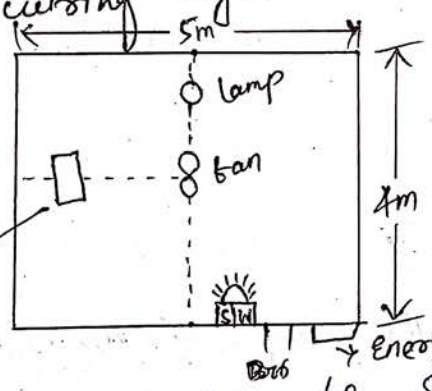
Domestic Installation

Dt-13/12/19

Q) The plan of a single room of size 5m X 4m is given below. The room is required to be provided with one lamp, one fan, one florescent tube 15A socket outlet. Each of the point controlled by individual switch, draw the installation plan & its wiring diagram. Calculate the total length of wire & other material & prepare a list of material required for wiring the room in concealed conduit wiring system.



* Assume:-
→ Total height floor to selling = 3.5M
→ Height of horizontal run from floor = 3.0m
* Height of s/w board from floor = 1.5m
→ Light & tube point from selling = 0.5m
* Calculate for length of conduit pipe :- (20mm dia)
→ From s/w board to horizontal run = 1.5m
→ Floor to Energy meter = 2 + 0.5 = 2.5m

→ From HR to lamp point =
0.5+0.5+4 = 5m

→ From fan to tube point → 2.5+0.5 = 3

→ Taking 10% wastage. $12 \times \frac{10}{100}$ → Total = 12 meter
= 1.2m

→ Total length of conduit pipe = 12 + 1.2 = 13.2

* Calculation the length of phase wire :-

→ From point of entry of ckt into room upto
S/w board (SB). = 2.0 + 1.5 = 3.5m.

→ From SB upto fan = 1.5 + 0.5 + 0.5 + 2 = 4.5m

→ From SB to lamp = 4.5 + 1.5 + 0.5 + 0.5 = 7m

→ From SB to tube = 4.5 + 2.5 + 0.5 = 7.5m

→ Calculation of the length of Neutral wire :-

→ From point of entry of ckt into room upto
S/w board = 3.5m

→ From fan to lamp = 2.5m

→ From fan to tube = 3m

→ Total length of conductor = 3.5 + 4.5 + 2.5 + 3
= 13.5m

→ Total length of conductor (Phase / neutral)
= 13.5 + 22.5
= 36m

22.5m

* Taking 15% wastage =

$= 36 \times \frac{15}{100}$

$= 5.4\,m$

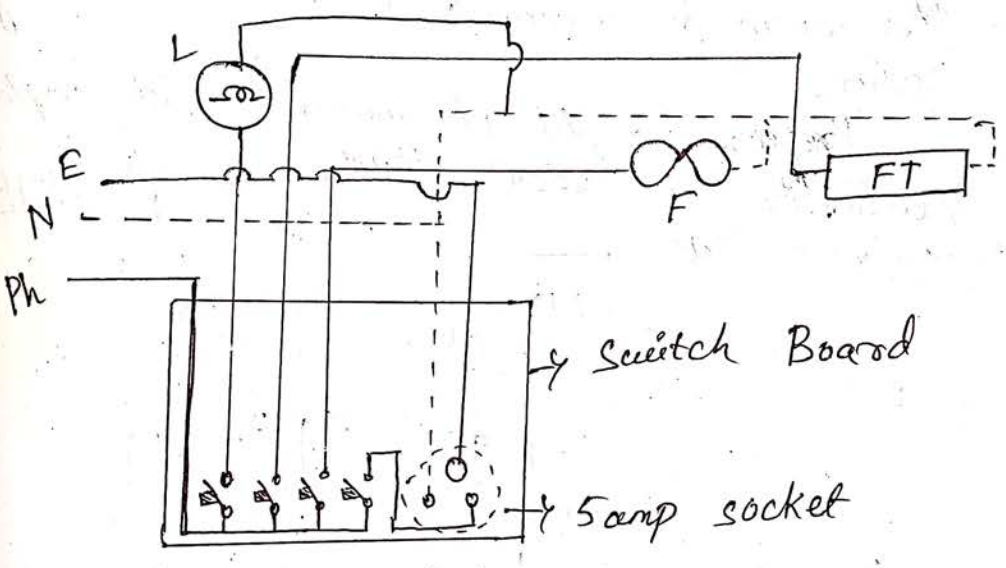
Total = $36 + 5.4 = 41.4\,m$

* Earth wire calculation :-

Dt-14/12/19

* From energy meter to S/w board =

$1.5 + 1.5 + 0.5 = 3.5\,m$



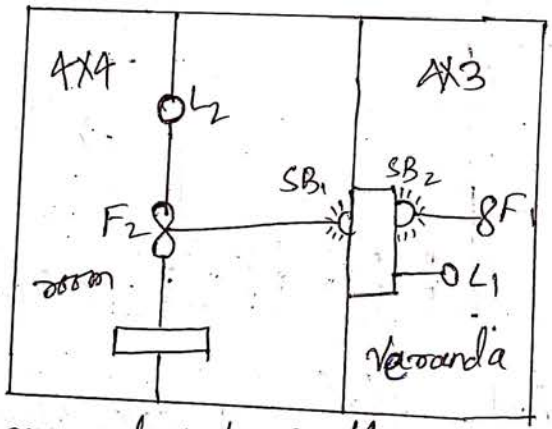
* Material list :-

Sl. No.	Name & specification	Quantity
01.	Conduit pipe (20mm dia)	13.2m
02.	Phase neutral wire ($1.2mm^2$)	41.4m
03.	Earth wire ($1.6mm^2$)	3.5m
04.	Switch (5 Amp)	4 no.
05.	Socket (5A)	1 no.
06.	Regulation (220V)	1 no.
07.	S/w board (20cm X 20cm)	1 no.
08.	Lamp holder	1 no.
09.	Thimbles	1 no.
10.	L-band pipe	3 no.
11.		

Q) A room and veranda the plan of which is given below is require to be provided with electrical wiring. Mark the location of energy meter, main s/w & s/w board and electrical points suitably. and draw the installation plan. so supply path to each point & wiring diagram. Calculate the total length of wire require for wiring diagram for the room & varanda in batten wiring system.

Prepare a list of material with complete specification of each items. Dt-07/01/2020

1) Installation plan:-



2) Assume :- Energy meter from floor = 2M

i) The height of selling = 3.5M

ii) Height of H.R. from floor = 3M

iii) Height of s/w board from floor = 1.5M

iv) location of EM & Main SB = 0.5M

v) (Inside veranda on room wall)

3) Calculation of load :-

Lamp → 2 = 120 watt = 60w X2

Fan → 2 = 120 watt = 60w X2

Socket → 2 = 200 watt = 100w X2

F.T.(Light) - 1 = 40 watt = 40w X1

Total → 480 watt

voltage = 230 V

$\Rightarrow$ current = $\frac{\text{Power}}{\text{voltage}} = \frac{480}{230} = 2.08$ Amp

4) selection & rating of main s/w :-
The 5A, 250V DPIC main s/w is selected.
(Double pole iron clad)

5) Calculation for length of pipe (batten) :-

i) Main SB to HR = 1M (13X13MM, 2 wire)

ii) From EM to SB = 1.5 + 1.5 = 3M
4m (13X13MM, 2 wire)

iii) From SB-1 to H.R = 1.5M (25 X 13 MM, 4 wire)

iv) From SB-2 to HR = 1.5m (31X13 mm, 5 wire)

v) From HR to fan-1 = 0.5m + 1.5m = 2m (13 X13 MM, 2 wire)

vi) From HR to fan-2 = 0.5 + 2 = 2.5m (25 X13MM, 4 wire)

vii) From fan 2 to lamp = 2.5M (13 X13 MM, 2 wire)

viii) From Fan 2 to F.T. = 2.5M (13X13MM, 2 wire)

A) 13X13MM, 2 wire = 4 + 2 + 2.5 + 2.5 = 11m

B) 25 X13MM, 4 wire = 1.5 + 2.5 = 4m

C) 31X13 mm, 5 wire = 1.5M

A) Wastage of 13X13mm, 2 wire = 11M
10% wastage = $\frac{11 \times 10}{100}$ = 1.1M
$\Rightarrow$ total = 11 + 1.1 = 12.1m

B) Wastage of 25 X13MM, 4 wire = 4m
10% wastage = $4 \times \frac{10}{100}$ = 0.4m
$\Rightarrow$ total = 4 + 0.4 = 4.4m

C) Wastage of 31X13MM, 5 wire = 1.5M
10% wastage = $1.5 \times \frac{10}{100}$ = 0.15M
$\Rightarrow$ total = 1.5 + 0.15 = 1.65m

* Length of conducter :—

01. 13 X 13 mm, 2 wire = 11 X 2 = 22 M
02. 25 X 13 mm, 4 wire = 4 X 4 = 16 M
03. 31 X 13 mm, 5 wire = 1.5 X 5 = 7.5 M

Total length = 22M + 16M + 7.5M = 45.5 M

15% wastage = 15 X 45.5 / 100 = 6.825 m
=> total = 6.825 + 45.5 = 52.325 m

* Calculation for length of earth wire :—

=> SB to SB1 to SB 2 = 1 + 1.5 + 1.5 + 0.25 = 4.25 m

10% wastage = 4.25 X 10/100 = 0.425

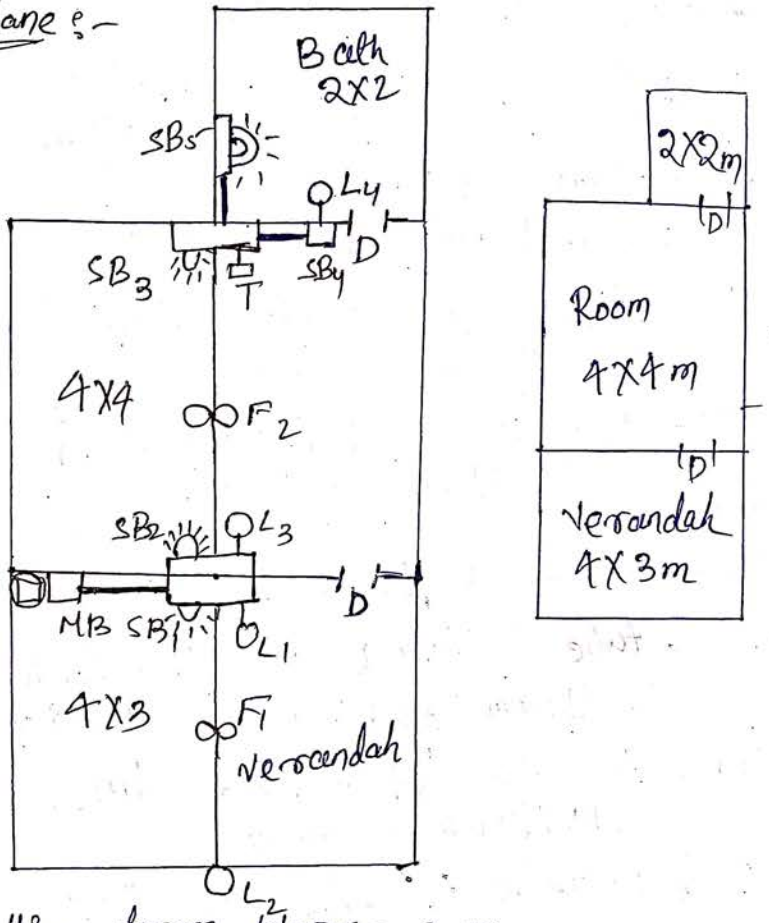
=> total = 4.25 + 0.425 = 4.675 m

* Material list :—

i) DPIC main S/w (5 amp, 230V)
ii) Batten (13 X 13 mm) = 11m
iii) " (25 X 13 mm) = 4m
iv) " (31 X 13 mm) = 1.5m
v) Total phase & neutral wire = 45.5
vi) Switch (5 Amp) = 7 no.
vii) Fan = 2 no.
viii) Socket = 2 no.
ix) Lamp = 2 no.
x) F. Tube = 1 no.
xi) Fan Regulator = 2 no.
xii) S

Q) A newly constructed varandah room & an attached bath room are required to be provided with electrical wiring suitable. The bath room must be provided with one 15 amp. socket apart from a lamp. The lamp outside the verandah must be controlled from inside the room also. Decide the nem of electrical points suitable to provided max possible convenience to the consumer.

* Installation plane :-



* Assumption :-

i) Heigh of celling from floor = 3.5m
ii) Height of H.R from floor = 3m
iii) Height of S.B for floor = 1.5m
iv) Height of main s/w from floor = 2m

* Calculation of load :-

i) Fan → 2 = 2X60w = 120w.
ii) Lamp → 4 = 4X60w = 240w.
iii) Tube → 1 = 1X40w = 40w.
iv) Socket → 3X100w = 300w.
v) 15A socket = 1000w.

Total = 1700 watt

$$I = \frac{P}{V} = \frac{1700}{230} = 7.39 \text{ Amp.}$$

* Selection & rating of main s/w :-

15 Amp, 250V, DPIC main switch.

* Calculation of conduit pipe :-

i) Energy meter to s/w board = 1.5m + 1.5m + 0.5m = 3.5m
(verandah) : (13 x 13mm)

ii) SB1 to lamp = 1.5m
(25mm x 13mm 4 wire system)

iii) H.R. to Fan (lamp to fan) = 0.5m + 1.5m = 2m.
(25 x 13 mm 3 wire)

iv) Fan-1 to Lamp-2 = 1.5m + 0.5m = 2m
(13 x 13mm 2 wire)

Room :-

v) SB-2 to Lamp-3 = 1.5m (25 x 13mm 4 wire)

vi) H.R. to ... to fan-2 = 0.5m + 2 = 2.5m
(25 x 13mm 3 wire) => 2.5 x 2 = 5m

vii) Fan-2 to SB3 = 2 + 0.5m + 1.5m = 4m
(13 x 13mm 2 wire)

viii) SB-3 to tube = 1.5m (25 x 13mm 3 wire system)

ix) Tube to SB4 = 2m (13 x 13mm 2 wire)

* 13 x 13mm conduit :-

3.5m + 2 + 4 + 2 = 11.5m

→ 10% wastage ; $\frac{11.5 \times 10}{100}$ = 1.15m

→ Total = 1.15m + 11.5m = 12.65m

* 25 x 13mm conduit :-

1.5m + 2 + 1.5m + 5m + 1.5m = 11.5m

→ wastage 10% = 1.15m

=> total = 11.5m + 1.15m = 12.65m

* Conduit for power ckt :-

* Energy meter to power ckt ;

= (0.5m + 1.5m + 0.25m + 1.5m + 0.5m + 4 + 0.5m + 1.5m + 0.25m + 1)

= 11.5m

→ wastage 10% = 1.15m

→ Total = 11.5m + 1.1s = 12.65m (13x13mm size conduit)

→ Calculation of length of wire :-

* For 1st room :-

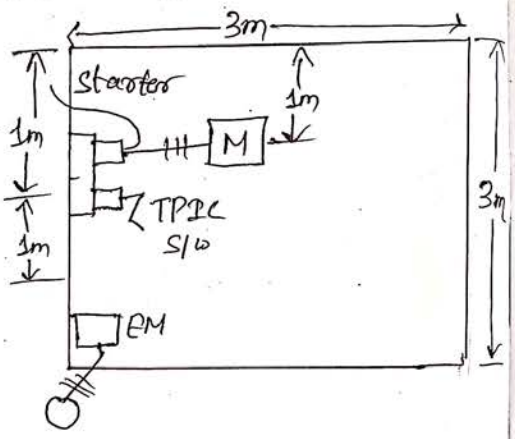
1) Energy meter to SB = 1 (↑) + 1.5 (→) + 1.5 (↓) = 4m

2) SB_1 to lamp = 1.5m (↑)

3) SB_1 to fan = 1.5 (↑) + 0.5 (↑) + 1.5 (→) = 3.5m

Q) If it is purpose install a power consumption of 3φ 5HP IM for an agriculture tubel in the room of size 3x3x3m (lxbxh). The motor is 1M away from to nearest wall. Prepare the estimate in the following orders;-
(a) Draw the installation plant
(b) Single line diagram
(c) Wiring diagram
(d) Calculate length of wire conduit & earth wire & prepared the material list.

*Assumption:-
1) The motor will be installed 0.5m above flow level on a suitable foundation.
2) S/w.B. to floor = 1.5m
3) Energy meter to floor → 2m



*Load Calculation:-

5HP = 5 x 746
= 3730 watt
cos Q = 0.8, V = 400V
P = √3 V I cos Q
→ I = 3730 / (√3 x 0.8 x 400) = 6.72 amp

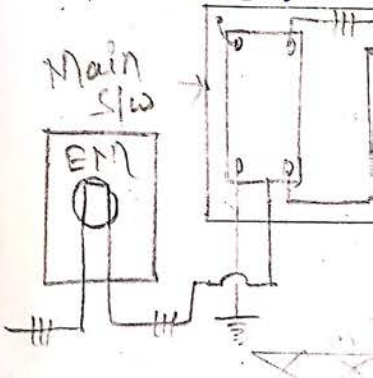
→ Taking 150% over loading, so the load I drawn by the motor =
6.72 x 150/100 = 10.08 Amp
6.72 x 50/100 = 3.36
→ 6.72 + 3.36 = 10.08 amp

*Selection & rating of main s/w:-
16.00 Amp, 400V, TPIC main s/w to be selected.

*Conduit pipe calculation:- (Trench → 0.25m)
1) Main board to top of the motor foundation →
→ 1.5 + 0.25 + 1 + 0.25 + 0.5 = 3.5m
* wastage 10% = 0.35
→ Total = 3.5 + 0.35 = 3.85m (25 x 25 mm dia pipe)
2) conduit for earth wire (15 mm dia)
3.5 x 2 = 7m
→ wastage 10% = 0.7m (Rigid conductor)
→ Total = 7 + 0.7 = 7.7m

*Calculation for
→ Energy meter to
→ Main switch boar
→ Starter to top
→ Foundation to mo
* wastage 10% =
→ Total = 2.5
*Calculation for
→ The conduit has
∴ length wire =

* wastage 15% =
→ Total = 18
→ length of earth
* wastage 15%.
→ 1M extra for



*Material list:-
1) Main S/w
2) conduit pipe
3) Earth wire
4) Phase wire
5) Motor
6) Starter
7) Soldel

* Calculation for the length of flexible conduit :-

→ Energy meter to main s/w = 0.5 + 1 = 1.5m
→ Main switch board to starter = 0.5m
→ Starter to top of the pipe = 0.25m
→ Foundation to motor terminal = 0.25m
2.5m

* wastage 10% = 0.25m

→ Total = 2.5 + 0.25 = 2.75m

* Calculation for length of wire :-

→ The conduit has 3 wire ie. 3 wire for 3ϕ.

∴ length wire = length of conduit (Rigid + flexible) × 3

= 3.5 × 3 = 10.5
= 2.5 × 3 = 7.5
18. m

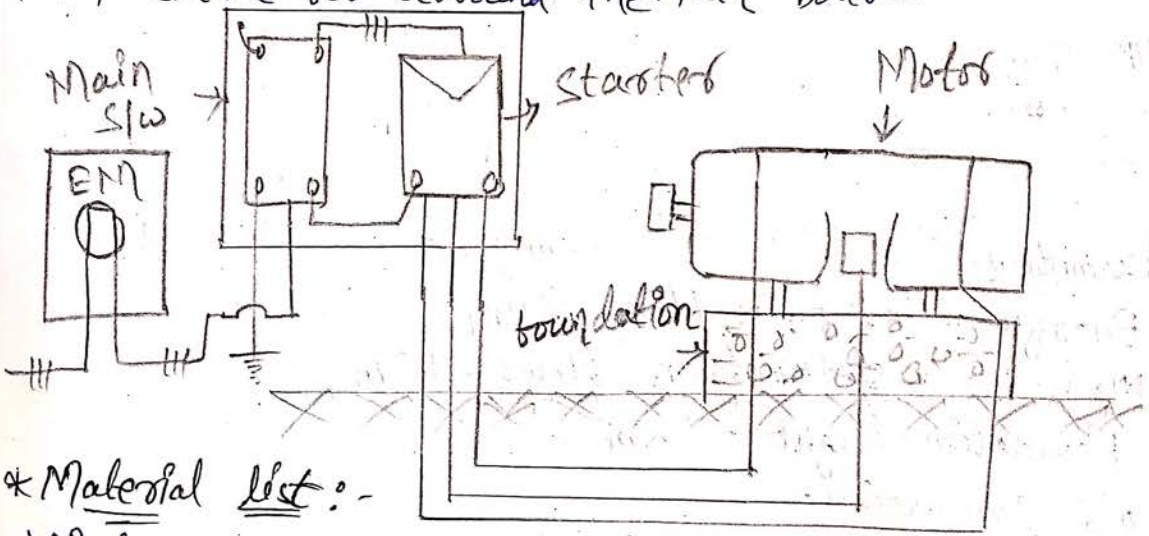
* wastage 15% = 2.7m

→ Total = 18 + 2.7 = 20.7M

→ Length of earth wire = 7m

* wastage 15% = 1.05 → total = 7 + 1.05 = 8.05m

→ 1M extra for around the main board.



* Material list :-

1) Main s/w
2) conduit pipe
3) Earth wire
4) Phase wire
5) Motor
6) Starter
7) Saddel
8) Putti
9) Danger plate
10) Flexible wire
11)

Q/ In a workshop of size 25m x 10m, the plan of which given below; at 10BHP, 400 volt, 3φ IM is to be installed for a wood cutting m/c. The service connⁿ are received in one corner of the work-shop from nearest distribution pole. Prepare the estimate scheme in the following sequence.

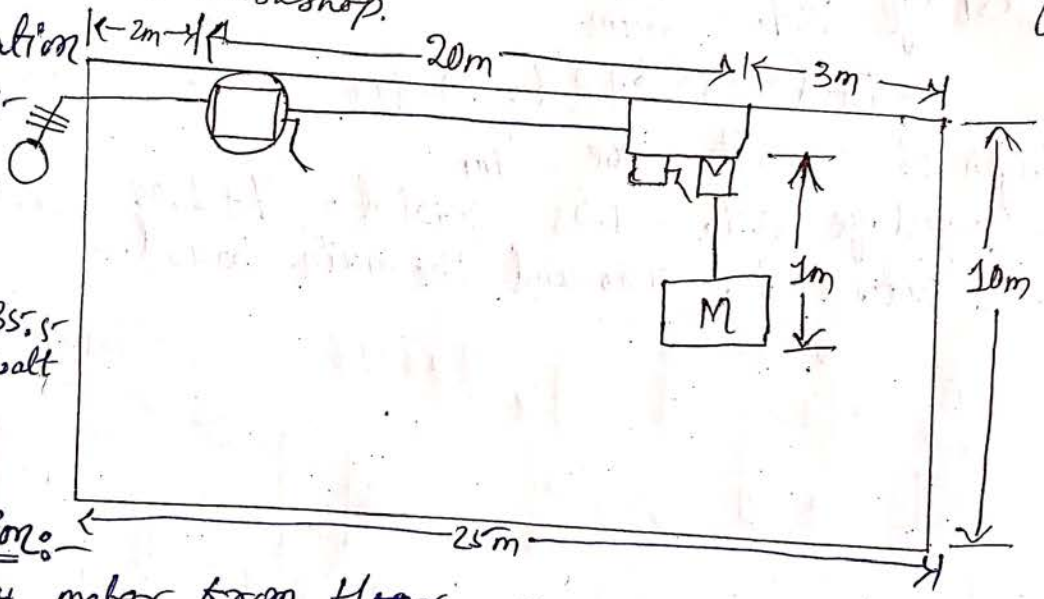
(i) Draw the installation plan & showing the location of main control equipment, motor & motor control.

(ii) Single line diagram.

(iii) Wiring diagram

(iv) Calculate the length of wire, conduit, earth wire, prepare a complete list of material for installing motor for a workshop.

*Installation plane :-



BHP = 735.5 watt

* Assumption :-

1) Energy meter from floor = 2m
2) Main s/w & stater from floor = 1.5m
3) Foundation height = 0.5m

* Load Calculation :-

Power = 735.5 × 10 = 7355 watt = 7.355 KW

V = 400v. , $\cos\theta = 0.8$

$P = \sqrt{3} V I \cos\theta$

$\Rightarrow I = \frac{735.5}{\sqrt{3} \times 400 \times 0.8} = 13.27$ Amp

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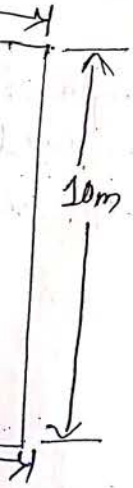


* Taking 150% over loading, so the load I drawn by the motor = $13.27 \times \frac{150}{100} = 19.905A = 20Amp.$

* Select a rating of main s/w :-
32amp, C&C v. TPIC main s/w to be selected.

* Conduit pipe calculation :-
Main s/w board to the top up the motor foundation :-
$1 + 20 + 1.5 + 0.25 + 1 + 0.25 + 0.5 = 24.5m$

* Taking 10% wastage $= 24.5 \times \frac{10}{100} = 2.45m$
Total $= 24.5 + 2.45 = 26.95m$.

* Conduit earth wire :-
$24.5 \times 2 = 49m$

* 10% wastage $= 49 \times \frac{10}{100} = 4.9m$
Total $= 49 + 4.9 = 53.9m$

* Calculation for the length of flexible conductor :-
* From main SB to starter $= 0.5m$
From energy meter $= 0.5m$
For starter to conduit mouth $= 0.25m$
* From motor foundation to motor terminal block $= 0.25m$
* Total flexible $= 1.5m$

* 10% wastage $= 1.5 \times \frac{10}{100} = 0.15m$

Total $= 1.5 + 0.15 = 1.65m$.

* Calculation for length of wire :-
The conduit has 3 wire i.e. 3 wire for 3ϕ.
∴ length of wire $= (24.5 + 1.5) \times 3 = 78m$
* 15% of wastage $= 78 \times \frac{15}{100} = 11.7m$
* Total $= 78m + 11.7m = 89.7m$

* Calculation of earth wire :-

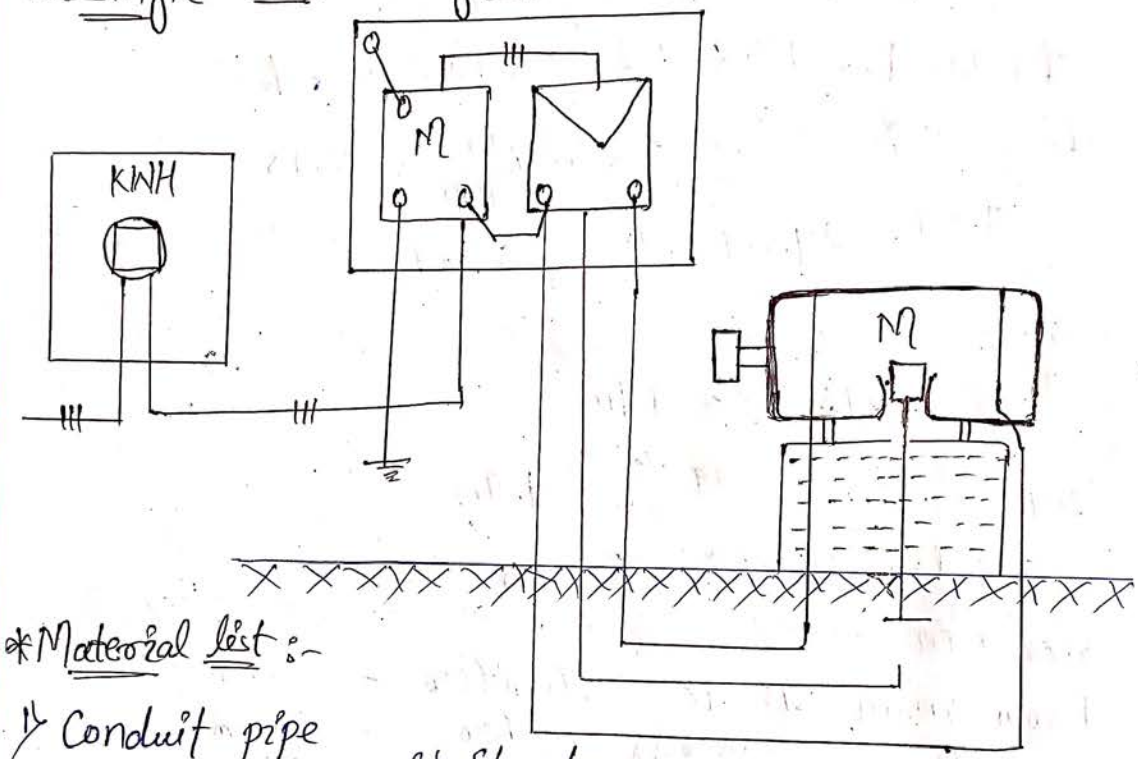
↓ The conduit of earth wire =

$24.5 \times 2 = 49\,m$

↓ 15% wastage $= 49 \times \frac{15}{100} = 7.35\,m$

Total $= 49 + 7.35 = 56.35$

* Single line diagram :-



*Material list :-

1) Conduit pipe
2) Flexible pipe
3) Earth wire
4) Phase wire
5) Main S/w
6) Starter
7) Motor
8) Energy meter
9) clamps
10) Saddel

Q) A small workshop of size 10m X 6m X 4m high is under construction. It is required to be provided with the following power connections for motors. The electrical connections to motors are to be taken along wall i.e. the floor is not to be provided with any wiring trench.

1. One 5HP 3ϕ motor for lathe.
2. One 3HP 3ϕ motor for a small lathe.
3. One 2HP 3ϕ IM for an automatic cool

manufa
4. One
5. One
Prepare
(a) Draw
main
board
motor
(b) Draw
energy
c) Draw
earth
& 3ϕ
d) Make
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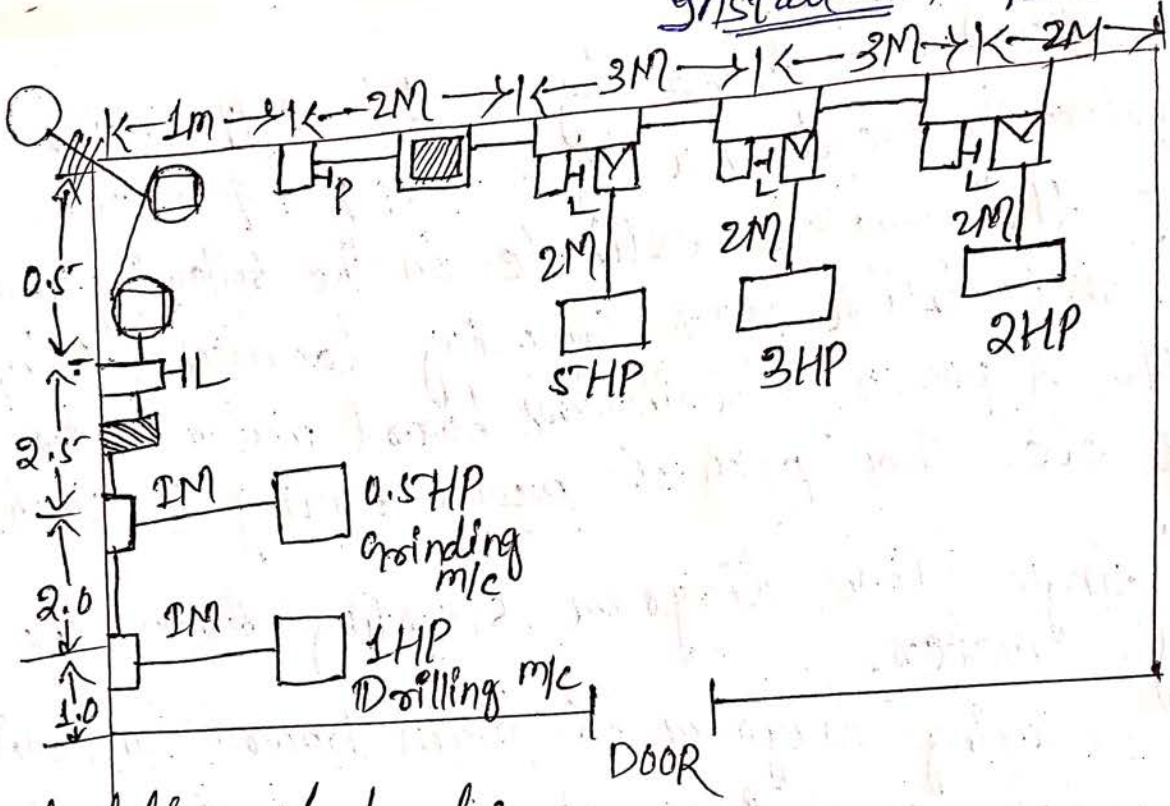
6) Height
as the

manufacturing m/c.
4. One drilling m/c driven by a 1ϕ 1HP motor.
5. One grinding m/c driven by a 0.5HP 1ϕ motor.
Prepare the complete estimate in the following sequence.
(a) Draw installation plan showing location of m/c's, main s/w & power distribution board motor control boards etc. show path of power wiring to each motor.
(b) Draw single line diagram starting from the energy meter.
(c) Draw wiring diagram of main board including earth wire connections showing connection of 1ϕ & 3ϕ energy meters main s/ws & distribution board.
(d) Make selection of important material & calculate the length of wire, conduit, earth wire etc. & prepare a material table with full specifications of items. Also estimate approximate cost for providing power wiring in the workshop.

—o—

⇒ Assumptions :—
1) Height of main s/w, motor s/w & control s/w from floor = 1.5m
2) Height of horizontal run from floor level = 2.5m
3) cost of motor & starter is not to be included in the estimate
4) Main distribution board or main control board is one metre from nearest corner of wall (centre of main board).
5) Height of motors for all 3ϕ & 1ϕ motor except drilling m/c motor is 0.5mt. above floor.
6) Height of drilling m/c is 1.5mt. above floor as the motor is mounted on the drilling stand.

Installation plan :-



* Calculation of load :-

→ I_L for 5HP motor = $\frac{5 \times 735.5}{400 \times \sqrt{3} \times 0.8 \times 0.75}$ = 8.86Amp

→ I_L for 3HP motor = $\frac{3 \times 735.5}{400 \times \sqrt{3} \times 0.8 \times 0.75}$ = 5.3Amp

→ I_L for 2HP motor = $\frac{2 \times 735.5}{400 \times \sqrt{3} \times 0.8 \times 0.75}$ = 3.53 Amp.

→ Total I_L = 8.86 + 5.3 + 3.53 = 17.69Amp.

→ Assuming 50% overload on all motor :-

$\frac{50 \times 17.69}{100}$ = 8.84Amp

→ Total I_L = 17.69 + 8.84 = 26.535 Amp.

18.22

4. One drilling machine driven by a single phase one HP motor.
5. One grinding machine driven by a 0.5 HP single phase motor.

Prepare the complete estimate in the following sequence :

(*a*) Draw installation plan showing location of machines, main switch and power distribution board, motor control boards etc. Show path of power wiring to each motor.

(*b*) Draw single line diagram starting from the energy meter.

(*c*) Draw wiring diagram of main board including earth wire connections showing connection of single phase and three phase energy meters, main switches and distribution boards.

(*d*) Make selection of important material and calculate the length of wire, conduit, earth wire etc. and prepare a material table with full specifications of each item. Also estimate approximate cost for providing power wiring in the workshop.

Assumptions :

(*a*) Height of main switch, motor switch and control switch from floor = 1.5 m.

(*b*) Height of horizontal run from floor level = 2.5 m.

(*c*) Cost of motor and starter is not to be included in the estimate.

(*d*) Main distribution board or main control board is one metre from nearest corner of wall (centre of main board).

(*e*) Height of motors for all 3 phase and single phase motors except drilling machine motor is 0.5 mt. above floor.

(*f*) Height of drilling machine is 1.5 mt. above floor as the motor is mounted on the drilling stand.

Calculation of load in amperes. Assuming efficiency of 3 phase motor 0.75 and power factor 0.8.

Therefore I_L for 5 HP motor $= \dfrac{5 \times 735.5}{400 \times \sqrt{3} \times 0.75 \times 0.8} = 8$ Amps (approximately)

I_L for 3 HP motor $= \dfrac{3 \times 735.5}{400 \times \sqrt{3} \times 0.75 \times 0.8} = 4.5$ Amps approx.

I_L for 2 HP $= \dfrac{2 \times 735.5}{\sqrt{3} \times 400 \times 0.75 \times 0.8} = 3.2$ Amps approx.

Total current in amperes for three 3 H.P. motors = 8.0 + 4.5 + 3.2 = 15.7 Amps

Assuming a 50% overload on all motors, the total current drawm = 15.7 + 7.8 (50% overload) = 23.5 amperes

Future extensions may not be possible due to sufficient number of motors already installed in the workshop within the limited space.

Selection and Rating of TPIC Main Swtich. The maximum current demand for power loads will be only 23.5 amperes as calculated above. It is therefore suggested that : a TPIC main switch of 45 amperes rating, 500 volts grade should be used as Main Switch.

Selection and Rating of TPIC Motor Switches. The maximum current demand for a highest rating motor (5 HP) is only 8 amperes. Assuming that the motor may have to run on 50% overload for some period of time, the maximum current demand is only 12 ampers. It is therefore suggested that : a TPIC motor switch of 32 amperes rating 500 volts grade should be selected for 5 HP motor and 16 ampers TPIC motor switches for the remaining three phase motors.

Selection and Rating of DP, Single Phase Main Switches for Single Phase Load :

The single phase load of two single phase motors does not exceed 6.2 amps (for one HP motor) + 3.5 amps (for half HP motor) = 9.8 amps say 10 amperes.

Assuming an equal load of single phase on light/fan/sockets. The total single phase load will not exceed 20 amperes if all the load is switched on simultaneously. It is therefore suggested that :

(*a*) a DPIC main switch of 30 amperes rating, 250 volts grade should be used as single phase main switch.

(*b*) 15 amperes one way switches with 15 amperes socket should be used as control switch for single phase motors.

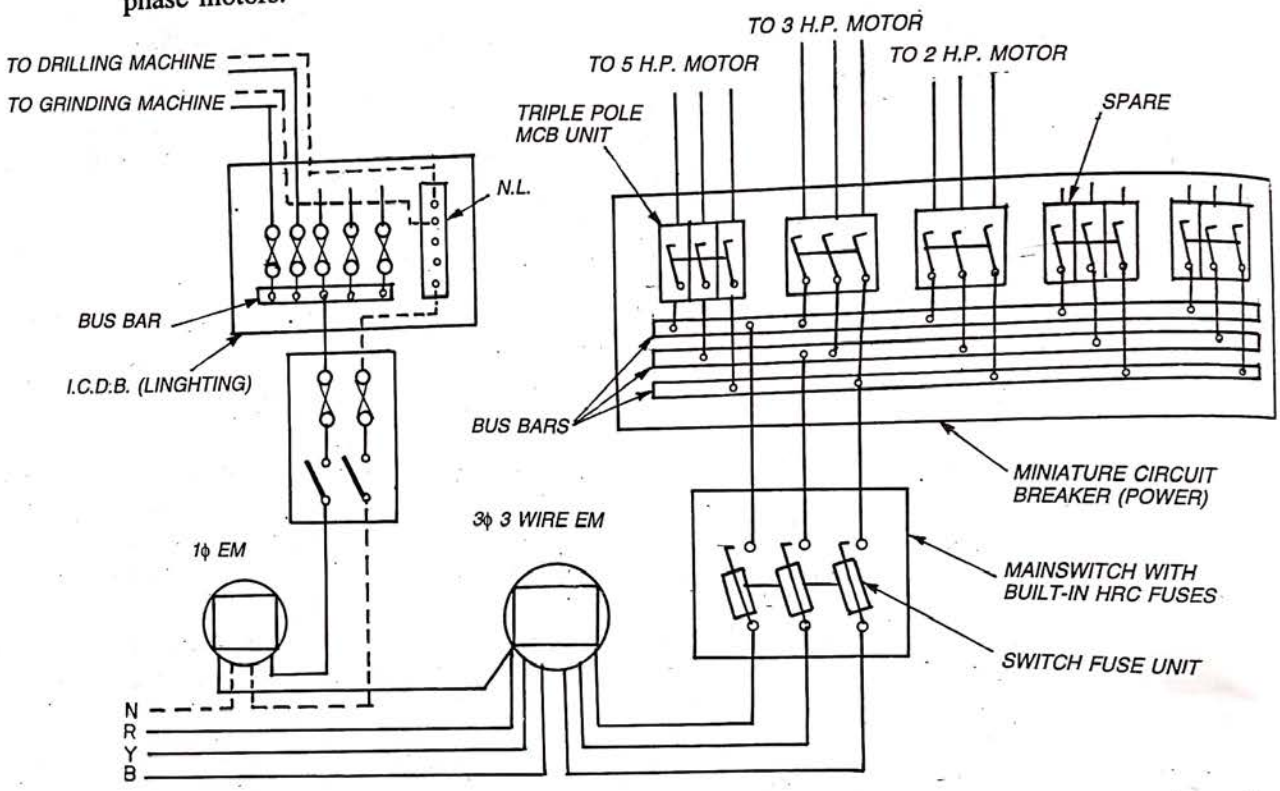


Fig. 18.17.

Selection and Rating of wire for Main Board, 5 HP motor and 3 HP motor :

For Main Board. The total load for hundred percent utilisation and 50 percent over load for motors is 23.5 amperes. The single core wire to carry this load should be selected as referred on Table No. 18.1.

"Single core PVC insulated aluminium conductor wire of size 7/1.70 dia. or 16 mm² should be used."

For 5 HP, 3 phase Motor. Refer Table 18.1 for selection of wire for 5 HP 3 phase motor which refers to '6 mm² or 1/2.80 mm diameter, single core, aluminium conductor, PVC insulated wire'.

For 3 HP, 3 phase Motor. Again refer Table 18.1 for selection of wire for 3 HP and 2 HP motors which is 'single core PVC insulated wire of size 4 mm², Aluminium conductor, 660 volts grade.

Calculations for length of heavy gauge conduit pipe of 25 mm diameter :

From MDB (Power) to 5 HP Motor = 1.0 (DB to horizontal run) + 2.0 (along horizontal run (HR) + 1.0 (HR to motor control board) + 1.5 (motor starter to floor level) + 0.25 (depth of trench) + 2.0 (along trench in floor) + 0.25 (trench bottom to floor level) + 0.5 (floor to motor bottom or floor to motor foundation top) = 8.5 mts

From MDB to 3 HP Motor = 1.0 + 5.0 + 1.0 + 1.5 (upto floor) + 0.25 + 2.0 + 0.25 + 0.5 = 11.5 mts

From MDB to 2 HP Motor = 1.0 + 8.0 + 1.0 + 1.5 + 0.25 + 2.0 + 0.25 + 0.5 = 14.5 mts.

Total length of conduit = 8.5 + 11.5 + 14.5 = 34.5 mts.

Total length of conduit pipe taking 10% wastage = 34.5 + 3.45 = 37.95 mts **say 38 mts.**

Calculations for length of heavy gauge conduit pipe of 20 mm dia. for single phase motors :

From MDB (lighting) to 0.5 HP Grinding Machine : 1.0 + 2.5 + 1.0 (upto motor switch) + 1.5 + 0.25 + 1.0 + 0.25 + 0.5 = 8.0 mts.

From DB (lighting) to 1 HP Drilling Machine : 1.0 + 4.5 + 1.0 + 1.5 (motor is installed 1.5 mt above floor) + 0.25 + 1.0 + 0.25 + 1.5 = 11.0 mts.

Total length of conduit pipe as calculated above for both motors = 19.0 mts.

Total length of conduit required taking 10% wastage = 19.0 + 1.9 + 20.9 **say 21 mts.**

Calculations for length of wire of size 6 mm² or 1/2.80 mm for 5 HP motor :

Total length of conduit pipe for 5 HP motor × 3 wires *i.e.* 34.5 mts × 3 wires = 103.5 mts.
(Because each conduit has three wires in it)

Taking 15% wastage = 103.5 + 15.5 (wastage) = 119 mts **say 120 mts.**

Calculations for length of wire of size 4 mm² or 1/2.24 mm for 3 HP and 2 HP Motor :

Total length of conduit pipe for 3 HP motor + 2 HP motor = 11.5 + 14.5 = 26.0 mts × 3 wires = 78.0 mts.

Taking 15% wastage = 78.0 mts + 11.7 (15% wastage) = 89.7 m **say 90 mts.**

Calculations for length of wire of size 2.5 mm² or 1/1.80 mm dia. for both single phase motors :

Total length of conduit pipe for both single phase motors as calculated above
= 19 mts × 2 wires = 38 mts. × 2 wires = 76.0 mts + 11.4 mts (15%) Wastage
= 87.4 mts **say 88 mts.**

Calculations for 8 SWG earth wire of G.I. for 3 phase motors : Each three phae and single phase induction motor will be connected with two earth wires independently which will run along the conduit pipes from distribution board upto motor. Two separate earthing sets will therefore be used.

Total length of earth wire = Total length of conduit pipe (for three phase and single phase motors × 2 wires + 10% wastage

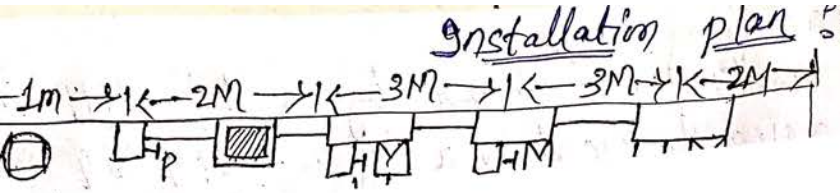
= 34.5 m + 19.0 = 53.5 × 2 wires = 107 + 10.7 (wastage) = 117.7 mts **say 118 mts.**

Calculations for the length of 15 mm dia. G.I. pipe to enclose earth wires from Motor control boards to motors but for 3 phase motors only

From motor control board to 3 phase motor = 1.5 + 0.25 + 2.0 + 0.25 + 0.5 = 4.5 × 2 pipes = 9.0 mts
Same length of pipe for each three phase motor = 3 × 9 mts = 27 mts
Taking wastage @ 10% = 27 + 2.7 = 29.7 mts **Say 30 Metres**

Table 18.6. Material Table

S. No.	*Description of Material with Specifications*	*Quantity*	*Rate*	*Amount*
1.	TPIC, main switch, 45 amps rating, 500 volts grade with built in HRC fuses	1 No.	450.00/each	450-00
2.	TPIC, motor switch, 32 amps rating, 500 volts grade with fuses	1 No.	270.00/each	270-00
3.	TPIC, motor switches, 16 amps rating, 500 volts grade with fuses	2 Nos.	125.00/each	250-00
4.	Iron Clad Distribution Board ICDB (Power) for 3 motors 45 amps rating 500 volts grade with built-in copper bus bars and fuses	1 No.	225.00/each	225-00
5.	Double Pole Iron Clad DPIC (lighting) main switch of 30 amps rating 250 volts grade as single phase main switch	1 No.	80.00/each	80-00
6.	ICDB (lighting), 6 way, with neutral link, 30 amps rating, 250 v. grade	1 No.	150.00/each	150.00
7.	15 amps one way switch and socket combined for single phase motors	2 sets	40.00/each	80-00
8.	Heavy gauge conduit of size 25 mm dia. black enamel for 3ϕ motors	38 mts	30.00/mt.	114-00
9.	Heavy gauge conduit of size 20 mm dia. black enamel for 1ϕ motors	21 mts	20.00/mt.	420-00



10.	(*a*) Conduit accessories for 25 mm dia. conduit :	12 Nos.	12.00/each	144-00
	Conduit bends	3 Nos.	10.00/each	30-00
	Conduit junction boxes to facilitate pulling of wires in conduits	10 Nos.	6.00/each	60-00
	Conduit sockets to connect two pieces of conduits	30 Nos.	3.00/each	90-00
	Conduit saddles to hold conduit with wall			
	(*b*) Conduit accessories for 20 mm dia. conduit :	8 Nos.	10.00/each	80-00
	Conduit bends	2 Nos.	8.00/each	16-00
	Conduit junction boxes	4 Nos.	5.00/each	20-00
	Conduit sockets	15 Nos.	3.00/each	45-00
	Conduit saddles			
11.	G.I. pipe of 15 mm diameter for earthwires to motor frames for 3ϕ motors	30 mts.	30.00/mt.	90-00
	Conduit accessories for 15 mm diameter G.I. pipe :			
	Conduit bends	6 Nos.	12.00/each	72-00
	Conduit sockets	3 Nos.	8.00/each	24-00
	Conduit saddles	10 Nos.	3.00/each	30-00
12.	PVC insulated, single core, aluminium conductor wire of size 7/1.70 mm dia. or 16 mm^2 for wiring the Main Board	5 mts.	5.00/mt.	25-00
13.	PVC insulated, single core, aluminium conductor wire of size 6 mm^2 or 1/2.80 mm dia. for supply to 5 HP motor	120 mts.	4.00/mt.	480-00
14.	PVC insulated, single core, aluminium conductor wire of size 4 mm^2 or 1/2.24 mm dia. for 3 HP & 2 HP motors	90 mts.	2.80/mt.	252-00
15.	6 mm^2 or 1/2.80 mm diameter, al. conductor, PVC insulated, single core wire for wiring the main board for single phase	2 mts.	4.00/mt.	8-00
16.	2.5 mm^2 or 1/1.80 mm diameter, al. conductor, PVC insulated, single core wire for wiring the single phase motors	88 mts.	2.30/mt.	202-40
17.	Galvanised Iron (G.I.) earth wire, 8 SWG for earthing motors, MB etc.	118 mts.	3.00/mt.	354-00
18.	Iron clad board for mounting main switch, and ICDB 'Power' of size 45 cm × 60 cm	1 No.	300/each	300-00
19.	Iron clad board for mounting single phase main switch, and ICDB 'Lighting' 30 cm × 45 cm	1 No.	180.00/each	180-00
20.	Iron clad board for mounting motor switch, and starter of size 30 cm × 30 cm	3 Nos.	130.00/each	390-00
21.	Rag bolts with nuts for fixing iron clad boards with wall 12 mm diameter 150 mm long four bolts for each board	8 Nos.	5.00/each	40-00
22.	10 mm diameter, 50 mm long bolts with nuts to hold both main switches, distribution boards, 3 motor switches and starters with iron clad boards	40 Nos.	2.00/each	80-00
23.	G.I. thimbles with nuts and bolts for connecting earth wires with main switches, DB's, motor switches starters etc.	40 Nos.	3.50/each	140-00
24.	Flexible conduit of 25 mm diameter @ 1.5 mt. for each motor approximately plus conduit required for main board	5.0 mts.	20.00/mt.	100-00
25.	Flexible conduit of 20 mm dia. for both single phase motors	2.0 mts.	15.00/mts.	30-00
26.	Flexible conduit attachement with lock nuts for 25 mm dia. pipe	18 Nos.	5.00/each	90-00

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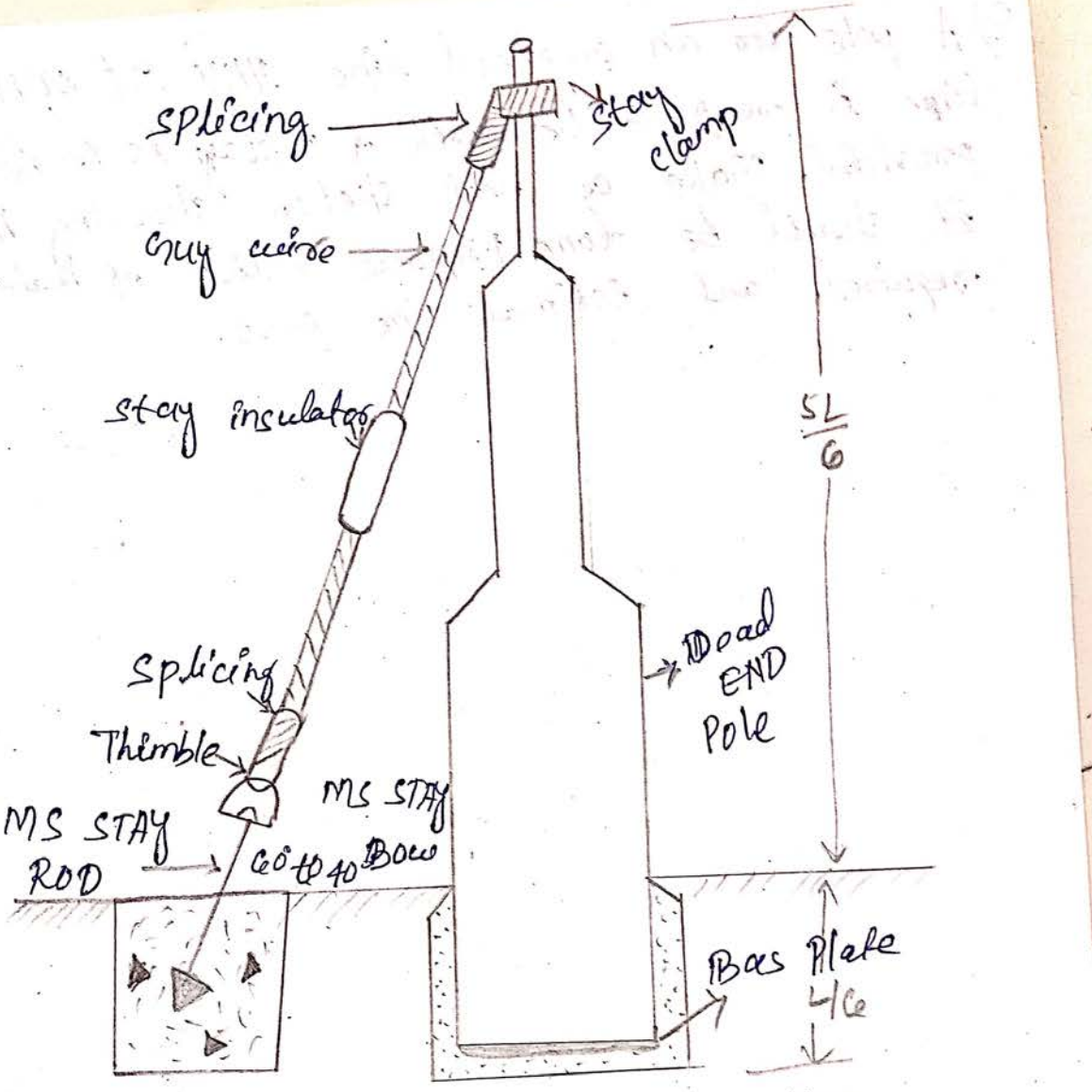
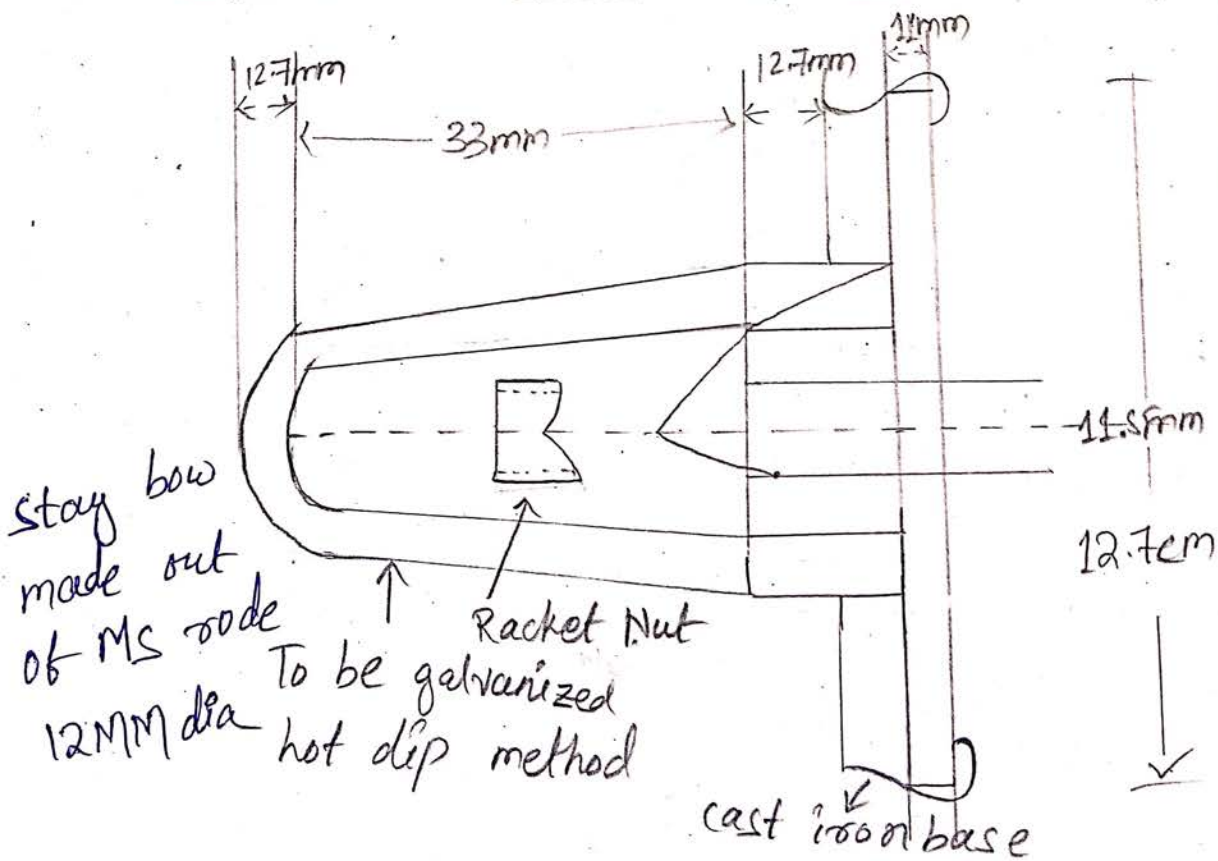




Q/ A pole for an overhead line 11KV 3φ 50HZ line is req^d to be earth & a stay is to be provided. Make a neat sketch showing how it should be done. Prepare a list of materials required and estimate the cost.

Dt- 11/03/

Q. Estimate the quantity of material reqr for 100KV, 11/0.4 KV pole mounted distribution substation also draw the sketch.

⇒ Assumption :-

→ H type pole mounted substation is adopted.

⇒ Primary current :-

$$P = \sqrt{3} V I$$

$$\Rightarrow I_1 = \frac{P}{\sqrt{3} V} = \frac{100 \times 10^3}{\sqrt{3} \times 11 \times 10^3} = 5.25 \text{ Amp.}$$

→ Starting current (200%) :-

$$= \frac{5.25 \times 200}{100}$$

$$= 10.5 \text{ Amp.}$$

→ Size of conductor 6/2.11 mm dia ACSR.

⇒ Secondary current :-

$$\Rightarrow I_2 = \frac{100 \times 10^3}{\sqrt{3} \times 0.4 \times 10^3} = 144.33 \text{ Amp}$$

→ Starting current (200%) :

$$= \frac{144.33 \times 200}{100} = 288.66 \text{ Amp}$$

→ Size of conductor 37/2.18mm dia ACSR.

⇒ Length of cable :-

→ From t/f secondary to nearest pole = 1m.

→ From t/f height to cable box height = 1m

→ Wastage = 0.5m

⇒ Total length = 2.5 × 4 = 10m

2.5 m

→ Height

→ From

Fuse

Operati handle for isolat

11/03/20

100KVA

tion

.

Amp

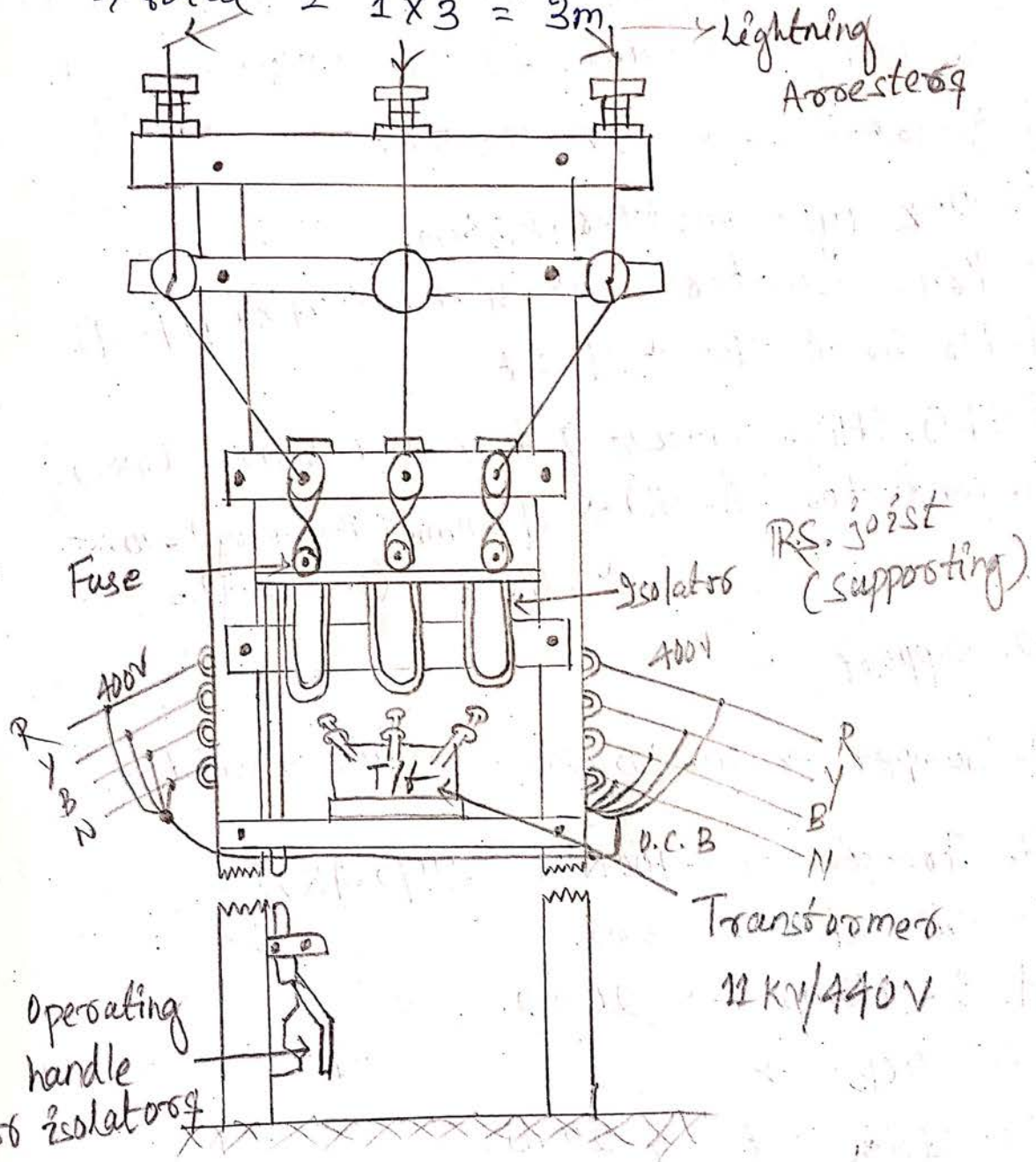
1m.

1m

⇒ Height of gumper wire ;-

⇒ From tlb bussing to isolator = 1m

⇒ total = 1 X 3 = 3m



⇒ Material list:-

1. H-type pole ⟶ 1 set
2. MS channel (mild steel) cross arm → 6 no. (6×2 12)
3. Lightning Arresters → 3 no. (11KV rating)
4. Isolator → 3 no. (11 KV)
5. Disk type insulator → 6 no.
6. Pin insulator → 14 no. (3+3+4+4=14)
7. Air break s/w → 1 set
8. H.G. (High Grade) fuse → 3 no. (11KV)
9. Conductor (ACSR) → 6/2.11mm (Primary)
   → 37/2.18mm (Secondary)
10. Support →
11. Jumper → 3m (bushing to pin insulator.
12. Transformer → 100KVA, (11/0.4KV)
13. Cut out → 3 no.
14. Z-clamp → 20 no.
15. OCB →
16. Stay set → 20 no.
17. Earthing → 2 nos.
18. Danger plate → 1 nos.
19. R.S. joist (supporting) 4 nos.
20. Nut-bolt → As per required
21. Anti-climbing device → 1 no.

Ch-5 {Service Connection} Dt-13/03/2020

Q) Prepare a list of material for giving service connᶜ to a single storeyed building a 230V., 50Hz. 1ϕ having a load of 5KW. The supply is to be given from over head line 20m. away from the building.

Soln:-

→ Load calculation :-

$P = VI$

⇒ $I = \frac{5 \times 10^3}{230} = 21.73$ Amp.

→ Starting current (150%.) :-

⇒ $\frac{21.73 \times 150}{100} = 32.595$ Amp.

→ The diameter of conductor (AAC - All alleminium conductor) of 36 amp is 1/3.55 mm and area 10mm². (According to conductor charge).

⇒ Length of GI pipe :-

→ Ground clearance of conductor + Vertical deviation due to sag + top bending + wall crossing — meter clearance from ground

⇒ 5.8 + 0.2 + 0.5 + 0.25 - 2.5 = 4.25m

⇒ Length of conductor :-

→ 2X(span length + 3% of sag of the span length + GI pipe length + 1m. swing at the pole + 0.5m swing at the pipe + 10% wastage at the span length)

$= 2\times\left(20+\frac{3\times20}{100}+4.25+1+0.5+\frac{10\times20}{100}\right)$

$= 2\times(20+0.6+4.25+1+0.5+2)$

$= 56.7\,m$

⇒ Length of GI support wire:—

⇒ (Span length + 3% sag + 1m. bending at the pole + 0.5m bending at the pipe)

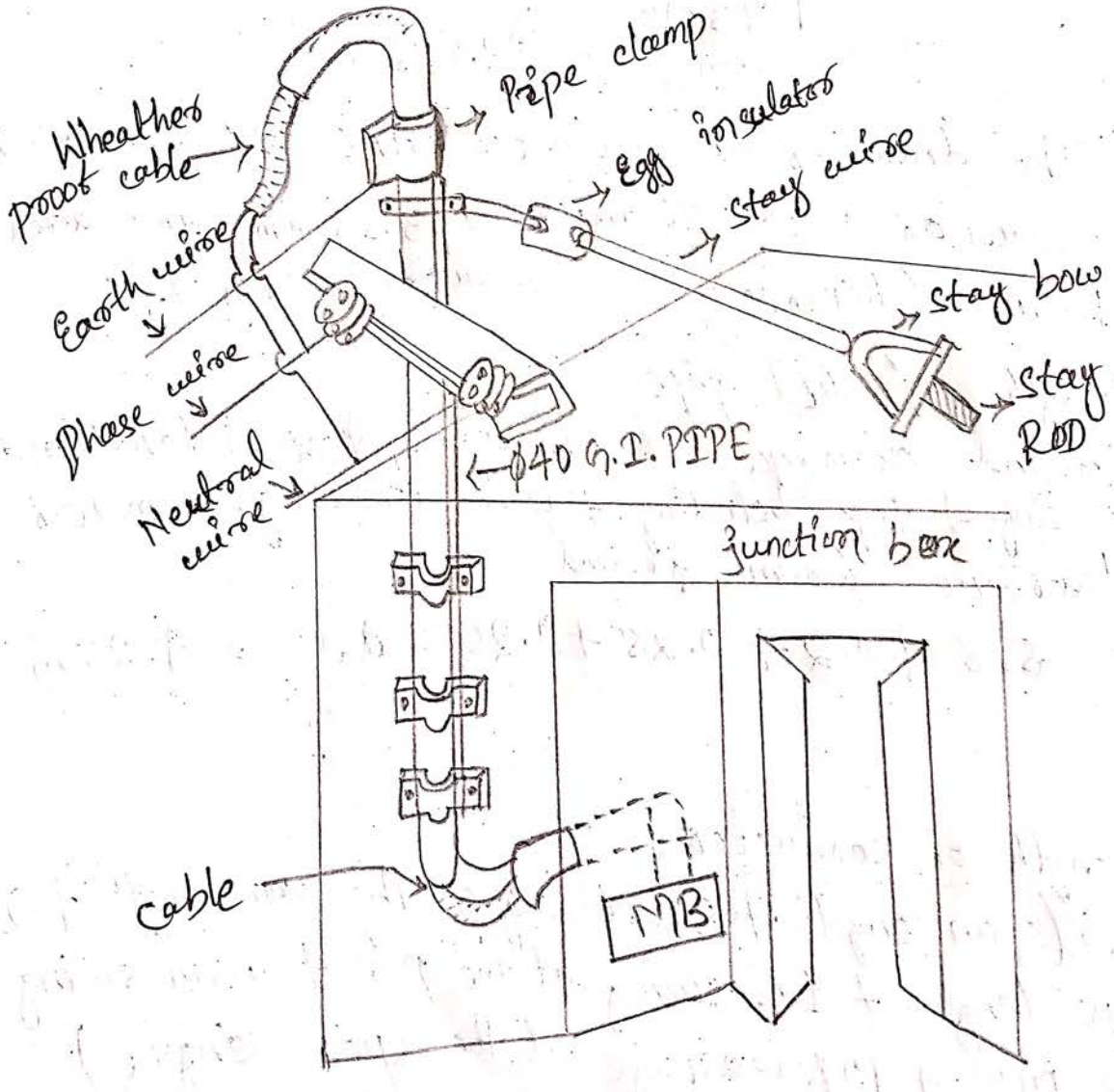
⇒ $20+0.6+1+0.5 = 22.1\,m$

⇒ Assumptions:—

→ Total height of ground floor = 3.5m

→ Height of service connection received = 5.8m

→ Height of energy meter from the ground = 2.5m



⇒ Material Terms

1) Length of

2) Length of

3) Length of al

4) Fuse

5) Neutral

6) Stay

7) Saddel

8) Mild st

9) Meter from c

10) Guttie

11) Nut &

9) Prepa a doub the sup a loa on e from bcild

⇒ Material list :-

Terms	Specification	Quantity
1) Length of GI pipe	= 15mm²	4.25m
2) Length of GI support wire	= 8 SWG (standard wire gauge)	22.1m
3) Length of alluminium conductor	= 10mm²	5-6.7m
4) Fuse	32A	1 no.
5) Neutral link	—	1 no
6) Stey set	—	2m
7) Saddel	—	10 no.
8) Mild steel hook	—	4 no.
9) Meter boeard (room cleed)	—	1 no.
10) Guttie	—	10 no.
11) Nut & bult	—	15 no.

Q) Prepare a material list the service conn: to a double storeyed building having 2 energy meter the supply is to be given at 230V, 1ϕ having a load of 5 subckt. (800) & 2 15Amp socket point on each floor (1000). The supply is to be given from over head line 20m. away from the building