator size = 20 KW. This is used to supply the EMDB load through an ATS.
Now, EMDB current (distributed load in 3 phase) c = 31.44 A
<u>So, 39 A TP MCCB and 4*2.5 rm NYY + 2.5 rm BYA ECC wire is required to connect **EMDB with MDB.**</u>

Current rating of Main Distribution Board (MDB):

Total MDB load = (Total SDB load of typical flat + Load of SDB_gnd + EMDB load + Pump load)*0.7

Total SDB load = 4*6*SDB of a typical flat = 24*6320 W = 151680 W

SDB_gnd load = 425 W

EMDB load (calculated in previous section) = 18080 W

Pump load (output) = 3 hp $\approx(input) = 3000W$

So, total MDB load = (151680 + 425 +18080+3000)*0.7 = 121229.5 W

Now, current for MDB (distributed load in 3 phase)= $\frac{Total\ MDB\ Load}{\sqrt{3}*V(L-L)*pf}$= $\frac{121229.5}{\sqrt{3}*415*0.8}$= 210.82 A

<u>So, 286 A TP MCCB and 4*95 rm NYY + 95 rm BYA ECC wire is needed to connect **MDB with Distribution Feeder line.**</u>

Size of the transformer = $\sqrt{3}\times VL\times IL$ = = $\sqrt{3}\times 415\times 210.82$ = 151.53 KVA

So, 160 KVA standard transformer is needed.

Current rating for pump =$\frac{3000}{\sqrt{3}*415*0.8}$ = 5.217 A

<u>So, 30 A TP MCCB and 4*1.5 rm NYY + 1.5 rm BYA ECC wire is needed to connect **pump with MDB**</u>

Each motor for one lift draws 9350W power (3 phase). So current for that motor = $\frac{9350}{\sqrt{3}*415*0.8}$ = 16.26A

<u>For safety purpose we use 30A TP MCCB and 4*1.5 rm NYY + 1.5 rm BYA ECC wire to connect **lift motor with EMDB.**</u>