United International University

QUEST FOR EXCELLENCE

DEPT. ELECTRICAL AND ELECTRONIC ENGINEERING

ELECTRICAL WIRING AND DRAFTING [EEE 2200]

TRIMESTER - SPRING 241

SECTION – A

<u>PROJECT SPECIFICATION:</u> Designing a 3451+ sq ft of 5 storied building [located at 416no. house, word 14, Narayanganj, Bangladesh] with civil layout, fitting fixture layout, conduitlayout, SB calculation, SB group calculation, SB grouping, SB connection diagram, SDB calculation, SDB connection diagram. And designing the full building with MDB calculation, MDB connection diagram, single line diagram, lightning protection setup, earthing system, light calculation, PV system, rooftop PV connection setup, fire detection and protection system layout.

PRESENTED BY

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ID: O21182032

PRESENTED TO

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Lecturer, Dept. of EEE

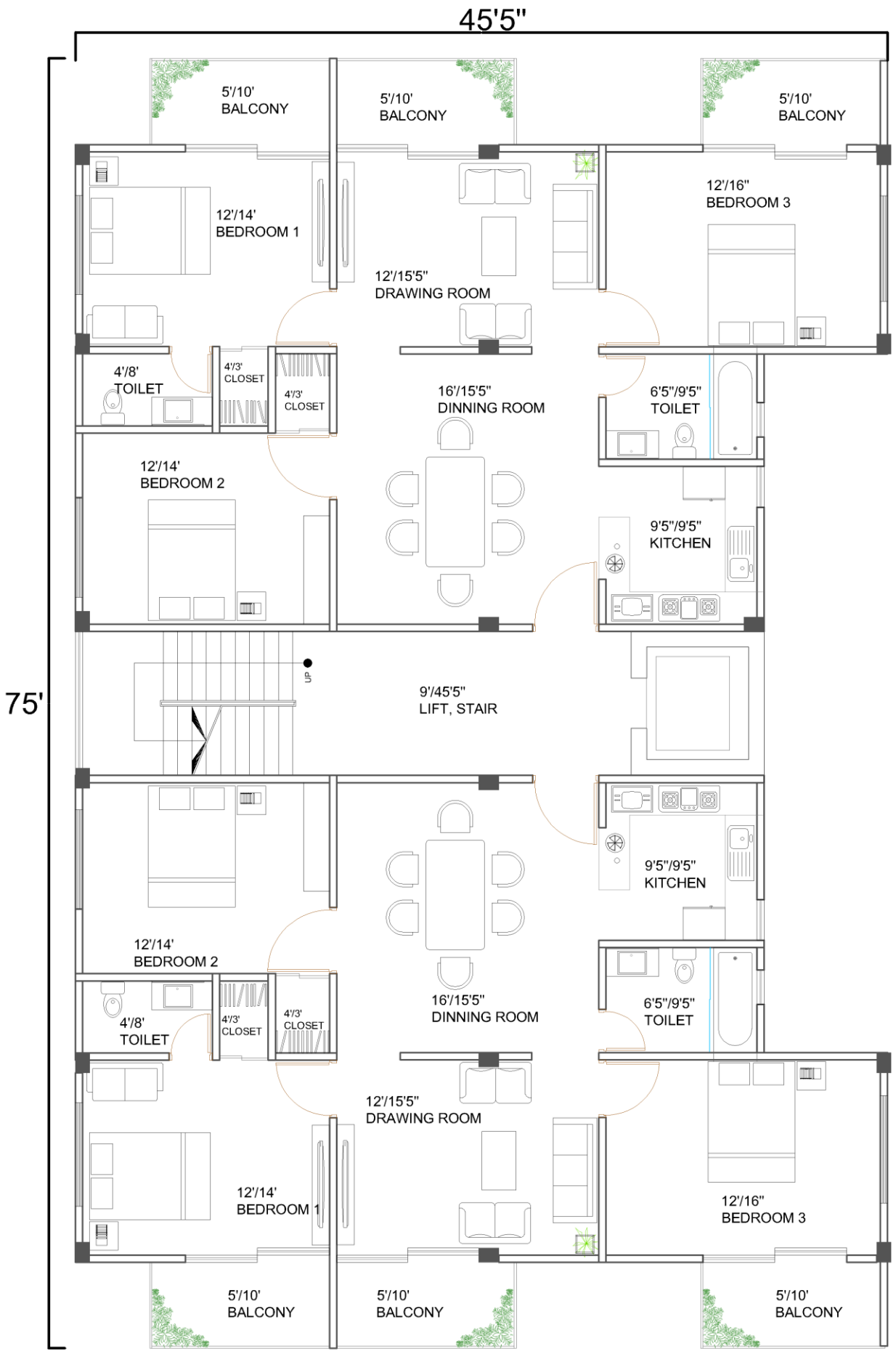
PROJECT INDEX

- ✓ **Civil Layout**
- ✓ **Fitting & Fixture Layout**
- ✓ **Conduit Layout**
- ✓ **Light Loads Connection**
- ✓ **Heavy Loads Connection**
- ✓ **Switch Board & SDB Connection**
- ✓ **Junction & MDB Connection**
- ✓ **Switch Board Calculation**
- ✓ **Switch Board Connection & Groups**
- ✓ **SDB & MDB Calculation**
- ✓ **Sub-Distribution Board Diagram**
- ✓ **Main-Distribution Board Diagram**
- ✓ **Load Division**
- ✓ **Single Line Diagram for Substation**
- ✓ **PV Calculation**
- ✓ **PV Diagram**
- ✓ **Earthing System**
- ✓ **Lightening Protection System**
- ✓ **Emergency Fire Protection System**

[3451+ sq ft of 5 storied building]

NOTE: ALL LAYOUT, DESIGN, SYMBOL, CALCULATION etc. are done according to BNBC 2020

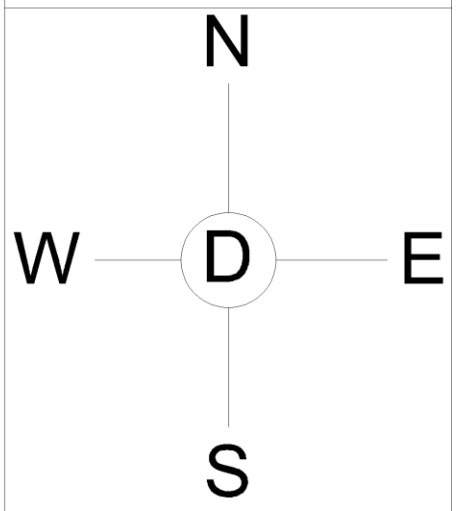
CIVIL LAYOUT



3412 SQFT, 5 STORIED BUILDING

LEGEND

LAYOUT 1



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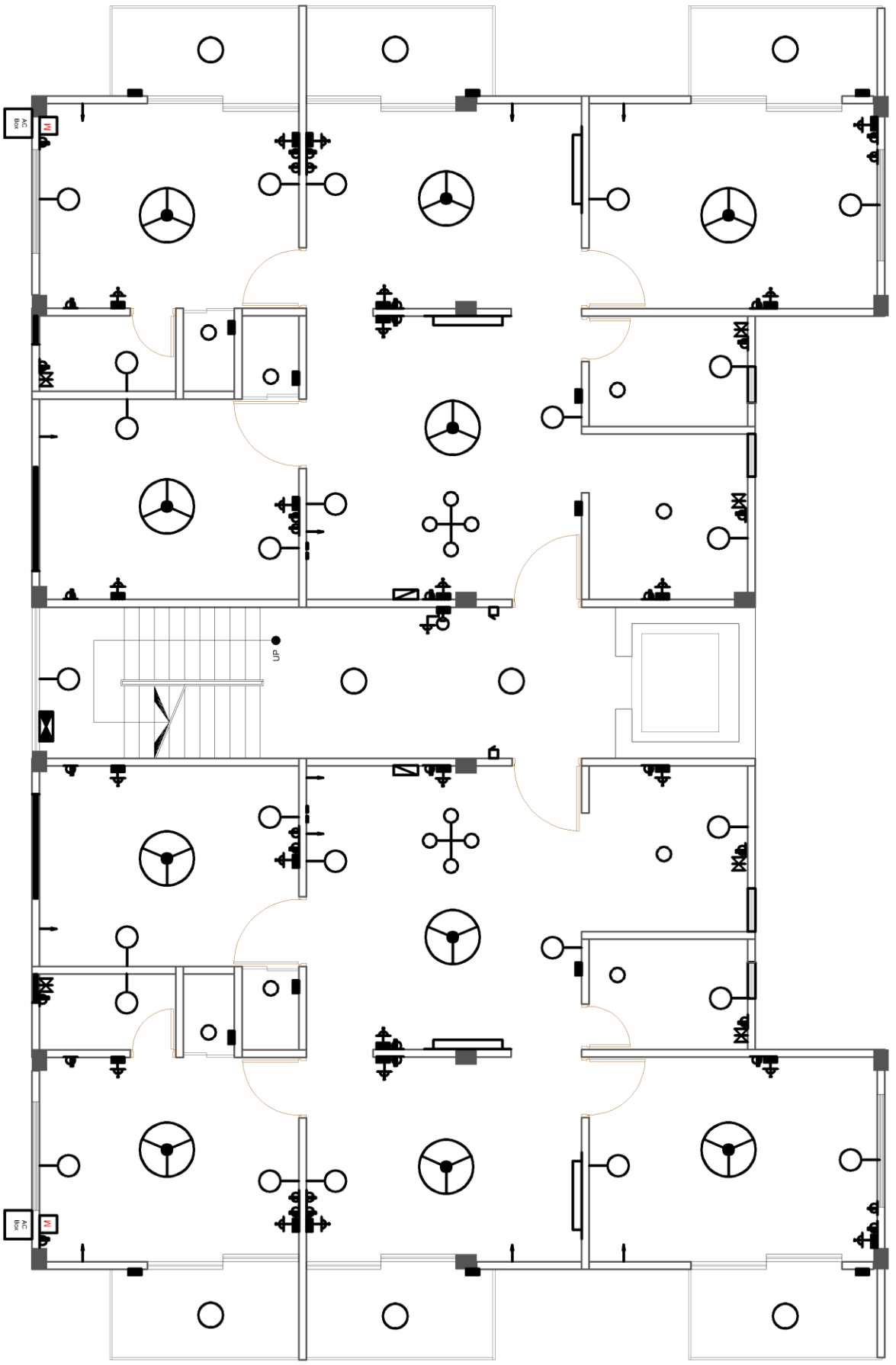
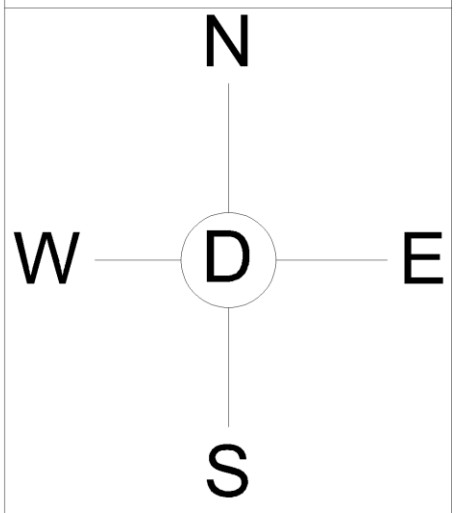
Drawing Title: Civil layout

Scale: Inch & Foot

Student Name: Joyanta Debnath
ID: 021182032

FITTINGS AND FIXTURES LAYOUT





Symbol	Descriptive Name
	Ceiling light
	Lintel level lamp
	Fluorescent wall light
	Ceiling fan
	Calling bell
	3pin 15amp socket
	2pin 5amp socket
	Exhaust fan
	AC
	AC box
	Switch board
	SDB
	MDB
	Antenna junction box
	Telephone junction box
	Telephone grommet
	4point chandelier light
	Push button
	2pin TV socket

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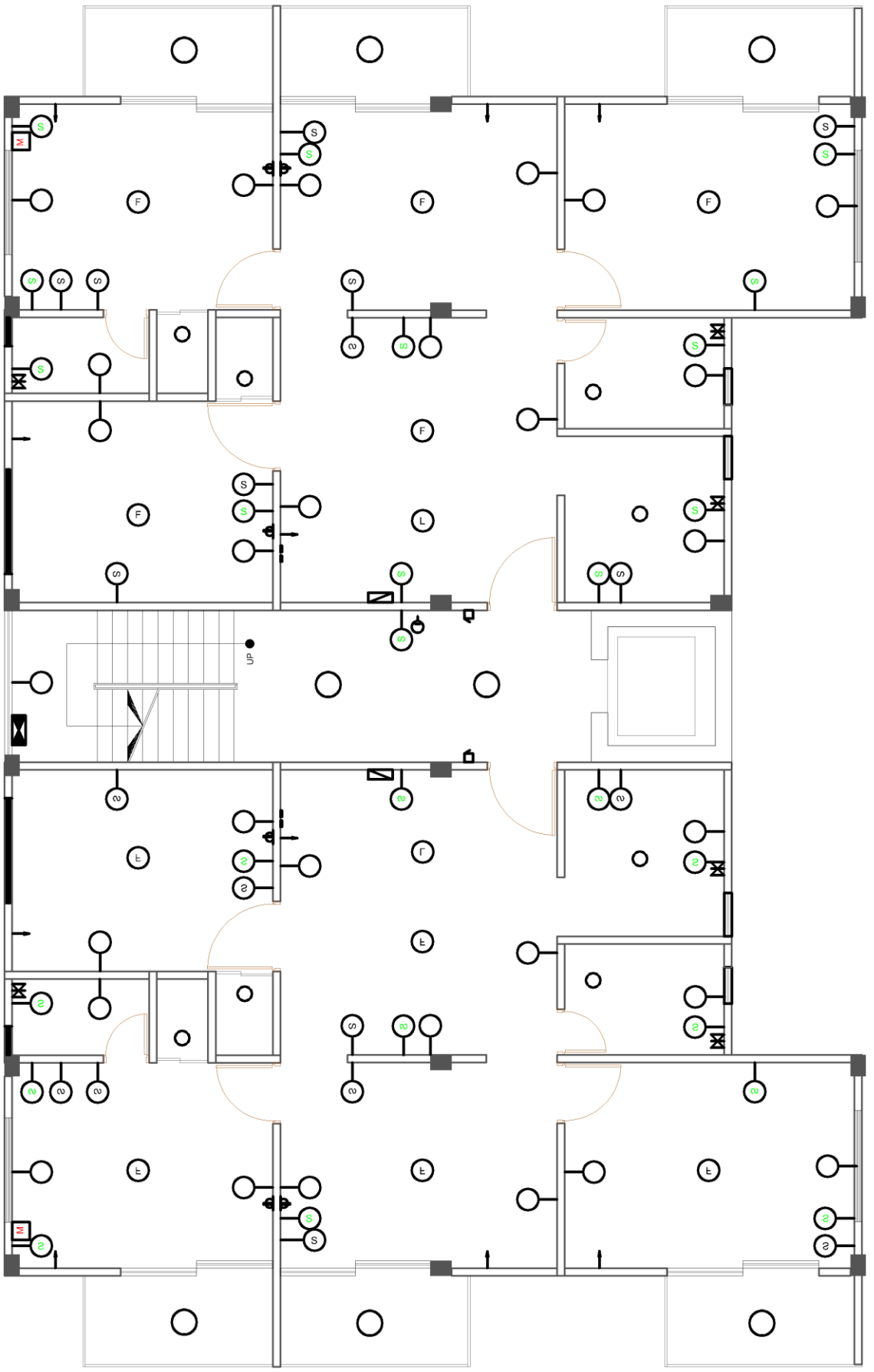
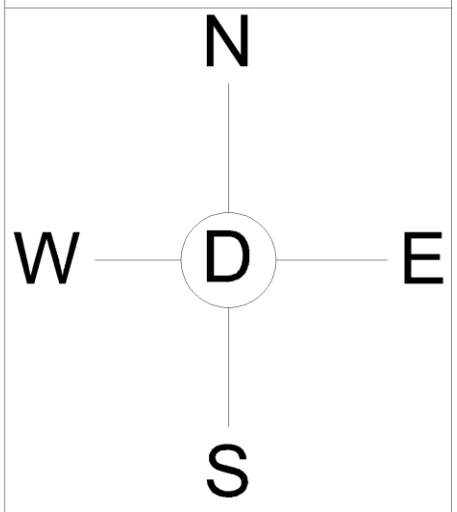
CONDUIT LAYOUT



LEGEND

LAYOUT 1



Symbol	Descriptive Name
	Lintel level light
	Fluresent wall light
	3pin 15amp socket
	2pin 5amp socket
	3pin 15amp socket at lintel level
	3pin 5amp socket at SB
	Ceiling fan
	Ceiling bell
	K - Type light
	Exhaust
	2pin T V antena Socket
	AC
	4 point Chandelier
	Push button
	Telephone grommet
	Switch board
	SDB
	MDB
	Antenna junction box
	Telephone junction box
	Mirror light

Faculty Name:
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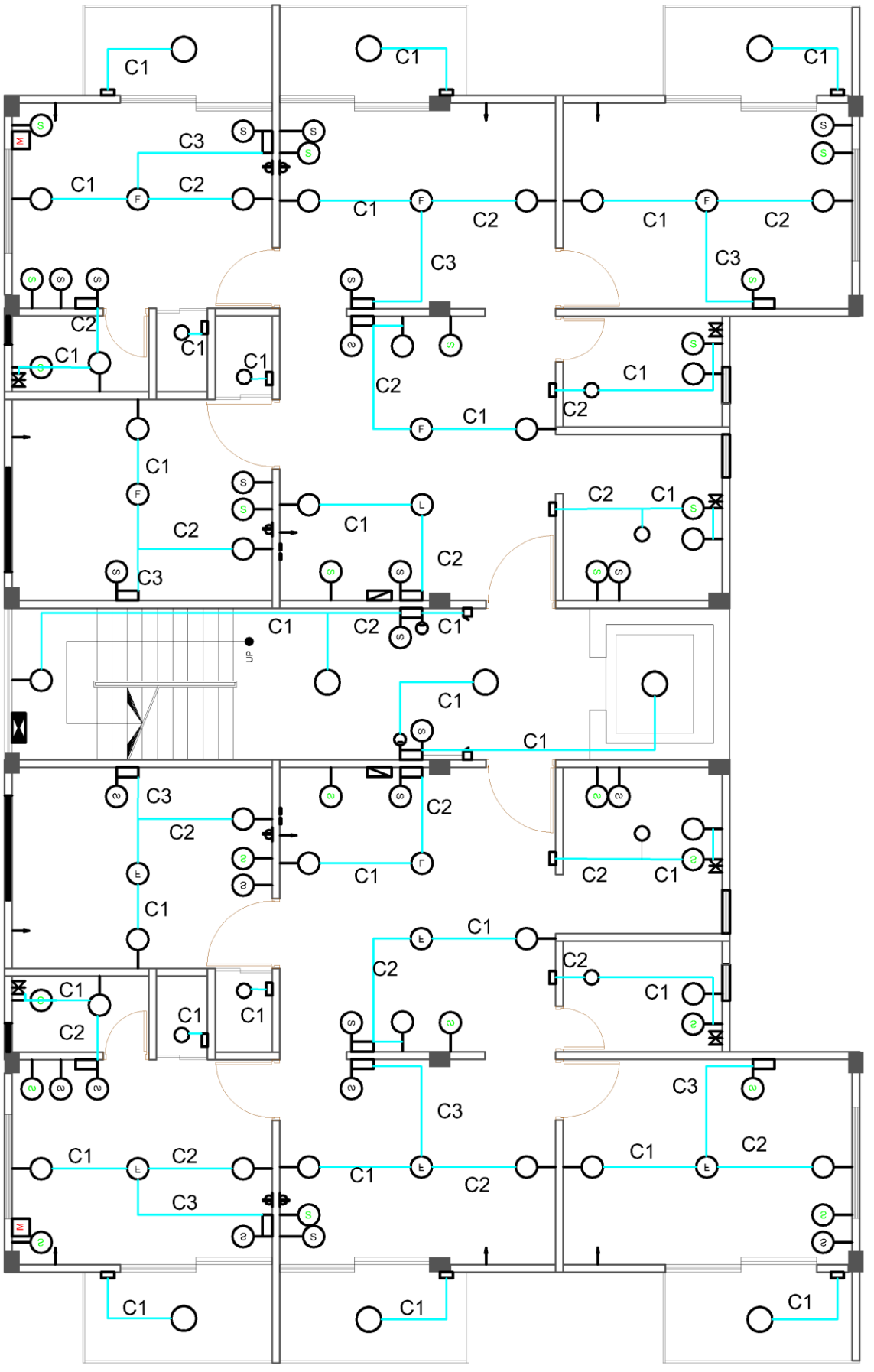
CONDUIT LAYOUT FOR LIGHT LOAD



LEGEND

LAYOUT 1

N

W D E

S

C1 - 2*1.5mm^2

C2 - 4*1.5mm^2

C3 - 6*1.5mm^2

C5 - 2*4mm^2

C6 - 2*6mm^2

C22 > 2 * C2 > 8*1.5 2

C1,22 - C1 + C22

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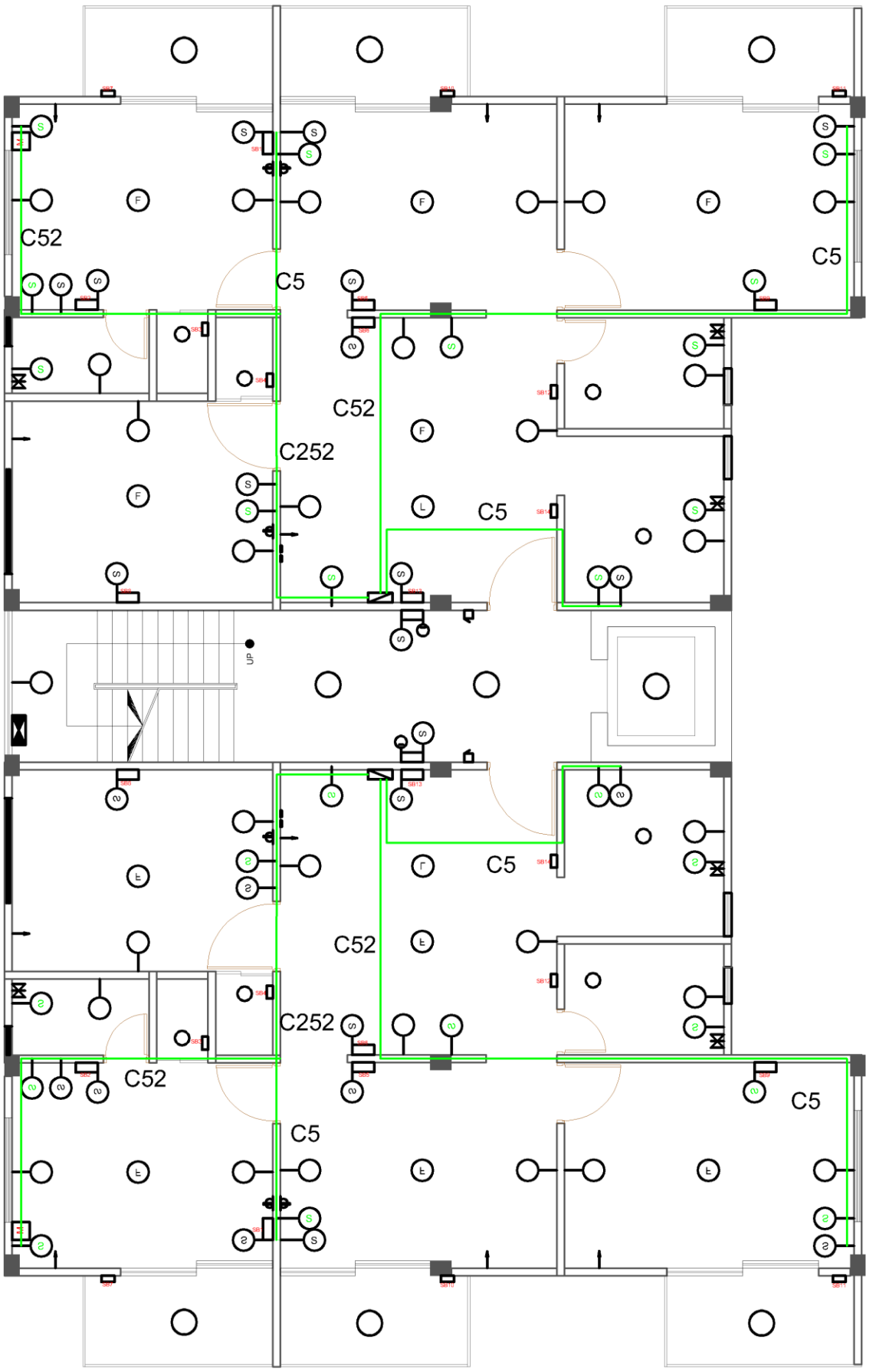
CONDUIT LAYOUT FOR HEAVY LOAD



LEGEND

LAYOUT 1

N

W D E

S

C5 - 2*4mm^2

C52 - 4*4mm^2

C5,52 = C5 + C52
=2*4mm^2 + 4*4mm^2

C52,252=C52+2*C52

C6 - 2*6mm^2

C26 - 2*C6,2c

C6,C26=C6+C26,3

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Drawing Title: Civil layout

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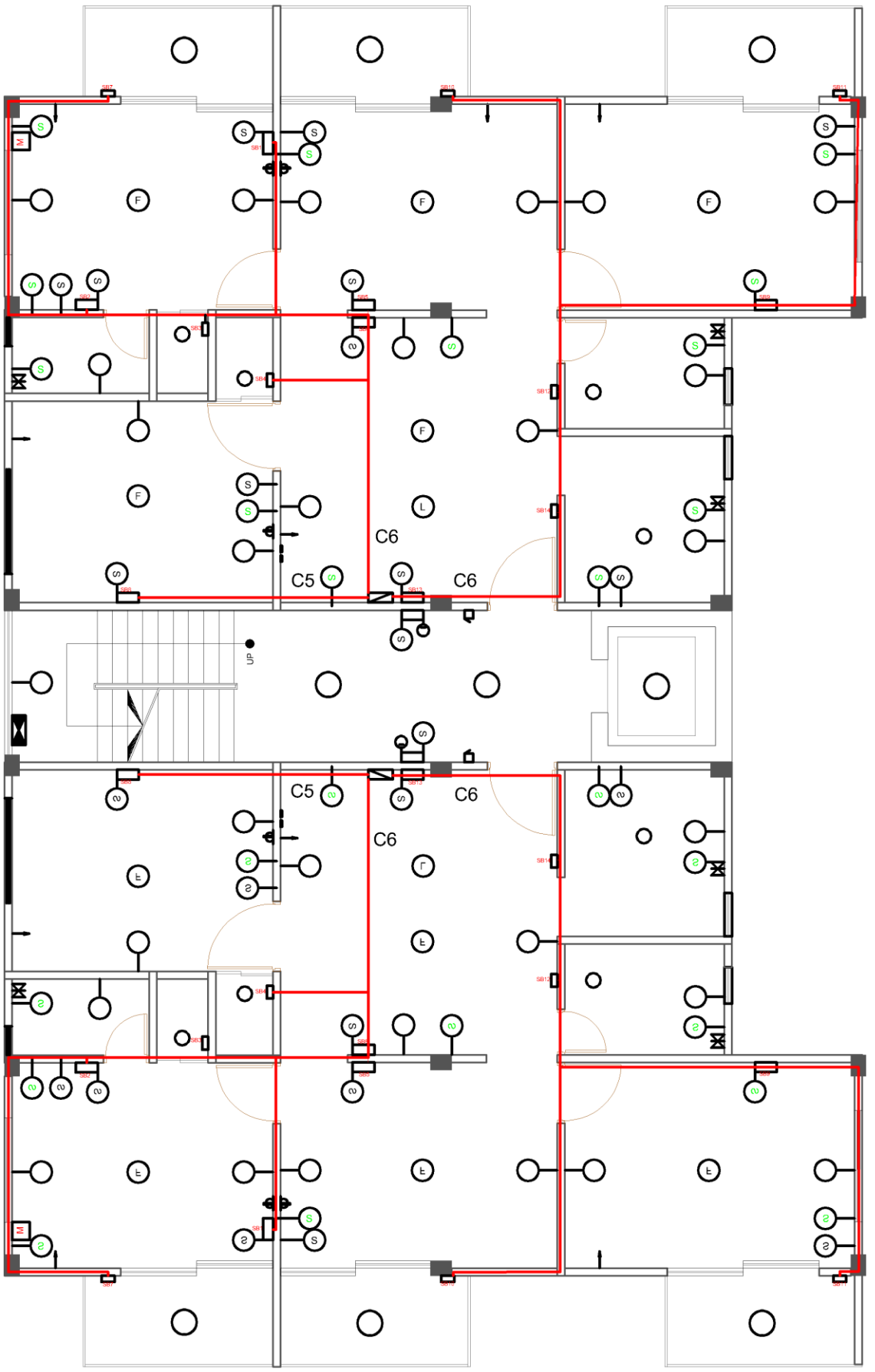
CONDUIT LAYOUT FOR SWITCHBOARD GROUPING AND CONNECTION



LEGEND

LAYOUT 1

N

W D E

S

C5 - 2*4mm^2

C52 - 4*4mm^2

C5,52 = C5 + C52
=2*4mm^2 + 4*4mm^2

C52,252=C52+2*C52

C6 - 2*6mm^2

C26 - 2*C6,2c

C6,C26=C6+C26,3

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Drawing Title: Civil layout

Student Name: Joyanta Debnath
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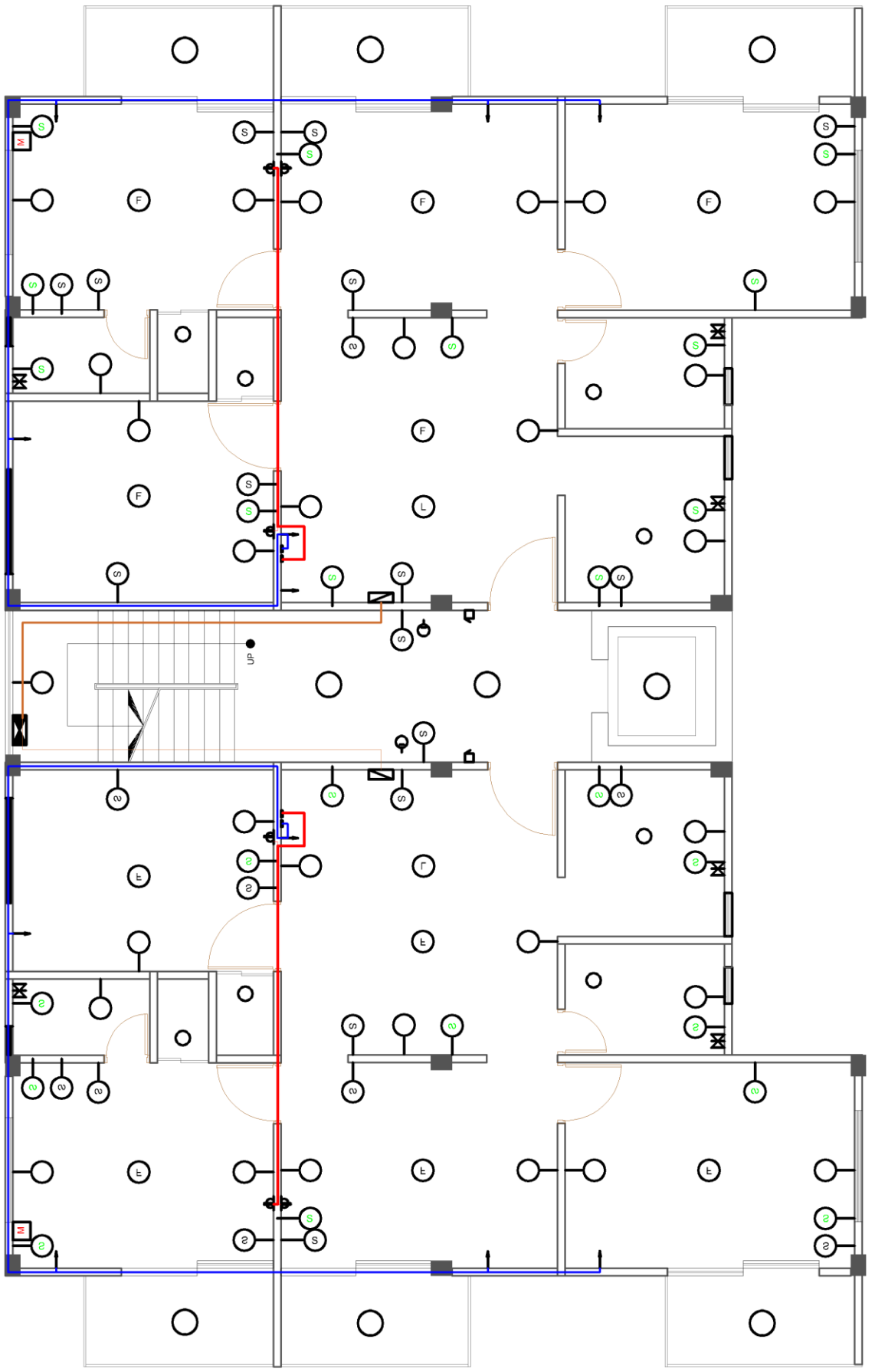
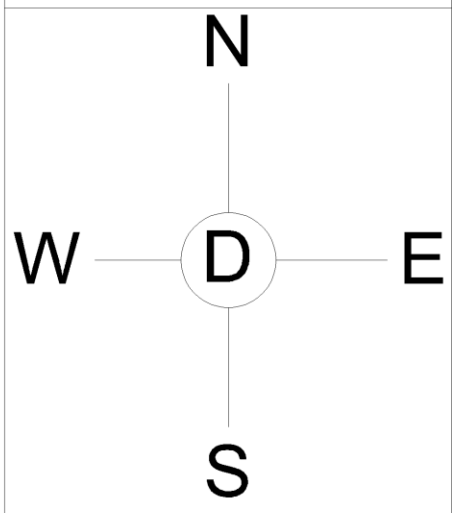
CONDUIT LAYOUT FOR ANTENNA JUNCTIONS AND MDB CONNECTION



LEGEND

LAYOUT 1



C5 - 2*4mm^2

C52 - 4*4mm^2

C5,52 = C5 + C52
=2*4mm^2 + 4*4mm^2

C52,252=C52+2*C52

C6 - 2*6mm^2

C26 - 2*C6,2c

C6,C26=C6+C26,3

Faculty Name:
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Drawing Title: Civil layout

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CALCULATION FOR SWITCHBOARD

Switchboard-1
- Light= 2*40W
- Fan= 1*80W
- TV Socket= 1*500W
- 2pin Socket= 1*500W

Total= 1160W
P= V*I*0.9
Here,
I= 1160/230*0.9= 5.6A

Switchboard-2
- Light= 1*40W
- Exhaust Fan= 1*60W
- 2pin Socket= 1*500W

Total= 600W
P= V*I*0.9
Here,
I= 600/230*0.9= 2.9A

Switchboard-3
- Light= 1*18W

Total= 18W
P= V*I*0.9
Here,
I= 18/230*0.9= 0.09A

Switchboard-4
- Light= 1*18W

Total= 18W
P= V*I*0.9
Here,
I= 18/230*0.9= 0.09A

Switchboard-5
- Light= 2*40W
- Fan= 1*80W
- TV Socket= 1*500W
- 2pin Socket= 1*500W

Total= 1160W
P= V*I*0.9
Here,
I= 1160/230*0.9= 5.6A

Switchboard-6
- Light= 2*40W
- Fan= 1*80W
- 2pin Socket= 1*500W

Total= 660W
P= V*I*0.9
Here,
I= 660/230*0.9= 3.2A

Switchboard-7
- Light= 1*40W

Total= 40W
P= V*I*0.9
Here,
I= 40/230*0.9= 0.2A

Switchboard-8
- Light= 2*40W
- Fan= 1*80W
- TV Socket= 1*500W
- 2pin Socket= 1*500W

Total= 1160W
P= V*I*0.9
Here,
I= 1160/230*0.9= 5.6A

Switchboard-9
- Light= 2*40W
- Fan= 1*80W
- TV Socket= 1*500W
- 2pin Socket= 1*500W

Total= 1160W
P= V*I*0.9
Here,
I= 1160/230*0.9= 5.6A

Switchboard-10
- Light= 1*40W

Total= 40W
P= V*I*0.9
Here,
I= 40/230*0.9= 0.2A

Switchboard-11
- Light= 1*40W

Total= 40W
P= V*I*0.9
Here,
I= 40/230*0.9= 0.2A

Switchboard-12
- Light= 1*40W
- Exhaust Fan= 1*60W
- 2pin Socket= 1*500W

Total= 600W
P= V*I*0.9
Here,
I= 600/230*0.9= 2.9A

Switchboard-13
- Light= 1*40W
- Chandelier= 1*60W
- 2pin Socket= 1*500W

Total= 600W
P= V*I*0.9
Here,
I= 600/230*0.9= 2.9A

Switchboard-14
- Light= 2*40W
- Exhaust Fan= 1*60W
- 2pin Socket= 1*500W

Total= 640W
P= V*I*0.9
Here,
I= 640/230*0.9= 3.1A

CIRCUIT BREAKER SELECTION FOR SWITCHBOARD GROUPS

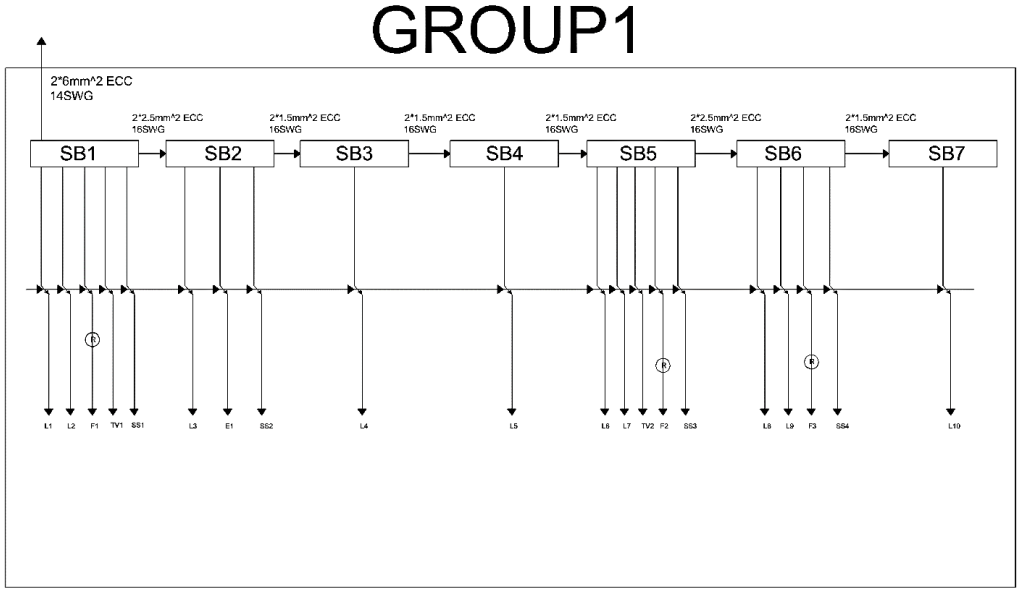
Group-1
For, Switchboard 1,2,3,4,5,6,7
I= (5.6+2.9+0.09+0.09+5.6+3.2+0.2) A
= 17.68A
So, 20A Circuit Breaker chosen.

Group-2
For, Switchboard 8
I= 5.6A
So, 10A Circuit Breaker chosen.

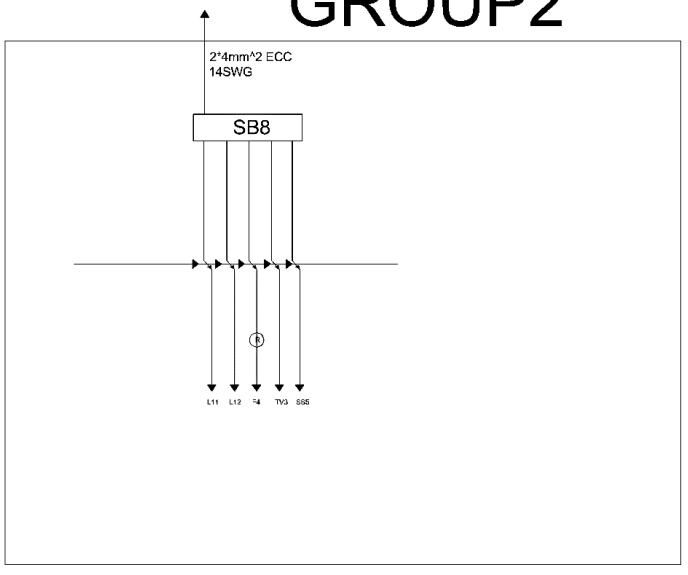
Group-3
For, Switchboard 9,10,11,12,13,14
I= (5.6+0.2+0.2+2.9+2.9+3.1) A
= 14.9A
So, 20A Circuit Breaker chosen.

SWITCHBOARD GROUPING

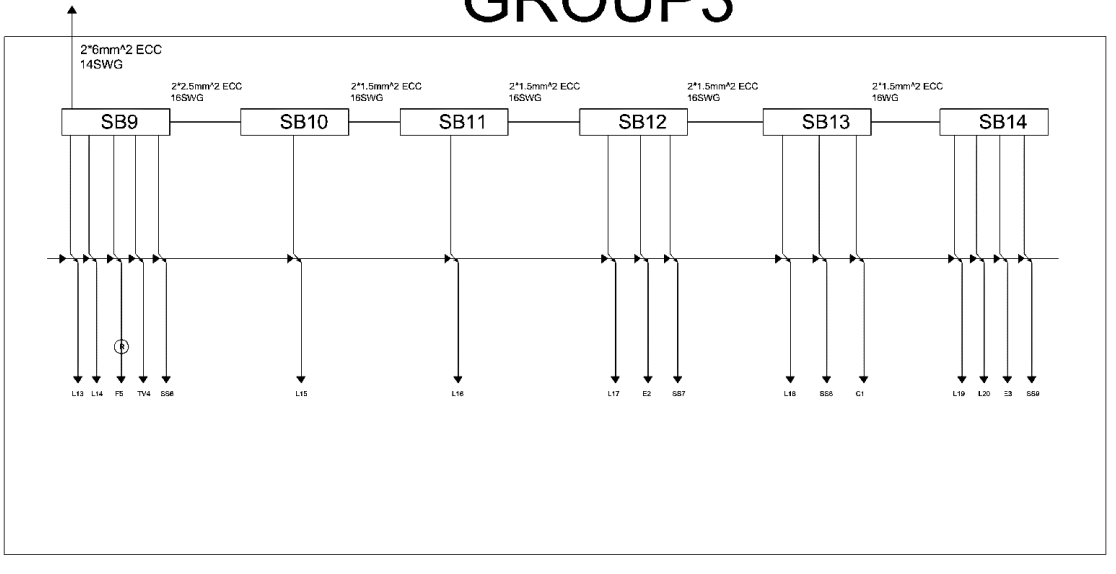
GROUP1



GROUP2



GROUP3



CALCULATION FOR SDB

3-Pin Socket 15A

9*3S= (9*1500) W

= 13500W

AC 20A

1*M= (1*2500) W

= 2500W

Total Power

= (7896*0.6) + (13500*0.7) + (2500*1) W

= 16687.6W

48 KW > 16.69KW > 9 KW So, required 3 phase line and supply must be 415V L_L.

Now, **P= 1.73*V_L*I_L*0.9**

Here, I_L= 16687.6/(1.73*415*0.9) A

= 25.83A

Including Safety Factor, I= (I_L*S.F.) + I_spare

= [(25.83*1.5) + 15] A

= 53.74A

So, 60A 440V TP Circuit Breaker chosen.

CALCULATION FOR MDB

Every Unit= 16687.6W

10 Units= 10*16687.6 W

= 166.876KW

Extra Load (Lights at lift and staircase),

Number of load*Load value*Number of floor

= 4*40*5 W

= 800W

Water Pump (1 of 7HP),

= 7*746 W

= 5222W

Lift (Single lift),

Chosen 800Kg lift (Around 8 person)

Speed= 1.8m/s

Motor Capacity= 9KW

MCCB Capacity= 30A

Total Power= (166.876+0.8+5.222+9) KW

= 181.9KW

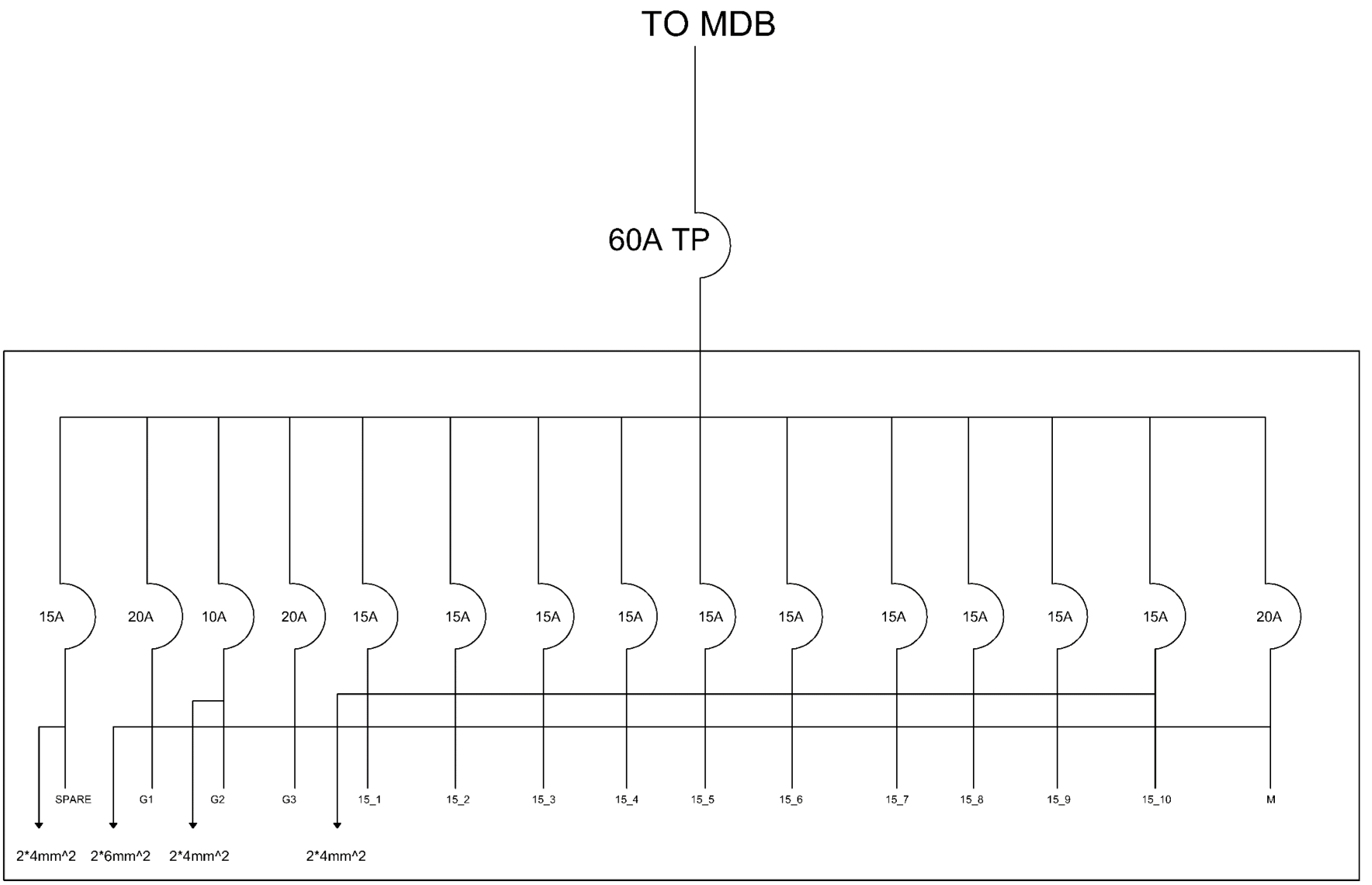
Now, **P= 1.73*V_L*I_L*0.9**

Here, I_L= (181.9*1000)/(1.73*415*0.9) A

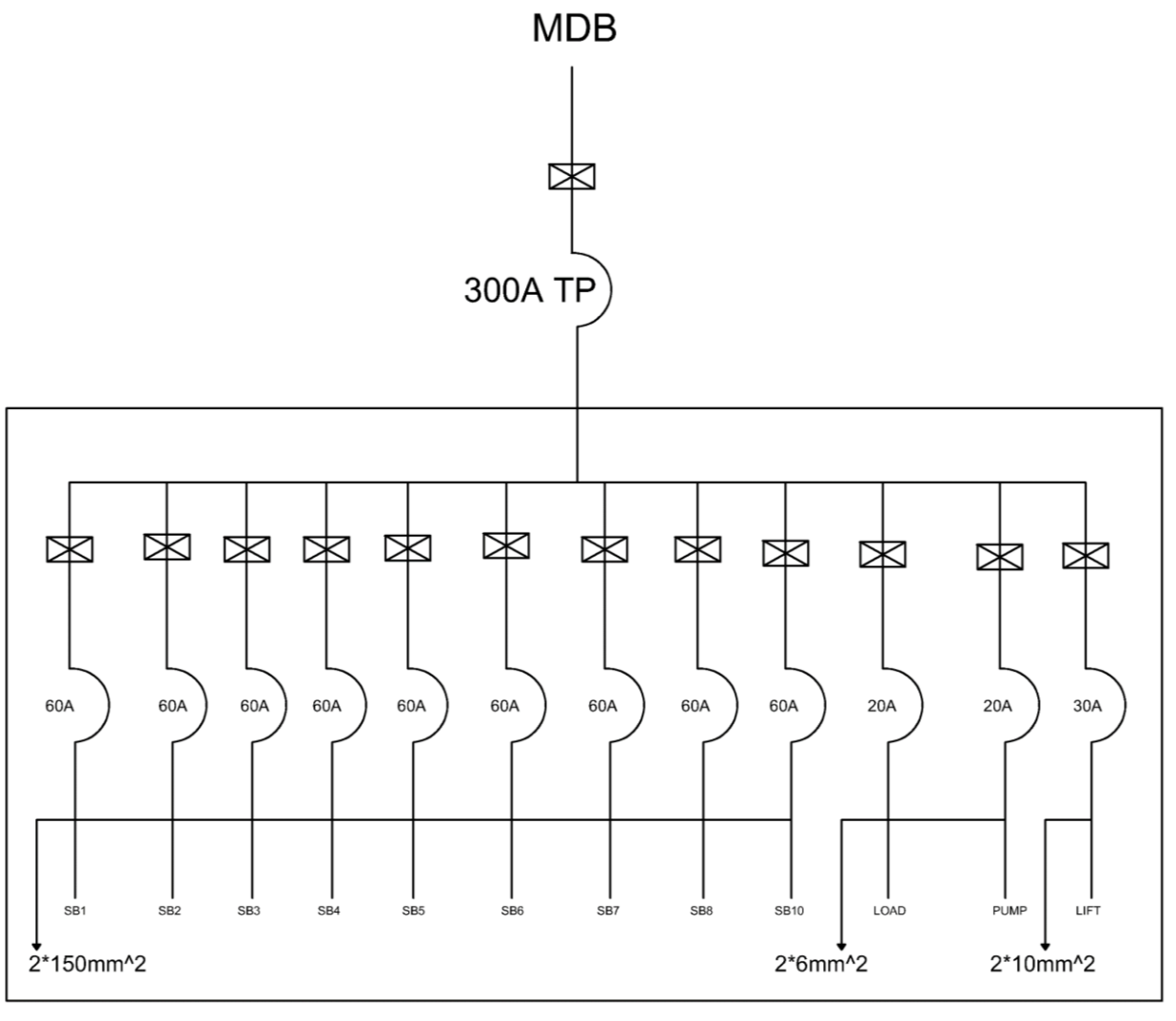
= 281.52A

So, 300A TP Circuit Breaker chosen.

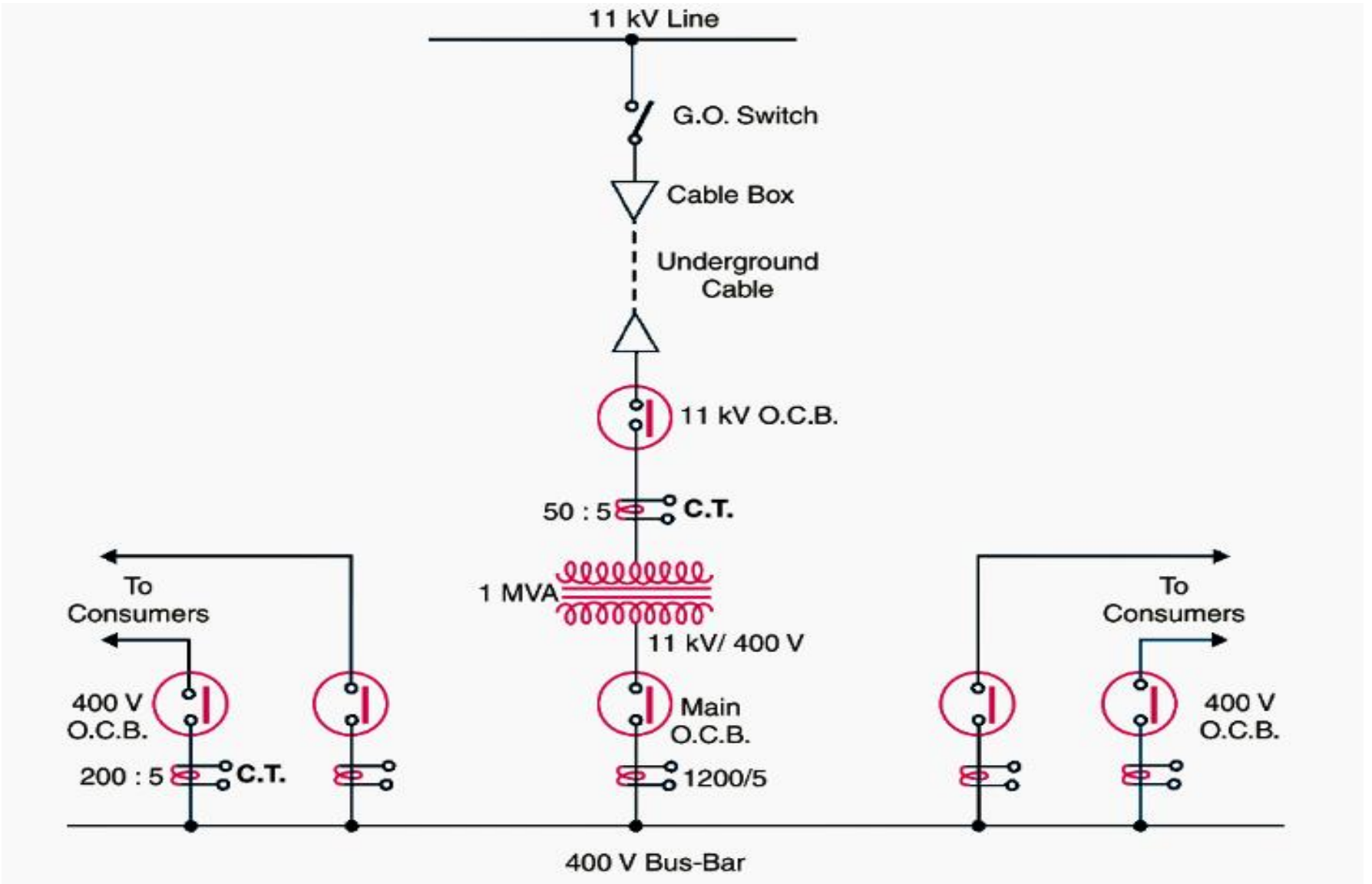
SUB-DISTRIBUTION BOARD DIAGRAM

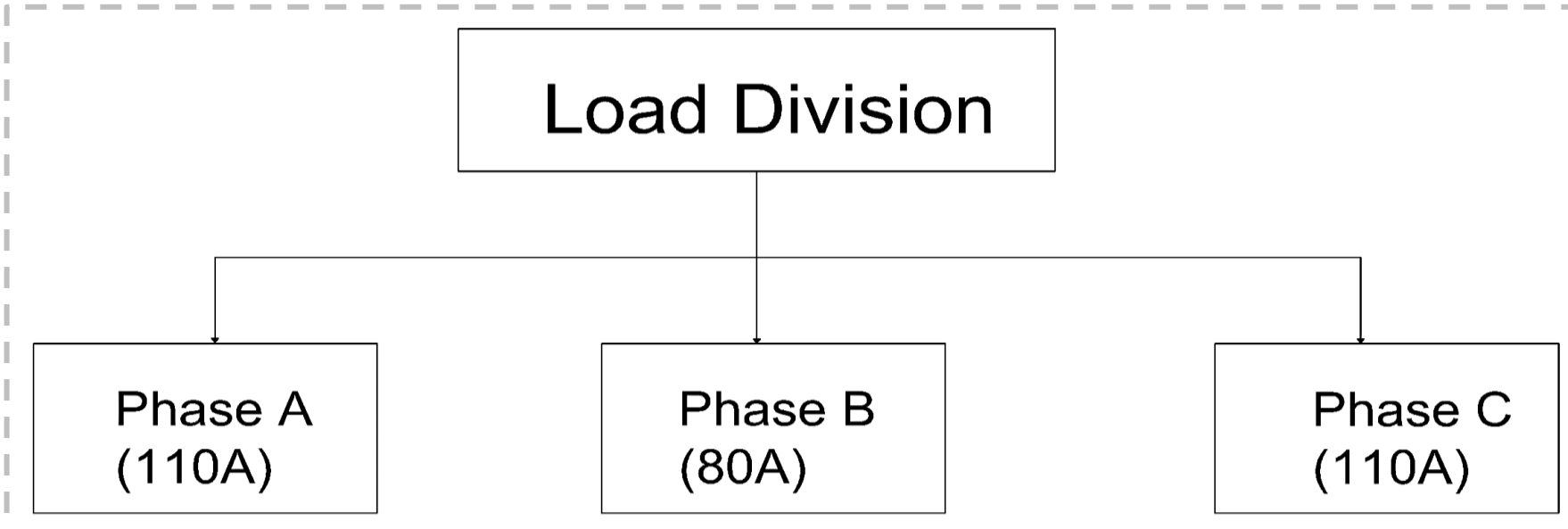


MAIN DISTRIBUTION BOARD DIAGRAM



SINGLE LINE DIAGRAM OF A TYPICAL 11KV/400V INDOOR SUBSTATION 11KV LINE





PV CALCULATION

Rooms	Light[T1]	Light[L]	Chandelier	Fan	TV
Bed	0	6	0	3	1
Toilet	2	2	0	0	0
Closet	2	0	0	0	0
Balcony	0	3	0	0	0
Kitchen	0	2	0	0	0
Drawing	0	2	0	1	1
Dinning	0	3	1	1	0

Content	Number	Power[Watt]	Usage[hr]	Energy[Whr]
Light[T1]	4	18	9	648
Light[L]	18	40	9	6480
Chandelier	1	60	6	360
Fan	5	80	9	3600
TV	2	500	6	6000

[**Total energy consumption** = 17088 Whr [***Each unit***]

[Note. 5 storied building, each floor 2 units.]

For, Each floor = (17088*2) Whr = 34176Whr

For, All floors [***10 units***] = (34176*5) Whr = 170880Whr

Now, **Total energy consumption** for entire building at 5% load,

E = 170880*0.05 = 8544Whr

Here, **Total power consumption** each floor = (2252*2) W = 4504W

Now, **Total power consumption** for entire building at 5% load,

Ptotal = (4504*5)*0.05 W = 1.126KW [Here, system nominal voltage 12V]

[Note. If system processing up to about 1.5KW- hr then system nominal voltage is 12 volts]]

Total energy & power consumption

Chosen Solar Panel Model - STM435/120-S3

Maximum Power = 435W

Maximum Voltage (V_{mp}) = 33.76V

Maximum Current I_{MAX-PV} = 12.89A

Open Circuit Voltage V_{OC} = 40.8V

Nominal Output Voltage = 12V

Short Circuit Current I_{SC} = 13.34A **Solar panel Model**

Total Amp-hr per Day= Total System Load/(Inverter loss*System Nominal Voltage)

= 8544/(0.85*12) Amp-hr/day = 837.65 Amp-hr/day

Total Amp-hr per Day with Batteries = Total Amp-hrs/Day*Losses and safety factor

= 837.65Amp-hr/day*1.25

= 1047.063Amp-hr/day **Battery side calculation**

Now, **Parallel PV Module**

= Total energy in Whr/(T peak solar∗nPV∗nINV∗nBATTERY∗VS.Nominal∗Imax−PV)

= 8544/(7*0.9*0.85*0.8*12*12.89) = 12.89 = 14 Module

Now, **Series PV Module**

= Vsys Nominal/Vpv Nominal

= 12/12 = 1 Module

Total No. of PV Module = No. of parallel PV module/ No. of series PV module

= 14*1 = 14 Module **No. PV calculation**

[**Chosen Lithium Battery Model** - RB300 12V 300Ah LiFePO4 Battery.

Voltage = 12V

Amp hours = 300Ah

Desired Reserve Time (Days) = 2 days

Now Minimum Battery Capacity

Battery Hours = (Total Amp-hr per day*Desired Reserve Time)/0.80

= (1047.063*2)/0.80 = 2617.66Amp-hr

Number of Batteries in Parallel

Parallel Batteries = Required Battery Capacity/Capacity of Selected Battery

= 2617.66/300 = 8.72 = 8 Batteries

Number of Batteries in Series

Series Batteries = Vsys Nominal/Vbattery

= 12/12 = 1 Battery

Total No. of Batteries = No. of parallel batteries*No. of series batteries

= 8*1 = 8 Batteries] **No. Battery calculation**

[**Charge Controller Size** = (PVparallel*IPV_{Sc}*S.F.) Amp

= (14*13.34*1.25) Amp

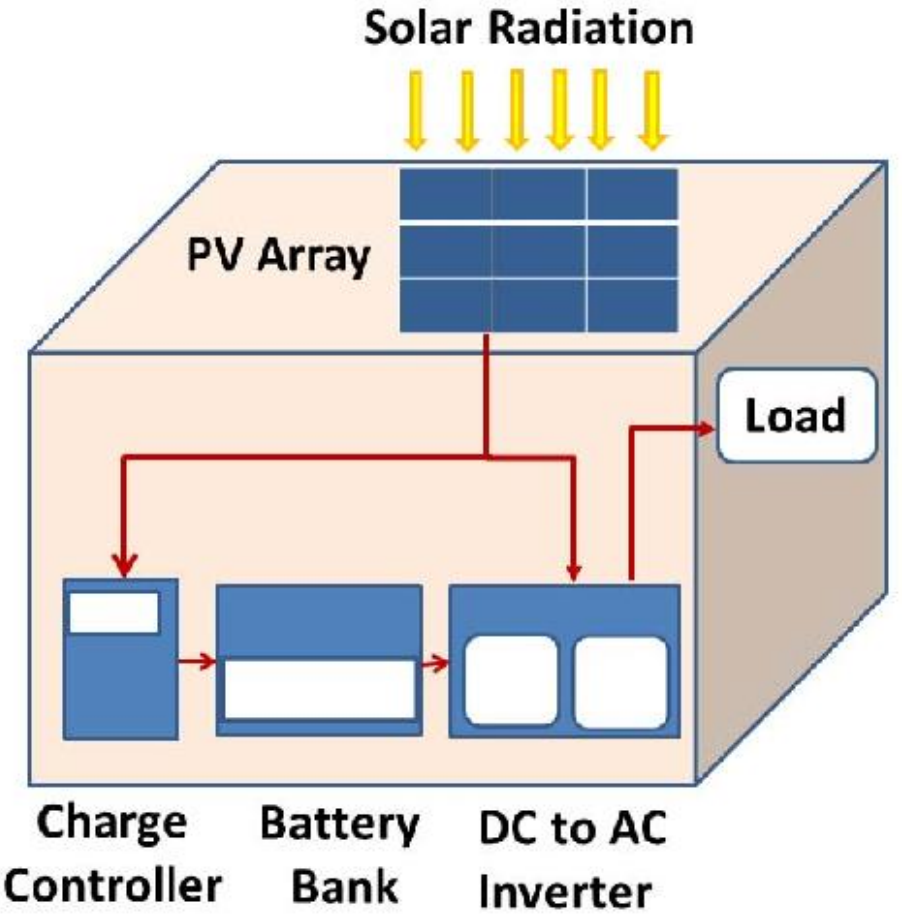
= 233.45Amp]

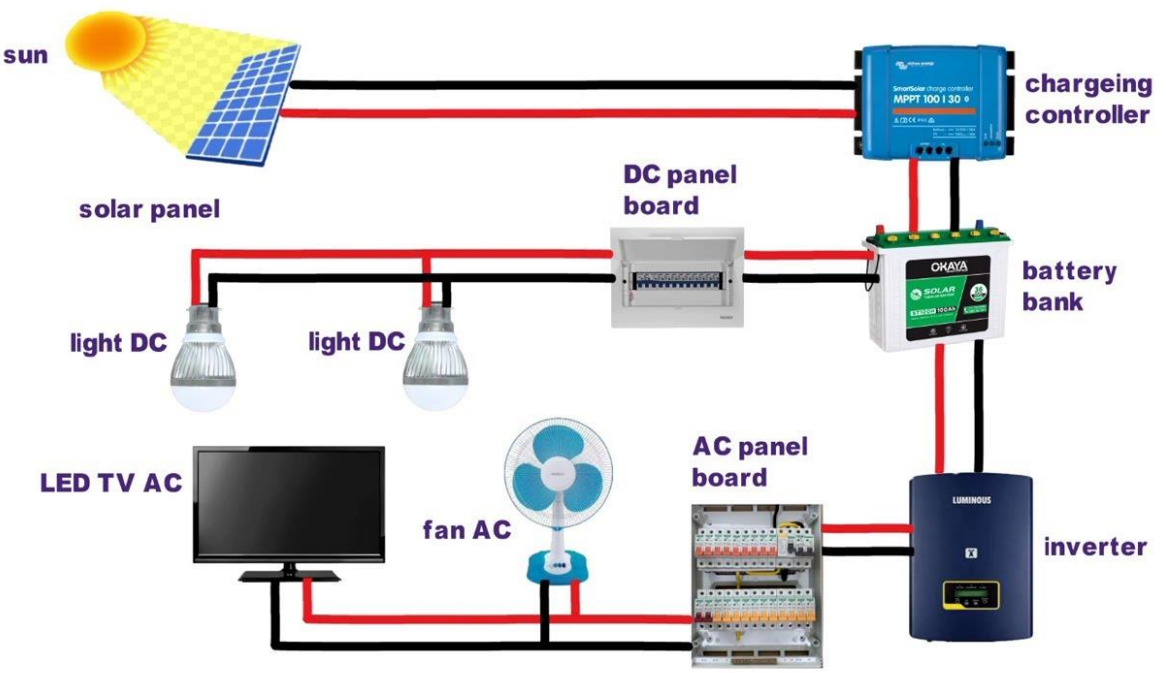
[**Inverter Size** = (Ptotal*S.F.)

= (1.126*1.25)

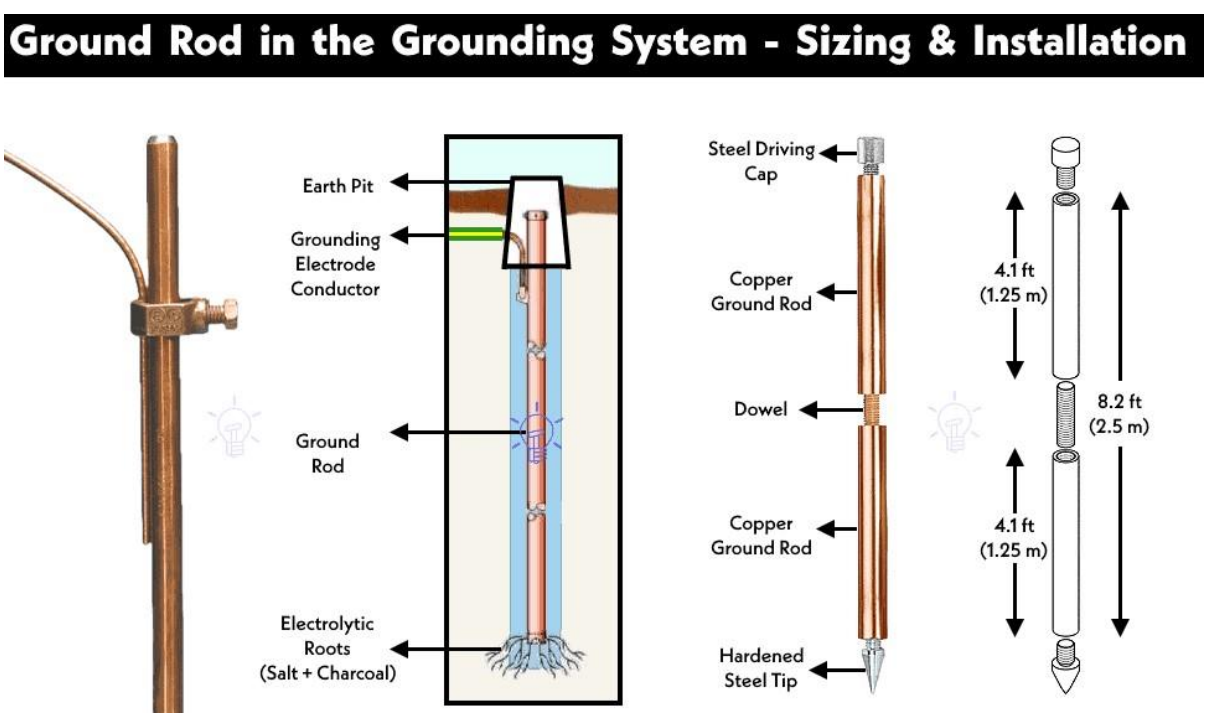
= 1.41KW]

PV DIAGRAM



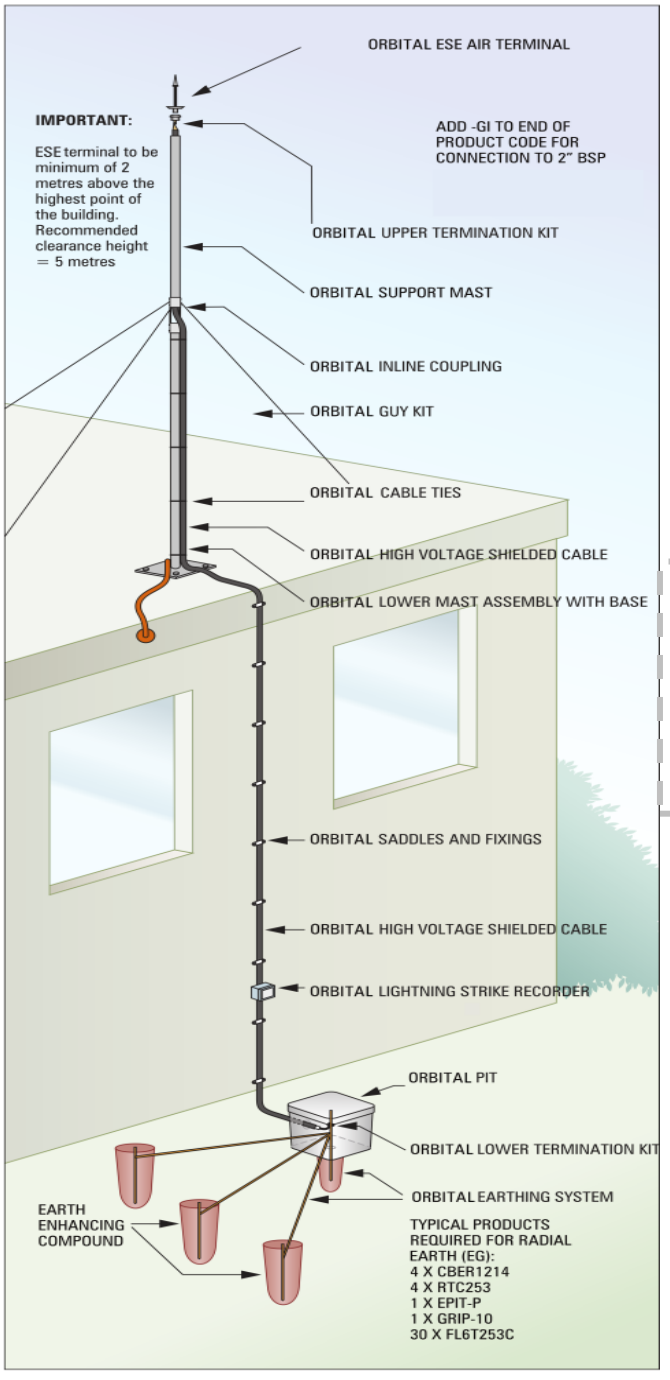


EARTHING SYSTEM



EMERGENCY FIRE PROTECTION SYSTEM

LIGHTENING PROTECTIONSYSTEM



THANK YOU