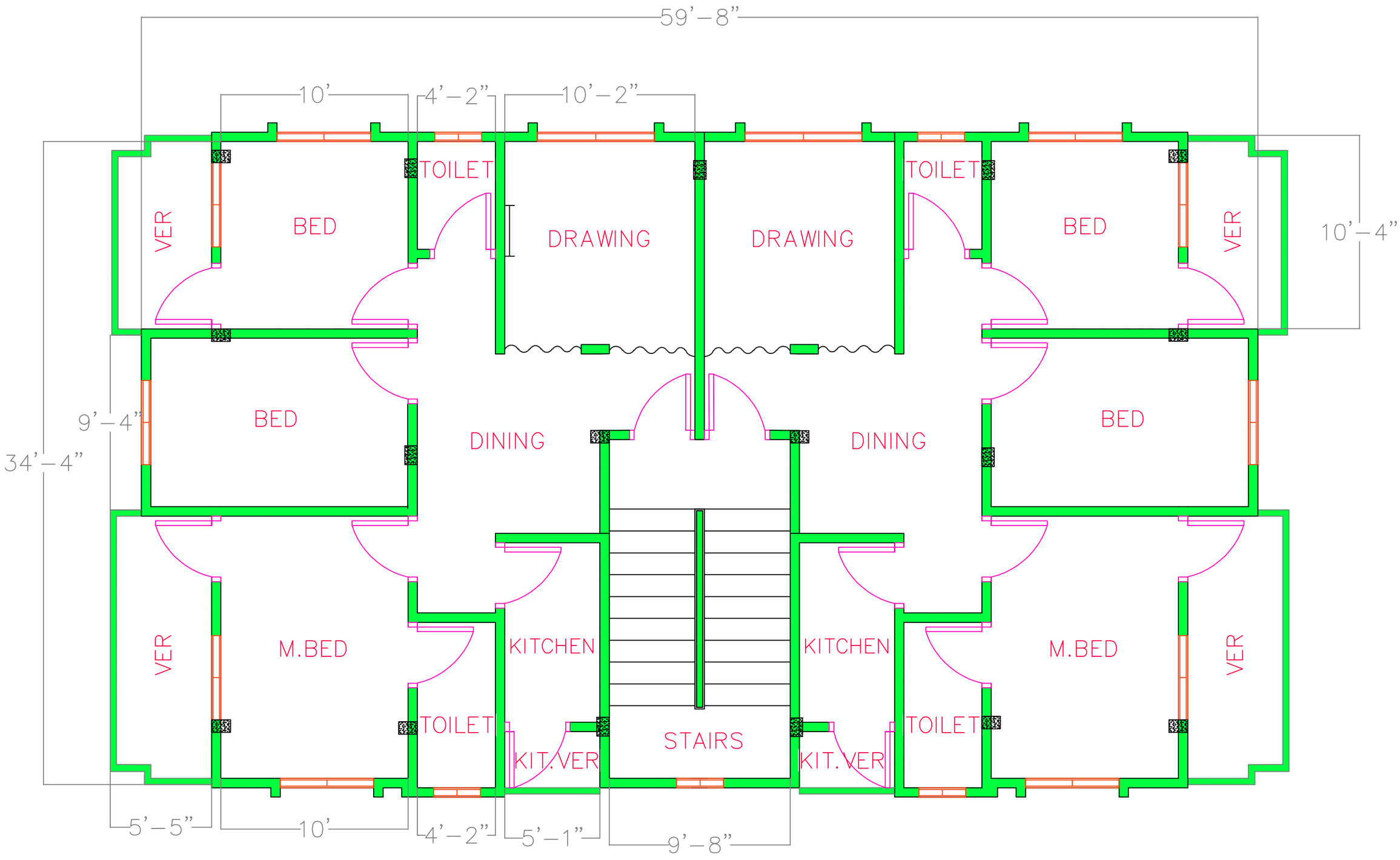
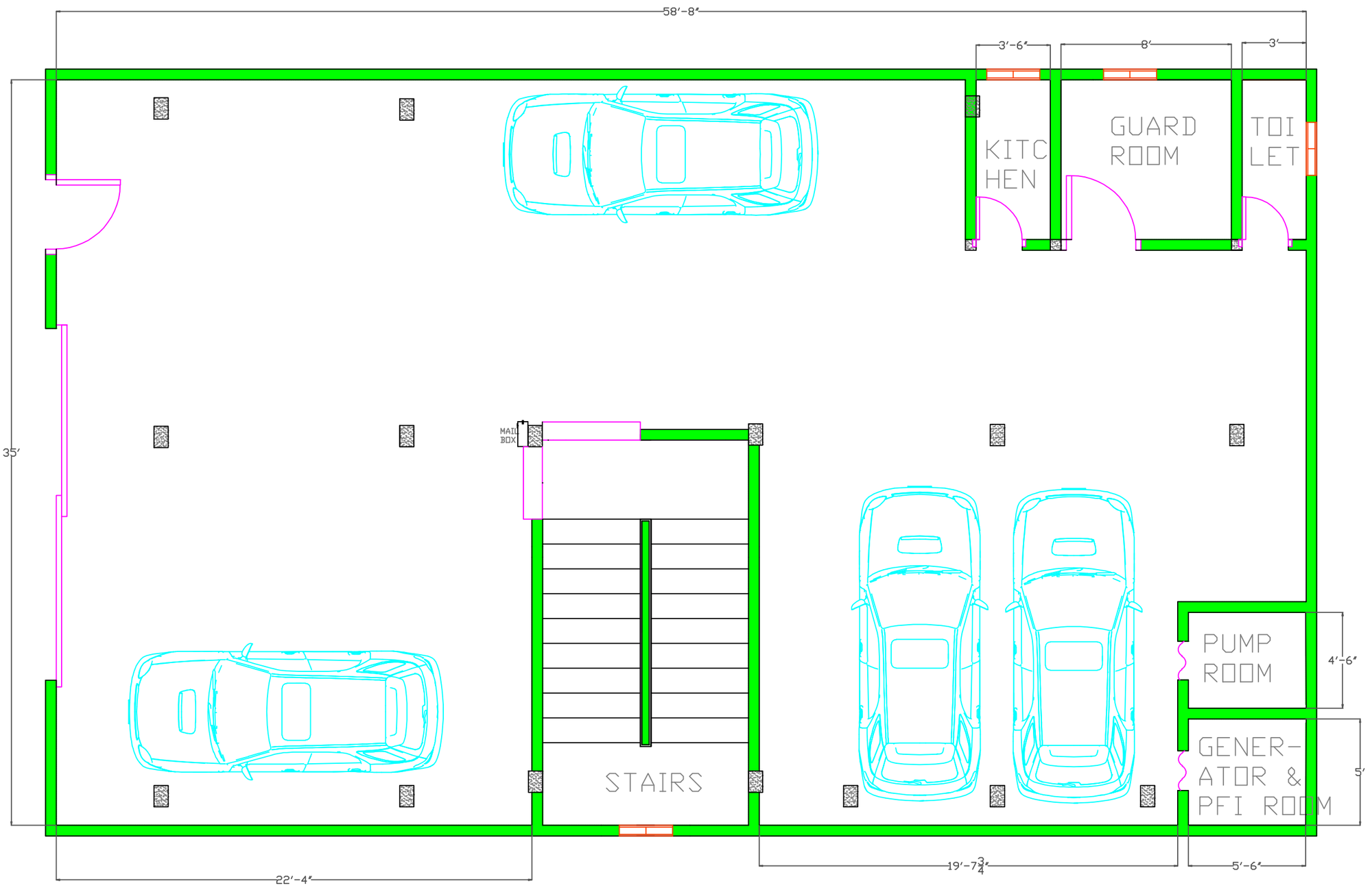
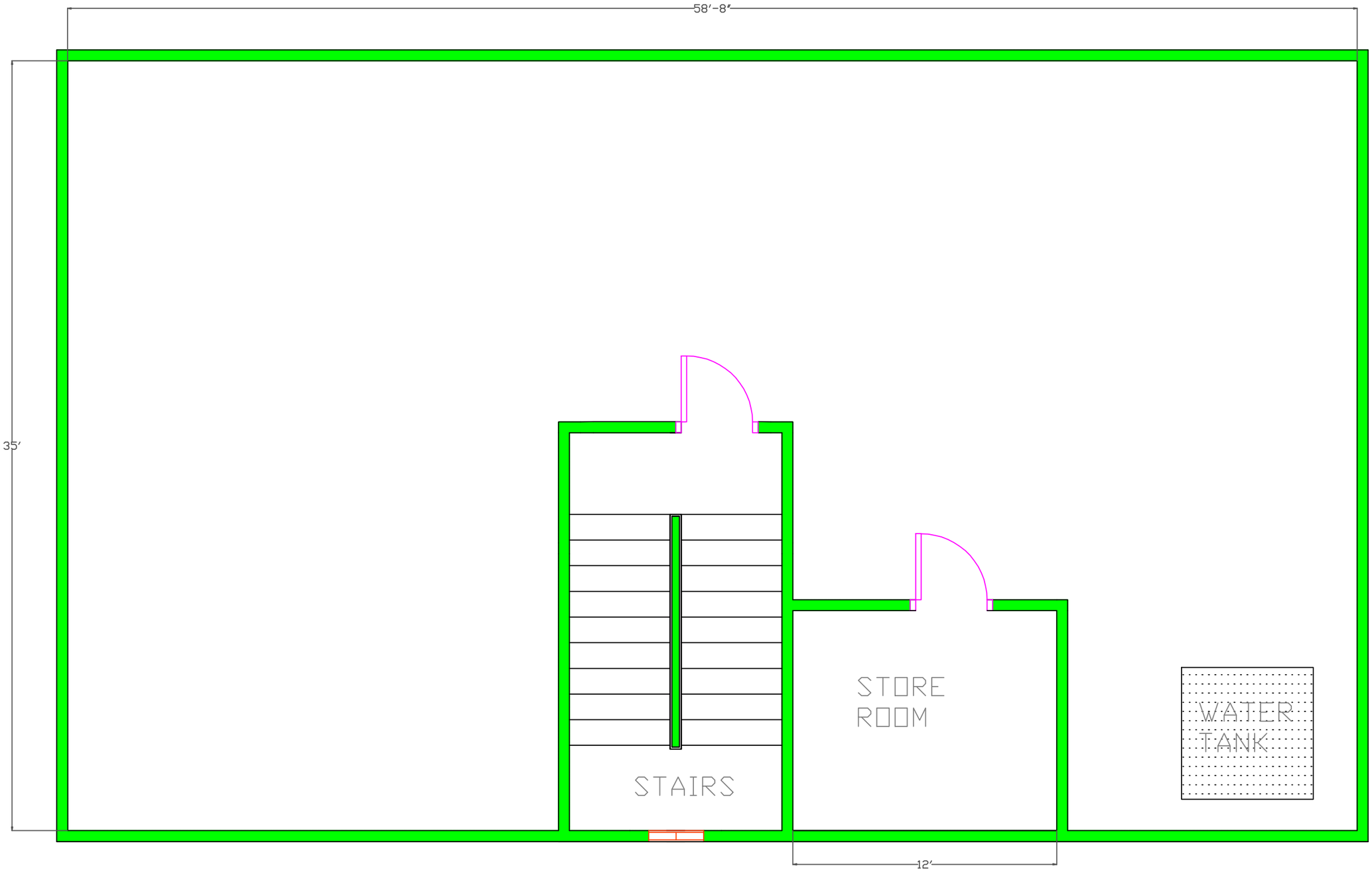
Typical Floor Plan



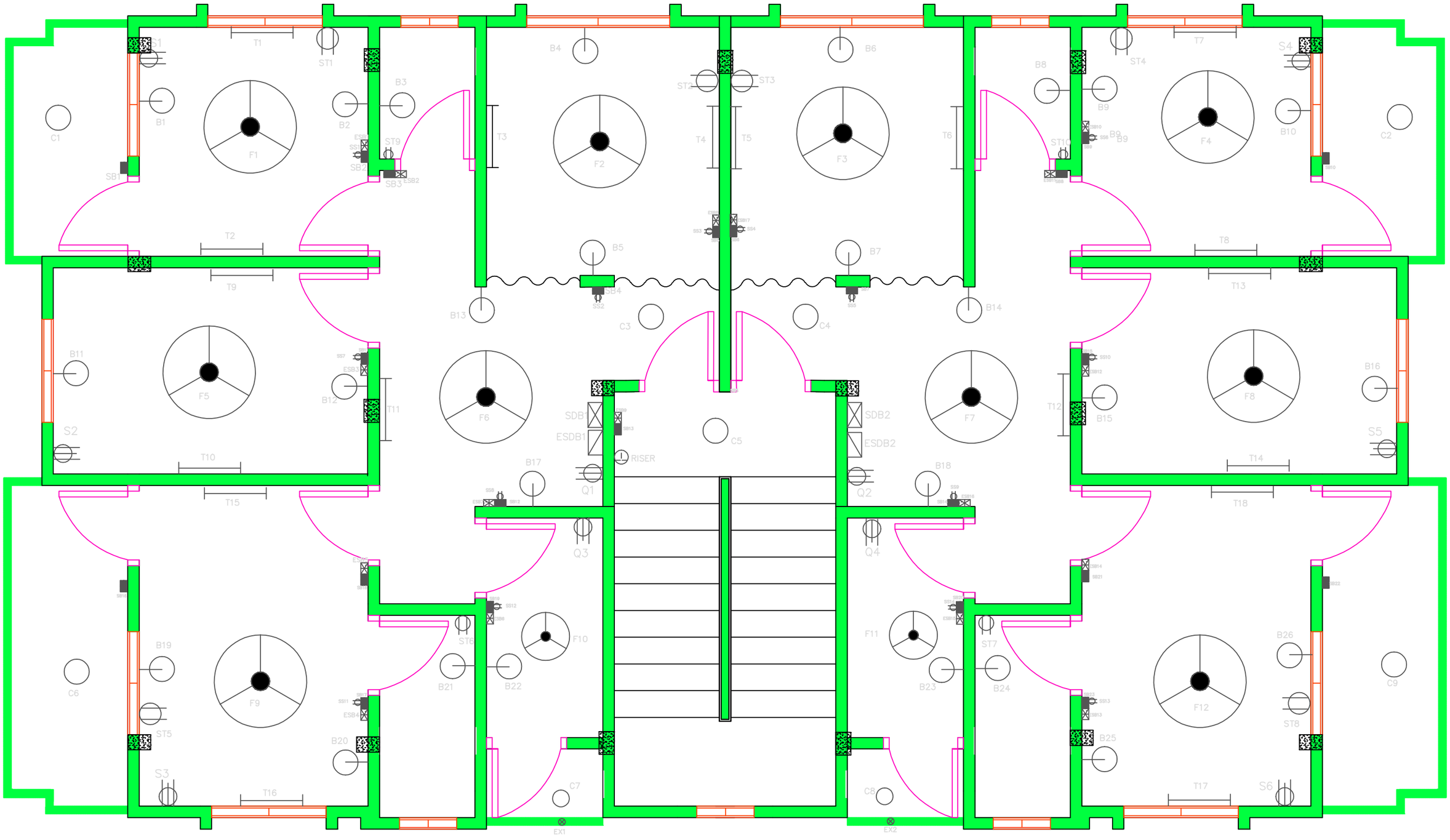
Ground Floor



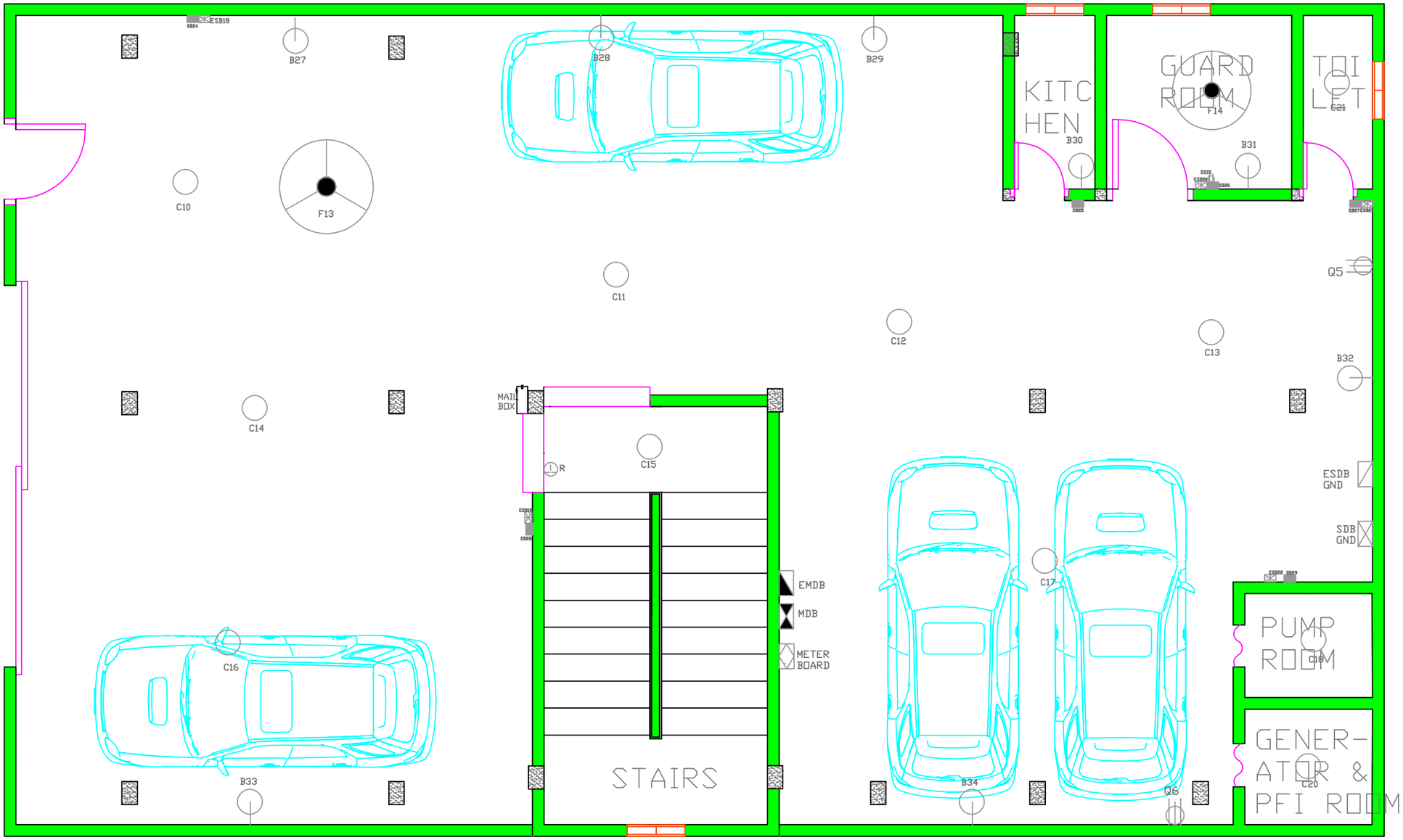
Rooftop



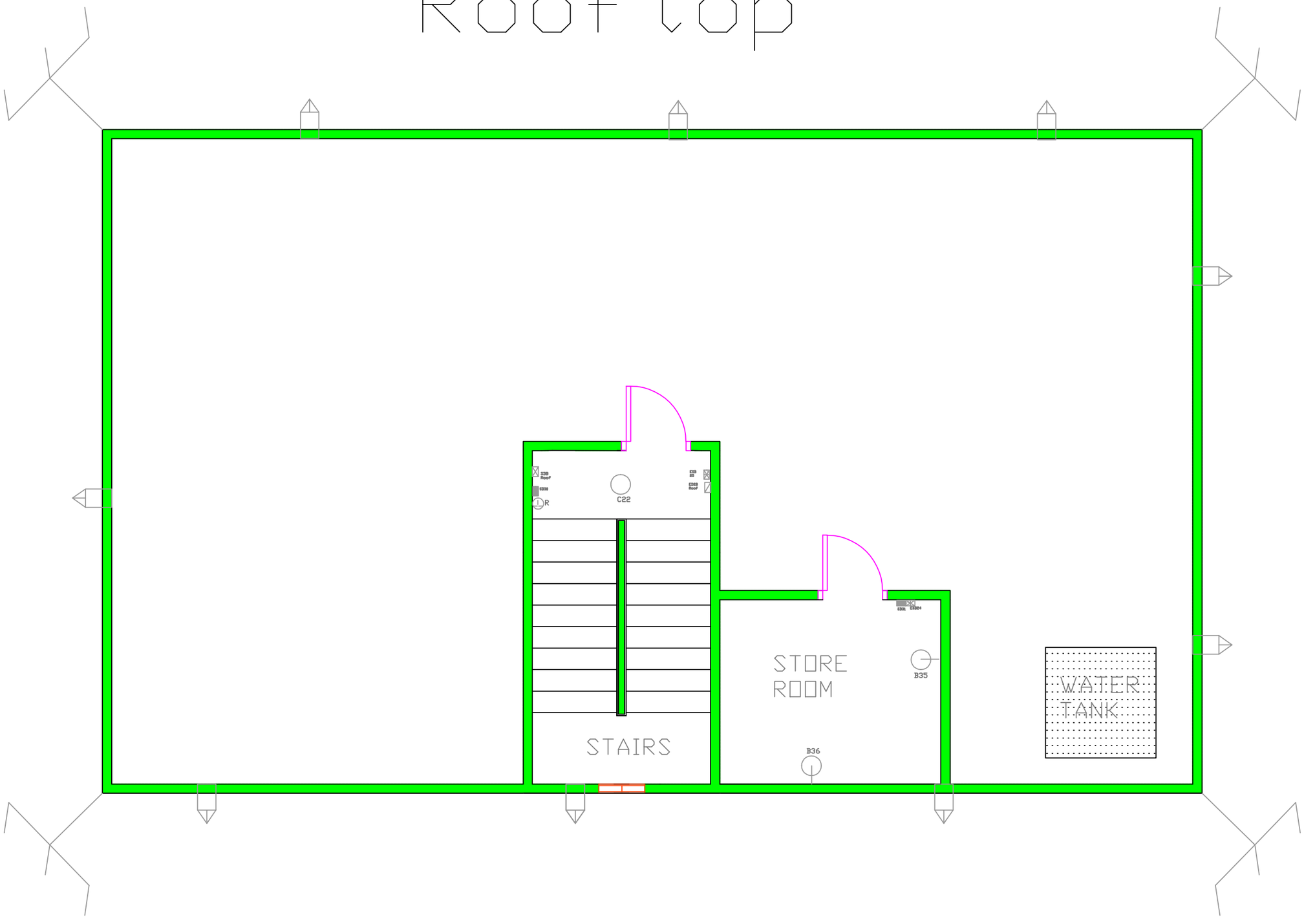
Fittings and Fixtures
Typical Floor



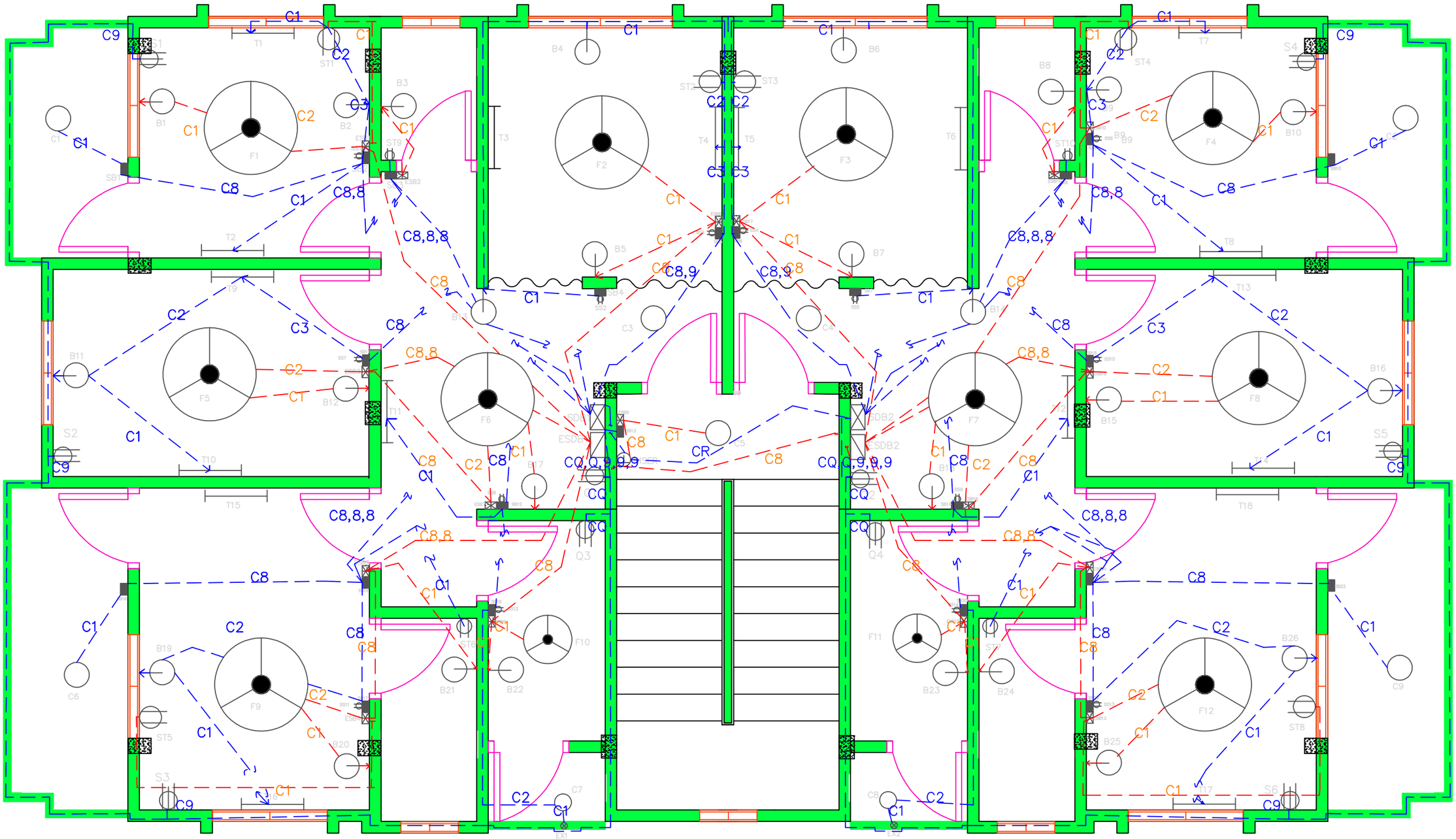
Ground Floor



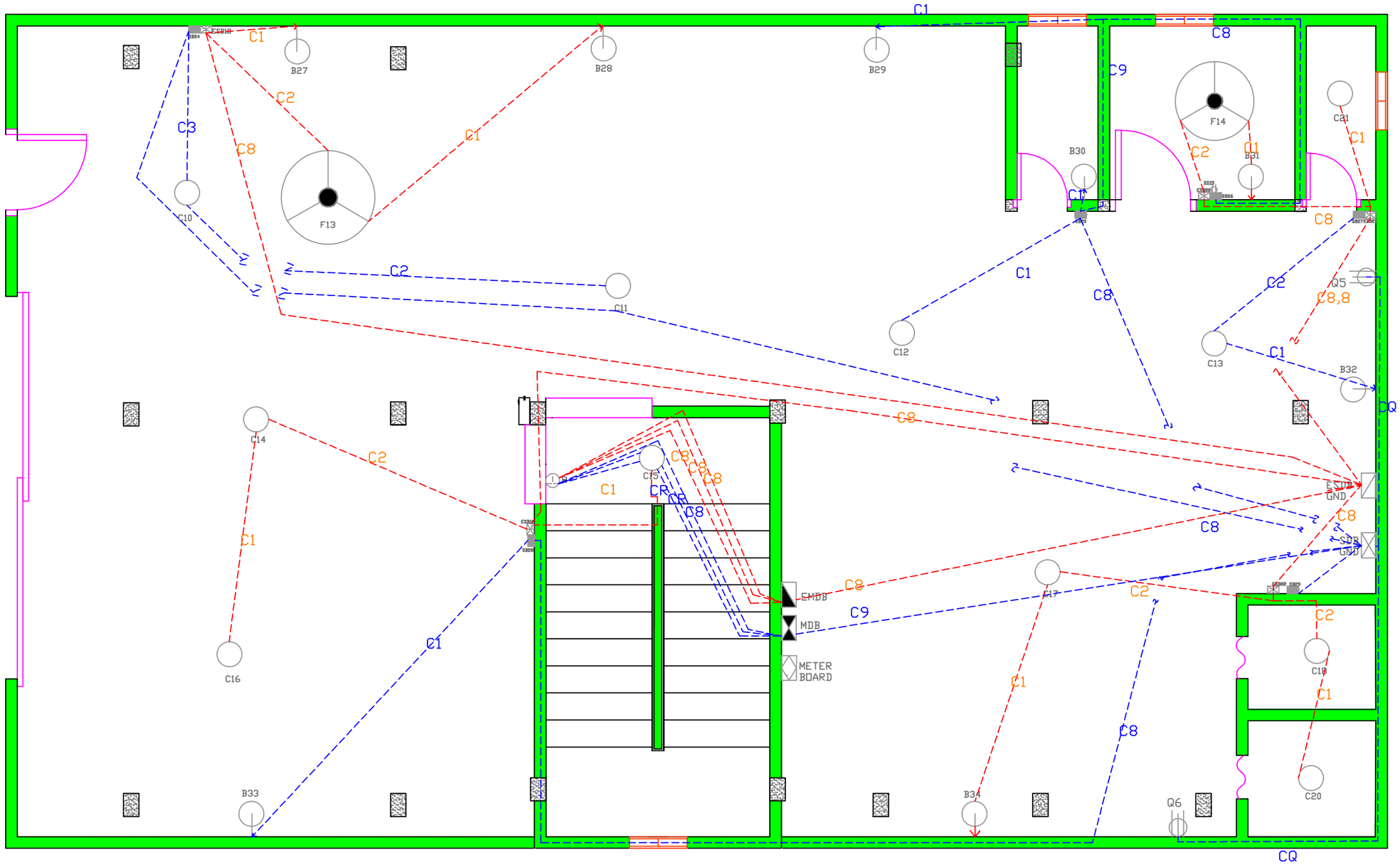
Rooftop



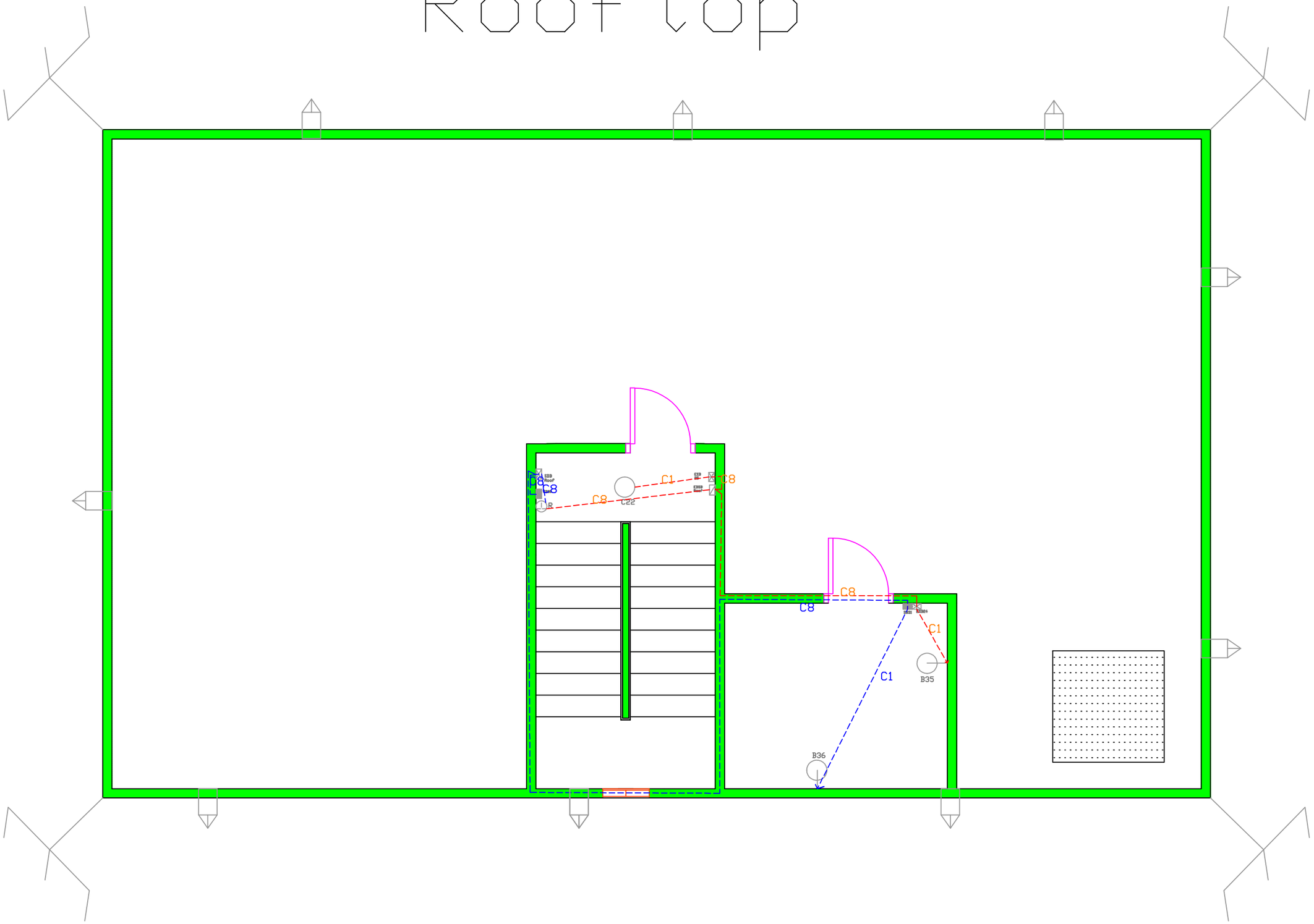
Conduit Layouts
Typical Floor



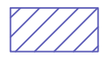
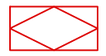
Ground Floor



Rooftop

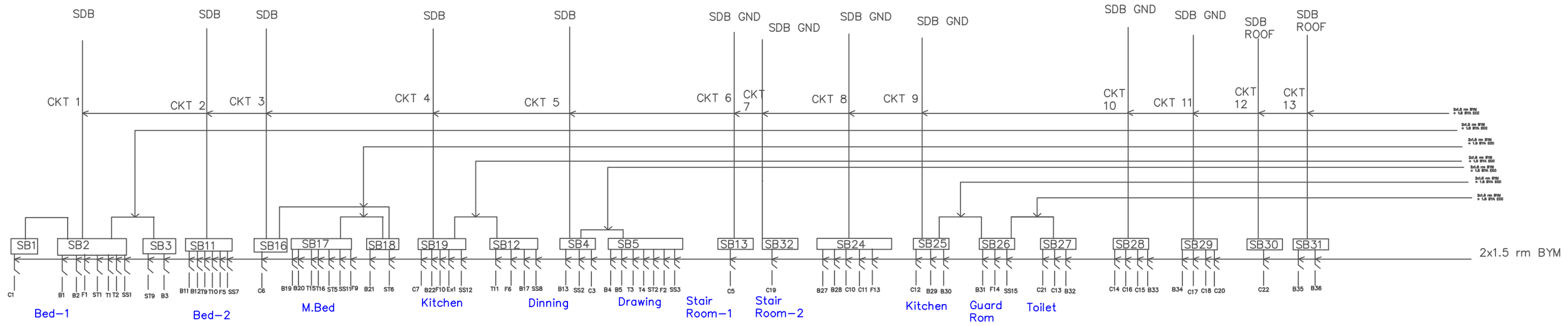


Legends

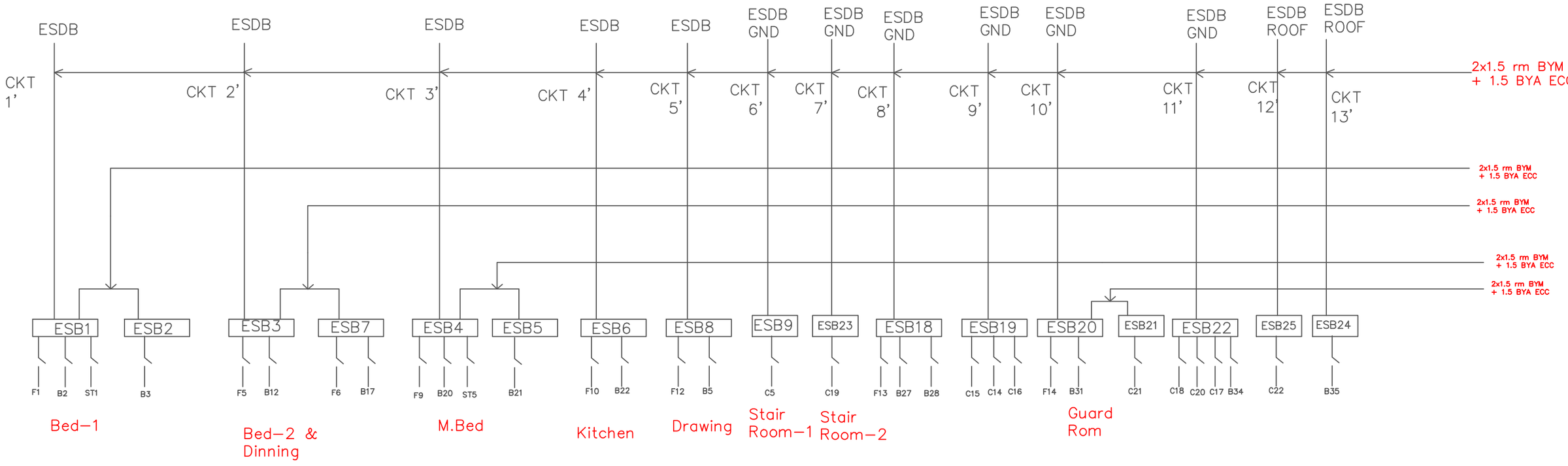
Symbol Description	Fittings and Fixture
Wall Bracket Light at Lintel Level	
2-Pin 5A Socket at SB Level	
3-Pin 5A/15A Socket	
2-Pin 5A Socket at Table Height	
2-Pin 5A Socket at Skirting Level for TV	
2-pin TV Antenna Socket	
Switch Board	
Fluorescent Wall Light Fitting	
Ceiling Light Fitting Type k	
Meter Board	
Main Distribution Board	
Exhaust Fan	
Ceiling Fan	
ESB	

LEGENDS FOR CONDUITS	CONDUIT SIZE
C1=2x1.5 BYM	¾”
C2=4x1.5 BYM	¾”
C3=6x1.5 BYM	¾”
C8=2x1.5 BYM +1.5 rm BYA ECC	¾”
C9=2x6 BYM +6 rm BYA ECC	1’1/4”
CQ= 2x10 rm BYM+10 rm BYA ECC	2’
CR= 2x16 rm BYM+16 rm BYA ECC	3’

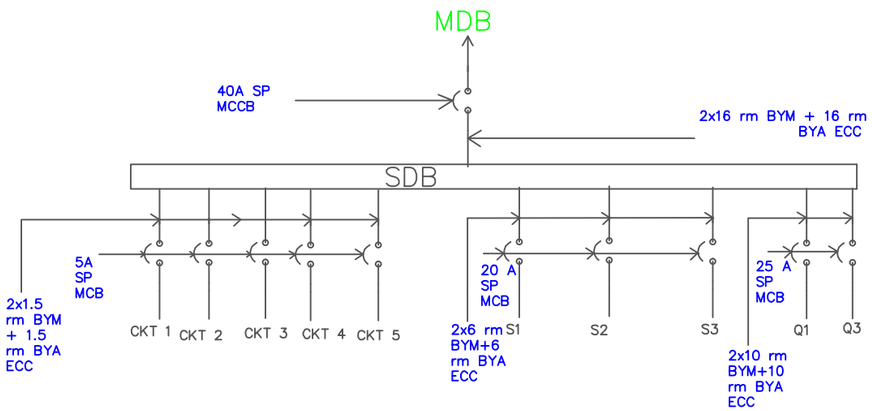
Switchboard Connection Diagram

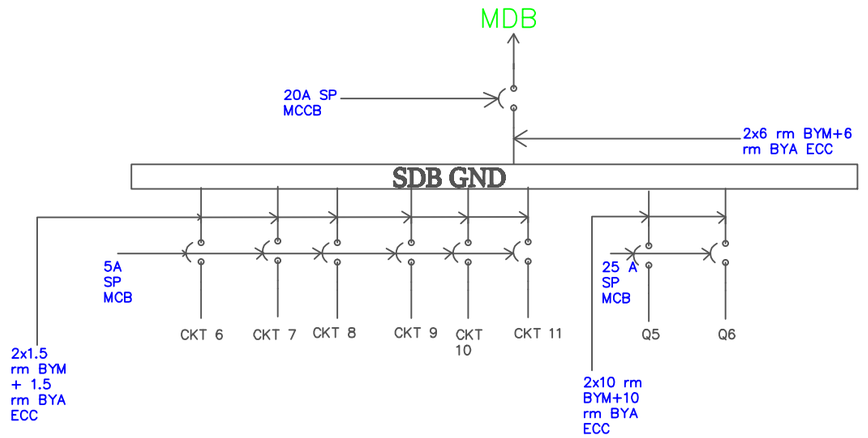


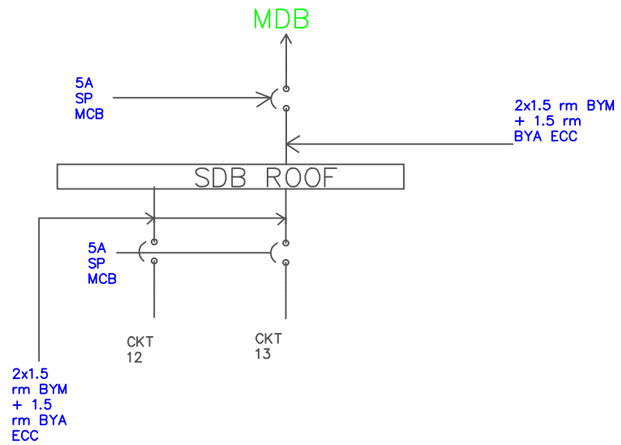
Emergency Switchboard Connection Diagram



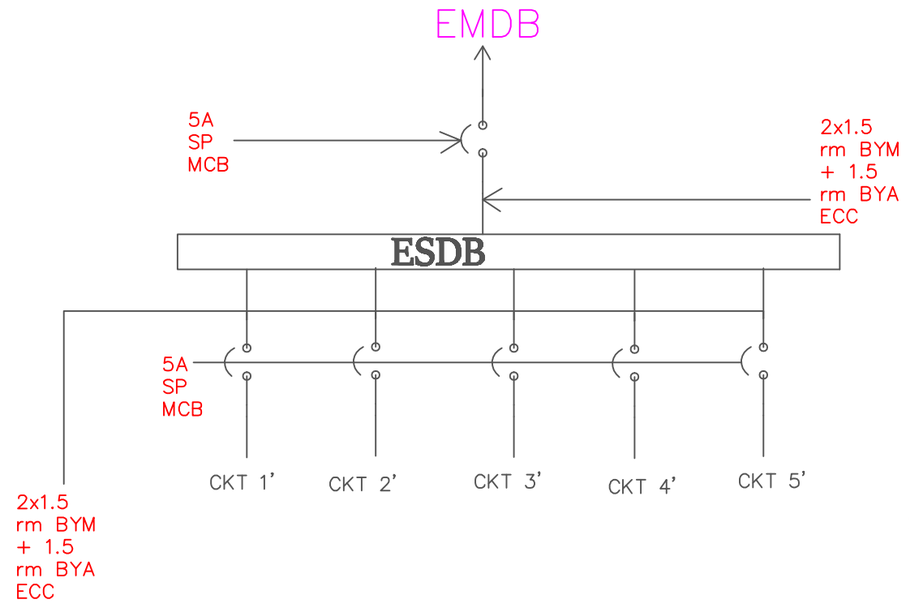
SUB Distribution Board Diagram

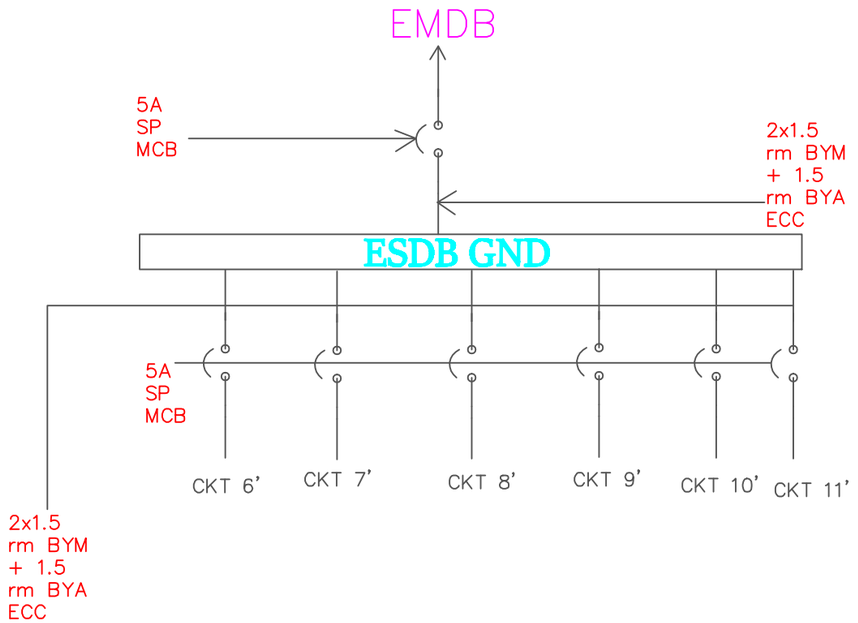


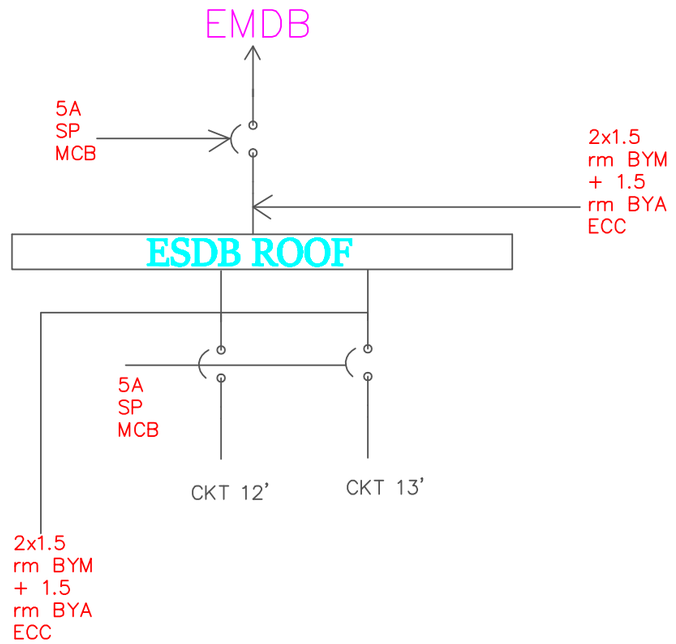




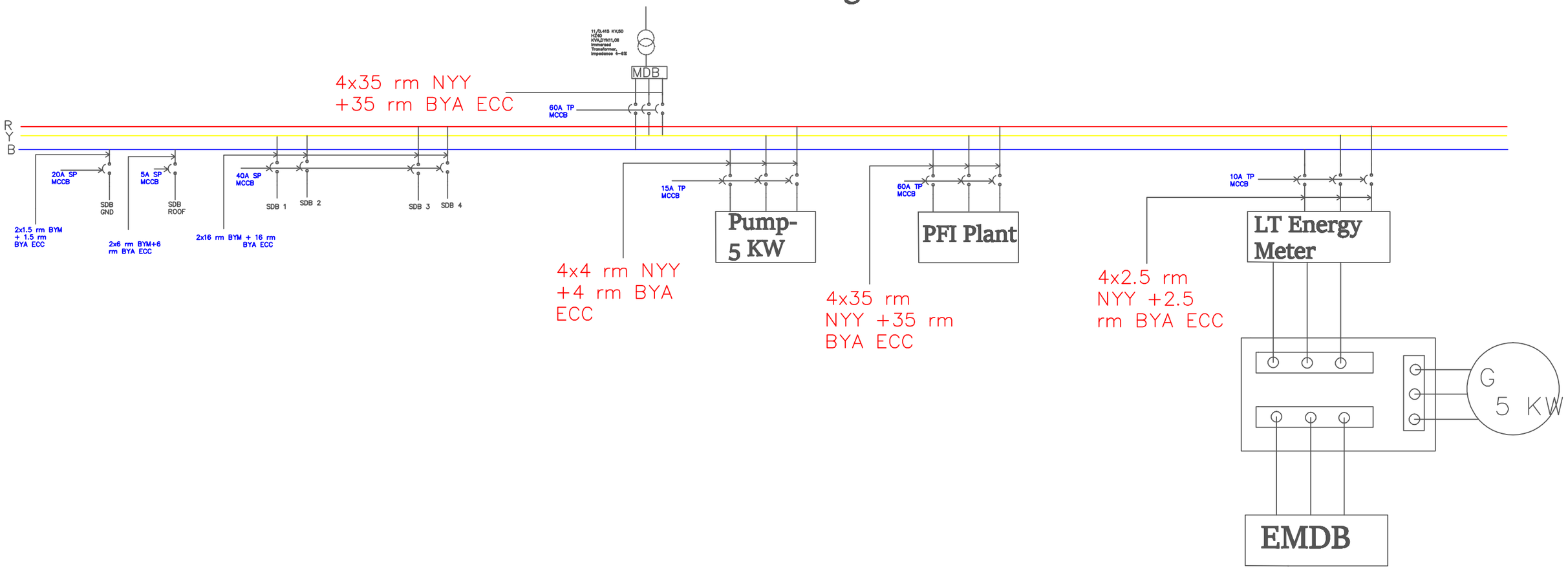
Emergency SUB Distribution Board Diagram



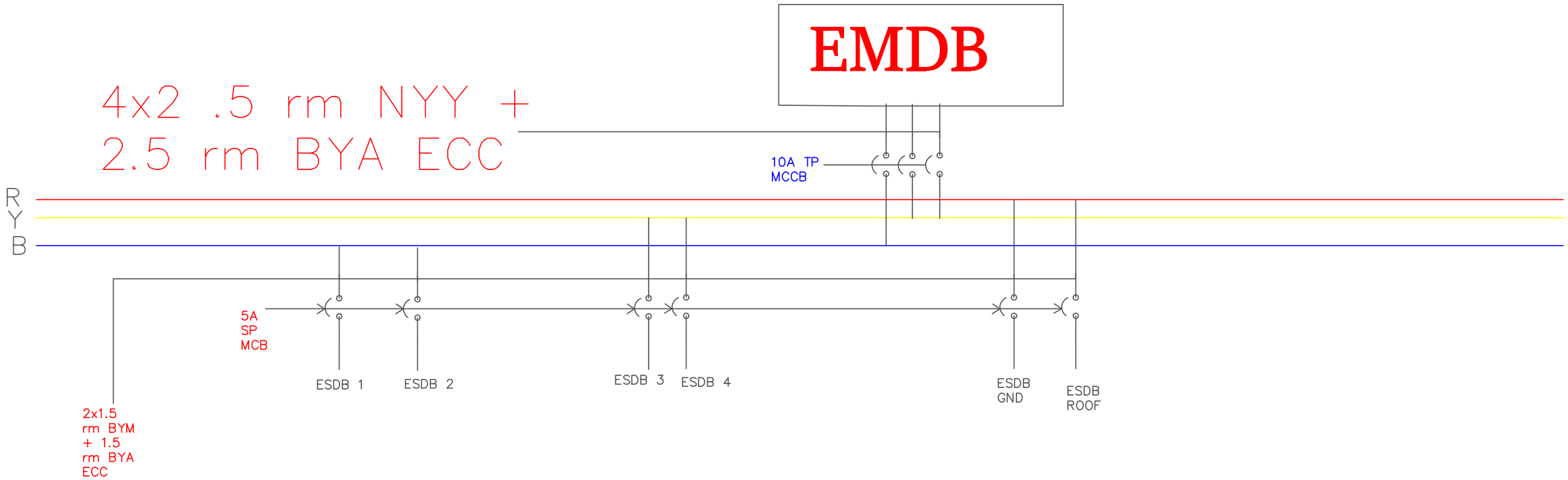




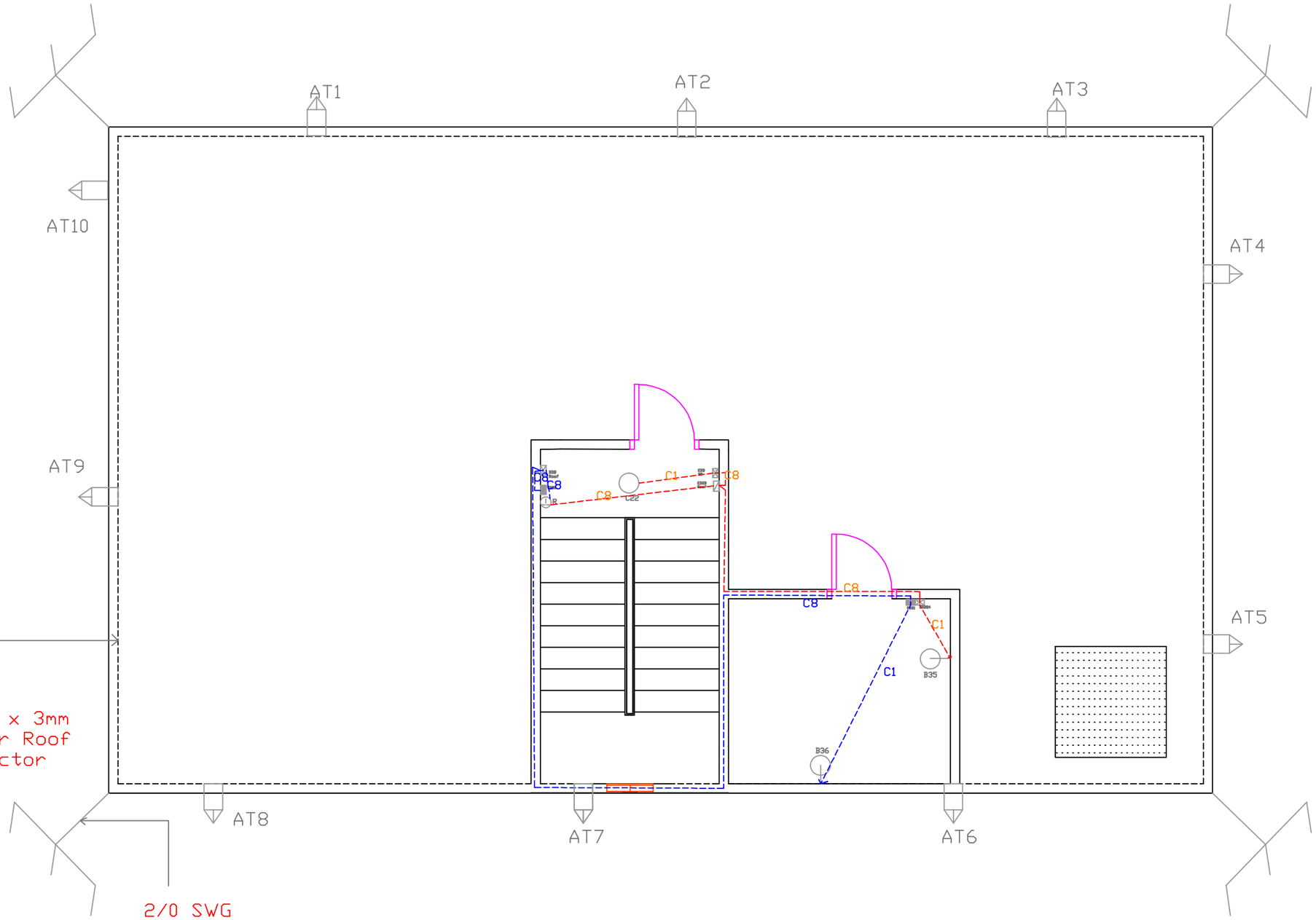
Main Distribution Board Diagram

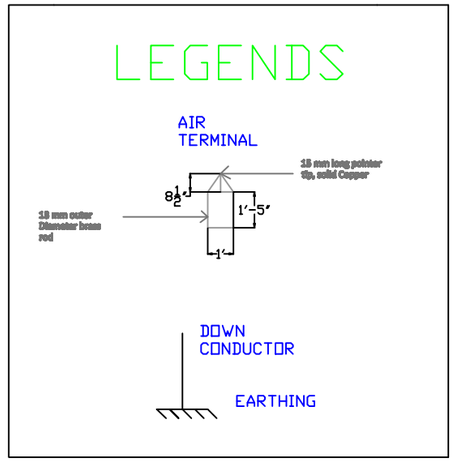


Emergency Main Distribution Board Diagram



LIGHTNING PROTECTION





Calculation for Light Bulbs (LB) and Fans (F):

Formula for Light Bulbs, E = $\frac{n*N*F*LLF}{A}$

One 56” diameter fan is needed every 100 sqft.

Number of Fans= $\frac{A}{100}$ (A in sqft)

Bedroom-1:

Area=10’ * 10’=100 sqft = 9.29 m^2

Illuminance, E = 100 Lumen/m^2

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

Number of lights per illuminaire, n=1

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

Calculating from above formula, N=1.08 ≈ 2

So, 1 Light Bulb and 1 tube light is needed.

Number of Fans=1

So, 1 Fan is needed.

Bedroom-2:

Area=12’-10” * 9’= 115.28148 sqft=10.71 m^2

Illuminance, E =100 Lumen/m^2

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

Number of lights per illuminaire, n=1

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

Calculating from above formula, N=1.06 ≈ 2

So, 1 Light Bulb and 1 tube light is needed.

Number of Fans=1.15

So, 1 Fan is needed.

M-Bedroom:

Area=10’ * 11’-4” = 113.34398sqft=10.53 m^2

Illuminance, E =100 Lumen/m^2

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

Number of lights per illuminaire, n=1

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

Calculating from above formula, N=1.2 ≈ 2

So, 1 Light Bulb and 1 tube light is needed.

Number of Fans=1.13

So, 1 Fan is needed.

Toilet-1:

Area=4’-2” * 7’-2” = 29.81603 sqft=2.77 m^2

Illuminance, E =100 Lumen/m^2

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

Number of lights per illuminaire, n=1

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

Calculating from above formula, N=0.317 ≈ 1

So, 1 Light Bulb is needed.

Toilet-2:

Area=4’-2” * 6’-3” = 26.04866 sqft=2.42 m^2

Illuminance, E = 100 Lumen/m^2

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

Number of lights per illuminaire, n=1

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

Calculating from above formula, N=0.277 ≈ 1

So, 1 Light Bulb is needed.

Drawing:

Area=9.333’ * 11.333’= 105.8092 sqft=9.83 m^2

Illuminance, E =100 Lumen/m^2

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

Number of lights per illuminaire, n=1

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

Calculating from above formula, N=1.12 ≈ 2

So, 1 Light Bulb and 1 tube light is needed.

Number of Fans=1.058

So, 1 Fan is needed.

Dining:

Area=9’-9” * 10’-4” = 100.771729 sqft=9.362 m^2

Illuminance, E = 100 Lumen/m^2

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

Number of lights per illuminaire, n=1

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

Calculating from above formula, N=1.07 ≈ 2

So, 1 Light Bulb and 1 tube light is needed.

Number of Fans=1.0071

So, 1 Fan is needed.

<u>Kitchen</u>:

Area=5'-2" * 7'-7" = 39.180634 sqft=3.64 m^2

Illuminance, E = 200 Lumen/m^2

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

Number of lights per illuminaire, n=1

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

Calculating from above formula, N=0.416 ≈ 1

So, 1 Light Bulb is needed.

1 Exhaust Fan is needed.

<u>Garage</u>:

Total lightning Area without the room and Staircase = 1797.112 sqft= 166.96m^2

Illuminance, E =75 Lumen/m^2 [For Garage we will use bit dimmer luminance than other rooms]

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

Number of lights per illuminaire, n=1

Flux=1400 Lumen

Calculating from above formula, N=12.77 ≈ 13

So total 13 Light Bulb and Ceiling mounted Light Bulb will be needed combinedly.

<u>Staircase</u>:

1 Ceiling mounted Light Bulb is needed.

Veranda:

Area=10’-4” * 5’-4” = 55.11 sqft=5.11 m^2

Illuminance, E =200 Lumen/m^2

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

Number of lights per illuminaire, n=1

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

Calculating from above formula, N=0.584 ≈ 1

So, 1 Ceiling mounted Light Bulb is needed.

Calculation for conduits

Formula for Ampere Rating, I = $\frac{P}{V*Pf}$

Pf = 0.7 is considered on average.

Energy Saving bulb = 20 w

Tube light = 20 w

Ceiling light = 20 w

Ceiling fan = 100 w

Switch board socket = 100 w

Wall 2 Pin Socket (max) = 200 w

Exhaust Fan = 60W

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

To Sub Distribution Board (SDB)

CKT1 Rating

$$I = \frac{20+(20*4+200+100+100)+(200+20)}{220*7} = 4.67 \text{ A}$$

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

CKT2 Rating

$$I = \frac{20*4+100+100}{220*7} = 1.81 \text{ A}$$

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

CKT3 Rating

$$I = \frac{20+(20*4+200+100+100)+(200+20)}{220*7} = 4.67 \text{ A}$$

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

CKT4 Rating

$$I = \frac{(20*2+100+60+100)+(20*2+100+100)}{220*0.7} = 3.5 \text{ A}$$

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

CKT5 Rating

$$I = \frac{(2*20+100)+(4*20+200+100+100)}{220*0.7} = 4.02 \text{ A}$$

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

To Sub Distribution Board Ground:

CKT6 Rating

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

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

CKT7 Rating

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

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

CKT8 Rating

$I = \frac{(4*20)+100}{220*0.7} = 1.43$ A

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

CKT9 Rating

$I = \frac{(3*20)+(20+100+100)+(3*20)}{220*0.7} = 2.21$ A

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

CKT10 Rating

$I = \frac{4*20}{220*0.7} = 0.52$ A

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

CKT11 Rating

$I = \frac{4*20}{220*0.7} = 0.52$ A

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

To Sub Distribution Board Roof:

CKT12 Rating

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

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

CKT13 Rating

$I = \frac{20*2}{220*0.7} = 0.26$ A

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

To Emergency Sub Distribution Board (ESDB):

CKT1' Rating

$I = \frac{(100+20+100)+20}{220*0.7} = 1.558$ A

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

CKT2' Rating

$I = \frac{(100+20+100)+20}{220*0.7} = 1.558$ A

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

CKT3' Rating

$I = \frac{(100+20+100)+20}{220*0.7} = 1.558$ A

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

CKT4' Rating

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

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

CKT5' Rating

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

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

To Emergency Sub Distribution Board (ESDB) GND:

CKT6' Rating

$I = \frac{20}{220*0.7} = 0.1298$ A

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

CKT7' Rating

$I = \frac{20}{220*0.7} = 1.558$ A

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

CKT8' Rating

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

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

CKT9' Rating

$I = \frac{20*3}{220*0.7} = 0.389$ A

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

CKT10' Rating

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

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

CKT11' Rating

$I = \frac{20*4}{220*0.7} = 0.5195$ A

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

To Emergency Sub Distribution Board (ESDB) Roof:

CKT12' Rating

$I = \frac{20}{220*0.7} = 0.1298$ A

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

CKT13' Rating

$I = \frac{20}{220*0.7} = 0.1298$ A

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

Calculations for SDB

SDB Load = Total load * 0.7 + Total S Socket load (20 A) * 0.2 + Total Q Socket Load (25 A) * 0.3

Total Load = Ckt 1 load + Ckt 2 load + Ckt 3 load + Ckt 4 load + Ckt 5 load

S load = 3000 w

Q load = 4000 w

Voltage = 220 V

Pf = 0.7

Ckt 1 load = 20 + (20 * 4 + 200 + 100 + 100) + (200 + 20) = 720 w

Ckt 2 load = 20 * 4 + 100 + 100 = 280 w

Ckt 3 load = 20 + (20 * 4 + 200 + 100 + 100) + (200 + 20) = 720 w

Ckt 4 load = (20 * 2 + 100 + 60 + 100) + (20 * 2 + 100 + 100) = 540 w

Ckt 5 load = (2 * 20 + 100) + (4 * 20 + 200 + 100 + 100) = 620 w

Total Load = 2880 w

SDB Load = 2880 * 0.7 + 3000 * 0.2 * 3 + 4000 * 0.3 * 2 = 6216 w

SDB Current = $\frac{6216}{220*0.7}$ = 40.36 A

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

Calculations for SDB GND:

SDB GND Load = Total GND load x 0.7 + Total GND S Socket Load x 0.2 +
Total GND Q Socket Load x 0.3

Total GND Load = CKT6 + CKT7 + CKT8 + CKT9 + CKT10 + CKT11

CKT6 Load = 20 w

CKT7 Load = 20 w

CKT8 Load = (4 x 20) + 100 = 180 w

CKT9 Load = (3 x 20) + (20 + 100 + 100) + (3 x 20) = 340 w

CKT10 Load = 4 x 20 = 80 w

CKT11 Load = 4 x 20 = 80 w

Total GND Load = 720 w

Total SDB SND Load = 720 x 0.7 + 4000 x 0.3 x 2 = 2904 w

SDB GND Current = $\frac{2904}{220*0.7}$ = 18.85 A

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

Calculations for SDB Roof:

SDB Roof Load = Total Roof Load x 0.7

Total Roof Load = CKT12 Load + CKT13 Load

CKT12 Load = 20 w

CKT13 Load = 20x 2 = 40 w

Total Roof Load = 60 w

Total SDB Roof Load = 60 x 0.7 = 42 w

SDB Roof Current = $\frac{42}{220*0.7}$ = 0.27 A

So, 5 A SP MCCB is needed from SDB Roof to MDB.

Calculations for ESDB:

ESDB Load = Total ESB Load x 0.7

Total ESB Load = CKT1' + CKT2' + CKT3' + CKT4' + CKT5'

CKT1' Load = (100 + 20 + 100) + 20 = 240 w

CKT2' Load = (100 + 20) + (100 + 20) = 240 w

CKT3' Load = (100 + 20 + 100) + 20 = 240 w

CKT4' Load = 100 + 20 = 120 w

CKT5' Load = 100 + 20 = 120 w

Total ESB Load = 960 w

Total ESDB Load = 960 x 0.7 = 672 w

ESDB Current = $\frac{672}{220*0.7}$ = 4.36 A

So, 5A SP MCCB is needed from ESDB to EMDB.

Calculations for ESDB GND:

ESDB GND Load = Total ESB GND Load x 0.7

Total ESB GND Load = CKT6’ + CKT7’ + CKT8' + CKT9’ + CKT10’ + CKT11’

CKT6’ Load = 20 w

CKT7’ Load = 20 w

CKT8’ Load = 100 + (20 x 2) = 140 w

CKT9’ Load = 20 x 3 = 60 w

CKT10’ Load = (100 + 20) + 20 = 140 w

CKT11’ Load = 20 x 4 = 80 w

Total ESB GND Load = 460 w

Total ESDB GND Load = 460 x 0.7 = 322 w

ESDB GND Current = $\frac{322}{220*0.7}$ = 2.09 A

So, 5A SP MCCB is needed from ESDB GND to EMDB.

Calculations for ESDB Roof:

ESDB Roof Load = Total ESB Roof Load x 0.7

Total ESB Roof Load = CKT12’ Load + CKT13’ Load

CKT12’ Load = 20 w

CKT13’ Load = 20 w

Total ESB Roof Load = 40 w

Total ESDB Roof Load = 40 x 0.7 = 28 w

ESDB Roof Current = $\frac{28}{220*0.7}$ = 0.18 A

So, 5A SP MCCB is needed from ESDB Roof to EMDB.

Calculation for Minimum Load Density:

According to Rajuk, for Air-Conditioned Dwelling abodes 100 W/m^2 should be unit load.

Here, Length of 1 unit = 10.64 m

Width of 1 unit = 7.874 m

In our apartment load density is = $\frac{Total\ Load}{Apartment\ Size\ in\ meter\text{^}2} = \frac{6216+672}{7.874*10.64}$

= 82.22 W/m^2

Calculations for EMDB:

EMDB Load = Total ESDB Load + Total ESDB GND Load + Total ESDB Roof Load

Total ESDB Load = 4 x ESDB Load

EMDB Current = $\frac{EMDB\ Load}{\sqrt{3}*Line\ Voltage*Pf}$

Phase Voltage = 220 V

Line Voltage = √3 x 220 V = 381.05 V

Power Factor, Pf = 0.7

ESDB Load = 672 w

EMDB Load = 672 x 4 + 322 + 28 = 3038 w

EMDB Current = $\frac{3038}{\sqrt{3}*381.05*0.7}$ = 6.57 A

So, 10 A TP MCCB needed from EMDB to MDB.

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

Calculations for MDB:

MDB Load = Total SDB Load + EMDB Load + PUMP Load

Total SDB Load = 4 x SDB Load + SDB GND Load + SDB Roof Load

MDB Current = $\frac{MDB\ Load}{\sqrt{3}*Line\ Voltage*Pf}$

Phase Voltage = 220 V

Line Voltage = √3 x 220 V = 381.05 V

Power Factor, Pf = 0.95 (Due to PFI Plant)

SDB Load = 6216 w

SDB GND Load = 2904 w

SDB Roof Load = 42 w

PUMP Load = 5000 w x 0.7

EMDB Load = 3038 w

Total SDB Load = 6216 x 4 + 2904 + 42 = 27810 w

MDB Load = 27810 + 3038 + 5000 x 0.7 = 34348 w = 34.348 kw

MDB Current = $\frac{34348}{\sqrt{3}*381.05*0.95}$ = 54.78 A

So, 60 A TP MCCB needed from MDB to main.

Calculations for PFI Plant:

cos θ = 0.7

sin θ = $\sqrt{1-(0.7)^2}$ = 0.714

Q = Ptan θ = 3VIsin θ = 35.042 kw

After PFI improvement sin θ = 1

I = $\frac{Q}{3vsin\theta}$ = $\frac{35.042}{3*220*1}$ = 53.1 A

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

Calculations for Transformer:

S = 3VI = 3 x 220 x 54.78 = 36154.8 VA = 36.15 KVA

So, $\frac{11}{0.415}$ kv , 50 Hz, 40 KVA, OYN 11 Oil Immersed Transformer with 4-6% impedance is needed.

Calculations for Air Terminal:

Total Circumference = 2 x (59’ – 8”) + 36’ feet

= 191.33 feet = 58.32 m

Air Terminal should be placed a 20 feet distance.

Air Terminal number = $\frac{191.33}{20}$ = 9.56

So, 10 Air Terminals are required.