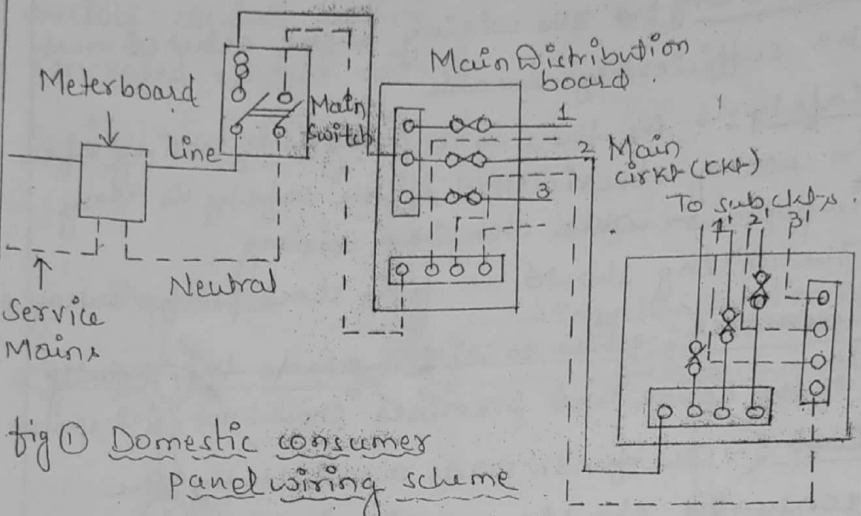
RS-20

DOMESTIC WIRING Module 3(b)

Domestic Wiring Installation (Meter board & Distribution board)



fig① Domestic consumer panel wiring scheme

*) Bet^n the lines the o/p level is 400V and bet^n the line and neutral the o/p level is 230V.

*) The small cables used bet^n the distribution stations and consumer premises are called "service mains".

*) The supply is given first to the meterboard which consists of energy meter, service cable, sealing end box, bus bar arrangement, service fuse and neutral link.

*) From mt board the supply is taken to main switch board where fuse is installed (or MCB) along with main switch.

*) Then supply is given to the main Distribution board from where the supply is given to the subckts.

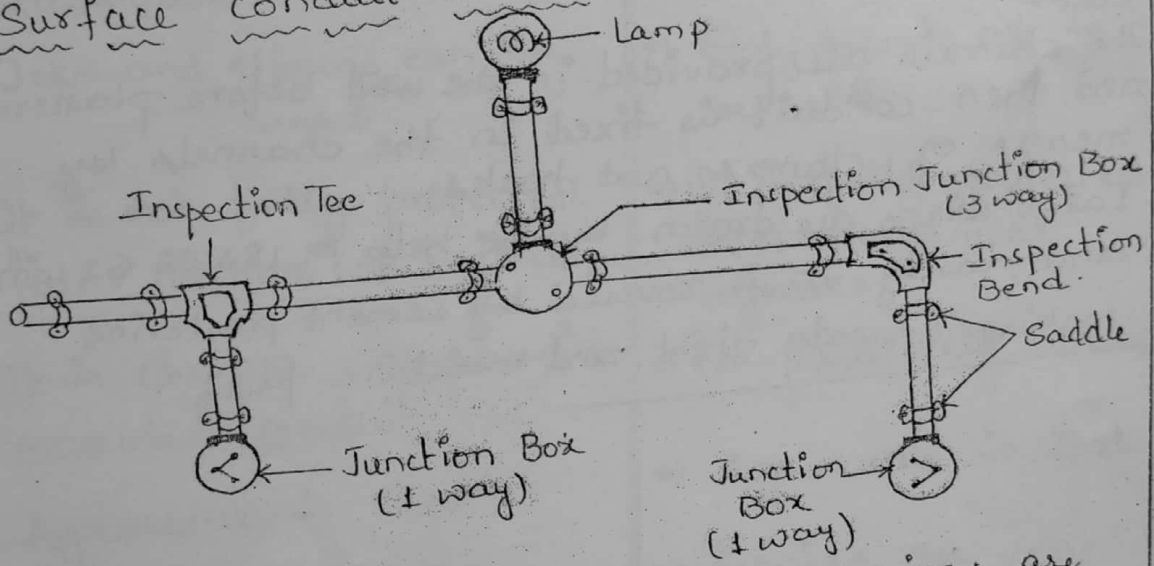
*) The various loads like fans, tubelights etc are connected in ||el with the subckts.

Conduit wiring :-

In this method metallic tubes & PVC pipes which are called conduits are used to run the wires. There are two types in conduit wiring:-

i) Surface conduit wiring
ii) Concealed conduit wiring.

i) Surface conduit wiring :-



*) In this system of wiring, conduits & pipes are fixed on the surface of walls & ceilings with the help of saddles as shown in fig above.

*) The saddles are secured to wooden gutties with screws at the interval of one meter.

*) The VIR or PVC wires & cables are drawn by means of 18 SWG GI wire.

*) The earth wire is fixed by means of earth clips.

Advs :- i) It is cheaper compared to concealed conduit-wiring.
ii) It is Repairs are not too difficult.
iii) Tees and elbows can be used.
iv) High skilled labours are not required.

Disadvs :- i) Not fully protected from mechanical injuries. hence less Durable.
ii) Appearance is not good.
iii) life is short.

ii) Concealed conduit wiring :-

* In this system of wiring, conduit is burried under the wall & ceiling.
* Now a days PVC conduit is popularly used as it requires less time to install and cheaper in cost.
* The channels are provided in the wall before plastering and then conduit is fixed in the channels by means of clamps and hooks.
* Later wires are drawn by the help of 18SWG GI wire and lastly it is covered by cement plastering making it water tight and moisture proof.

Q:: Compare surface conduit and concealed conduit wiring.

Surface conduit wiring	Concealed conduit wiring
*> The conduit & pipe is fixed on the wall.	*> Conduit & pipe is completely sunk in wall & RCC slab.
*> They are fixed ~~wi~~ by using slabs	*> They are fixed by using 'J' hooks.
*> Tees and elbows can be used.	*> Only bends are to be used.
*> It is not fully protected from mechanical injuries	*> It is fully protected from mechanical injuries.
*> It is cheaper compared to concealed conduit	*> Comparatively costlier
*> Appearance is bad	*> Appearance is good.
*> Repairs are not too difficult	*> Repairs are very difficult.
*> Highly skilled labours are not required	*> Highly skilled labours are required.
*> Less Durable and short life.	*> More Durable and long life.

IV) Wiring Schemes :→

Q.3) With the help of ckt diagram explain the two way control of lamp. (OR)

OR

Q.3) Explain the staircase wiring. (Remarks)

Ans:

Two way control of lamps (or) Staircase wiring

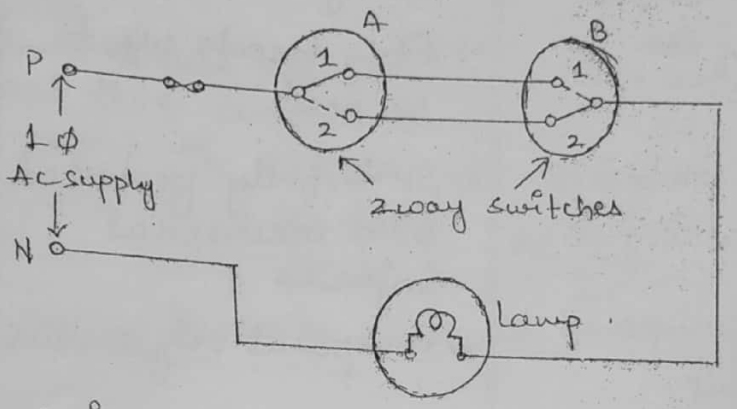


fig (1)

Two way control of lamp

Switching table

Switch	A	B	LAMP
Position	1	1	ON
	1	2	OFF
	2	1	OFF
	2	2	ON

*) It consists of two way switches A & B.

*) Assume that lamp is on first floor & switch A is on first floor & B is on second floor.

*) The lamps with open let us see the working of switch to glove (or) to off the lamp by using Switching table.

Position 1) :- switch A position is 1 and switch B position is also 1 then lamp will glove (or) ON ∵ the ckt becomes closed one.

Position 2) :→ Switch A position is 1 but switch B is 2 then lamp will turn off (OFF) because the ckt becomes open.

Position3 :→ Switch A position is changed to 2 but now switch B position is also changed to 1; then again the ckt becomes open and lamp will remain off.

Position4 :→ Switch A remain in the same position ie; 2 & switch B position is changed to 2. Now the ckt becomes closed so the lamp will turn ON.

It means that if the switches A & B which are present at first and second floor are in the same position ie; 1 1 or 2 2 then the lamp is ON otherwise it is off.

Q)4) Explain with the ckt (circuit) diagram the 3-way control of lamps. (4 marks)

Ans:

3 way control of lamps :→

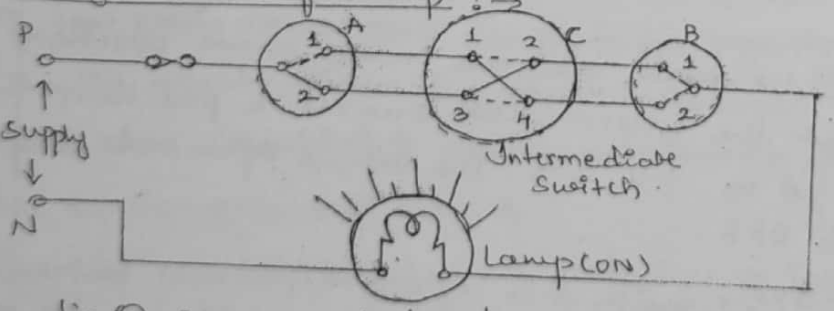


fig ② 3way control of lamps

→ As shown in fig ② it consists of two way switches A & B & one intermediate switch C.

→ The intermediate switch can have the position to connect the points 1-4, 3-2 as shown or 1-2, 3-4 shown dotted.

→ The switch A is on first floor & switch B is on third floor then the intermediate switch is on second floor.

→ In the position shown in the fig ② the lamp is ON.

→ The working of switches to glove it to OFF the lamp can be seen from switching table.

Switching table :→

Switch	A	C	B	LAMP
Positions	1	1-2, 3-4	1	ON
	1	1-4, 2-3	1	OFF
	1	1-2, 3-4	2	OFF
	1	1-4, 2-3	2	ON
	2	1-2, 3-4	1	OFF
	2	1-4, 2-3	1	ON
	2	1-2, 3-4	2	ON
	2	1-4, 2-3	2	OFF

Position 1 :→ The two way switches A & B are in same position ie; 1 & the intermediate switch C is 1-2, 3-4. So, the ckt is closed and the lamp is ON.

Position 2 :→ Again A & B are in the same position ie; 1 But the intermediate switch C position is changed to 1-4, 2-3. The ckt is open one hence lamp is OFF.

Position 3 :→ Swith A is in same position but B is changed to 2 & the swith C is in the same position as 1 ie; 1-2, 3-4. So the ckt remains open & Lamp also remains OFF.

Position 4 :→ Again A & B are in the same position as earlier ie; 1 & 2 but the intermediate switch C has changed its position to 1-4, 2-3. Now the ckt becomes closed and lamp is ON.

In the remaining four case s the switch A is in position 2 but the switches B & C positions are repeated similar to the previous four positions and according to that the lamp results are obtained as shown in the switching table.

5) Fuse :→

Q) 5) What is fuse? Why it is used in the electric ckts? (6 marks) (5)

Ans: Defn

Fuse is a simplest protecting device which consists of small piece of metal connected in series ckt. When c/t through it increases beyond some preset value, the metal melts to interrup the ckt c/t (current)

In electric ckts (circuits) many types of faults occurs which may damage the entire equipments and other devices connected to the faulty equipments. Excessive high c/ts in such equipment can cause overheating, short circuiting, firing and damaging the equipments.

Excessive high v/ts (voltages) can cause damage of the equipments and danger to the operator.

The v/t fluctuations can cause interruped op^{n} of devices, partial & permanent damage to the equipments and loss.

Due to excessive high c/ts failure of insulation of the conductors takes place which can cause sever shock to the operators which are life threatening.

The atmospheric lightning strokes can cause fire and damage to the buildings and structures.

Due to excessive high c/ts the insulation failure takes place and whole wiring system will burn out and some times the fire & firing of building & structure takes place.

Due to all these reasons ie; to interrupt the flow of the excessive high c/t in the electric ckt the fuse is used.

VI | Important Definitions

(Q)6) Define the following:
i) fusing c/t ii) Rated c/t iii) fusing factor iv) fuse v) fuse element/fuse wire. (5 marks).

i) fuse :→ The fuse is a protecting device which consists of small piece of metal, which is connected in series. when c/t through it increases beyond some preset value the metal melts to interrupt the circuit current.

ii) fuse element :→ The part of the fuse which melts when excessive current flows through it.

iii) Rated c/t of fuse :→ It is that Max^m c/t which fusing element can carry normally without melting.

It depends on:
*) Temperature rise of fuse contacts
*) fusing element material
*) Deterioration of fuse due to oxidation.

iv) fusing ~~factor~~ (current) :→ The min^m value of the c/t (current) at which the fuse element melts to interrupt the current and it is always more than rated c/t of fuse.

It depends on :-
*) fuse element material
*) Diamt of the fuse element
*) Size & location of the terminals.

v) fusing factor :→ It is the ratio of Min^m fusing current to the Max^m rated c/t of the fuse. The fusing factor is always ~~more~~ greater than 1

ie; fusing factor = $\frac{\text{Min}^m \text{ fusing c/t}}{\text{Max}^m \text{ rated c/t of fuse}} > 1$.

for household fuse the fusing factor is 2.

VII) **Earthing And Necessity of Earthing :→**

Q) 7) What is Earthing? Explain the necessity of Earthing (5 marks) (6)

Ans :- **Defn**

The connection of electrical machinery to the general mass of earth with a conducting meterial of very low resistance is called earthing or grounding.

Necessity of Earthing :→

Consider a 1φ machine which is not earthed carrying a current I. The pontential bet? the line and neutral is V volts. The resistance bet? the windings and the frame is say R_i. called insulation resistance. and R_{body} is the resistance of the person body. Neutral is generally earthed at supply system as shown in fig ①.

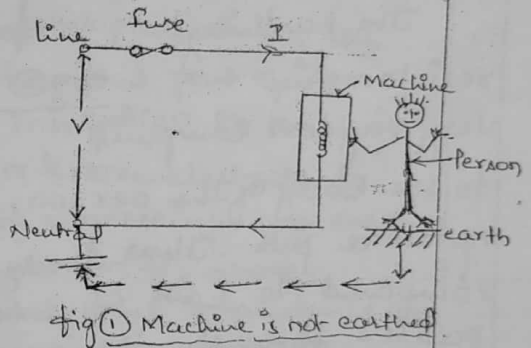


fig ① Machine is not earthed

Let I_m = Machine c/r & I_{body} = c/r passing through body of the person

R_E = resistance of the earth.

When a person, standing on the earth touches the machine, c/r I gets an alternative path through the body of the person to the earth as shown in fig.

$$\therefore I_{body} = \frac{V}{R_i + R_{body} + R_E}$$

When insulation of the m/c is perfected then $R_i = \infty$

$$\therefore I_{body} = \frac{V}{\infty} = 0$$

ie; in normal operating cond? there is no c/r passing through the body of the person. But when insulation fails & one of the wdg (winding) is touching the frame directly due to fault then $R_i = 0$. Now resistance of body & earth ie; R_{body} & R_E are not high & hence I_{body} becomes very high

and person receives a fatal shock. and such c/t is called leakage c/t (current).

In case of earthing frame of machine is earthed as shown in fig ②

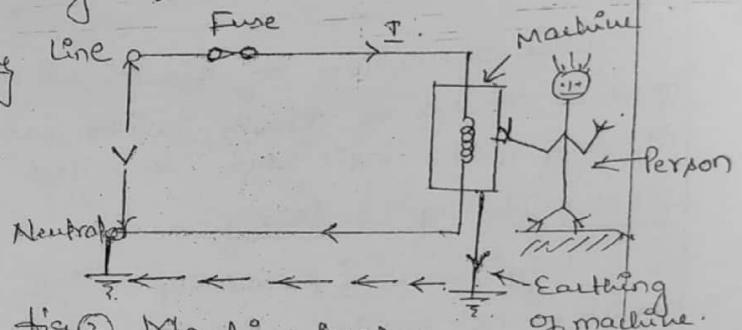


fig ② Machine (M/c) is Earthed.

The earthing resistance is very very low compared to the body of the person, c/t prefers low resistance path. Thus I_{body} is negligibly small compared to Earth c/t. So entire leakage c/t passes through the earthing. So body of the person carries very low c/t which is not sufficient to cause any shock.

VIII) Earth leakage circuit Breakes (ELCB).

Q) 8) Explain the necessity and operation of ELCB.

Ans:- Necessity of ELCB:→

* There are certain situations where leakage current flows through the metal bodies of appliances. Thus person touching to such appliances may get a shock.
* There is risk of fire due to such leakage c/t flowing to the earth.
* The MCB & fuse can not provide protection against earth leakage c/ts.
* Hence there is a need of a device which can directly detects the earth leakage c/ts and cut the supply if such c/ts exceeds a preset value.

Defn

ELCB:→ Earth leakage c.B is a protecting device which detects the earth leakage c/ts and cut the supply if such c/ts exceeds a preset value.

XI) Elementary first Aid against Shock :→

Q) 11) Write about elementary first aid against shock. (05 marks)

Ans :- The 1st aid against an electric shock involves the following steps :-

i) Do not panic.

ii) Carry the affected person and lay him in a comfortable position and call the doctor immediately.

iii) Look for stoppage of breathing.

iv) Start giving him artificial respiration if breathing is stopped.

v) Never give anything to drink when person is unconscious.

vi) The artificial respiration should be continued for longer time.

vii) The burns caused due to electric flashes should be covered with sterile dressing and then bandaged.

viii) Do not make crowd round and let patient get fresh air.

XII) Safety Precautions against Electric shock.

Q) 12) Write about precautionary measures taken against electric shock. (5 marks)

Ans :- i) Insulation of the conductors used must be proper and good in cond?.

ii) Megger test should be conducted and insulation must be checked.

iii) Earthing ~~must~~ should be always maintained in proper cond?.

iv) Make the mains supply switch off and remove the fuse before starting work.
v) Fuses must have correct ratings.
vi) Use rubber soled shoes while working.
vii) Use some wooden supper under the feet.
viii) Use rubber gloves while touching any terminals or removing insulation layer from the conductor.
ix) Use line tester to check a 'live' terminal carries any ckt or not.
x) Always use insulated screwdriver, pliers, line tester etc
xi) Never touch two different terminal at the same time.
xii) Never remove the plug by pulling the wire connected to it.
xiii) The sockets should be fixed at a height beyond the reach of the children.

—END—

low v/t C.B or Miniature C.B

i) Actuator lever :- Movable handle (ON or OFF)
ii) Trip Mechanism :- Thermal trip or Magnetic trip
iii) Contacts :- fixed & Moving
iv) Terminals
v) Calibration screw
vi) Arc driver / Extinguisher :-

ii) Plate Earthing :-

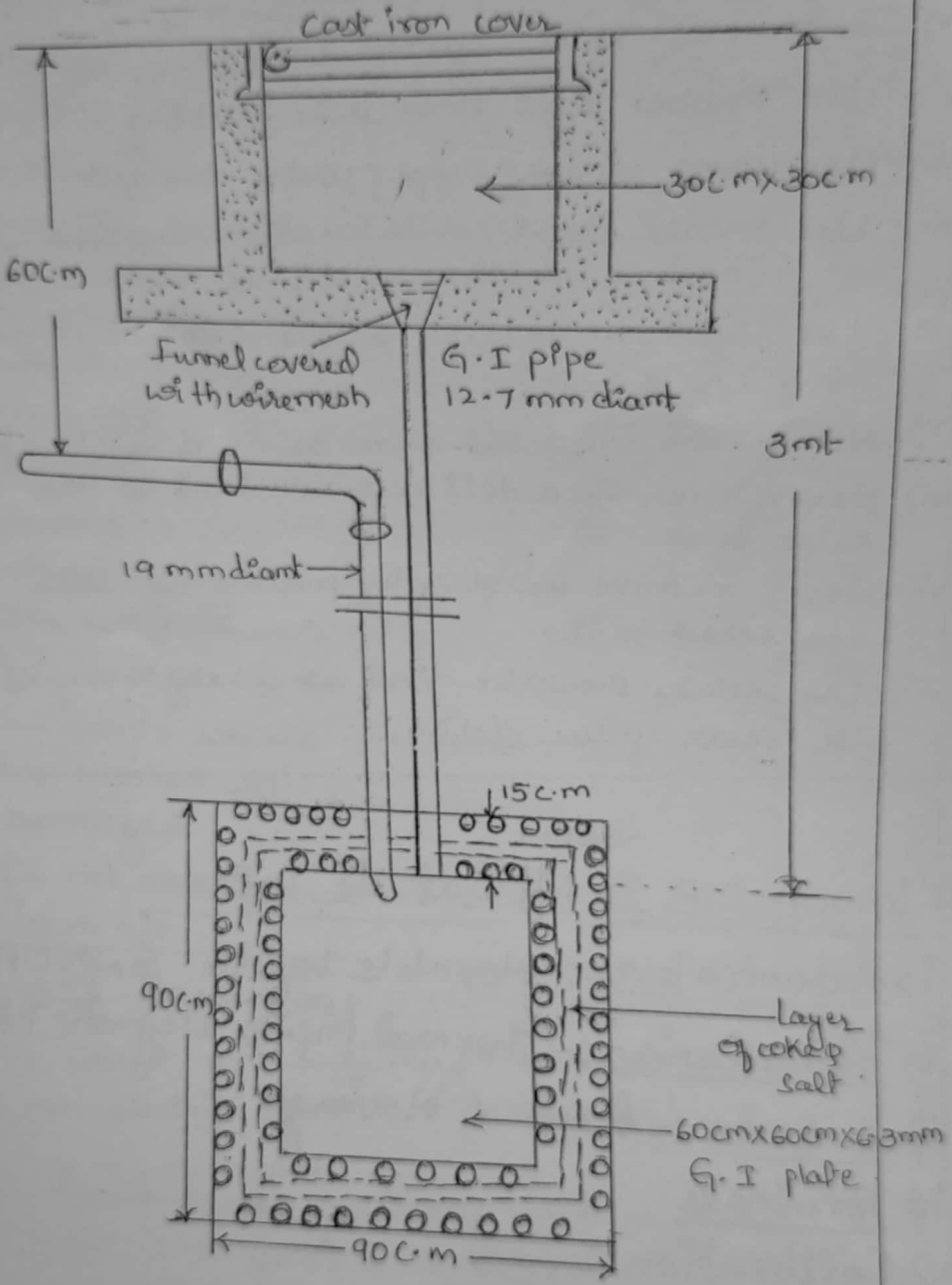


fig:- plate Earthing

Explaination :- Fig shows the method of plate earthing in which a copper plate of size 60cm x 60cm x 6.38mm is used for the purpose of Earthing. The plate is kept with its face vertical at a depth of 3mt and it is so arranged that it is embedded in alternate layers of coal and salt for a minimum thickness of about 15 cm to reduce the resistance. The earthing wire is bolted to the earth plate with the help of bolt, ~~and~~ nut & washer. Care should be taken to see that copper bolts and nuts are used for copper plate earthing and GI bolts & nuts ~~are~~ are used for GI plate Earthing.

Methods of Earthing :-

i) Pipe Earthing
ii) Plate Earthing

i) Pipe Earthing :→

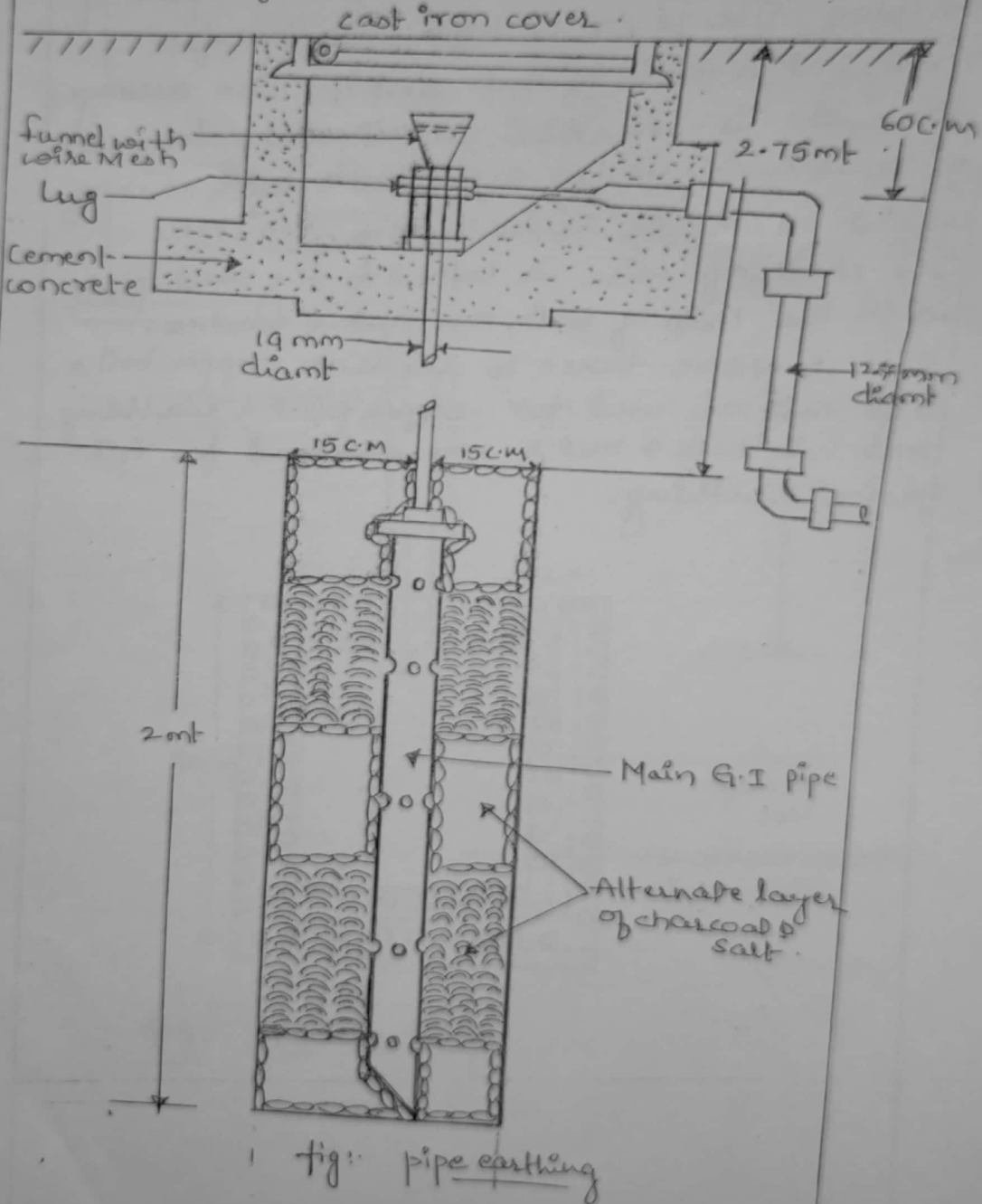


fig: pipe earthing

Explanation:- Fig shows the method of pipe earthing in which Galvanised Iron (G.I) pipe of approved length and diamt is used. According to ISI standards, the diameter of the galvanised pipe should not be less than 38.1 mm ϕ length 2mt. It should be placed to a depth of 4.75 mt.

The pipe must be placed upright and must be placed permanently in a wet ground. The pipe at the bottom should be surrounded by broken pieces of coke & charcoal for a distance about 15 c.m around the pipe. Charcoal is mixed with salt to reduce the resistance. In usual the salt and charcoal is put in alternate layers as shown in fig.

The leading wire from the body of the apparatus to the earthing pit must be made of G.I wire. The earth wire, from the GI pipe of diamt 19mm, should be carried in a conduit of G.I pipe of diamt 12.7mm at a depth of about 60 c.m below the ground.