

UNIT-VI SERVICE MAINS

1. Define service mains

Service mains is tapping of electrical energy from the supplier's pole to consumers premises. Or it is a means of providing electric power supply from the existing pole up to the meter board.

2. Code of Practice for service mains

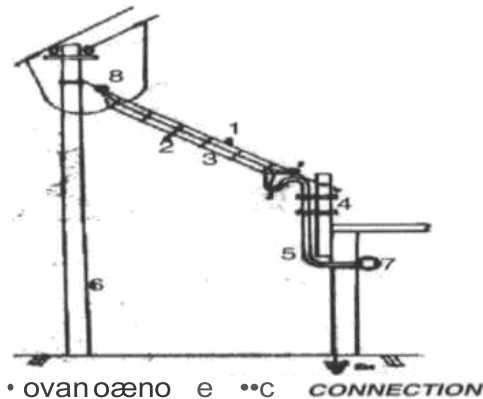
- a) Service line from over head lines should be tapped only at the point of support.
- b) Over head service lines should be within 30m length and U.G. Service should be within 60m.
- c) Insulated service line erected other than across or along street should not be less than 5.7m above the ground level, elsewhere 4.3m.
- d) Lead in pipes should be used for service connection.
- e) The meter board must always be placed at the entrance room at a height of 1.5 meter.
- f) The meter earth should not be tapped for other earthings.
- g) When the total load exceeds 8 KVA, even for single phase loads 3phase service connection is to be taken and the load is to be distributed for all the 3 phases.
- h) E.L.C.B.(earth leakage circuit breaker) are to be used when the load exceeds 5kVA.

3. List the types of service mains

There are two types of service mains

- a) Over head service connection
- b) Underground service connection

4. Explain Over Head Service Mains with diagram



The figure shows the over head service connection for tapping a 3 phase power supply. The top most wire (1) which takes mechanical load is called messenger wire. This messenger wire is tied to the supporting pipe (4) in one side and to the pole (6) on the other side. The messenger wire is broken at both ends by means of L1W break insulator (8). To this messenger wire reel insulators (2) are suspended through which double sheathed PVC cables (3) are drawn. Finally the cables are taken to the meter board (7) through service pipe (5). The service pipe is fixed to the support pipe by means clamps. If the horizontal distance between pole and support pipe is more than 15meter, then in order to maintain support pipe vertically a stay is required to the poles usually called hall pole). Which is to be broken at the middle by means of 1.1KV break insulator it to be provided. Earthing is to be provided to the meter with 8 SWG G.I.Wire.

5. List the materials

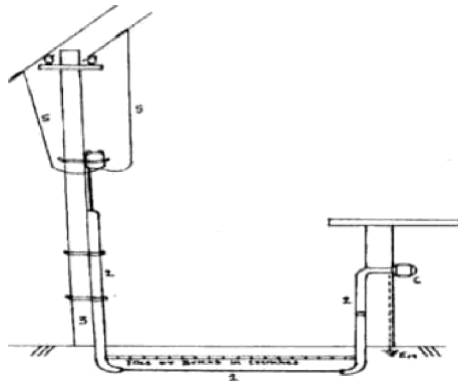
- Messenger wire
- Reel insulator
- PVC cable
- Supporting pipe

- Pole
- Meter board
- Break insulator

& specification of materials used for overhead service.

- Messenger wire:- 10 SWG G.I wire
- Support pipe:- 40mm dia. 3mm thick G.I pipe 1.8m long for 1-phase or 50mm dia. 3mm thick G.I pipe 1.8m long for 3-phase installation.
- Service pipe:- PVC pipe 2mm thick of appropriate diameter depending the size and number of cables. Usually 2m in length with 3 numbers of bends of the same dia.
- Break insulator:- 1.1KV porcelain break insulator.

- e) Service cables:- 2.5, 4, 6, 10, ---24sqmm double sheathed PVC aluminum cable.
 - f) Meter board:- 305x305x65mm for 1-phase and 500x500x65mm TWMB for 3-phase.
 - g) Earthing:- G.I.pipe 40mm diameter, 2.95mm thick, 2.5m long 12.5mm holes drilled at an interval of 300mm.the whole pit of 340mm diameter is to be filled with coal and salt.
 - h) Earth wire:- 8 SWG G.I wire
 - i) Fuse unit:- porcelain fuse unit of required current rating and voltage grade.
7. Explain UG Service Mains with diagram



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Generally the under ground cable system is preferred to that of over head service system. Particularly in cosmopolitan cities like Bangalore, Mysore, Mangalore, Hubli etc, The UG-cable from meter-board is taken to ground through GI-pipe using bends, In the ground usually trench laying is done in case of no obstruction. However, in case of road crossing etc in the ground also the cable is taken through GI-pipe. Using tends from where it is with PVC double sheathed cables which are flexible. For single phase twin core UG- cable is used. For 3 phases either 4-core or 3 and half core UG-cable is used. Always we are selecting steel armoured UG-cable. The fixation of these steel armouring in a concentric way without effecting insulation is called bonding,

8. List the materials

- a) Underground cable
- b) G.I.pipe
- c) Pole
- d) Pot head
- e) PVC double sheathed cables
- f) Meter board

9. Specifications of materials used in U.G. cable

a. Under ground cable:

Size of cable: - In g Mm. Such as 4, 6, 10, 16, 25, 35, 50, 70, 95, 120, ISO, 225 etc

Conductor material:- Aluminium only (ACSR)

No of core:- 2 for single phase , 3 or 3x1f2 or 4 for 3 phase

Insulation:- PVC sheathed with additional sheathing of either paper insulation or lead alloy.

Voltage grade:- 1.1KV class for low and medium voltage.

Armouring:- Steel wire armoured or tape armoured,

b. Pot head:

Voltage grade:- 1.1KV or 11KV.

Material:- cast iron.

c. Stone ware pipe :

Size : -101.6mm dia.

Length :- 61m.

d. G.I pipe :

Diameter of pipe:- 40mm dia. for 6, 10 and 16 sq.mm cables or 50mm dia. higher size.

e. PVC Cables :

Size :- in sq.mm such as 2.5, 4, 6, 10, 16, 25 etc

Conductor:- Aluminium.

Insulation:- PVC

Voltage grade:- 250V for single phase or 500V for 3 phase

f. Meter Board :

300x300x65mm —for single phase VTWB

500x500x65mm—for 3 phase VTWB

g. Earthing :- 40mm G.I pipe 3mm thick, 2.5m long, 12.5mm holes drilled at an interval of 300mm. the whole pit of 340mm dia. Is to be filled with coal and salt.

10. Standard wire table

Wire table for current rating for aluminium cables.

Area (sq.mm)	Current Rating (A)
1.5	10
2.5	15
4.0	20
6.0	27
10.0	34
16.0	43
25.0	59
35.0	69
70.0	134
95.0	153

11. Load calculation of overhead service, Size of wire, Type of wire, Protective devices

a. Load calculation of over head service.

Total load = Given light load + power load

$$\text{Load current} = \frac{\text{light load} + \text{power load}}{\text{Vf} \times \text{t}^* \times \text{k}^*} = \text{amps}$$

b. Size of wire

Take factor of safety = 2 for over head and

= 3 for underground service.

Total current = load current x factor of safety

Referring the wire table as per the current rating to selecting the size of wire.

c. Type of wire

1. PVC double sheathed aluminium 250Vg cable for over head service and
2. PVC double sheathed aluminium 250Vg 2 core for 1-phase and 3, 3x1/2 or 4 core three phase 500Vg underground service.

d. Protective devices

As per the total current rating to select the fuse unit.

Eg:- total load current = 28 amps. Then fuse rating will be

30A porcelain fuse unit 250Vg.

Examples: For Single phase

1. prepare an estimate of cost for providing Over head Service mains to feed power supply to an AEH installation having a lighting load of 800 W and a power load of 2.5 KW, for a distance of 10 m.

Ans:-

1) Material calculation.

$$\text{a) Load current} = \frac{\text{light load} + \text{power load}}{\text{voltage}}$$

$$\text{load current} = \frac{2500}{175}$$

14.35 Amps

Factor of safety= 2

Load current 14.35 x 2 = 28.7 amps. Say = 29 Amps.

The size of the aluminium cable is 10 sq.mm.

Length of each side Pole side + Horizontal + Loose + meter side
= 2 + 10 + 1 + 3 = 16m.

Therefore the total length of cable required = 16 x 2 = 32m.

b) 38mm G.I. Pipe 1.8 m.

c) No. break insulator= 2

d) No of reel insulator one lead = Horizontal distance/ 0.75

$$10/0.75 = 13.33 \text{ say } 13 \text{ N}$$

No of reel insulator for 2 lead = 13 x 2 = 26 say 2dozen

e) 30mm PVC service pipe = 2m.

f) No bends with same dia. 3 Nos.

g) 300 x 250 x 45 VTW Meter board 1 No.

h) 40mm G.I. Pipe 2.5m for earthing and 1kg of 8 SWG G.I. Wire.

i) 15A fuse units 2 No

j) Massanging wire 1kg

k) Miscellaneous materials.

2) MATERIAL REQUIRED FDR 1- PHASE OVER HEAD SERVICE

SLNo	Particulars	Quantity
1	10 sq.mm aluminium double sheathed PVC cable 250yg	32m
3	38mm C.I. pipe 3mm thick 1.8m supporting	1No
3	1.1KV porcelain break insulator	2No
4	Porcelain reel insulator 10mm dia.	2dozen
5	30mm PVC pipe 2mm thick for servicing	2m
6	PVC bends suitable for 30mm pipe	3No
7	300 x 250 x 45mm VTW Meter board	1No
8	40mm G.I. Pipe 3mm thick	2.5m

9	g swc c.l. wire for earthing	1kg
10	15A porcelain fuse unit 250Vg	2No
11	10 SWG G.I. for massanging	1kg
12	Miscellaneous materials	LS

3) Cost of Estimation

Si.No	Particulars	Unit	Quantity	Rate Rs Ps	Cost Rs Ps
1	10 sq.mm aluminium double sheathed PVC cable 250vg	100M (coil)	32	700.00	224.00
2	38mm G.I. pipe 3mm thick 1.8m supporting	M	1.8	120.00	216.00
3	1.1KV porcelain break insulator	No	2	1.50	3.00
4	Porcelain reel insulators 15mm dia	Dozen	2	2.00	4.00
5	30mm PVC pipe 2mm thick for servicing	M	2	10.00	
6	PVC bends suitable for 30mm pipe	No	3	2.00	6.00
7	300 x 250 x 65mm VTW Meter board	No	1	200.00	225.00
8	40mm G.I. Pipe 3mm thick earthing	M	2.5		250.00
9	8 SWG G.I. wire for earthing	kg	1	32.00	
10	15A porcelain fuse unit 250Vg	No	2	20.00	40.00
11	10 SWG G.I. for massanging	kg	1	33.00	
12	Miscellaneous materials like screws, gutties, rawl plugs and bituminous compound.		LS		100.00
13	Labour charges a) for servicing Rs. b) earth work Rs. 50.00				170.00
			Total		1323.00
14	Add contingencies and unforeseen things @5%A				66.15

Examples: For three phase

2. Prepare an estimate for over head service connection to feed power supply to a factory of 15 HP. Load for a distance of 10 m.

Ans:-

1) Material calculation

a) Approximate current = $1.6 \times 15 = 24$ amps.

Factor of safety = 2

Load current = $24 \times 2 = 48$ amps.

The size of the aluminium cable is 16sq.mm.

Length of each lead = Pole side + Horizontal + Loose + meter side

$$= 3 + 10 + 3 + 4 = 20\text{m.}$$

Therefore the total length of cable required = $20 \times 4 = 80\text{m.}$

a) 50mm G.I. Pipe = 1.8 m.

b) No. break insulator = 2

c) No of reel insulator one lead = Horizontal distance/ 0.75

$$= 10/0.75 = 13.33 \text{ say } 13 \text{ N}$$

No of reel insulator for 4 lead = $13 \times 4 = 52$ say 5 dozen

d) 40mm PVC service pipe = 2m.

e) No bends with same dia. = 3 Nos.

f) 500 x 500 x 65 VTW Meter board = 1 No.

- g) 40mm G.I.Pipe 2.5m for earthing and 1kg of 8 SWG G.I. Wire.
- h) 30A fuse units — 3 No
- i) Massanging wire = tkg
- j) Miscellaneous materials.

2) MATERIAL REQUIRED FOR 3 PHASE OVER HEAD SERVICE

SL.No	Particulars	Quantity
1	16 sa.mm aluminium double sheathed PVC cable 500vg	80m
2	50mm G.i, pipe 3mm thick 1,Bm supporting	1No
3	1.1KV oorcelain break insulator	2No
4	Porcelain reel insulators 15mm dia.	sd ozen
5	40mm PVC pipe 2mm thick for servicing	2m
6	PVC bends suitable for 40mm pipe	3No
7	500 x 500 x 65mm VTW Meter board	1Mo
8	40mm G.I.Pipe 3mm thick	2.5m
9	8 SWG G,I, wire for earthing	1kg
10	30A porcelain fuse unit 50OVg	3NO
11	ID SWG G.I. far massanging	1kg
12	Miscellaneous materials	LV

3) Cost of Estimation

Sl.No	Praticulars	Unit	Quantity	Rate Rs Ps	Cost Rs Ps
1	16 sq.mm aluminium double sheathed PVC cable 500vg	t00M (*^!!)	80	900.00	720.00
2	50mm G.I. pipe 3mm thick 1.8m supporting	M	1.8	140.00	252.00
3	1.1KV porcelain break insulator	No	2	1.50	3.00
4	Porcelain reel insulators 15mm dia	Dozen	5	2.00	10.00
5	40mm PVC pipe 2mm thick for servicing	M	2	10.00	20.00
6	PVC bends suitable far 30mm pipe	No	3	2.00	6.00
7	500 x 500 x 65mm VTW Meter board	No	1		225.00
8	40mm G.I.Pipe 3mm thick earthing	M	2.5	100.00	250.00

9	8 SWG G.I. wire for earthing	kg	1	32.00	32.00
10	30A porcelain fuse unit 500vg	No	3	25.00	75.00
11	10 SWG G.I. for massang\ng	kg	1	33.00	33.00
12	Miscellaneous materials like screws, guttles, rawl pugs and bitumlnous compound.		LS		105.00
13	Labour charges a) for servicing Rs. 120.00 b) earth work Rs. 50.00				170.00
				Total	1901.00
14	Add contingencies and unforeseen things @5%				95.05
				Grand Total Say	1996.05 2000.00
	(Rupees two thousand only j				

Examples: For single phase UG SERVICE

3. prepare an estimate of cost for providing UG Service mains to feed power supply to an AEH installation having a lighting load of 800 W and a power load of 2.5 KW, for a distance of 10 m.

Ans:-

1) Material caculatinn

Given:

Lighting load = 800 W

Power load = 2.5 KW

Distance = 10 m

$$\text{Load current} = \frac{\text{light load} + \text{power load}}{\text{voltage}}$$

$$\text{IDad current} = \frac{800 + 2500}{210}$$

$$= 14.35 \text{ amps.}$$

Factor of safety = 3

Therefore actual current = load current x factor of safety

$$= 14.35 \times 3 = 43.05 \text{ Amps}$$

Size of cable - 10 Sq.mm, 250 V grade, double sheathed PVC cable

- a) Hence iron pot of 50 A, 2 terminals, 250 V grade is required = 1 No.
- b) Length of GI pipe = 3m (pole side) + 2m (meter side) + 2.5m (earthing)
= 7.5m
- c) No. of GI bends = 3 Nos.
- d) Length of UG cable = 10m horizontal + 1m looseness + 3m pole side + 2m meter side
= 16 m.
- Add 10% for wastage = 1.6 + 16 = 17.6 say 18 m
- e) 6 sq.mm double sheathed PVC cable = 12m for connection to overhead line
- f) No of bricks
Size of bricks = 11.5cm x 23cm x 7.5 cm
- $$\text{No. of bricks} = \frac{11.5 \times 23 \times 7.5}{23}$$
- $$= 43.47 \text{ or say } 45$$
- g) Number of 15A fuse units = 2 Nos.
- h) 300mm x 300mm x 45mm VTWB = 1
- i) Clamps for fixing GI pipe with pole and meter side - 5

2) Material Required for 1-phase UG service

SL.No	Particulars	Quantity
1	10 sq.mm PVC UG cable Aluminium 2 core 1.1 KV class. GI steel tape armoured , 250V grade.	18m
2	Bricks 11.5cm x 23cm x 7.5cm	45 No
3	38mm diameter, 3mm thick GI pipe for laying cable and earthing	7.5M
4	Iron pot SOA, 250 V grade with two terminal	1 No
5	PVC cable, 6sq.mm double sheathed	12M
6	Porcelain fuse units 15A, 250V grade	2 No
7	38mm dia, 3mm thick GI bends	3 No
8	300mm x 300mm x 45mm VTWB	1 No
9	Earthing set	1 No
10	Clamps for fixing GI pipe with pole and meter side	5 No

3) Cost of Estimation

Sl.No	Particulars	Unit	Quantity	Rate	Cost
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				Rs	Ps	Rs Ps
1	10 sq.mm PVC UG cable Aluminium 2 core 1.1 KV class. GI steel tape armoured . 250V grade.	M	18		m	730.00
2	Bricks 11.5cm x23cmx7.5cm	No	45	5.00		225.00
3	38mm diameter, 3mm thick GI pipe for laying cable and earthing	M	7.5	165.00/m		1237.50
4	Iron pot SOA, 250 V grade with two terminal	No	1	168.00		
5	PVC cable, 6sq.mm double sheathed	M	12	7.65/m		91.80
6	Procelain fuse units 15A, 250V grade	No	2	40.00		80.00
7	38mm dia, 3mm thick GI bends	No	3	31.00		63.00
8	300mm x 300mm x 45mm VTWB	No	1	50.00		50.00
9	Earthing set	No	1	1200.00		1200.00
10	Clamps for fixing GI pipe with pole and meter side	No	5			90.00
11	Miscellaneous materials like screws, guttles, rawl pugs and bituminous compound.		LS			50.00
			Total			3975.30
12	Labour charges @ Rs. 10.00/m					180.00
			Total			4155.30
13	Add 5% for contingency, unforeseen and variation on material cost of Rs. 3975.00					198.75
			Grand Total			4354.05
			Say			4400.00
	(Rupees four thousand four hundred only)					

Examples: For three phase uG sERVICE

4).prepare an estimate of cost for providing UG Service mains to feed power supply to an workshop of 10 HP load for a distance of 10 m.

Ans:-

1) Material caculation

Given:

Power load = 10 HP

Distance = 10 m

a) Approximate current = $1.6 \times 10 = 16$ amps.

Factor of safety = 3

Load current = $16 \times 3 = 48$ amps.

Size of cable = 16 sq.mm, 500Vg, 4 core double sheathed PVC aluminum cable.

Length of UG cable = 10m horizontal + 1m looseness t 3m pole side + 2m
meter side
= 16 m.

Add 10% for wastage = 1.6 +16 = 17.6 say 18 m.

b) Hence iron pot of SO A, 4 terminals, 500 V grade is required =1No.

c) Length of GI pipe = 3m (pole side) + 2m (meter side) +2.5m {earthing}
= 7.5m

d) No. of GI bends = 3 Nos.

e) 16 sq,mm double sheathed PVC cable = 12m for connection to overhead line

f) No of bricks

Size of bricks = 11.5cm x 23cm x 7.5 cm

No. of bricks = $\frac{18 \times 16 \times 1000}{11.5 \times 23 \times 7.5}$

= 43.47 or say 45

g) Number of 16A fuse units = 3 Nos.

h) 500mm x 50mm x 65mm VTWB = 1

i) Clamps for fixing GI pipe with pole and meter side - 5

2) MATERIAL REQUIRED FOR 3 PHASE UG SERVICE

SL.No	Particulars	Quantity
1	16 sq.mm PVC UG cable Aluminium 4 core GI steel tape armoured . 500V grade.	18m
2	Bricks 11.5cm x23cmx7.5cm	45No
3	50mm diameter, 3mm thick GI pipe for laying cable and earthing	7.5M
4	Iron pot SOA, 500 V grade with 4 terminal	1No
5	PVC cable, 16sq.mm double sheathed	12M

6	Procelain fuse units 15A, SOOV grade	3No
7	58mm dia. 3mm thick GI bends	3No
8	500mm x500mm x 65mm VTWB	1No
9	Earthing set	1No
10	Clamps for fixing GI pipe with pole and meter side	5No

3) Cost of Estimation

Sl.No	Praticulars	Unit	Quantity	Rate Rs Ps	Cost Rs Ps
1	16 sq.mm PVC UG cable Aluminium 4 core GI steel tape armoured . SOOV grade.	M	18	80.00/M	1440.00
2	Bricks 11.5cm x23cmx7.5cm	No	45	5.00	
3	50mm diameter, 3mm thick GI pipe for laying cable and earthing	m	7.5	200.00/m	1500.00
4	Iron pot SOA, 500 V grade with 4 terminal	No	1	225.00	225.00
5	PVC cable,16sq.mm double sheathed	m	12	7.65/m	91.80
6	Procelain fuse units UA, SOOV graoe	No	3	40.00	120.00
7	50mm dia. 3mm thick GI bends	No	3	30.00	90.00
8	500mm x500mm x 65mm VTWB	No	t	80.00	80.00
9	Earthing set	No	J		1200.00
10	Clamps for fixing GI pipe with pole and meter side	NO	5	18.00	90.00
11	Miscellaneous materials like screws, gutties, rawl pugs and bituminous compound.		LS		100.00
		Total			5161.80
12	Labaur charges @ Rs. 30.00/m	AB.00 x 30			540.00
		Total			5701.80
13	Add 5% for contingency, unfore seen and variation on material cost of Rs. 5701.80				285.09
	Grand Total Say				5986.89 6000.00
	(Estimated rupees six thousand only)				

TASK

1. Prepare the schedule of materials for providing OH service connection to a residential building with 1050 W lighting and 2.5 KW heating load .The supply pole is 10 m away. Prepare the estimate of cost.
2. Prepare the schedule of materials for providing UG service connection to a residential building with 1 KW lighting and 2.5 KW heating load .The supply pole is 10 m