INSTALLATION OF CABLES

Laying Underground Cables can be done by the 3 methods namely:

- Direct Laying
- Draw in system
- Solid system

Direct laying:

This method of laying underground cables is simple and cheap and is much favored in modern practice. In this method, a trench of about 1·5 meters deep and 45 cm wide is dug. The trench is covered with a layer of fine sand (of about 10 cm thickness) and the cable is laid over this sand bed. The sand prevents the entry of moisture from the ground and thus protects the cable from decay. After the cable has been laid in the trench, it is covered with another layer of sand of about 10 cm thickness.

The trench is then covered with bricks and other materials in order to protect the cable from mechanical injury. When more than one cable is to be laid in the same trench, a horizontal or vertical inter-axial spacing of at least 30 cm is provided in order to reduce the effect of mutual heating and also to ensure that a fault occurring on one cable does not damage the adjacent cable. Cables to be laid in this way must have serving of bituminized paper and hessian tape so as to provide protection against corrosion and electrolysis.

Advantages

(*i*) It is a simple and less costly method.

(*ii*) It gives the best conditions for dissipating the heat generated in the cables.

(*iii*) It is a clean and safe method as the cable is invisible and free from external disturbances.

Disadvantages

(*i*) The extension of load is possible only by a completely new excavation which may cost as much as the original work.

(*ii*) The alterations in the cable network cannot be made easily.

(*iii*) The maintenance cost is very high.

(*iv*) Localization of fault is difficult.

(*v*) It cannot be used in congested areas where excavation is expensive and inconvenient.

This method of laying cables is used in open areas where excavation can be done conveniently and at low cost.

Draw-in system:

In this method, conduit or duct of glazed stone or cast iron or concrete are laid in the ground with manholes at suitable positions along the cable route. The cables are then pulled into position from manholes. Figure shows section through four-way underground duct line. Three of the ducts carry transmission cables and the fourth duct carries relay protection connection, pilot wires. Care must be taken that where the duct line changes direction, depths, dips and offsets be made with a very long radius or it will be difficult to pull a large cable between the manholes. The distance between the manholes should not be too long so as to simplify the pulling in of the cables. The cables to be laid in this way need not be armored but must be provided with serving of hessian and jute in order to protect them when being pulled into the ducts.

Advantages

(*i*) Repairs, alterations or additions to the cable network can be made without opening the ground.

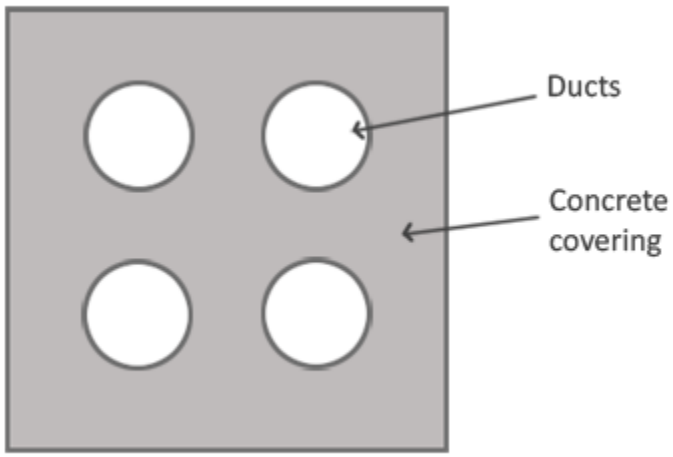
(*ii*) As the cables are not armored, therefore, joints become simpler and maintenance cost is reduced considerably.

(*iii*) There are very less chances of fault occurrence due to strong mechanical protection provided by the system.

Disadvantages

(*i*) The initial cost is very high.

(*ii*) The current carrying capacity of the cables is reduced due to the close grouping of cables and unfavorable conditions for dissipation of heat.



Solid system:

In this method of laying, the cable is laid in open pipes or troughs dug out in earth along the cable route. The toughing is of cast iron, stoneware, asphalt or treated wood. After the cable is laid in position, the toughing is filled with a bituminous or asphaltic compound and covered over. Cables laid in this manner are usually plain lead covered because toughing affords good mechanical protection.

Disadvantages

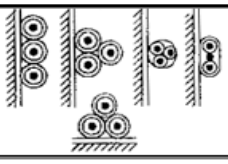
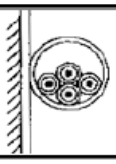
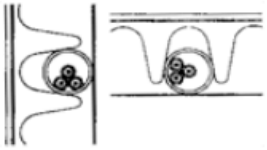
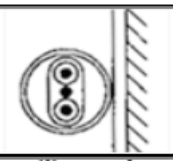
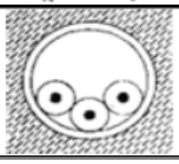
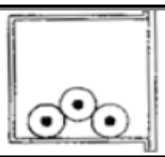
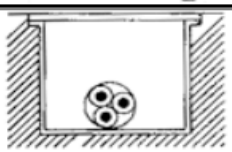
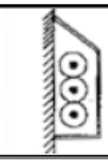
(*i*) It is more expensive than direct laid system.

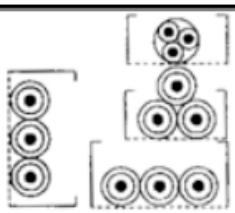
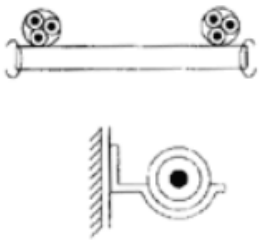
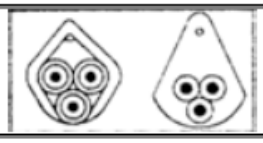
(*ii*) It requires skilled labor and favorable weather conditions.

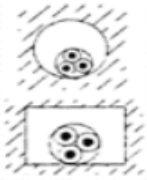
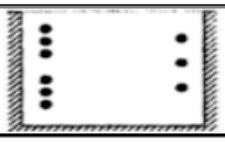
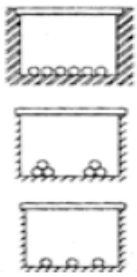
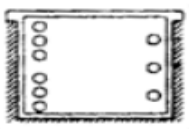
(*iii*) Due to poor heat dissipation facilities, the current carrying capacity of the cable is reduced.

In view of these disadvantages, this method of laying underground cables is rarely used now-a days.

APPENDIX 3 - Typical Methods of Installation of Cables

Installation Method		Example	Appropriate Reference Method for determining current carrying capacity
No.	Description		
1	2	3	4
Open and clipped direct:			
1	Sheathed cables clipped direct to or lying on a non-metallic surface.		Method 1
In conduit:			
3	Single-core non-sheathed cables in metallic or non-metallic conduit on a wall or ceiling		Method 3
4	Single-core non-sheathed cables in metallic or non-metallic conduit in a thermally insulating wall or above a thermally insulating ceiling, the conduit being in contact with a thermally conductive surface on one side.**		Method 4
5	Multicore cables having non-metallic sheath, in metallic or non-metallic conduit on a wall or ceiling.		Method 3
6	Sheathed cables in conduit in a thermally insulating wall etc (otherwise as Ref Method 4).		Method 4
7	Cables in conduit embedded in masonry, brickwork, concrete, plaster or the like (other than thermally insulating materials).		Method 3
In trunking:			
8	Cables in trunking on a wall or suspended in the air.		Method 3
9	Cables in flush floor trunking		Method 3
10	Single-core cables in skirting trunking		Method 3
On trays:			

Installation Method		Example	Appropriate Reference Method for determining current carrying capacity
No.	Description		
1	2	3	4
11	Sheathed cables on a perforated cable tray, bunched and unenclosed. A perforated cable tray is considered as a tray in which the holes occupy at least 30% of the surface area.		Method 11
In free air, on cleats, brackets or a ladder:			
12	Sheathed single-core cables in free air (any supporting metal work under the cables occupying less than 10% of the plan area): 2 or 3 cables vertically one above the other, minimum distance between cable surfaces equal to the overall cable diameter (D_e); distance from the wall not less than $0.5D_e$ 2 or 3 cables horizontally, with spacing as above 3 cables in trefoil, distance between wall and surface of nearest cable $0.5D_e$ or nearest cables $0.75D_e$		Method 12
13	Sheathed multicore cables on ladder or brackets, separation greater than $2D_e$. Sheathed multicore cables in free air distance between wall and cable surface not less than $0.3D_e$ Any supporting metalwork under the cables occupying less than 10% of the plan area.		Method 13
14	Cable suspended from or incorporating a catenary's wire.		Method 12 or 13(as appropriate)
Cables in building voids:			
15	Sheathed cables installed directly in a thermally insulating wall or above a thermally insulating ceiling, the cable being in contact with a thermally conductive surface on one side (otherwise as Ref Method No 4).		Method 4

Installation Method			Example	Appropriate Reference Method for determining current carrying capacity
No.	Description			
1	2		3	4
16	Sheathed cables in ducts or voids formed by the building structure, other than thermally insulating materials.			Method 4 Where the cables has a diameter D_e and the duct has a diameter not greater than $5D_e$ or a perimeter not greater than $20D_e$ Method 3 Where the duct has either a diameter greater than $5D_e$ or a perimeter greater than $20D_e$ Note 1 – Where the perimeter is greater than $60D_e$, installation Methods 18 or 20, as appropriate, should be used. Note 2 – D_e is the overall cable diameter. For groups of cable D_e is the sum of the cable diameters.
Cable in trenches:				
17	Cables supported on the wall of an open or ventilated trench, with spacing as indicated for Ref Method 12 or 13 as appropriate.			Method 12 or 13, as appropriate
18	Cables in enclosed trench 450mm wide by 300mm deep (minimum dimensions) including 100mm cover.	2 single-core cables with surfaces separated by a minimum of one cable diameter; three single-core cables in trefoil and touching throughout. Multicore cables or groups of single-core cables with surfaces separated by a minimum of 50mm.		Method 18 Use rating factors in Table 6 of Appendix 1.
19	Cables in enclosed trench 450mm wide by 600mm deep (minimum dimensions) including 100mm cover.	Single-core cables arranged in flat groups of two or three on the vertical trench wall with surfaces separated by one diameter with a minimum distance		Method 19 Use rating factors in Table 6 of Appendix 1.