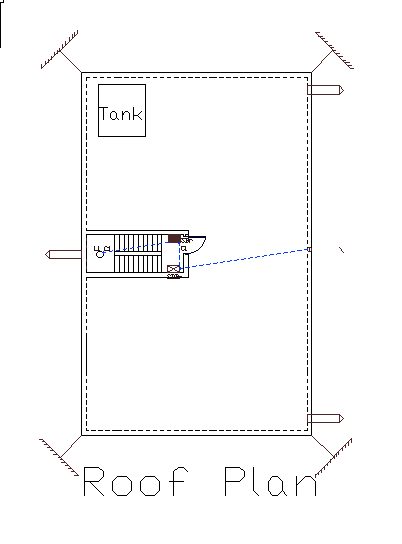
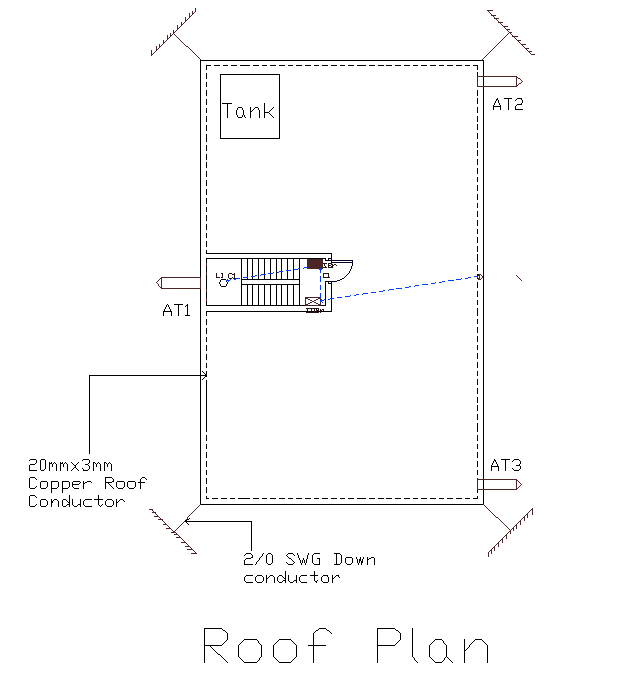
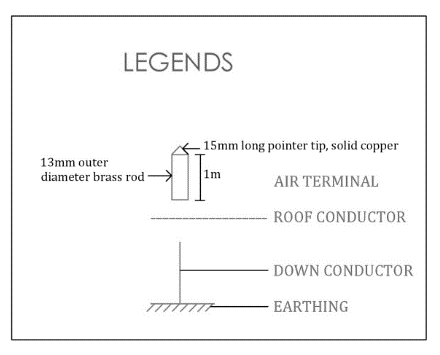


* Roof Plan:

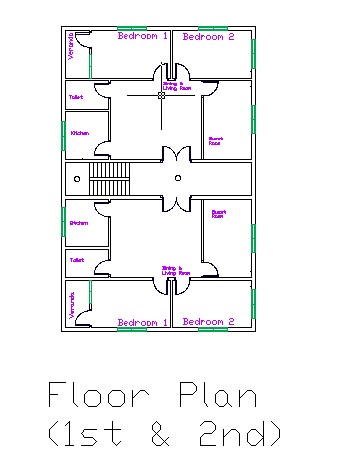


* Lighting Protection:

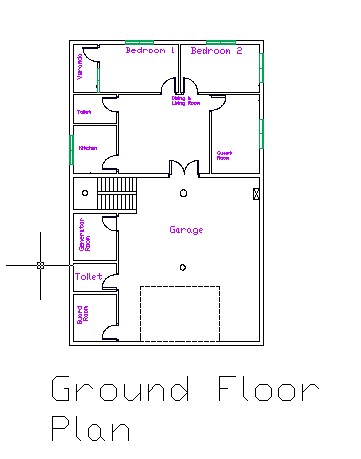




* Floor Plan(1st and 2nd):

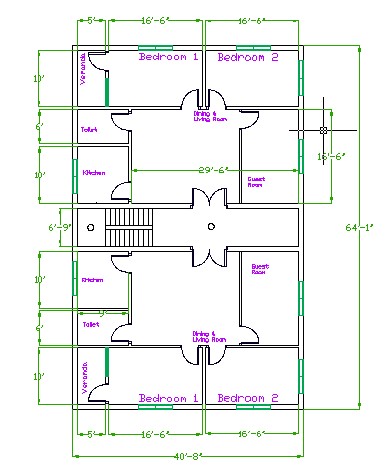


Ground Floor Plan:

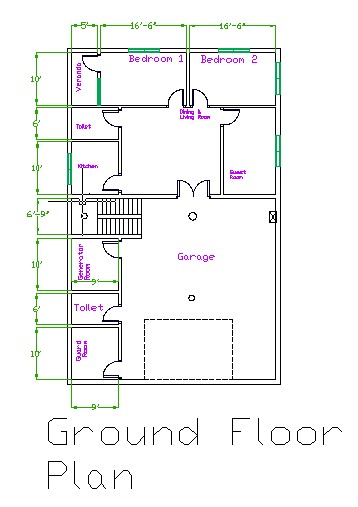


* Dimensions:

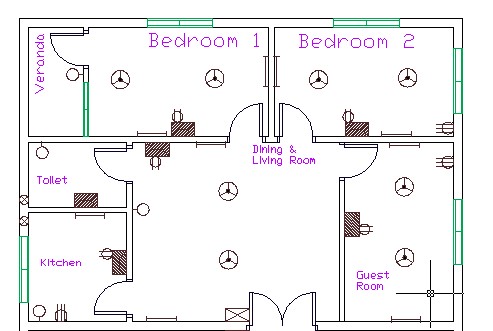
1st and 2nd Floor:



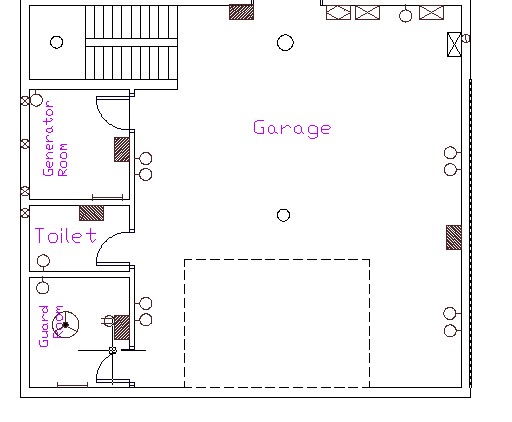
Ground floor:



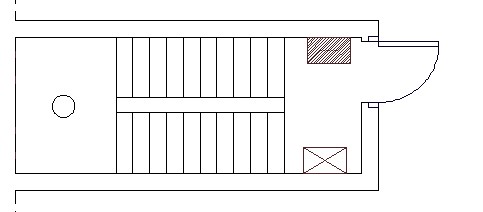
* Fittings and Fixtures: Apartment Unit:



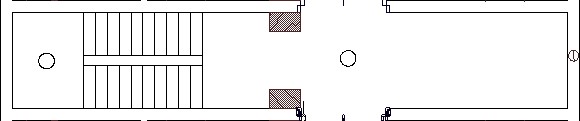
Garage Unit:



Roof corridor:

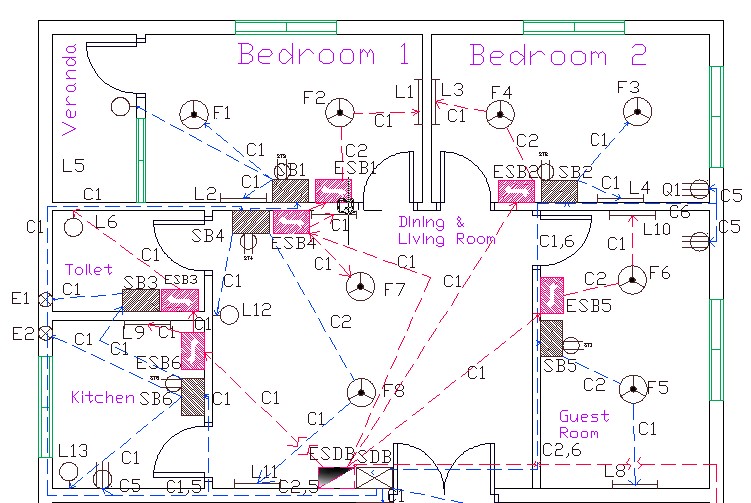


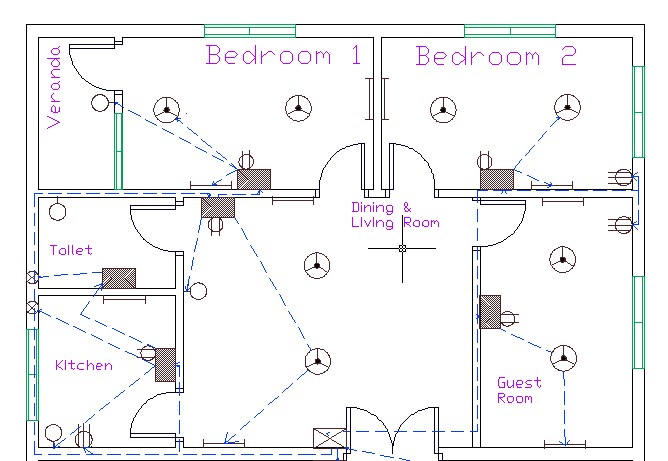
Apartment Corridor:



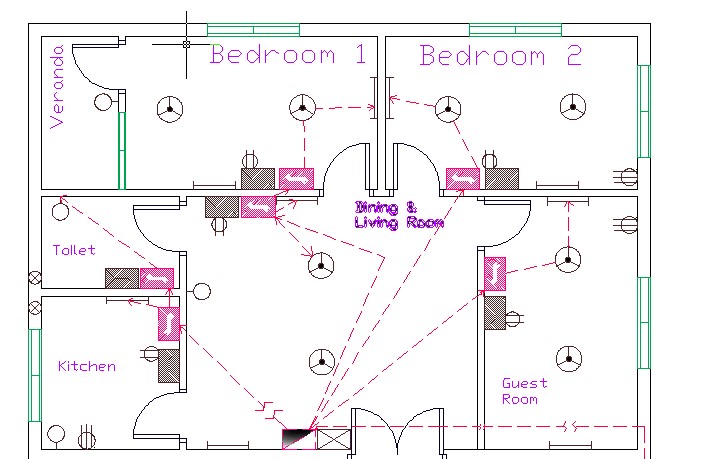
* **Conduit Layout:**

Apartment Unit:

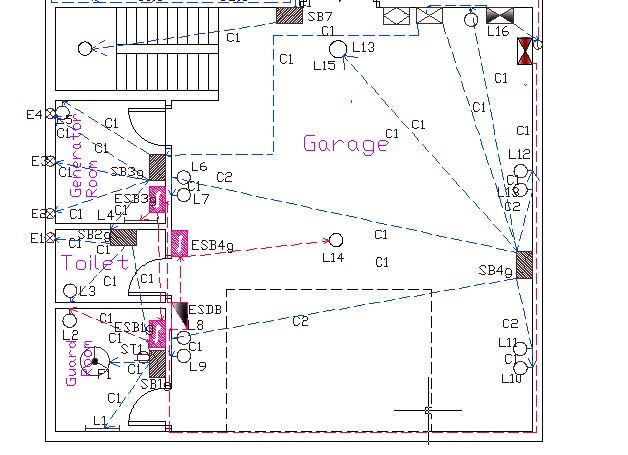


Normal conduit layout:

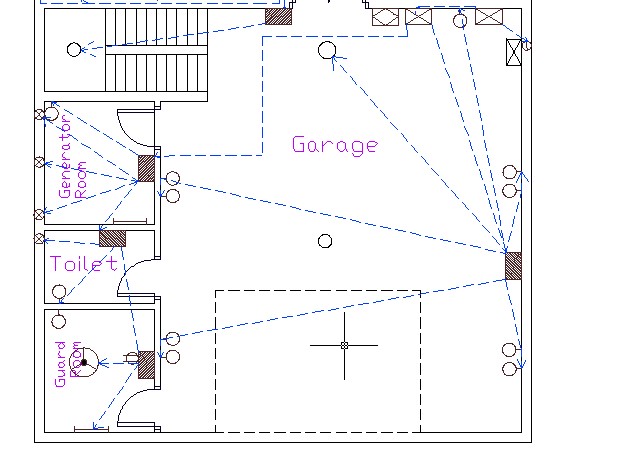
Emergency conduit layout:



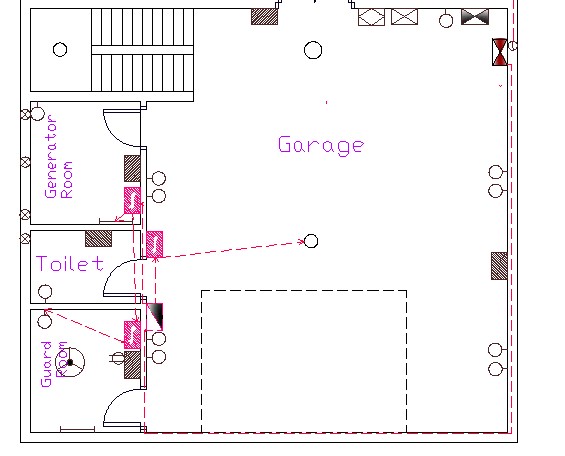
Garage Unit:



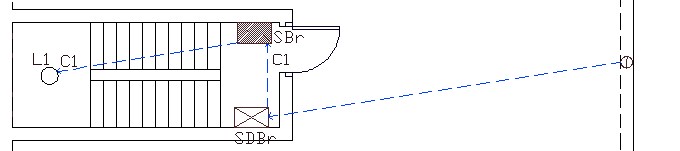
Normal conduit layout:



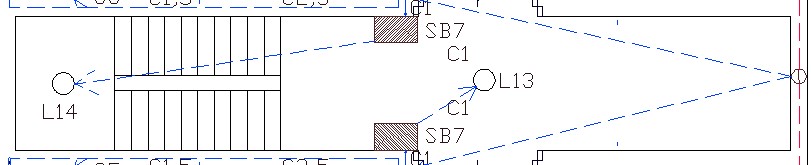
Emergency conduit layout:



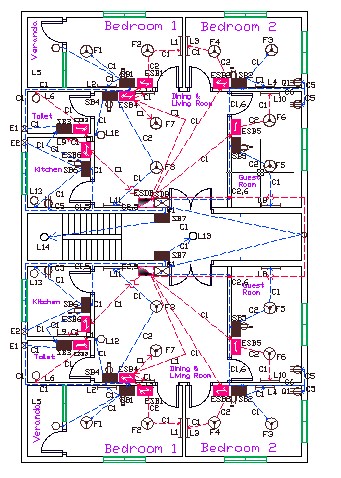
Roof corridor:



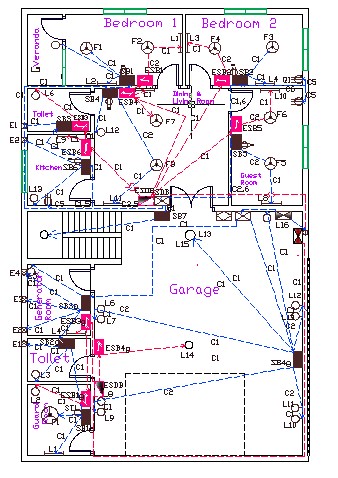
Apartment Unit Corridor:



1st and 2nd Floor:

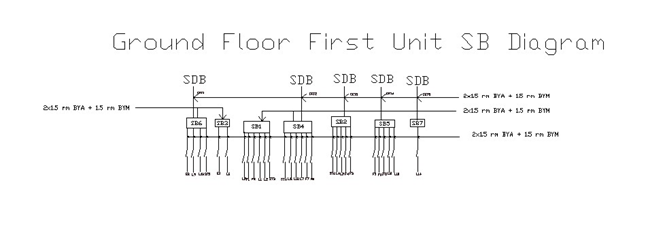


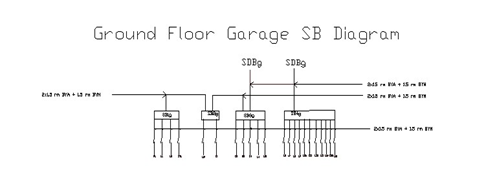
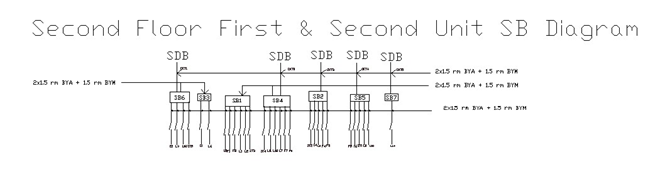
Ground Floor:

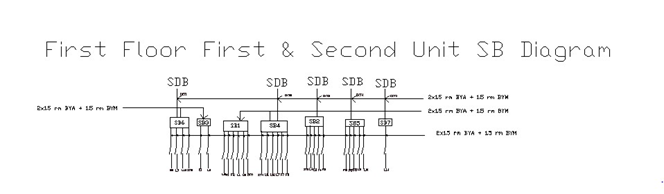


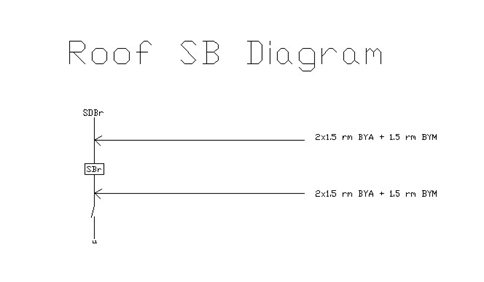
* **Connection Diagrams:**

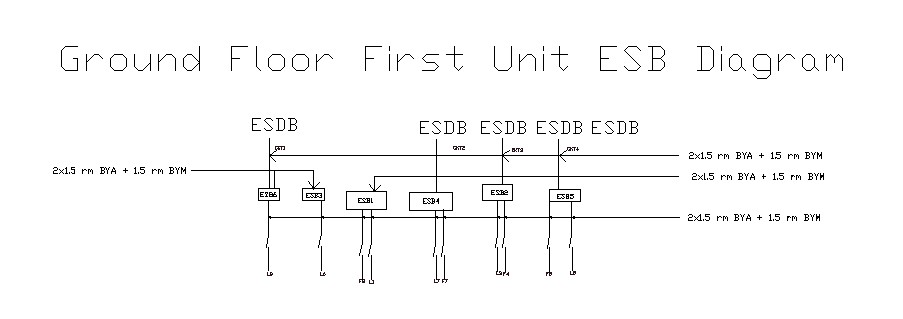
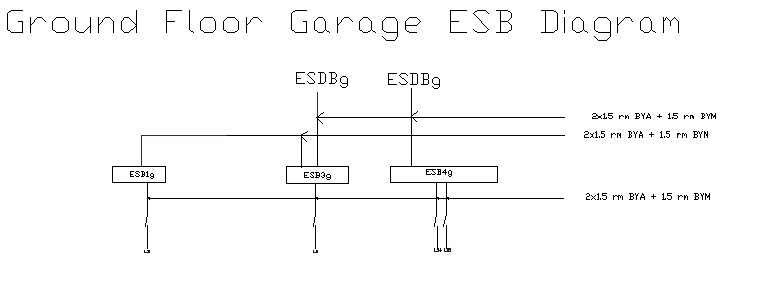
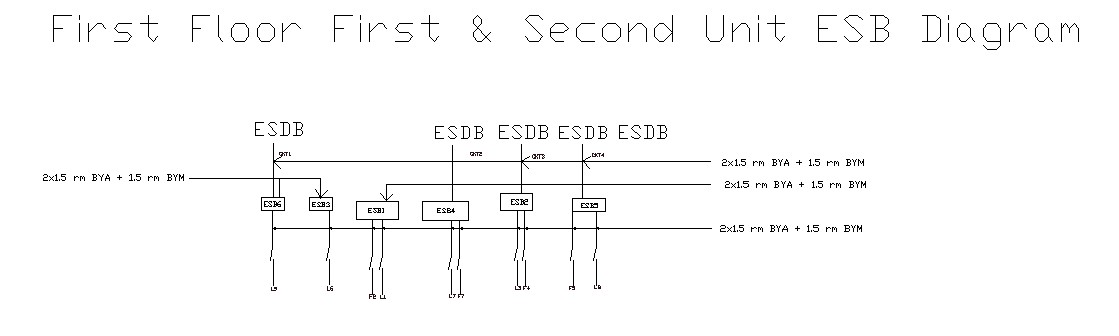
Normal switch Board Diagram:

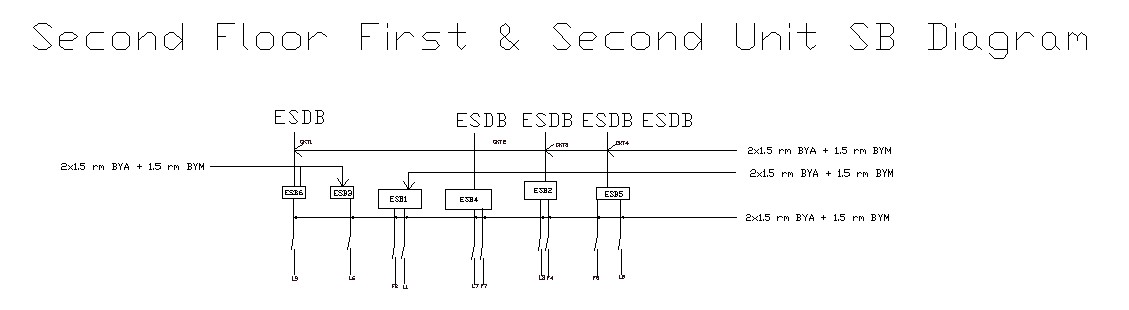




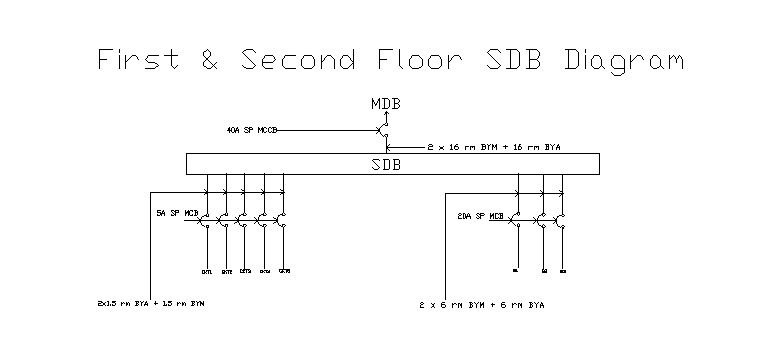
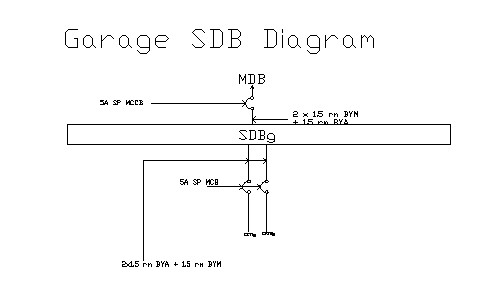




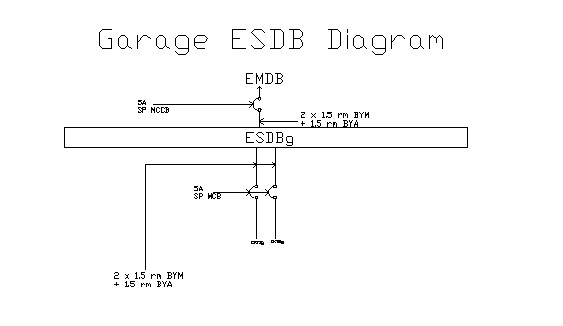
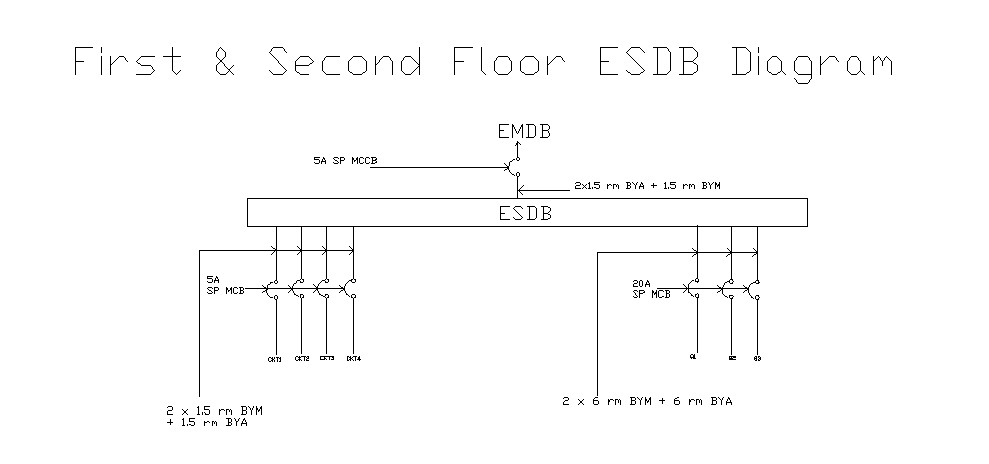
Emergency Switch Board Diagrams:



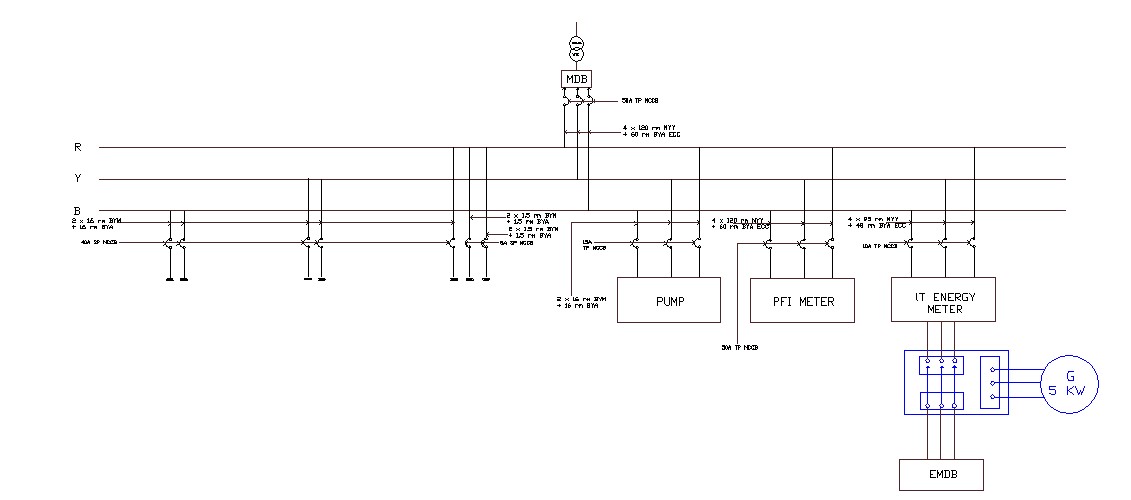
Normal Sub-distribution Board Diagram:

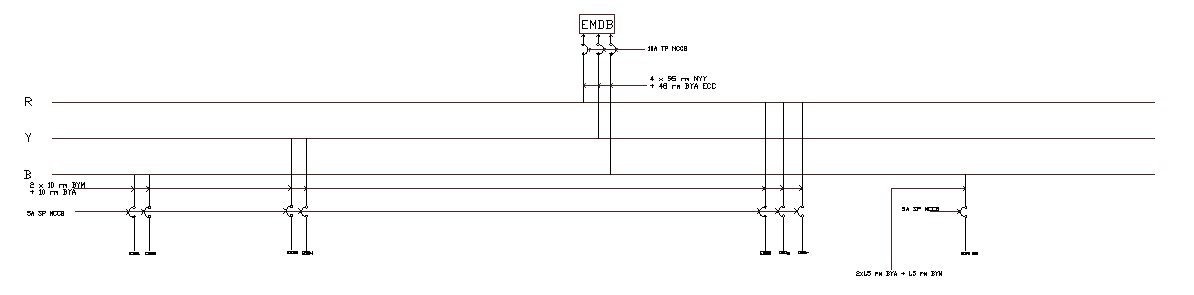


Emergency Sub-distribution Board Diagram:

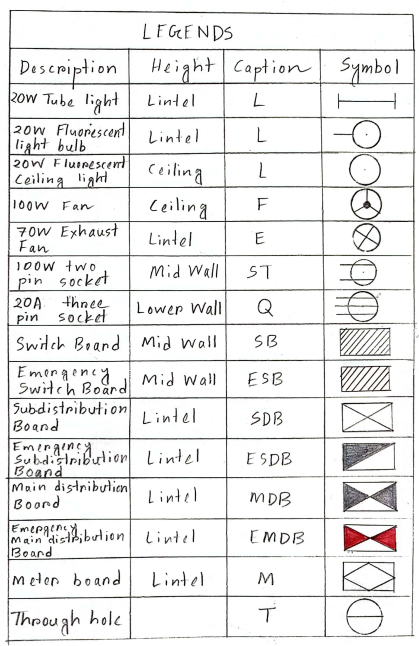


Normal Main Distribution Board Diagram:



Emergency Main Distribution Board Diagram:

* **LEGENDS for Fittings and Fixtures:**

****

* **Legends for Conduits:**

|  |  |
| --- | --- |
| ***C1=2x1.5 rm BYM +1.5 rm BYA ECC*** | ***¾”*** |
| ***C2=4x1.5 rm BYM +1.5 rm BYA ECC*** | ***¾”*** |
| ***C3=6x1.5 rm BYM +1.5 rm BYA ECC*** | ***¾”*** |
| ***C5=2x6 rm BYM +6 rm BYA ECC*** | ***¾”*** |
| ***C6=4x6 rm BYM +6 rm BYA ECC*** | ***1”*** |
| ***C1,5= 2x1.5 rm BYM +1.5 rm BYA ECC & 2x6 rm BYM +6 rm BYA ECC*** | ***¾” & ¾”*** |
| ***C1,6=2x1.5 rm BYM +1.5 rm BYA ECC & 4x6 rm BYM +6 rm BYA ECC*** | ***¾” & 1”*** |
| ***C2,5=4x1.5 rm BYM +1.5 rm BYA ECC & 2x6 rm BYM +6 rm BYA ECC*** | ***¾” & ¾”*** |
| ***C2,6=4x1.5 rm BYM +1.5 rm BYA ECC & 4x6 rm BYM +6 rm BYA ECC*** | ***¾” & 1”*** |
| ***C7=2x16 rm BYM +16 rm BYA ECC*** | ***2’’*** |

***N.B: The approximate and plausible dimension of the conduits are given above instead of the exact.***

* CALCULATIONS FOR LIGHT BULBS (LB) & FANS (F)
* **Formulae:**

Light Bulbs , E = (Area 🡪 A in m^2)

Number of Fans , F = (Area 🡪 A in sqft)

Illuminance 🡪 E

Light Loss Factor 🡪 LLF

Utilization Factor 🡪 UF

Number of lights per illuminaire 🡪 n

Flux 🡪 F

* **BEDROOM- 1**

Area : 16.5x10 ft^2 = 15.35 m^2

Illuminance , E = 100 Lumen/m^2

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

Number of lights per illuminaire , n= 1

Flux = 1000 Lumen

Number of lights , N = 1.75

**So, 2 Tube Lights are needed**

Number of Fans = 1.65

**So, 2 Fans are needed.**

* **BEDROOM- 2:**

Area : 16.5x10 ft^2 = 15.35 m^2

Illuminance , E = 100 Lumen/m^2

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

Number of lights per illuminaire, n= 1

Flux = 1250 Lumen

Number of lights , N = 1.75

**So, 2 Tube Lights are needed**

Number of Fans = 1.65

**So, 2 Fans are needed.**

* **Guest Room:**

Area : 16.5x10 ft^2 = 15.35 m^2

Illuminance , E = 100 Lumen/m^2

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

Number of lights per illuminaire, n= 1

Flux = 1250 Lumen

Number of lights , N = 1.75

**So, 2 Tube Lights are needed**

Number of Fans = 1.65

**So, 2 Fans are needed.**

* **Living and Dining Room:**

Area : 19x16.5 ft^2 = 29.13 m^2

Illuminance , E = 100 Lumen/m^2

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

Number of lights per illuminaire, n= 1

Flux = 1250 Lumen

Number of lights , N = 3.3

**So, 3 Lights are needed**

Number of Fans = 2.27

**So, 2 Fans are needed.**

* **KITCHEN**

Area : 10x9 ft^2= 8.37 m^2

Illuminance , E = 100 Lumen/m^2

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

Number of lights per illuminaire , n= 1

Flux = 1250 Lumen

Number of lights , N = 1.91

**So, 2 light Bulbs are needed.**

* **TOILET**

Area : 9x6 ft^2= 5.02 m^2

Illuminance , E = 100 Lumen/m^2

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

Number of lights per illuminaire , n= 1

Flux = 1250 Lumen

Number of lights , N = 0.57

**So, 1 light Bulb is needed.**

* **Generator Room:**

Area : 10x9 ft^2= 8.36 m^2

Illuminance , E = 100 Lumen/m^2

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

Number of lights per illuminaire , n= 1

Flux = 1250 Lumen

Number of lights , N = 0.95

**So, 1 light Bulb and a tube light is needed.**

* **Guard Room:**

Area : 10x9 ft^2= 8.36 m^2

Illuminance , E = 100 Lumen/m^2

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

Number of lights per illuminaire , n= 1

Flux = 1250 Lumen

Number of lights , N = 0.95

**So, 1 light Bulb and a tube light is needed.**

Number of Fans = 0.9

**So, 1 Fan is needed.**

* **Garage:**

Area : 34.58x29.5 ft^2= 94.76 m^2

Illuminance , E = 100 Lumen/m^2

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

Number of lights per illuminaire , n= 1

Flux = 1250 Lumen

Number of lights , N = 10.83

**So, 11 light Bulbs are needed.**

* **Veranda:**

Area : 10x5 ft^2= 4.64 m^2

Illuminance , E = 100 Lumen/m^2

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

Number of lights per illuminaire , n= 1

Flux = 1250 Lumen

Number of lights , N = 0.37

**So, 1 light Bulb is needed.**

* **CALCULATION FOR CONDUITS :**
* **Formulae :**

for ampere rating , I = (A)

Power Factor , pf = 0.7

* **Apparatus :**

Energy Saving Bulb, **K** = 20 W

Tube Light, **L** = 20 W

Ceiling Light , **L**  = 20 W

Ceiling Fan ,**F** = 100 W

Switch-Board Socket , **SS**= 100 W

Exhaust Fan ,**EF** = 60 W

* CALCULATIONS FOR

SDB🡪 SB

* **CKT-1 RATING :**

It consists of SB3 & SB6:

*P1* = 20\*3+60\*2+100 = 280*W*

*I* = = 1.81*A*

According to the chart, this current rating is below 5*A*.

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

* **CKT-2 RATING :**

It consists of SB1 & SB4:

*P2 =* 20\*6+100\*4+100\*2= 720 *W*

*I* = = 4.67 *A*

According to the chart , this current rating is below 5*A* .

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

* **CKT-3 RATING :**

It consists of SB2:

*P3 = 20\*2+100\*2+100*= 340 *W*

*I* = = 2.2 *A*

According to the chart, this current rating is below 5*A*.

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

* **CKT-4 RATING :**

It consist of SB5:

*P4 =20\*2+100\*2+100* = 340 *W*

*I* = = 2.2 *A*

According to the chart, this current rating is below 5*A*.

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

* **CKT-5 RATING :**

It consist of SB7:

*P5=20W*

*I* = = 0.13 *A*

According to the chart, this current rating is below 5*A*.

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

**SWITCH BOARD (SB) :** From switch board to all fittings we will use 2 x 1.5 rm B

* **CALCULATIONS FOR SDB(Ground)**🡪 **SB(Ground)**

**SUB DISTRIBUTION BOARD (SDB)**

* **CKT-1 RATING :**

It consists of SB1g,SB2g & SB3g:

*P1* = 20\*5+60\*4+100\*2 = 540*W*

*I* = = 3.5*A*

According to the chart, this current rating is below 5*A*.

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

* **CKT-2 RATING :**

It consists of SB4g:

*P2 =* 20\*11= 220 *W*

*I* = = 1.42*A*

According to the chart , this current rating is below 5*A* .

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

* **CALCULATIONS FOR ESDB** 🡪 **ESB**

**EMERGENCY SUB DISTRIBUTION BOARD (SDB)**

* **CKT-1 RATING :**

It consists of ESB3 &ESB6

*P1* =20\*2 = 40 *W*

*I* = = 0.26 *A*

According to the chart, this current rating is below 5*A*.

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

* **CKT-2 RATING :**

It consists of ESB1 & ESB4:

*P2* = 20\*2+100\*2 =240 *W*

*I* = = 1.56 *A*

According to the chart, this current rating is below 5*A*.

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

* **CKT-3 RATING :**

It consists of ESB2

*P3* = 20+100 = 120 *W*

*I* = = 0.78 *A*

According to the chart, this current rating is below 5*A*.

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

* **CKT-4 RATING :**

It consists of ESB5

*P4* = 100+20 = 120 *W*

*I* = = 0.78 *A*

According to the chart, this current rating is below 5*A*.

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

* **CALCULATIONS FOR ESDB(Ground)**🡪 **ESB(Ground)**

**EMERGENCY SUB DISTRIBUTION BOARD (SDB)**

* **CKT-1 RATING :**

It consists of ESB1g & ESB3g:

*P1* = 20\*2 = 40*W*

*I* = = 0.26*A*

According to the chart, this current rating is below 5*A*.

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

* **CKT-2 RATING :**

It consists of ESB4g:

*P2 =* 20 *W*

*I* = = 0.13*A*

According to the chart , this current rating is below 5*A* .

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

* **CALCULATIONS FOR MDB** 🡪 **SDB**

SDB Load = Total load x 0.7 + Total P socket load x 0.2 + Total Q socket load x 0.3

SDB Current = A

Total Load = P1 + P2 + P3 + P4 +P5= 280+720+340+340+20 = 1700 W

We did not use ant P-socket.

* **Q - SOCKET:**

Current Rating : 20 *A*

Power factor : 0.3

Total Q socket used : 3

Power for Q socket : 4000W

* **CIRCUIT BREAKER :**

20A SP MCB is needed from MDB 🡪 Q Socket

* **CONDUIT :**

2 x 6 rm BYM + 6 rm BYA ECC are used.

SDB Load = 1700 \*0.7+ (3\* 4000 \*0.3) = 4790 W

SDB Current = A = 31.1A

* **CIRCUIT BREAKER :**

40A SP MCCB is needed from MDB to SDB

* **CONDUIT :**

2 x 16 rm BYM + 16 rm BYA ECC are used.

* **CALCULATIONS FOR EMDB** 🡪 **ESDB**

ESDB Load = Total load x 0.7 + Total P socket load x 0.2 + Total Q socket load x 0.3

ESDB Current = A

Total Load = P1 + P2 + P3 + P4= 40+240+120+120 = 520 W

No P/Q sockets were used in the emergency circuits

ESDB Load = 520\*0.7=364 W

ESDB Current = A = 2.36 A

* **CIRCUIT BREAKER :**

5A SP MCCB is needed from EMDB to ESDB

* **CONDUIT :**

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

* **CALCULATIONS FOR MDB** 🡪 **SDB(G)**

SDB Load = Total load x 0.7 + Total P socket load x 0.2 + Total Q socket load x 0.3

SDB Current = A

Total Load = P1 + P2 = 540 + 220= 760W

We did not use ant P/Q-socket.

SDB(G) Load = 760\*0.7=532W

SDB(G) Current = A = 3.45A

* **CIRCUIT BREAKER :**

5A SP MCCB is needed from MDB to SDB

* **CONDUIT :**

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

* **CALCULATIONS FOR EMDB** 🡪 **ESDB(G)**

ESDB Load = Total load x 0.7 + Total P socket load x 0.2 + Total Q socket load x 0.3

ESDB Current = A

Total Load = P1 + P2 = 40+20 = 60 W

No P/Q sockets were used in the emergency circuits

ESDB(G) Load = 60\*0.7=42 W

ESDB(G) Current = A = 0.27 A

* **CIRCUIT BREAKER :**

5A SP MCCB is needed from EMDB to ESDB

* **CONDUIT :**

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

* **CALCULATIONS FOR EMDB:**

EMDB Load = Total ESDB Load + Lift load(Already multiplied with 0.7 so no need to multiply again)

Total ESDB Load = 5x ESDB Load+ ESDB(G) Load

EMDB Current =

Phase Voltage = 220V

Line Voltage = 381.05 V

Pf = 0.7

No lift in our design

ESDB Load = 364 W, ESDB(G) Load=42W

Total ESDB Load = 5\*364+42=1862 W

EMDB Load=1862W

EMDB Current = = 4.03 A

**10 A TP MCCB is needed for EMDB to MDB.(**Just to be safe)

* **CALCULATIONS FOR MDB:**

MDB Load = Total SDB Load + (EMDB Load + Pump)

Total SDB Load = 5 x SDB Load + SDB(G) Load

MDB Current =

Phase Voltage = 220V

Line Voltage = 381.05 V

Pf = 0.95(due to PFI plant)

SDB Load = 4790 W

SDB(G) Load=532W

Pump load=5000W

Total SDB load=5\*4790+532=24482W

MDB Load = 24482+5000 = 29482W

MDB Current = = 47.02 A

**50 A TP MCCB is needed for MDB to Main line.**

* **CALCULATIONS FOR TRANSFORMER:**

**S = 3 VI = 3 \* 220 \* 47.02 =31.033kVA**

So, 11/0.415 KVA, 50Hz, 50 KVA ,DYN 11,OIL IMMERSED TRANSFORMER WITH 4-6% LINE IMPEDANCE IS REQUIRED.

* **CALCULATIONS AIR TERMINALS:**

Total circumference = 2 \*(61.1+40.7) = 203.6 feet=62 m (approx.)

Air terminals should be placed at 20m distance.

Air terminal number = 62/20 = 3.1 =3(After rounding up)

* **CALCULATIONS FOR MINIMAL LOAD DENSITY:**

According to RAJUK, for Air conditioned dwelling abodes 100 W/m^2 should be unit load.

In our case minimal Load = Total Load/Apartment size in m^2

= (4790+532)/(40.7\*27.8)\*0.3048\*0.3048

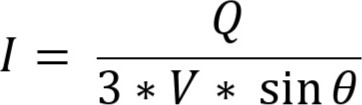
**=** 50.62 W/m^2

* **Calculations for PFI Plant:**

cosθ = 0.7 sin θ= 0.714

3Vlsinθ= Ptanθ = 30.1 KVAR

After Pf improvement, sinθ = 1



sino

=36.88A

**So, 50 A TP MCCB is needed from PFI to MDB**